



CHAPTER ONE

EXISTING AIRPORT ACTIVITY AND FACILITY INVENTORY

As of 2008, Burlington International Airport (BTV) is one of seventeen (17) public use airports in the State of Vermont and is located directly adjacent to Burlington in the City of South Burlington. BTV is the principal gateway to the State for air travelers and serves a vital function in promoting the city, region and state.

1.1 INTRODUCTION

The purpose of the Vision 2030 Master Plan Update is to re-examine and update the 1990 Airport Master Plan and 2006 Airport Layout Plan (ALP). Specifically, this effort will result in updated forecasts of the aviation demand over the next twenty year planning period (until 2030).

Major planning issues to be examined in the Master Plan Update include:

- **Activity Planning Forecasts:** Forecasts of passenger enplanements, especially examining service area beyond the Canadian border; commercial operations; cargo tonnage; cargo operations; and, based business/general aviation aircraft and operations will be generated. These forecasts will take into account the most recent FAA Terminal Area Forecast prepared by the FAA and historical trends from data supplied by airport management.
- **Facility Requirements:** The activity planning forecasts will generate specific facility requirements at the airport; however, additional non-demand driven facility requirements may also be required. Regardless of facility requirements identified through the study effort, the plan will provide the airport with flexibility to accommodate unforeseen facility requirements while minimizing disruption to airport operations.
- **Airport Access:** Access to the airport will be studied as various independent local studies are underway to improve access to and around the airport. As the study findings become available, they will be incorporated into the overall development plan. See **Section 1.3**, Airport Location and Access, for details on these studies.
- **Airfield Geometry:** Based on the updated facility requirements, the development plans will identify necessary runway/taxiway system improvements to support the aviation



demand forecasts. However, based on the preliminary findings of existing activity no significant changes to the basic Runway 15-33 and Runway 1-19 facilities are anticipated.

- **Land Use Coordination:** In an effort to improve compatibility between residential and commercial interests, BTV is conducting a federally-funded voluntary land acquisition program for residences located within the 65-decibel noise contour of the airport. The Noise Land Inventory Update and Reuse Plan, launched in October 2008, will guide the process. See **Section 1.6**, Land Use and Zoning, for more information on the land acquisition program.

The development plan will focus on maximizing the remaining airport property, recognizing that the existing airfield property is approximately 90-percent developed. However, the recommended development plan will retain flexibility so that airport management can take advantage of unforeseen business opportunities that may arise either as a result of increased activity at the airport or due to the success of local economic development initiatives.

1.2 DATA COLLECTION

The inventory of existing facilities and activities was collected through on-site inspections, aerial photography and mapping conducted in October 2008, a review of previous and on-going studies and reports prepared for the airport, and a review of FAA and airport management historical records. The major sources of data used in this report are identified below and complete references can be found in **Appendices A through L**:

- 1) 2006 Airport Layout Plan Update – Campbell and Paris
- 2) 2000 South End Development Report - Campbell and Paris
- 3) 1990 Airport Master Plan Update - Campbell and Paris
- 4) Historical Operational Statistics - BTV
- 5) Forecasted Operational Statistics - FAA-Terminal Area Forecasts (TAF)

1.3 AIRPORT LOCATION AND EXISTING ACCESS

BTV is located within the incorporated limits of the City of South Burlington, Vermont, which is in the County of Chittenden. The airport is approximately three miles east of the central business district of Burlington, Vermont (refer to **Figure 1.1**). According to the 2006 City of Burlington Municipal Development Plan, Burlington is within one day's drive of over 70 million people.

The existing surface access to the airport includes interstate, regional and local roadways. The closest interstate interchange to the airport is Exit 14 at US Route 2 which leads to an intersection with Airport Drive. Airport Drive serves the passenger terminal and airport parking, while also providing access to the adjacent residential neighborhood. US Route 2 is a principal arterial that carries significant peak period commuter volumes, which cause traffic to seek alternative routes; this can send traffic through the surrounding neighborhoods. The congestion

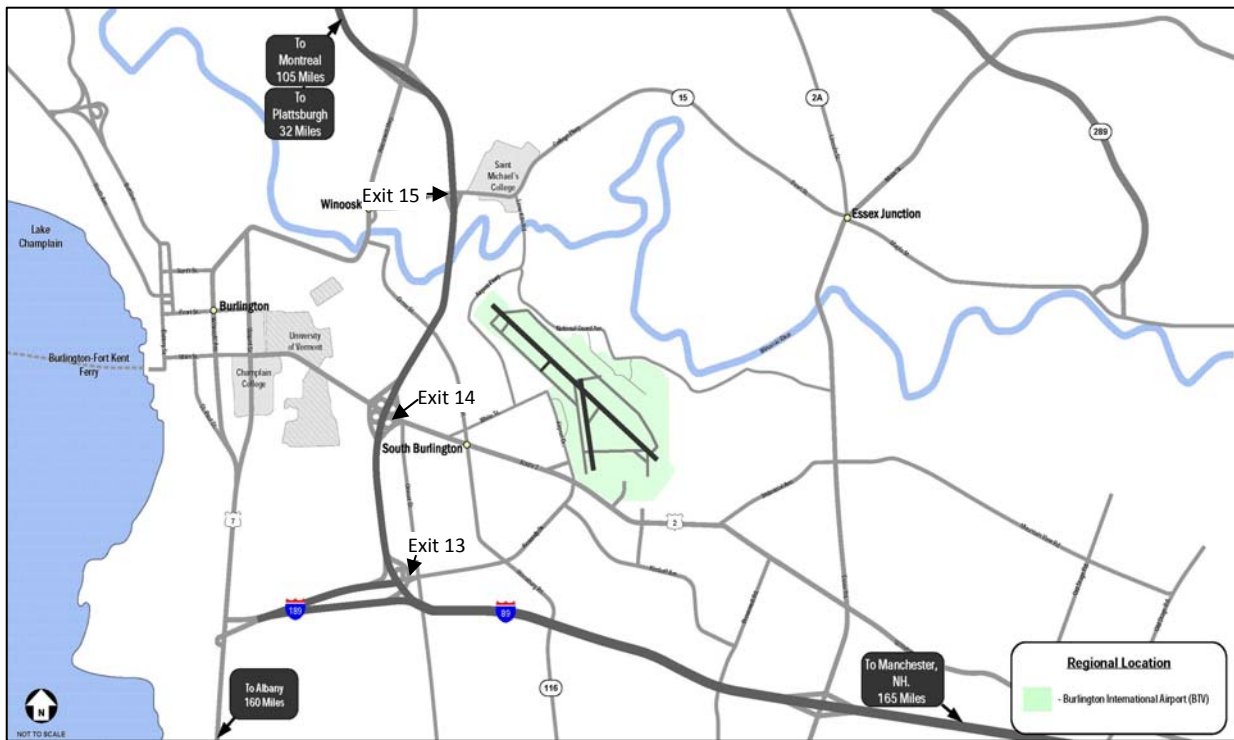


Burlington International Airport South Burlington, Vermont

along Route 2 is a known impediment in the area; also, the presence of airport-related traffic on residential streets is a point of contention.

Additional access to the airport exists via Lime Kiln road from the north and Kennedy Drive from the south. US Route 2, Lime Kiln Road, and Kennedy Drive traffic approach the terminal area via Airport Drive, Airport Parkway, Airport Road and White Street. Portions of these latter streets are within the residential neighborhood that sits immediately to the west of the airport.

Figure 1.1: Airport Location and Access



GOROVE/SLADE ASSOCIATES, INC.
Transportation, Traffic and Parking

Lime Kiln Road is significant in that it provides one of few crossings of the Winooski River north of the airport. Lime Kiln Road connects to VT Route 15, which has limited connectivity with I-89 at Exit 15. Kennedy Drive connects to Exit 13; however this interchange does not serve all turning movements. Exit 13 essentially provides access to Interstate 189, which connects with the southern end of downtown Burlington and Route 7. The core of downtown Burlington has airport access via US Route 2.

In general, BTV connection to the regional transportation system is limited, due to congestion and a road system that does not efficiently link to the interstate. Currently, vehicular traffic arriving at and departing from the airport mixes with a significant amount of local traffic.



The following is a brief list of projects near the airport that are in various levels of consideration and implementation. See **Appendix G** for a compilation of road access and transportation studies. Additional proposals to improve airport connectivity will be discussed in **Chapter Four**, Alternatives Analysis.

- Proposed Exit 12B-I-89/VT Route 116 Interchange: A proposed interchange on I-89 at VT Route 116, Hinesburg Road. This proposal is included in the Chittenden County Metropolitan Planning Organization (CCMPO) 2025 Metropolitan Transportation Plan. The interchange would improve regional access to South Burlington and would help to relieve congestion at the I-89 Exit 14/Route 2/Dorset Street intersection, but will not provide a direct airport connection to I-89.
- Exit 13- I-89/I-189 Interchange Upgrades: This upgrade would complete all connections between I-89, I-189 and the Kennedy Drive/Dorset Street Intersection. This alternative would offer a more direct I-89 access alternative for the airport than the Proposed Exit 12B Interchange.
- Airport Drive Extension: An extension of Airport Drive north of White Street to connect directly with Airport Parkway has been considered. This general concept is being expanded as part of the Noise Land Re-Use Plan. The concept uses parcels acquired by the Noise Land Re-use Plan to replace Airport Drive with a new roadway cross-section, which would extend from US Route 2 and join up with the existing alignment of Airport Parkway north of Kirby Road. The roadway would provide noise and visual buffers, such as a living wall, between the adjacent residential neighborhood and the airport. The concept would also disconnect from many residential streets in order to separate the neighborhood from airport through-traffic.

1.4 AIRPORT ROLE

The National Plan of Integrated Airports Systems (NPIAS) is a document created by the Federal Aviation Administration (FAA) to assist in programming federal funds to support required aviation development at airports included in the NPIAS. The United States has over 5,190 landing strips or airports open to the public, with 66-percent of these airports included in the 2009-2013 NPIAS. Of the 3,356 existing airports included in the 2009-2013 NPIAS, 522 (or 16-percent) are either primary or non-primary commercial service airports.

Nine principles guide the development costs included in the NPIAS in order to assure that the national airport system has the ability to meet the demand for air transportation. It is important to include these principles in this study because the development recommended for BTW should support these principles.



The guiding principles of the NPIAS are:

- 1) Airports should be safe and efficient, located at optimum sites, and developed and maintained to appropriate standards;
- 2) Airports should be affordable to both users and Government, relying primarily on user fees and placing minimal burden on the general revenues of local, State and Federal Government;
- 3) Airports should be flexible and expandable, able to meet increased demand and to accommodate new aircraft types;
- 4) Airports should be permanent, with assurance that they will remain open for aeronautical use over the long term;
- 5) Airports should be compatible with surrounding communities, maintaining a balance between the needs of aviation and the requirements of residents of neighboring areas;
- 6) Airports should be developed in concert with improvements to the air traffic control system and technological advancements;
- 7) The airport system should support national objectives for defense, emergency readiness, and postal delivery;
- 8) The airport system should be extensive, providing as many people as possible with convenient access to air transportation, typically by having most of the population within 20 miles of a NPIAS airport;
- 9) The airport system should help air transportation contribute to a productive national economy and international competitiveness.

BTV is classified as a small hub, primary commercial service airport in the 2009-2013 NPIAS. A primary commercial service airport is defined in the NPIAS as any airport in which annual enplanements total more than 10,000 passengers. Of the 522 existing commercial airports in the country, 72 are small hub airports. These small hub airports are defined as airports with enplanements between 0.05 percent and 0.25-percent of total national.

The NPIAS also includes forecasted roles for each airport currently in the NPIAS and for airports planned to be included in the NPIAS (i.e., newly constructed airports). The 2009-2013 NPIAS identifies the role of BTV to remain the same over the next five years. **Figure 1.2** illustrates the types of airports in Vermont and parts of New Hampshire and New York based on their NPIAS designation. Even though it is not a part of the NPIAS, Montréal-Pierre Elliott Trudeau International Airport, in Quebec, is labeled “Commercial Service-Primary” in order to demonstrate its proximity to BTV.

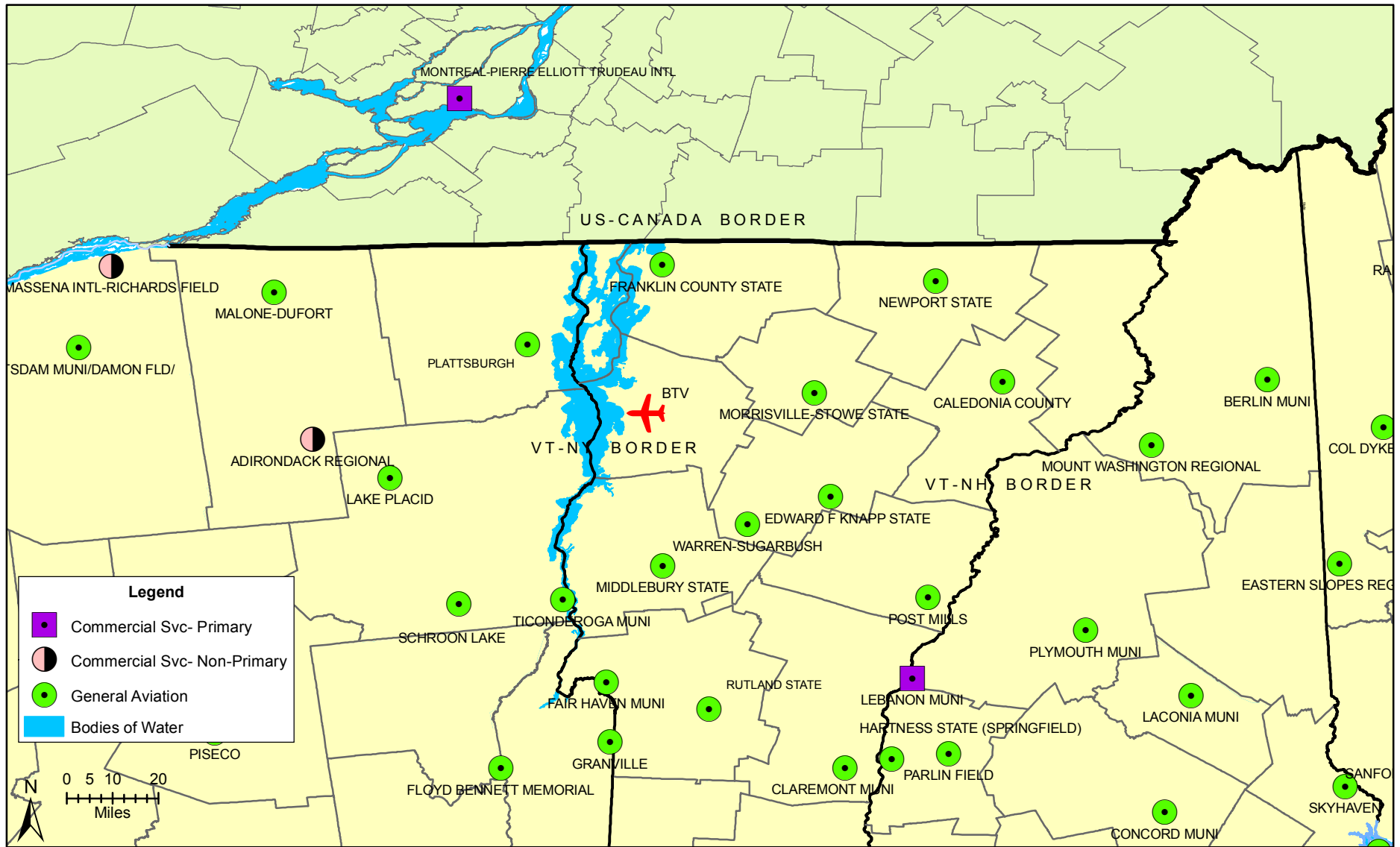


Figure 1.2

Airports in New England by Existing NPIAS (2009-2013) Designation

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1.5 AIRPORT SERVICE AREA AND SOCIO-ECONOMIC TRENDS

The airport service area is defined as the area within a 90-minute drive time of BTV, regardless of the US-Canadian border (at the time this study was conducted (January 2009), U.S. Customs and Border Protection reported no wait times Vermont-Canada Border Crossings.) A 2009 study by the Chittenden County Metropolitan Planning Organization reports that 47% of BTV passenger trips originate north of the City of Burlington. In addition, license plate surveys of the parking garage indicate that approximately 25% of cars originate from Quebec. These factors support the assumption that there is a strong demand to use the airport facilities by Canadians.

For statistical purposes, the United States counties and Canadian census divisions with their centroid within the airport service area boundary were considered to be part of the service area. This includes the six Vermont counties Addison, Chittenden, Franklin, Grand Isle, Lamoille, and Washington, plus Clinton, NY, and two census divisions in Quebec: Brome-Missisquoi and Le Haut-Richelieu.

1.5.1 Population

The 2008 population estimate of 621,270 for the State of Vermont ranks Vermont as 49th of 50 states in total population. Population within Vermont is relatively concentrated in the airport service area and in particular within the Champlain Valley of Vermont.

The airport service area population includes parts of both the United States and Canada and totals 597,967. United States counties below the border make up 442,355 of this population (using 2007 population figures from the U.S. Census) and the Canadian census divisions Brome-Missisquoi and Le Haut Richelieu account for the remaining 155,612 (using 2006 population figures from the Census of Canada). More specifically, New York census tracts account for 73,470 of the total ASA population; and Vermonters comprise the remainder, 368,885. This means that 59% of Vermonters live within the airport service area.

The United States portion of the airport service area (portions of the seven U.S. counties) has increased by a compounded annual rate of growth of 0.76% since 2000, from a total of 419,453 to 442,355. The Canadian portion of the airport service area increased at a compounded annual rate of growth of 0.41% between 2000 and 2006. In total, the airport service area increased by a compounded annual rate of growth of 0.65% between 2000 and 2007. In contrast, the state of Vermont has increased by a compounded annual rate of growth of 0.26% since 2000.

Figure 1.3 outlines population information for whole counties and census divisions included in the airport service area. The population of these counties grew at a compounded annual rate of 0.47% between 2000 and 2007. The counties of Grand Isle, Franklin, Lamoille, and Chittenden were the fastest growing within the service area, with Grand Isle, Franklin, and Lamoille growing at rates higher than that of the entire service area. The population growth of those areas within the airport service area is higher than that of the State of Vermont as a whole.



These population increases support the growth in demand that the airport has experienced over the past 10 years. It is also indicative of a healthy market. As the airport's market population continues to grow demand for aviation services can be expected to increase as well.

Figure 1.3						
BTV Service Area Population Growth: 1990-2007						
County/Census Division	Population				Annual Rate of Growth	
	1990	2000	2003	2007	1990-2000	2000-2007
Addison, VT	32,953	35,974	36,914	36,760	0.88%	0.31%
Chittenden, VT	131,761	146,571	150,698	151,826	1.07%	0.50%
Franklin, VT	39,980	45,417	48,129	47,934	1.28%	0.77%
Grand Isle, VT	5,318	6,901	7,482	7,601	2.64%	1.39%
Lamoille, VT	19,735	23,233	24,307	24,676	1.65%	0.86%
Washington, VT	54,928	58,039	59,139	58,926	0.55%	0.22%
Clinton, NY	85,969	79,894	81,166	82,215	-0.73%	0.41%
Brome-Missisquoi, CA (a)	43,748	45,582	46,148	46,912	0.41%	0.41%
Le Haut-Richelieu (a)	101,964	106,241	107,558	109,338	0.41%	0.41%
TOTAL	516,356	547,852	561,541	566,188	0.59%	0.47%
VERMONT	562,758	609,876	616,702	621,254	0.81%	0.26%
ASA	n/a	571,276	582,488	597,967	n/a	0.65%
Source: U.S. Census Bureau, Census Canada						
(a) Population for Canadian census divisions found by applying 2010-2025 CARG for Quebec, 0.41%, to both 2006 populations from Census Canada.						

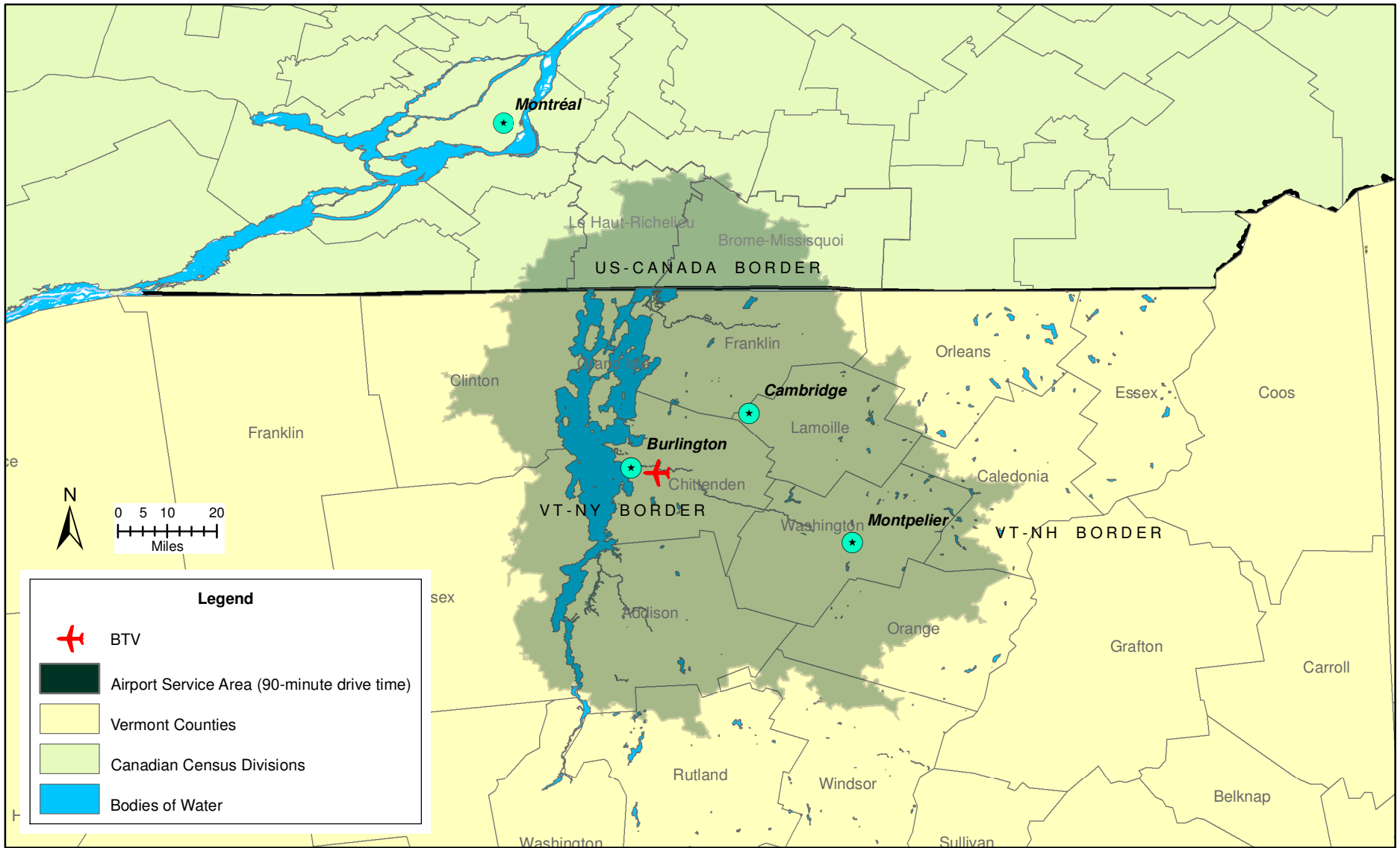


Figure 1.4

Airport Service Area

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Burlington International Airport South Burlington, Vermont

Forecasted Population: The population forecast for the BTV airport service area was generated using data from the U.S. Census, the Vermont Department of Labor, and the Program on Applied Demographics (PAD) at Cornell University (for Clinton, NY projections). The population of the airport service area is anticipated to increase at a compounded annual growth rate of 0.4%. This is essentially the same growth that of the State of Vermont is experiencing. The counties of Grand Isle, Lamoille, Franklin, and Chittenden are expected to grow at faster rates than the other communities within the airport service area. This population forecast follows the historical population growth trends, which show that the counties within the airport service area are expected to grow at a slightly faster rate than the overall state of Vermont. With this forecast it can be understood that as population is projected to increase demand for air travel services at BTV will also increase.

The 2007 ASA population (from census tracts) used in **Figure 1.3** was extrapolated using the same rate of growth as the whole counties and census divisions which make up the ASA (0.43%). This produces reasonable estimate of the population of the ASA through 2025.



Figure 1.6							
BTV Service Area Projected Population: 2005-2025							
County	Population						CARG 2005-2025
	2005	2007	2010	2015	2020	2025	
Addison, VT	37,052	36,760	37,907	38,805	39,813	41,267	0.54%
Chittenden, VT	152,846	151,826	157,471	161,491	165,813	171,869	0.59%
Franklin, VT	47,617	47,934	49,583	51,701	54,065	56,040	0.82%
Grand Isle, VT	7,423	7,601	7,923	8,433	8,958	9,285	1.13%
Lamoille, VT	24,442	24,676	25,601	26,756	27,898	28,917	0.84%
Washington, VT	59,141	58,926	59,931	60,636	61,322	63,562	0.36%
Clinton, NY	82,102	82,215	81,492	80,621	79,366	77,582	-0.28%
Brome-Missisquoi, Can.	46,529	46,912	47,491	48,275	49,474	50,497	0.41%
Le Haut-Richelieu, Can.	108,447	109,338	110,689	112,977	115,312	117,695	0.41%
TOTAL	565,599	566,188	578,088	589,695	602,021	616,713	0.43%
VT POPULATION	625,935	621,254	639,241	652,199	666,041	681,162	0.42%
ASA	n/a	597,967	605,714	618,849	632,270	645,981	0.43%
Sources:							
Vermont Department of Labor, Economic-Demographic Profile Series (2008); U.S. Census, Estimated 2007 Population; Program on Applied Demographics (PAD), Cornell University							
(d) Populations for Canadian census divisions found by applying 2010-2025 CARG for Quebec to 2006 populations. (0.41%) to 2006 populations from Census Canada.							

1.5.2 Labor Force and Employment

With 59% of Vermonters living within the airport service area, it is not surprising that the Vermont portion of the airport service area also comprises over 50% of the statewide civilian labor force. The civilian labor force is defined by the Vermont Department of Labor as members of the population who are 16 years of age or older, and who currently work, look for work or are unemployed from firms in areas other than where they reside. According to data from the Vermont Department of Labor, the civilian labor force of the Vermont portion of the airport service area totaled 189,300 persons in 2007, or approximately 53.5% of the Vermont state labor force. The civilian labor force for the entire airport service area totaled 353,900 people in 2007.

Unemployment figures for U.S. counties were obtained from state Departments of Labor and



vary from 3.3% to 5.6% in 2007. Figures for the Canadian census divisions Brome-Missisquoi and Le Haut-Richelieu were obtained from the 2006 Canadian census, and are 5.1% and 4.8%, respectively. The parts of the airport service area with the highest unemployment rates are Grand Isle, VT, Clinton, NY, and Brome-Missisquoi, Canada, all of which are above 5%.

The employed population within the airport service area totaled approximately 298,790 persons in 2007, or approximately 52.8% of the airport service area population and 95.7% of the civilian labor force within the airport service area. Thus, the unemployment figure for the entire airport service area is 4.5%, which is higher than the 2007 unemployment rate of the state of Vermont, 3.9% but lower than the 2007 national unemployment rate of 4.6%. The employment center of the region appears to be Chittenden County, which has a relatively low unemployment rate (3.3%). This data represents a strong labor force and employment center within the ASA. The presence of a strong labor force also supports the growth in air service demand that has been seen at BTV.

Figure 1.7: Selected Labor Statistics

County	2007 Population	2007 Pop. in Labor Force	2007 Pop. Employed	2007 Pop. Un-employed	Un-employed Rate	Median HH Income (b)
Addison, VT	36,760	21,650	20,850	800	3.7%	\$53,475
Chittenden, VT	151,826	87,850	84,950	2,850	3.3%	\$58,376
Franklin, VT	47,934	26,250	25,150	1,100	4.2%	\$51,145
Grand Isle, VT	7,601	4,300	4,050	250	5.2%	\$53,546*
Lamoille, VT	24,676	15,150	14,450	700	4.6%	\$48,084
Washington, VT	58,926	34,100	32,750	1,350	4.0%	\$51,333
Clinton, NY	82,215	39,800	37,600	2,200	5.6%	\$45,758
Brome-Missisquoi, Can. (a)	46,912	24,220	22,970	1,245	5.1%	\$38,795
Le Haut-Richelieu, Can. (a)	109,338	58,845	56,020	2,825	4.8%	\$42,390
ASA POPULATION	566,188	312,165	298,790	13,320	4.5%	\$48,669
VERMONT STATE	621,254	353,900	340,100	13,800	3.9%	\$49,382
Sources: Vermont Dept. of Labor, Economic-Demographic Profile Series (2008); Census Canada; U.S. Census						
*Figure taken from 2000 Census and converted to 2007 dollars using the Consumer Price Index						
(a) Canadian Median HH Income figures are from 2006 Census and have been converted to 2006 U.S. dollars using data from the Bank of Canada. Canadian per Capita Personal Income is 2006 GDP for Quebec divided by the 2006 population of Quebec.						
(b) Median HH Income and Per Capita Income are from U.S. Census American Community Survey 2005-2007 Estimates						

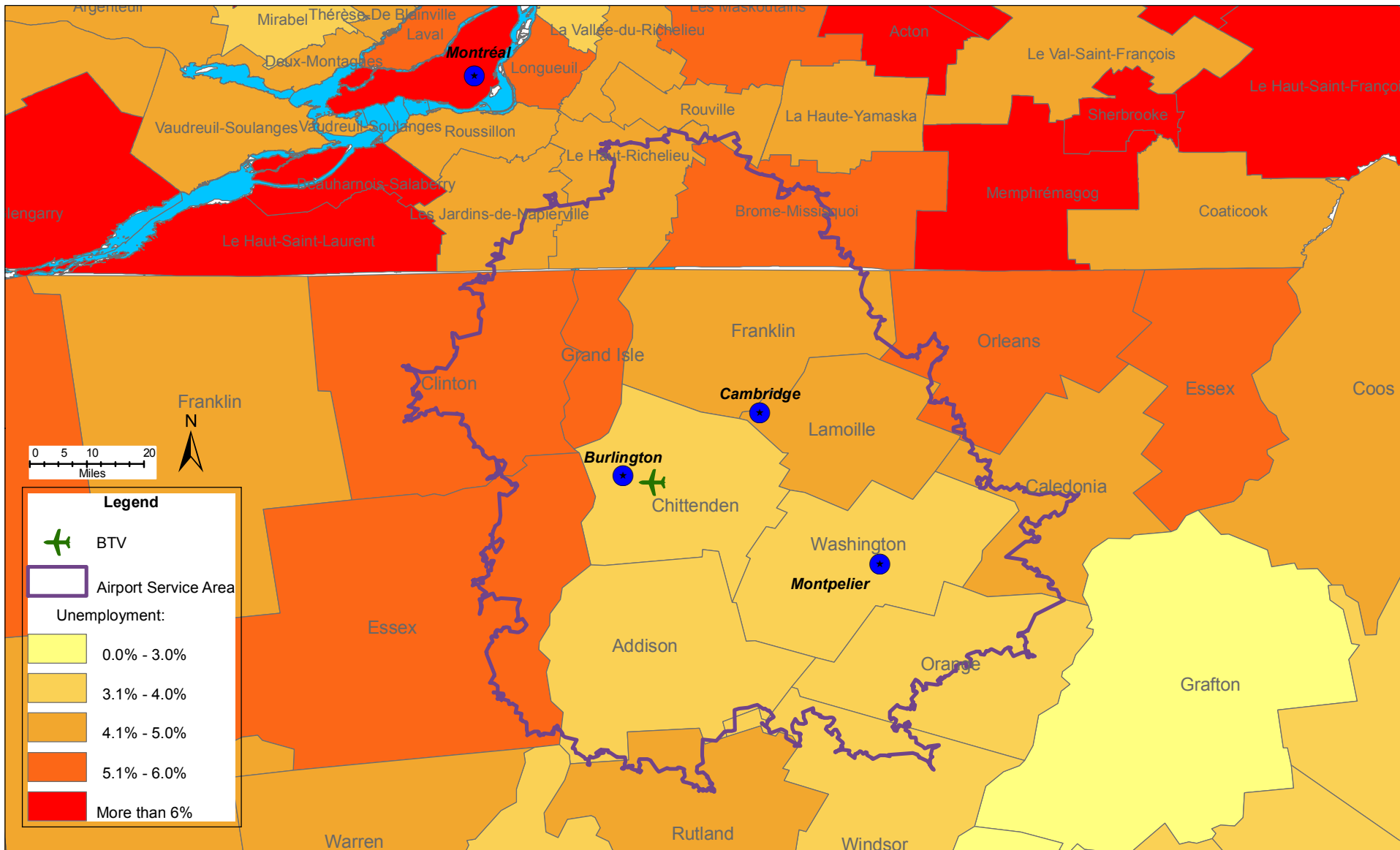


Figure 1.8

2007 County Unemployment Rates (U.S.)
 2006 Census Division Unemployment Rates (Canada)



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1.5.3 Measurements of Income

Per capita income is defined as total personal income divided by the total population of a given geographic area. Personal income in Vermont totaled \$23.2 billion in 2007 which is an increase from \$10.1 billion in 1990 and represents a compounded annual growth rate of 5.0%. Personal income in Vermont in 2006 was more than \$21.6 billion.

Personal income in the airport service area totaled approximately \$19.3 billion in 2006. The Vermont county portion of the airport service area totaled \$11.9 billion in 2006, or 54.9% of the total personal income for Vermont State. Within the service area, Chittenden, Washington and Franklin counties had total personal income of close to \$9.6 billion in 2006, which is 44% of the Vermont total.

Since 1990, total personal income for the airport service area has increased from \$9.4 billion to \$19.3 billion, which is a compounded annual growth rate of 4.61%. Per capita personal income has grown from \$17,621 in 1990 to \$33,315 in 2006, which represents a growth rate of 4.06%.

Vermont total personal income has grown at a rate of 4.91% during this time period, from \$10.1 billion to \$21.6 billion. Per capita personal income has grown from \$17,876 to \$35,142 over the 16-year time period, which is a 4.32% compounded annual rate of growth. By comparison over the same period national per capita income grew at a rate of 4.0%.

The growth of per capita personal income within the airport service area means that residents have more disposable income, and therefore more ability to take advantage of air travel at BTV. This trend in income growth supports the strong demand for air service that the airport has seen. The ASA's growth in income that exceeded the national average is indicative of the high growth in demand for air service.

Figure 1.9

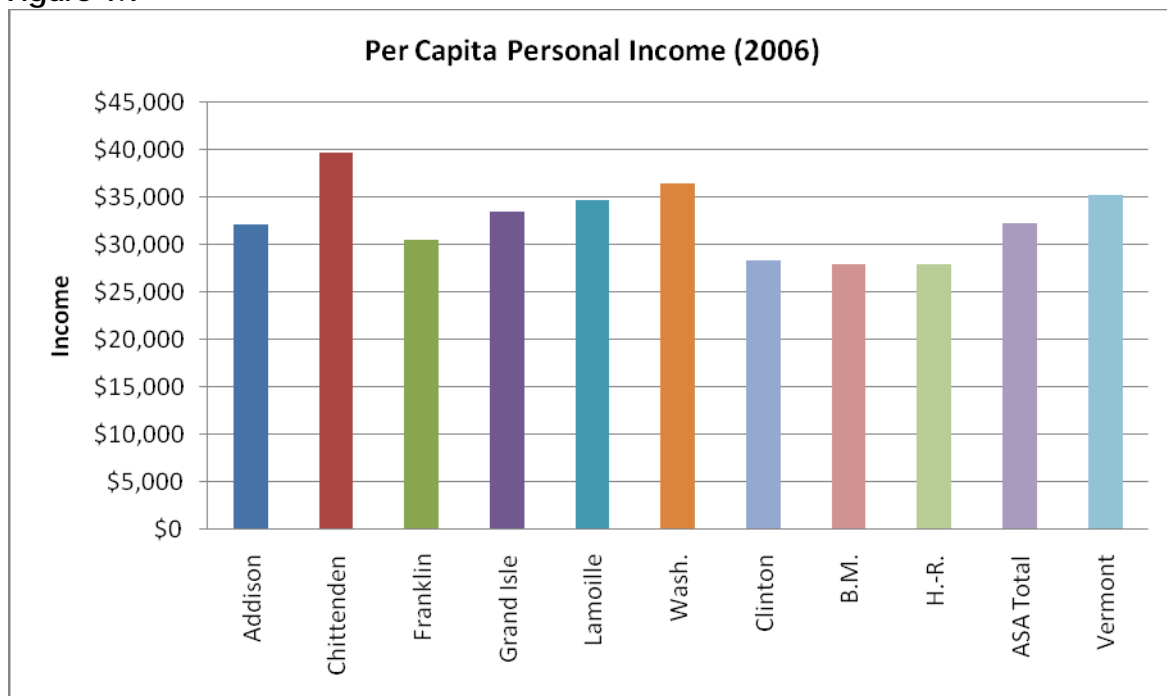
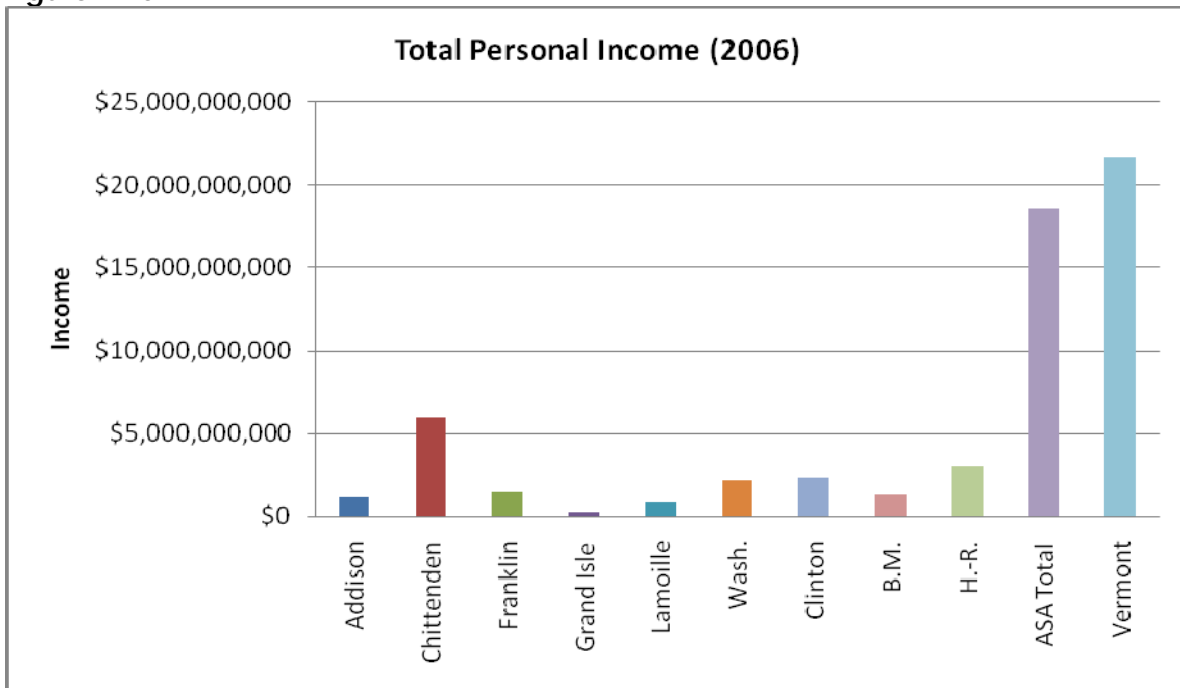


Figure 1.10



1.5.4 Business Climate

According to the Vermont Department of Labor, the majority of jobs in 2007 in the Burlington-South Burlington Labor Market Area (LMA) were in the manufacturing, service, and education and health services fields. This is not surprising given the existence of the many retail establishments in South Burlington, Fletcher Allen, a major health care institution, three private colleges, the Community College of Vermont, and the University of Vermont in the vicinity. Specifically, the manufacturing sector accounted for 13.2% of the jobs in the Burlington-South Burlington LMA in 2007; the service industry provided 64.8% of the jobs (within this number, the retail industry made up for 13.6% of total jobs) and education and health services accounted for 16.1% of all jobs.

Additionally, according to the South Burlington Comprehensive Plan, the scenic and recreational resources in Vermont and especially the City of Burlington's downtown core adds to the likelihood of sustained economic development in the region through tourism.

The number of business establishments in the Burlington-South Burlington LMA has increased at a rate of 0.65-percent annually since 2000 with approximately 7,180 establishments in 2007. The City of South Burlington Comprehensive Plan indicates that the airport is a "vital element in economic development" for the region, and states that the interests of the airport and of the City are very closely aligned in the areas of economic development and transportation. The airport is an important asset in the City's economic development program and important part to attracting new jobs and industry to the region.



1.6 ZONING AND LAND USE

BTV is zoned “Airport” by the City of South Burlington. The parcels of land surrounding airport property to the northeast are designated Mixed Industrial and Commercial; those surrounding the airport to the south (the South End Development area) are designated Airport Industrial; to the northwest, Municipal; and those parcels of land surrounding the airport to the west are designated Residential 4, which is meant for residential uses at moderate densities that are compatible with existing land and nearby undeveloped land. There is also an area of Residential 4 land which borders the northeastern side of airport property (See **Figure 1.11**).

Land uses such as open space, farm land, commercial, office, or industrial are generally considered more compatible with airports. Residential land uses are typically not considered compatible, particularly near the approach paths to the runways, as normal airfield operations may disturb some residents. In South Burlington, many residences were built next to airport property during the housing boom following World War II (1940s and 1950s). The city adopted zoning in 1947, meaning that many homes had already been built next to the airport before zoning was established. The 65 decibel noise contour is considered a non-compatible decibel level with noise-sensitive land uses such as residential. Portions of the neighborhood to the west of the airport are within the 65 decibel noise contour, as identified by the 2006 Part 150 Noise Compatibility Program.

The airport is currently in the process of purchasing residential properties that are within the 65 decibel noise level contour of the airport’s operations. In October 2008, the airport launched the Noise Land Inventory Update and Reuse Plan, which will guide the short, medium, and long-term portions of the airport’s land acquisition program. Federal funding is available to assist BTV with acquiring those properties with willing sellers.

Please see **Appendix M** for a more detailed discussion of the zoning and land use considerations in South Burlington.

Figure 1.11

Zoning Map

South Burlington, Vermont

Effective February 25, 2008

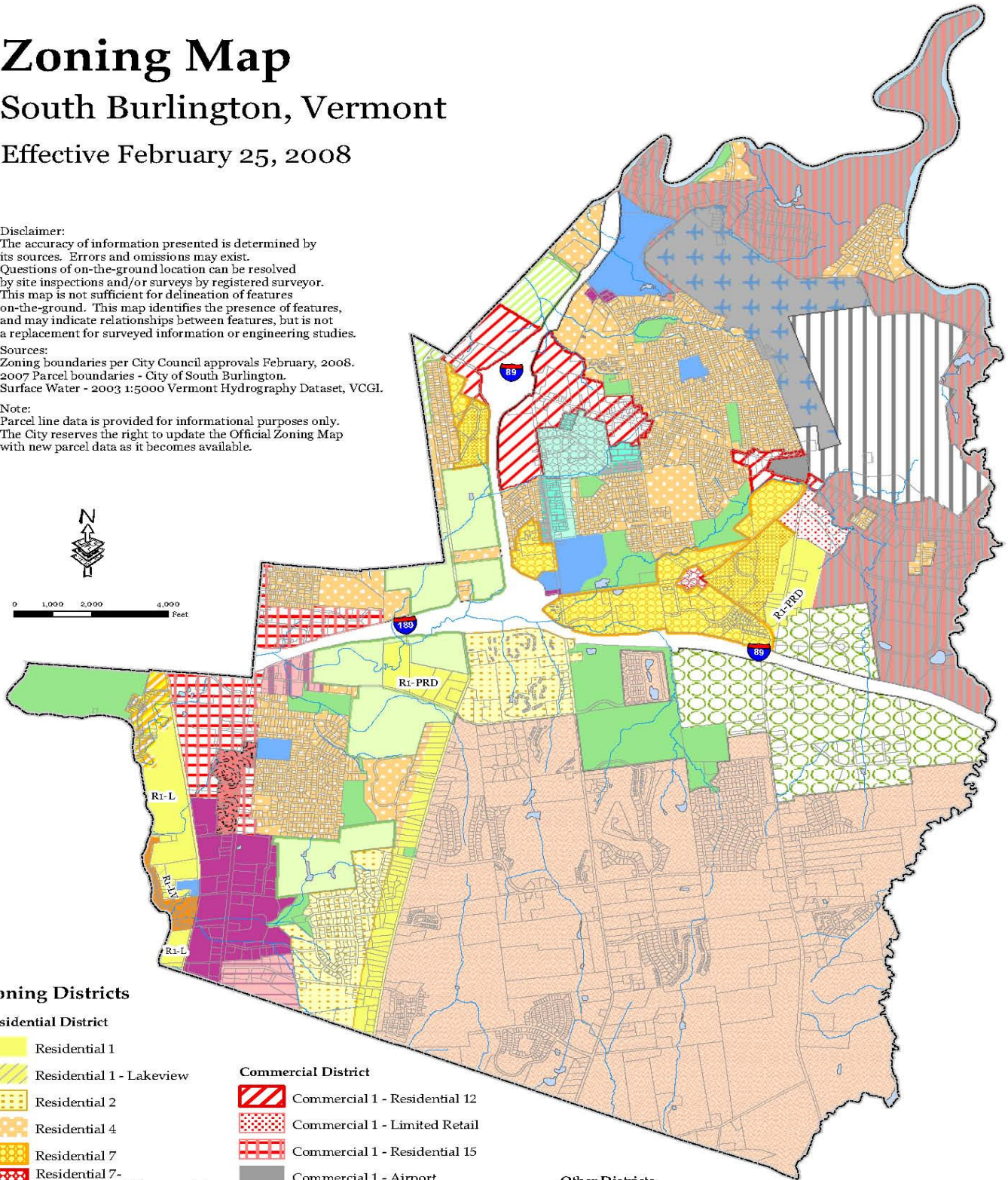
Disclaimer:
The accuracy of information presented is determined by its sources. Errors and omissions may exist. Questions of on-the-ground location can be resolved by site inspections and/or surveys by registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

Sources:
Zoning boundaries per City Council approvals February, 2008.
2007 Parcel boundaries - City of South Burlington.
Surface Water - 2003 1:5000 Vermont Hydrography Dataset, VCGL.

Note:
Parcel line data is provided for informational purposes only. The City reserves the right to update the Official Zoning Map with new parcel data as it becomes available.



0 1,000 2,000 4,000 Feet



Zoning Districts

Residential District

- Residential 1
- Residential 1 - Lakeview
- Residential 2
- Residential 4
- Residential 7
- Residential 7-Neighborhood Commercial
- Residential 12
- Lakeshore Neighborhood
- Queen City Park

Central District

- Central District 1
- Central District 2
- Central District 3
- Central District 4

Commercial District

- Commercial 1 - Residential 12
- Commercial 1 - Limited Retail
- Commercial 1 - Residential 15
- Commercial 1 - Airport
- Commercial 1 - Automobile
- Commercial 2
- Swift Street
- Allen Road

Industrial and Airport District

- Mixed Industrial & Commercial
- Airport
- Airport Industrial
- Industrial & Open Space

Other Districts

- Institutional & Agricultural-North
- Institutional & Agricultural-South
- Park & Recreation
- Municipal
- Southeast Quadrant
- Interstate Highway Overlay

- City boundary
- Roads
- Tax parcels
- Stream / River
- Lakes / Ponds



1.7 AIRSIDE FACILITIES

The following section describes the airside components of BTV as they existed in 2009. Included is a review of runways and taxiways, ramps, navigational aids (NAVAIDs) on the airfield, business/general aviation facilities and airport airspace. Refer to **Figure 1.13** for an illustration of these facilities.

1.7.1 Airport Classification and Design Criteria

The FAA defines the critical aircraft of a facility as the largest or most demanding aircraft that conducts at least 500 operations a year at the airport. The critical aircraft is in turn used to determine FAA design and safety standards for runways, taxiways and aprons. An airport, such as BTV, has multiple types of aircraft using various facilities on the airfield and is not unusual to have multiple critical aircraft for different areas of the airport. The critical aircraft is designated by an alpha-numeric code that correlates with the published approach speed and wingspan of the aircraft (see **Figure 1.12**).

Figure 1.12: Airport Reference Code Designations		
Approach Category	Approach Speeds of:	Example Aircraft
A	less than 91 knots	Beech Bonanza
B	greater than 91 knots but less than 121 knots	Beech King Air
C	greater than 121 knots but less than 141 knots	Gulfstream III
D	greater than 141 knots but less than 160 knots	Boeing 777
E	greater than 161 knots	Lockheed SR-71
Airplane Design Group	Wingspans of:	Example Aircraft
I	less than 49-feet	Beach Baron
II	greater than 49-feet but less than 79-feet	Cessna Citation
III	greater than 79-feet but less than 118-feet	Boeing 737-500
IV	greater than 118-feet but less than 171-feet	Boeing 757
V	greater than 171-feet but less than 214-feet	Boeing 747-400
VI	greater than 214-feet but less than 262-feet	Lockheed C-5B
Source: FAA AC 150/5300-13 <i>Airport Design</i>		

According to the approved 2006 ALP, the overall critical aircraft at BTV is currently the Boeing 757. This aircraft has an approach speed of 135 knots (approach category C) and has a



wingspan of 124.8-feet (design group IV).

The critical aircraft for the business/general aviation specific facilities, including Runway 1-19, is currently the CL-604 “Challenger” aircraft manufactured by Bombardier. The Challenger aircraft has a published approach speed of 117 knots which places it in approach category B and a published wingspan of 64-feet which places it in design group II. In critical movement areas such as near the Fixed Base Operators (FBOs), group III design standards will be adhered to so that larger business use aircraft such as the Gulfstream 550 may safely use the facility.

The critical aircraft for cargo facilities is currently the narrow-body cargo aircraft, Boeing 737 aircraft. Boeing 737 aircraft are in approach category C and have wingspans between 95-feet and 115-feet placing them in design group III.

The Master Plan Update will re-examine the critical aircraft in Chapter Three Facility Requirements and provide a recommendation for the airport's future critical aircraft.

1.7.2 Runway System

The existing airfield configuration at BTV consists of two runways; one oriented in a northwest-southeast direction (Runway 15-33) and one oriented in a north-south direction (Runway 1-19). The two runways intersect approximately 3,325-feet from the Runway 15 threshold and 3,015-feet from the Runway 33 threshold. Runway 15-33 is the primary commercial service and military runway while Runway 1-19 is used by general aviation aircraft.

Runway 15-33: This runway is 8,322-feet in length by 150-feet in width. Runway 15 has a surveyed runway end elevation of 303.2-feet above mean sea level (amsl) while Runway 33 has a surveyed runway end elevation of 333.2-feet amsl which equates into an effective runway gradient (ERG) of 0.36-percent. The slope of the runway is constant from the runway high point (Runway 33 threshold) to the runway low point (Runway 15 threshold).

Runway 15-33 was rehabilitated in winter 2010 with bituminous concrete along the majority of the length, and Portland Cement Concrete on each runway end. It has a pavement strength rating of 100,000 pounds single-wheel, 175,000 pounds dual wheel, and 355,000 pounds dual tandem wheel (Airport Master Record 5010 Form 4/13/06, <http://www.gcr1.com/5010web/>). Runway 15-33 has several visual navigational aides including high intensity runway lighting (HIRL), a visual approach slope indicator (VASI) on the approach end of Runway 33 and Runway End Identification Lights (REILs) on the approach end of Runway 33. Additionally, both approach ends of Runway 15-33 have approach lighting systems (ALS) with Runway 15 having a Medium Intensity Approach Lighting System with Runway Alignment Identification Lights (MALSR) and Runway 33 having a MALS with Sequenced Flashers (MALSF).

Runway 1-19: This runway is 3,612-feet in length by 75-feet in width. Runway 1 has a surveyed runway end elevation of 334.5-feet above mean sea level (amsl) while Runway 19 has a

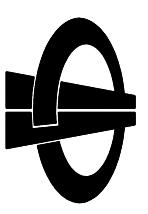
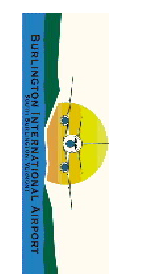
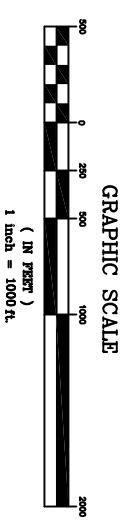
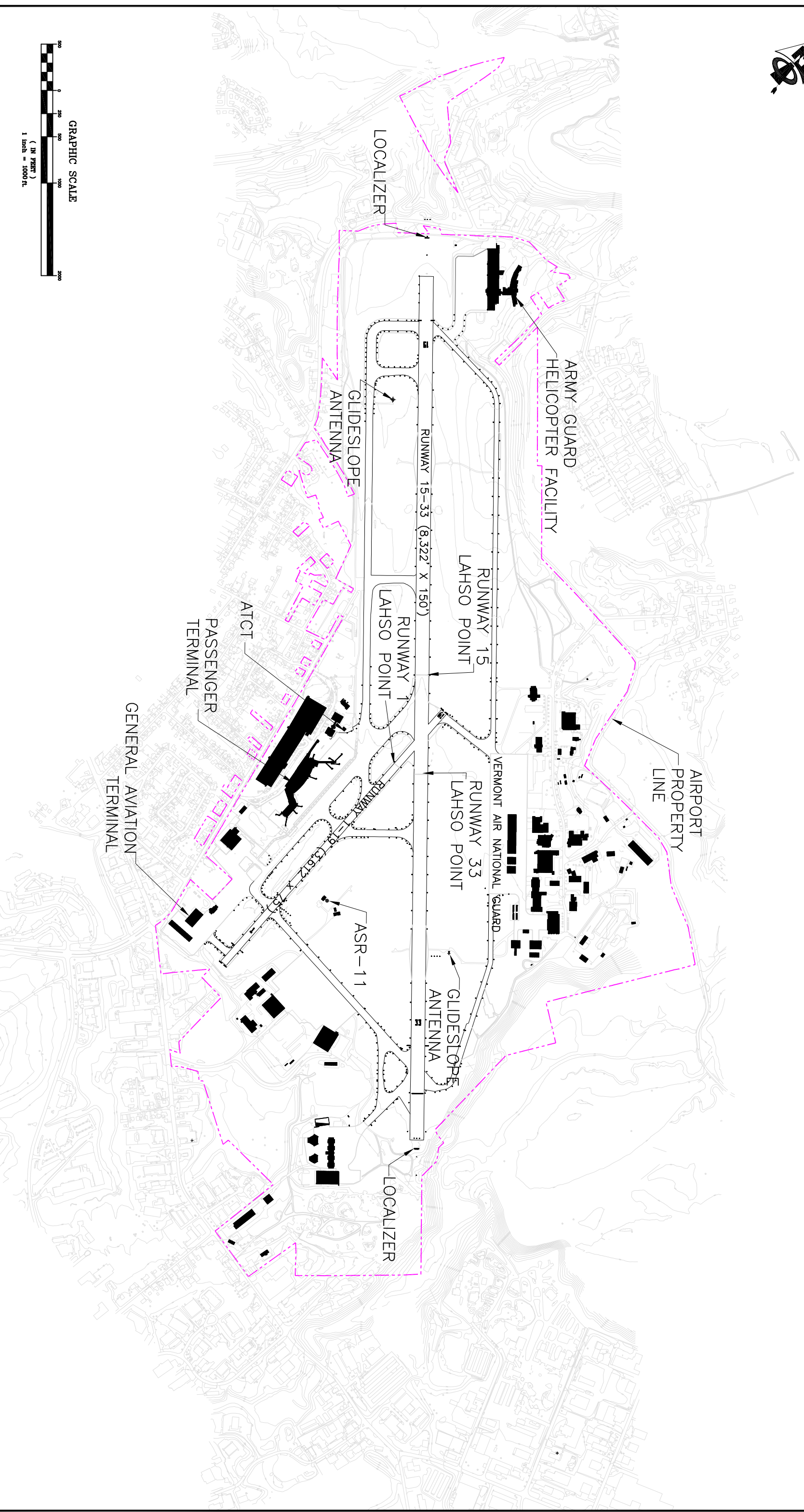


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surveyed runway end elevation of 329.4-feet amsl which equates into an effective runway gradient (ERG) of 0.14-percent. The runway high point for Runway 1-19 is 334.5-feet amsl located at the Runway 1 threshold. The runway low point is the Runway 19 threshold (329.4-feet amsl). Visual navigation aids include medium intensity runway lighting (MIRLs) and a VASI for Runway 1 and a precision approach path indicator (PAPI) for Runway 19.

Runway 1-19 is constructed of bituminous concrete. Due to various rehabilitation efforts and to accommodate commercial aircraft taxiing along sections of Runway 15-33, there are various pavement strengths along its length. The various sections are as follows:

- From the South end to Taxiway "C" = Reconstructed in 1993 with 8" P209, 4" P401 Strength- S 30,000; D 60,000; DT 90,000
- From Taxiway "C" to just south of Runway 15/33 = Reconstructed in 1993 with 11" P209, 13" P401 Strength- S 75,000; D 209,000; DT 400,000
- North of Runway 15/33 to North End = Constructed in 1958, and overlaid in 1985 resulting in 5.5" Gravel, 1.5" Hot Mix, 6" P401 overlay; Strength- S 30,000; D 60,000; DT 90,000



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FIGURE 1.13

2009 Existing Facilities



Displaced and Relocated Thresholds: Due to property boundary and land use constraints as well as surrounding topography, three of the four approach ends to the two runways have either relocated or displaced thresholds. The end of Runway 15 was located to its present position effectively creating a 488-foot paved blast-pad beyond the threshold. Similarly, the end of Runway 33 was located to its present position effectively creating a 523-foot paved blast pad beyond the runway end. The threshold to Runway 33, however, is displaced an additional 503-feet in order to meet the required FAA Runway Safety Area length beyond the threshold of 1000-feet. Operationally, this 503-foot displacement can be used for westerly departures. The threshold to Runway 1 was displaced 225-feet from the runway end to accommodate the required 300-feet of Runway Safety Area length.

Declared Distances: Associated with the displaced thresholds; declared distances were established for both runways in order to maximize the amount of runway available for operations and to provide for full runway safety areas. According to FAA Advisory Circular 150/5300-13 "Airport Design," declared distances are defined as "The distances the airport owner declares available for the airplane's takeoff run (TORA), takeoff distance (TODA), accelerate-stop distance (ASDA) and landing distance (LDA) requirements." These distances can be established for several reasons including safety area and other design standards, pavement condition, or obstacles in the approach/departure areas. While the FAA approves these distances, many of these distances are performance dependent and, as such, must be determined by the aircraft operator for his specific circumstances.

Figure 1.14: 2009 Published Declared Distances^a

	RW 15	RW 33	RW 1	RW 19
TORA	7,820'	8,320'	3,611'	3,611'
TODA	7,820'	8,320'	3,611'	3,611'
ASDA	7,820'	8,320'	3,611'	3,386'
LDA	7,820'	7,820'	3,386'	3,386'

Land and Hold Short Operations: FAA air traffic control at BTV maintains Land and Hold Short Operations (LAHSO) for the approaches to Runways 1, 15 and 33 (Runway 19 does not have a hold short procedure due to the proximity of Runway 19 threshold to Runway 15-33). LAHSO operations are generally conducted during periods of VMC weather when visibility is greater than 3 miles and ceiling heights are above 1,000-feet. Several types of visual navigational aids are typically present on runways that support LAHSOs in order to inform the pilot of the hold-short location. These typically include special runway markings, signage and lighting. The hold short markings are standard runway hold position markings as found in FAA AC 150/5340-1H "Standards for Airport Markings". Runway signs at the location of the hold short point include

^a The Declared Distances were updated in 2012 following the pavement extension to Runway 19. Please refer to the ALP Sheet (Section Seven) for updated declared distances. At the time that these 2009 Declared Distances were computed, the lengths of Runways 1-19 and 15-33 were reported to be 3,611-feet and 8,320-feet, respectively.



standard runway signs indicating to the pilot the runway they are currently on and the intersecting runway/taxiway designation.

According to the United States Government Flight Information Publication, Runway 1-19 has one LAHSO position for operations on Runway 1. The hold short point for LAHSOs on Runway 1 is approximately 2,600-feet from the threshold. Runway 15-33 has two LAHSO positions. For LAHSOs on Runway 33, the hold short point is approximately 2,900-feet from the threshold and for LAHSOs on Runway 15; the hold short point is 3,750-feet from the threshold (see **Figure 1.13**).

1.7.3 Taxiway System

The taxiway system at BTV serves the various users of the airfield (commercial, general aviation and military) through a series of parallel and connecting taxiways. As of 2009, there were 11 taxiways connecting the runways and aprons at the airport. All of the taxiways have medium intensity taxiway lights (MITLs). **Figure 1.15** presents the designation and the location of the taxiways as they existed in 2009.

Runway 15-33: There are eight exit taxiways available for aircraft landing on Runway 15-33 at BTV, two of which are for military use only and access the National Guard facilities. Five of the remaining are available to operations in either direction. Runway 15-33 is served by Taxiways Bravo, Hotel, Alpha, Charlie, Golf 1 and Golf.

Runway 1-19: The length of Runway 1-19 (3,600-feet) generally restricts the runway from being able to accommodate aircraft larger than Category B. Additionally, the exit taxiways that are provided have been placed at locations that enhance the access from Runway 15-33 to the commercial apron (i.e., Taxiway Bravo). Runway 1-19 is served by Taxiways Golf, Alpha, Bravo, and Charlie.

A taxiway rehabilitation and expansion project was completed at the airport in winter 2010, which included rehabbing the pavement on Taxiway Charlie as well as extending Taxiway Golf the full length of Runway 15-33 in order to provide full parallel capability, and demolishing Taxiways Kilo and Juliet. See Airport Layout Plan Sheet 3 (**Section Seven**) for the taxiway alignment at the airport as of late 2010. A rehabilitation of the remainder of Taxiway Golf (toward the Runway 15 end) and Taxiway Bravo is planned for 2012.

Summary: The exit locations at BTV support the use of Runway 15-33 for commercial and military activity and Runway 1-19 for small commuter aircraft and business/general aviation activity.

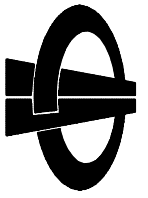
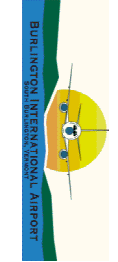
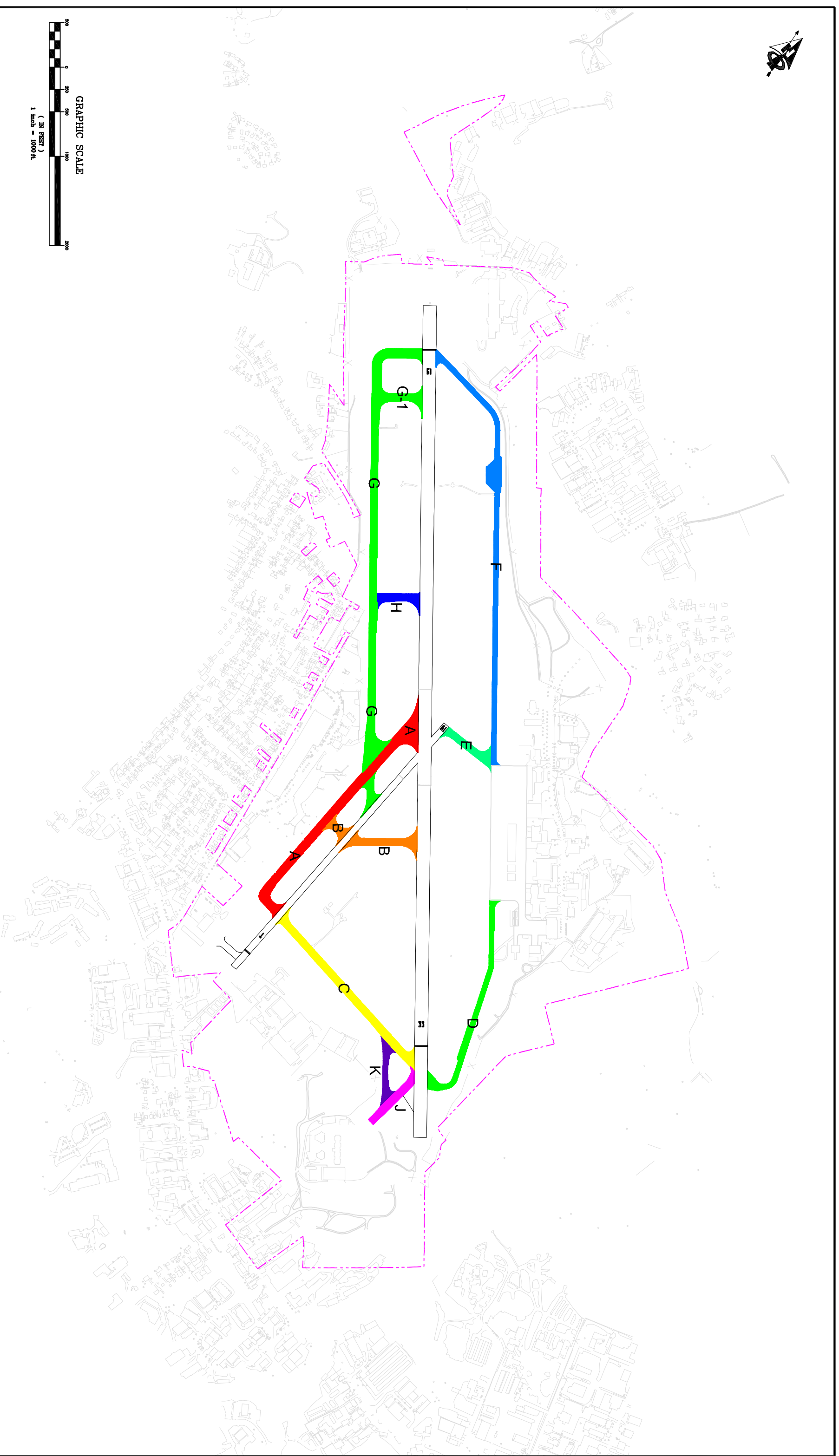
1.7.4 Aprons

The apron system at BTV is well developed, with approximately 207,000 square yards in apron pavement. The commercial apron is approximately 74,000 square yards in size. The cargo apron is approximately 44,000 square yards. The GA apron south of the terminal is



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approximately 41,000 square yards and the GA apron in the South End area is approximately 31,000 square yards. A new South End Development (SED) cargo apron space is currently being constructed, and measures approximately 17,000 square yards (see **Figure 1.16**).



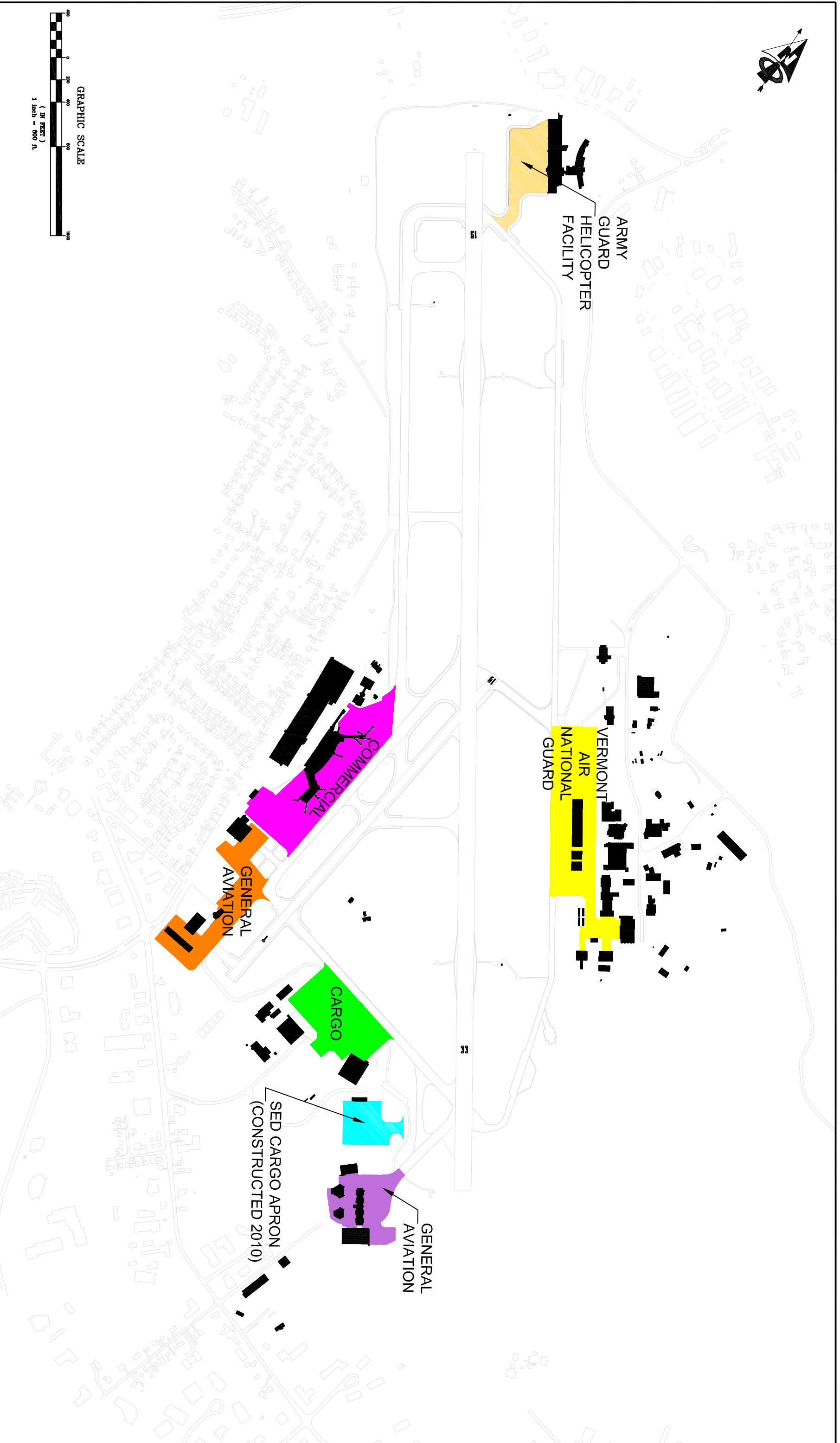
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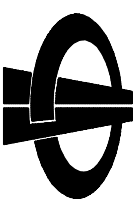
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FIGURE 1.15

2009 Taxiway Locations and Designations



GRAPHIC SCALE
(IN FEET)
1 inch = 800 ft.



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FIGURE 1.16

2010 Airport Ramps



1.7.5 Navigational Aids

There are two primary types of navigation aids that help pilots locate the airport and execute approaches: electronic and visual. Electronic navigational aids transmit data via radio waves which are then received by the aircraft and transmitted to the pilot via instruments in the cockpit. Visual navigational aids transmit data that is interpreted directly by the pilot. Visual navigational information is often used to confirm information transmitted by the electronic navigational instruments, especially during periods of transition between instrument flight rules and visual flight rules (when an aircraft is conducting a precision instrument approach and gains visual contact with the runway).

Electronic: Electronic navigational aids (NAVAIDs) at BTV include the localizer antenna arrays, glideslope antennas, the Airport Surveillance Radar (ASR), the Terminal Very High Frequency Omni-directional Range (TVOR), and the Air Traffic Control Tower (ATCT) located near the passenger terminal building. All of the electronic navigational aids have either line of sight criteria or critical areas that are required to be protected. The critical areas are established to minimize signal degradation by controlling the placement of objects that could interfere with signal quality. The following is a brief description of the various systems, their associated critical areas, and any known issues or concerns for possible signal degradation.

Localizer Antenna Array

The localizer antenna array provides horizontal guidance to pilots who are operating aircraft with the requisite instruments and forms one of the two components required for ground-based precision instrument approaches. The existing localizer antenna arrays are located approximately 900-feet in front of the Runway 15 threshold and 1,100-feet in front of the Runway 33 threshold. The critical area for these systems is 2,050-feet long by 400-feet wide with a keyhole shaped expansion surrounding the array itself. There are no known concerns of signal interference.

Glideslope Antennas

The glideslope antennas form the second part of the ground-based precision instrument approach system to Runways 15 and 33. The glideslope antennas transmit radio waves on a dedicated frequency to the runway surface. These radio waves are received by an aircraft's navigational radio. This informs the pilot if the aircraft is on a correct glide-path to the runway. The glideslope on Runway 15 defines an approach path with a 3 degree angle; the glideslope on Runway 33 defines an approach path with a 3.2 degree angle.

The two glideslope masts are approximately 45-feet in height and are located between the touchdown and aiming points on Runway 15 and Runway 33 and are approximately 355-feet and 320-feet from the centerline. Each glideslope has a critical area that extends from approximately 50-feet from behind the mast to 1,000-feet in front (into the direction of the approach) from the mast. Because the glideslope relies



on “bouncing” the signal from the ground, this area must be graded and kept free of any object that may interfere with the quality of the glideslope signal. Based on aerial mapping conducted in October 2008, each glideslope critical area is free of objects that may degrade signal quality.

Airport Surveillance Radar

The ASR has a primary function of transmitting telemetry data to the controllers in the Air Traffic Control Tower (ATCT). This data is used by controllers to sequence aircraft into the airport and to provide proper spacing between aircraft. The ASR is the primary instrument used to transition aircraft from Air Route Traffic Control Centers (ARTCCs) to the local airspace.

The airport surveillance radar (ASR) is located between Runway 15-33, Runway 1-19 and Taxiway Charlie, and is approximately 50-feet above ground level. In 2005 the previous analog based ASR-9 radar system was replaced by a digital-based ASR-11 system. The new ASR-11 allows controllers to have information delivered and refreshed at a quicker rate than with the previous analog system. This in turn allows controllers to sequence aircraft more efficiently and reduce spacing (although not below FAA required minimums) which allows the airspace to handle more operations.

There is a 1,500-foot critical area associated with the ASR-11. Objects can be placed within the ASR critical area provided that they remain below the feedhorn height of the primary surveillance radar portion of the ASR-11 and are not constructed of material that could reflect the signal. Objects within the 1,500-foot ASR-11 critical area include the passenger terminal complex, the general aviation apron, FBO building, Buildings 880 and 890 and their associated ramp space. An examination of the topography and objects within the glideslope critical area found no obvious obstructions that could cause signal degradation.

Visual: Several visual navigational aids are also utilized at BTV. Typically, visual navigation aids include pavement marking, approach lighting systems, runway lighting, runway end identifier lights (REILs), precision approach path indicators (PAPIs), windcones, segmented circles, and rotating beacons.

Pavement Markings and Runway Lighting

Pavement markings on Runway 15-33 are precision runway markings. These markings include standard threshold markings, runway end numerals, touchdown zone markings, aiming point markings and runway centerline markings. Pavement markings on Runway 1-19 include non-precision markings on Runway 1 and visual markings on Runway 19.



Approach Lighting System

An approach lighting system is a series of lights that extend into the approach area and help the pilot establish the runway centerline during periods of reduced visibility (effectively allowing the pilot to “see” the runway sooner). Runways 15 and 33 have approach lighting systems consistent with the published precision instrument approaches (see **Section 1.10**).

Runway 15 has a Medium Intensity Approach Lighting System with Runway Alignment Identification Lights, or a MALSR. The MALSR is a series of lights spaced 200-feet apart and extend from the threshold to 2,400-feet into the approach. The MALSR system includes a series of steady burning white lights that extend 1,200-feet into the approach and a series of five to seven flashing strobe lights that extend another 1,000 to 1,400-feet into the approach. The five to seven strobe lights flash at a rate of twice every second and form a “traveling white ball” that guides the pilot to the runway threshold.

All approach lighting systems have an area that is considered critical. This critical area is established to allow the pilot to have an unobstructed view of the approach lighting system. With each approach lighting system, a light plane is established which extends at a slope of 50:1 from the runway threshold to 200-feet past the last light in the approach lighting system. The light plane slope is required to be free of any object, particularly vegetation that could obscure one of the lights. Based on the aerial photography conducted in October 2008, the approach light plane for the MALSR to Runway 15 is free of penetrations.

Runway 33 has a MALSF, or Medium Intensity Approach Lighting System with Sequenced Flashers. The MALSF is a shorter approach lighting system than the MALSR, and has fewer sequenced flashing lights in the system. The MALSF is 1,400-feet in total length with the first 1,000-feet from the threshold containing steady burning white lights similar to the MALSR; however, the MALSF only has three flashing lights. Based on the aerial photography conducted in October 2008, the approach light plane for the MALSF to Runway 33 is free of penetrations.

Runway End Identification Lights (REILs)

Runway End Identification Lights, or REILs, help pilots identify a runway end when competing light sources from urbanization (streetlights) make finding the runway difficult. With BTV located in an urban area the REILs are an important part of the visual navigational aid system at the airport. REILs are strobe lights that flash at a rate of two times per second and are visible to pilots that are within 10-degrees of the runway alignment. All four runway ends at BTV have REILs, with the REILs on Runway 15 and Runway 33 forming an integral part of the approach lighting systems.



Precision Approach Path Indicators (PAPIs)

All four runway ends are equipped with Precision Approach Path Indicators, or PAPIs. A PAPI is not a portion of a precision instrument approach system; however, they are used to supplement electronic navigational information when a pilot gains a visual of the runway. The primary role of the PAPI is to provide visual descent information during periods of visual flight rules (VFR) and to inform the pilot if they are on the correct descent path to the runway. A PAPI consists of a series of lights that are located near the touchdown point of the runway. These lights have lenses inside that act as a prism and transmit either white or red light. The combination of white and red allow a pilot to determine if they are either too high on the approach, too low on the approach, or on the correct approach to the runway. Runways 15, 33, and 1 have 4-box PAPIs while Runway 19 has a 2-box PAPI.

Other Visual Navigational Aids

BTV has several other visual navigational aids, including a rotating beacon, a lighted windcone, and segmented circle. A rotating beacon is located on top of the General Aviation Terminal and helps pilots locate the airfield during nighttime operations or during periods of low visibility. The green-white-green pattern of light indicates that the airfield is a civilian airport. A segmented circle provides traffic pattern information to pilots while they are approaching the facility and informs pilots of how they should enter the traffic pattern and the flow of traffic in the pattern (i.e, right-turns or left-turns). According to the segmented circle located near the threshold to Runway 19, standard left turn entries onto the final approach to both runways have been established at the airport.

1.7.6 Pavement Analysis

According to a July 1999 Hoyle, Tanner, and Associates report (which includes the latest available pavement strength document), the majority of the runway, taxiway and aprons were constructed in the 1950s. There were at least nine different pavement sections on Runway 15-33 with a majority of the usable runway surface either having a surface course or an overlay consisting of P-401 Bituminous Asphalt. The center 7,000-foot section was overlaid in 1985 with 6-inches of P-401 on top of the existing 8-inches of gravel, 3-inches of bituminous concrete and 3-inches of P-401. Runway 15-33 was rehabilitated in winter 2010 using bituminous concrete for the majority of the runway length, and Portland Cement Concrete along both runway ends.

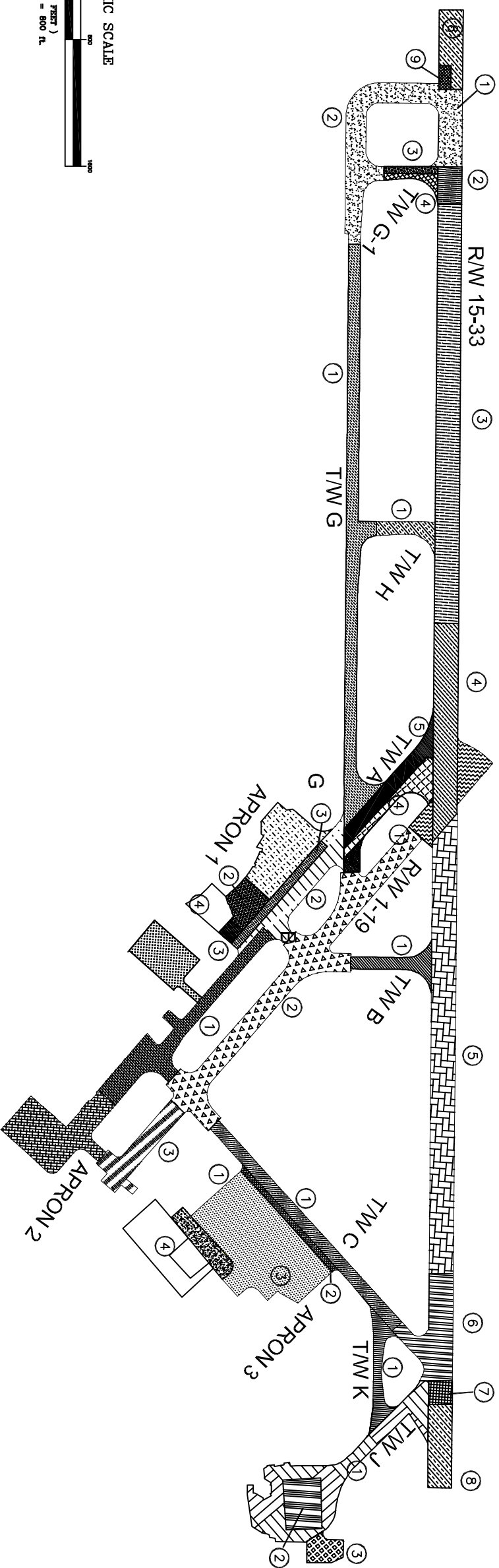
As described in **Section 1.7.2**, Runway 1-19 has three different pavement sections with varying strengths. In 1993, the center 2,300-feet of Runway 1-19 was reconstructed with a pavement section consisting of a surface course of 13-inches of P-401 on a base course of 11-inches of P-209 and is rated at a double tandem strength of 400,000 pounds. However, the first 650-feet of Runway 1, which was constructed in 1993, has a pavement section of 4-inches of P-401 on 8-inches of P-209 and is rated at a double tandem strength of 90,000 pounds. The first 650-feet of Runway 19 was constructed in 1958 and overlaid in 1985 with 6-inches of P-401, presumably as



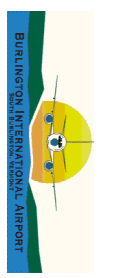
part of the overlay project for Runway 15-33.

A majority of the taxiways and aprons have a P-401 surface course; however, the depth of the course varies depending on the year of the overlayment. Taxiways Alpha and Hotel have a P-401 surface course of approximately 11-inches to 14-inches in depth. The inner half of Taxiway Golf-1 (the side nearest the glideslope antenna) was overlaid with 6-inches of P-401 in 1997. Additionally, Taxiway Hotel had a 6-inch P-401 overlay in 1985.

A taxiway rehabilitation project was completed in winter 2010 which rehabilitated Taxiway Charlie and extended Taxiway Golf toward the south to become a full parallel taxiway to Runway 15-33. This project required Taxiways Kilo and Juliet to be demolished. The taxiway rehabilitation project used bituminous concrete. A rehabilitation of the original Taxiway Golf (toward the Runway 15 end) and Taxiway Bravo is planned in the near future.



SYMBOL	SUBBASE CLASS	BASE COURSE	SURFACE COURSE	OVERLAY		PAVEMENT STRENGTH		CONSTRUCTION DATES		SYMBOL	SUBBASE CLASS	BASE COURSE	SURFACE COURSE	OVERLAY		PAVEMENT STRENGTH		CONSTRUCTION DATES	
				FIRST	SECOND	SINGLE	DUAL	ORIG.	OVERLAY					FIRST	SECOND	SINGLE	DUAL	ORIG.	OVERLAY
1	34" P-154	6" P-209	12" P-401			75,000	209,000	1997		1	5" P-154	11" P-401			75,000	209,000	1978		
2		6" GRAVEL	17" PCC	3" P-401	6" P-401	75,000	209,000	1951	'68/'84	2	34" P-154	6" P-209	12" P-401		75,000	209,000	1997		
3	21"	8" GRAVEL	3" BIT. CON.	3" P-401	6" P-401	75,000	209,000	1958	'84/'5	3	36" P-152	5" P-154	11" P-401		75,000	209,000	1978		
4		7" GRAVEL	2.5" BIT. CON.	3" P-401	6" P-401	75,000	209,000	1958	1985	4	36" P-152	5" P-154	11" P-401	6" P-401	75,000	209,000	1978	1997	
5	4.5" EM. ASPH.	3" COLD MIX	2.5" HOT MIX	3" P-401	6" P-401	75,000	209,000	1958	1985		5" P-154	11" P-401	6" P-401		75,000	209,000	1978	1985	
6		5" P-209	13" P-401			75,000	209,000	1984			8" GRAVEL	3" BIT. CON.			75,000	100,000	1952		
7		6" GRAVEL	17" PCC			75,000	209,000	1951		2	6" GRAVEL	10" PCC			75,000		1951		
8		STABILIZED OVERRUN (TYPICAL)								3	N/A	N/A					1982±		
9	34" P-154	14" P-209	4" P-401							1	9" P-209	4" P-401			30,000	60,000	1990		
RW 1-19:		5.5" GRAVEL	1.5" HOT MIX	6" P-401		30,000	60,000	1958	1985	1	6" P-209	18" P-501			75,000	209,000	1988		
1		11" P-209	13" P-401			75,000	209,000	1993		2	6" P-209	18" P-501			75,000	209,000	1987		
2		8" P-209	4" P-401			30,000	60,000	1993		3	6" P-209	14" P-401			75,000	209,000	1987		
T/W 'A':		6" P-209	14" P-401			75,000	209,000	1990		4	8" P-209	4" P-401			30,000	60,000	1987		
1		6" P-209	14" P-401			75,000	209,000	1986		5	7" P-154	3" P-401			30,000	60,000	1983		
2		PCC		P-401		30,000	60,000	1986		1	6" P-209	4" P-401			30,000	60,000	1980		
3		6" PCC	3" P-401			1983				2	6" GRAVEL	9" PCC	BIT. CON.						
4		7" P-209	3" P-401			1968				3	6" GRAVEL	9" PCC			50,000	75,000	'51/'8		
T/W 'B':		8" P-209	2.5" BIT. CON.	4" P-401		40,000	65,000	1981		4	6" P-209	4" P-401			45,000	80,000	1985		
1		9" P-209	4" P-401	N/A		N/A		N/A											



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 VISION 2030 MASTER PLAN UPDATE

FIGURE 1.17
 2009 Pavement Sections



1.8 LANDSIDE FACILITIES

1.8.1 Buildings

As of 2009, there are 24 buildings on airport property (not including the Vermont Air National Guard buildings north of Runway 15-33). In 2006 the airport completed a second expansion of the terminal building (the "NOTE 2") which added five gate positions to the airport. Tenants at the airport vary from commercial and corporate users of the airfield to National Guard and other governmental agencies. Thirteen of the buildings are hangars located on the southwestern portion of the airfield. In total, there are 12 t-hangars and 21 box hangars on airport property.

1.8.2 Aircraft Rescue and Fire Fighting (ARFF)

As of 2009, BTV had eight ARFF vehicles. These include two quick response vehicles, two ARFF trucks, a Water Tanker, Structural truck, heavy rescue vehicle, and a foam trailer to resupply the trucks.

1.8.3 Fuel Farm

The fuel farm is located on the south end of the airfield near the end of Runway 33. As of early 2009, the fuel farm has 3 above-ground, 20,000 gallon Jet-A storage tanks and one below-ground, 12,000 gallon AvGas tank.

1.8.4 Airport Airspace

FAA Order 7400.2A "Procedures for Handling Airspace Matters" defines five classifications of controlled airspace: Class A, Class B, Class C, Class D, and Class E airspace. Controlled airspace denotes an area of defined dimensions within which air traffic control services are provided to both instrument and visual flights. Additionally, each class of controlled airspace also carries different requirements for pilot qualifications, operating rules, and equipment requirements. Generally, the determination of airspace as one class of airspace or another is a function of the volume of aircraft movements, number of enplaned passengers (if applicable), the traffic density, and the type or nature of operations being conducted.

The airspace above BTV is classified on the March 2009 edition of the aeronautical sectional as Class C airspace. Class C airspace is generally controlled airspace from the surface up to 4,000-feet above the established airport elevation.

A typical class C airspace configuration consists of two concentric circles. The inner controlled area, called the surface area, is typically 5 nautical miles in diameter and extends from the surface to 4,000-feet above the established airport elevation. A second area of Class C airspace surrounds the surface area and has a diameter of 10 nautical miles and extends from 1,200-feet above the established airport elevation to 4,000-feet above the established airport elevation.



Burlington International Airport South Burlington, Vermont

Due to rising terrain located to the east and southeast of the airport, the Class C airspace above BTV is divided into three distinct areas. The surface has a 5 nautical mile diameter and extends to 4,400-feet above mean sea level (amsl) which is approximately 4,100 feet above the established airport elevation. The reason this is slightly greater than the 4,000-foot guidance is because altitude is typically rounded up to the nearest 100-foot. The second controlled area in the Class C airspace above BTV is split into two different areas: an “east” and “west” Class C airspace. The “east” Class C airspace has a surface elevation of 2,200-feet and extends up to 4,400-feet. The “west” Class C airspace has a surface elevation of 1,500-feet and extends up to 4,400-feet above established airport elevation.

Special use airspace does exist within the immediate vicinity of the Burlington VOR. The R-6501 A and B airspace is located to the east of BTV near Underhill, Vermont. The presence of the restricted airspace results in a one nautical mile reduction in the diameter of the eastern Class C airspace. Restricted airspace R6401-A is operational from the surface to 4,000-feet amsl from 0700 to 2300 hours Monday through Friday and all hours of the day Saturday and Sunday.

Additionally, R6501-B is operational from 4,000-feet to 13,600-feet on an intermittent basis. Burlington Approach Control is identified as the controlling agency for both R6501 A and B. **Figure 1-18** is taken from the Montreal sectional and shows the navigational information presented in the sectional.



Figure 1.18

Montreal Sectional Chart



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1.9 WEATHER AND WIND ANALYSIS

Weather conditions affect the operational performance of aircraft to varying degrees. Wind direction and wind speed affect landing and takeoff direction. Temperature, as well as wind, can affect how much runway length is required for a particular operation. High temperatures can result in payload restrictions being placed on thereby reducing their length of haul or cost efficiency. Local climatic trends are an important consideration in determining what configuration of facilities should be developed to best suit the airport users.

1.9.1 General

According to the National Oceanic and Atmospheric Administration (NOAA) weather recording station at BTV, a total of 83,121 individual observations of wind speed and direction were collected from 1998 to 2007. Data is presented in a format specifically designed by the FAA to be useful for evaluating airport operations at BTV and other nearby airports. Wind direction is grouped according to a 16-point compass rose (N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW). Wind speed is tabulated into groups of 0-3, 4-12, 13-15, 16-18, 19-24, 25-31 and 32 mph or greater. This data is generally displayed on a wind rose for each ceiling and visibility category evaluated (see **Figure 1.20**).

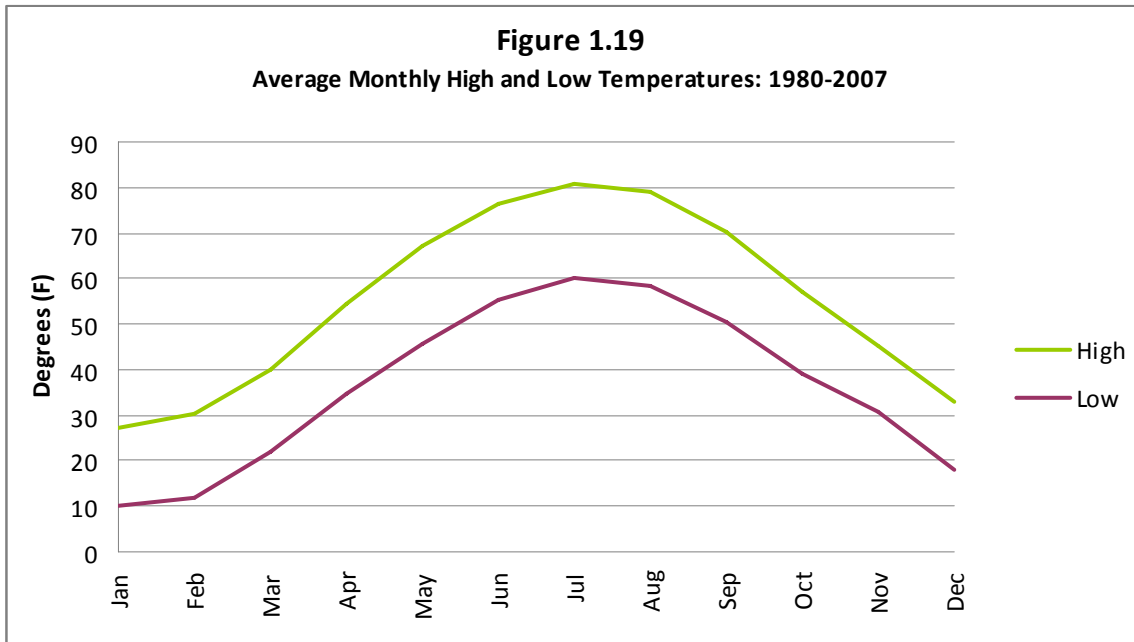
1.9.2 Local Climate

The geographic location of BTV in the upper latitudes of the northern hemisphere places the region in a climate that experiences extreme low temperatures during the winter months and cool springs, summers and falls.

According to the National Oceanic and Atmospheric Administration, the average daily maximum temperature of the hottest month since 1980 is approximately 81.0-degrees Fahrenheit (July) and the average daily minimum temperature of the coldest month is 10.1-degrees Fahrenheit (January) (See **Figure 1.19**). Average annual precipitation since 1980 is 36.26 inches, or about 3 inches per month. In 2008, Burlington received 35.78 inches of precipitation or an average of 2.98 inches per month. The heaviest month was July with 7.07 inches. Prevailing winds are generally from the west.

Snowfall during the winter months has averaged 17.3-inches since 1980 with total annual snowfall averaging 78.91-inches. Historically, the Burlington region receives snowfall from October through April with the heaviest snowfall occurring in December, January, February and March.

Conversely, the summer months in Burlington offer warmer temperatures and generally milder weather. The temperatures in spring, summer and fall rarely exceed 90-degrees Fahrenheit. Monthly precipitation in the spring, summer and fall months average 3-inches of rain. Annual rainfall since 1980 averages 36-inches of rain, with 11.6-inches of rain falling during the summer months.



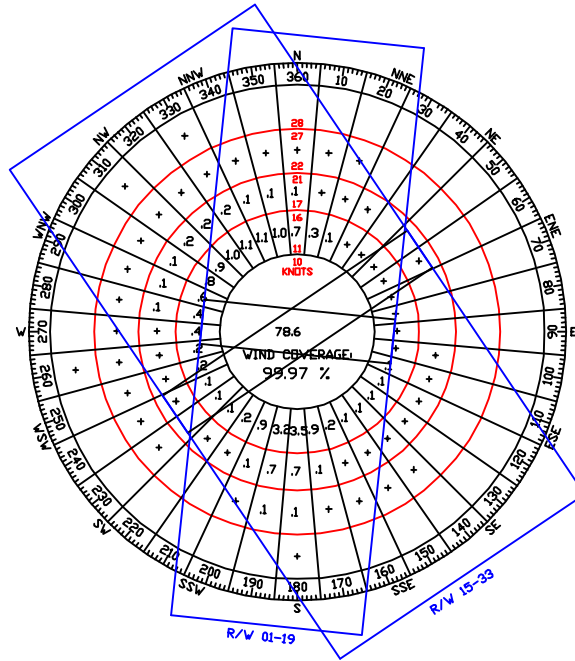
1.9.3 Wind Rose Analysis

A weather reporting station for the National Oceanic and Atmospheric Administration (NOAA) is located at BTV. The data provided by the NOAA's National Climatic Data Center (NCDC) was used in the wind rose analysis. Data from BTV was reported for the following weather conditions:

- **All Weather:** All weather conditions
- **VFR Weather:** Ceiling \geq 1,000-feet and Visibility \geq 3 miles
- **Non-Precision IFR Weather:** Ceiling \geq 200-feet but \leq 1,000 feet *and* Visibility \geq ½ mile but \leq 3 miles
- **Precision IFR Weather:** Ceiling \leq 200-feet and Visibility \leq ½ mile

Overall, 83,121 hourly observations were recorded at BTV (station ID #72617) for the years 1998-2007. Of these, approximately 77,943 observations (93.8-percent) were made under Visual Flight Rules (VFR), 4,585 observations (5.5-percent) were made under non-precision instrument flight rules and 581 observations (0.7-percent) were made under precision instrument flight rules.

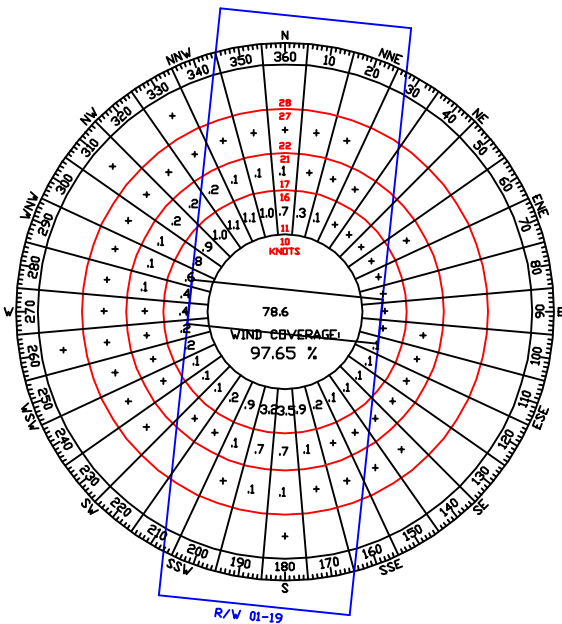
Figure 1.20: Windroses



STATION: BURLINGTON, VT
 RECORD PERIOD: 1998 - 2007
 TOTAL OBSERVATIONS: 83,121

COMBINED RUNWAY WIND COVERAGE

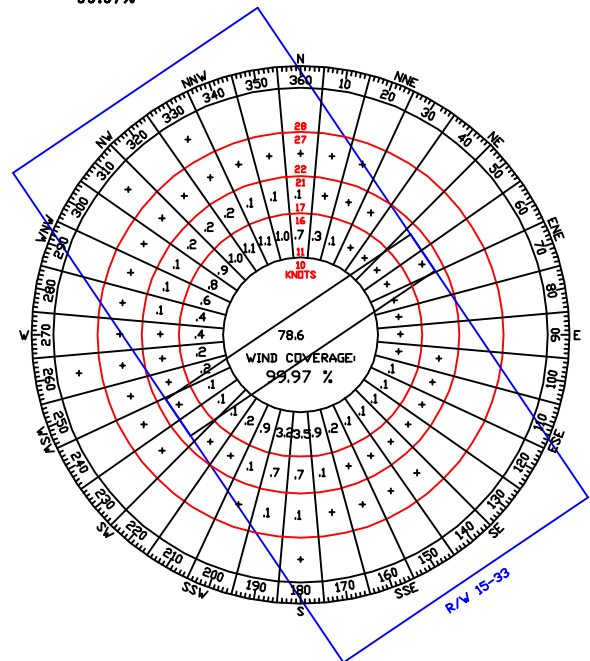
10.5 Knot	98.90%
13 Knot	99.59%
16 Knot	99.88%
20 Knot	99.97%



RUNWAY 1-19

INDIVIDUAL RUNWAY WIND COVERAGE

10.5 Knot	95.38%
13 Knot	97.65%
16 Knot	99.46%
20 Knot	99.91%



RUNWAY 15-33

INDIVIDUAL RUNWAY WIND COVERAGE

10.5 Knot	95.58%
13 Knot	98.55%
16 Knot	99.75%
20 Knot	99.97%



1.9.4 Historical Wind Velocities

Wind velocities in the region have historically been light to moderate, with more than 95-percent of “all weather observations” recording wind velocities below 16-knots. Additionally, almost 79-percent of the all weather observations recorded wind speed less than 10 knots. During periods of non-precision and precision instrument weather, wind velocities tend to become lighter as 0-knot to 10-knot wind velocities were reported 81.4-percent and 86.6-percent of the time respectively. Wind velocities in excess of 21-knots are rare (0.3-percent of total observations) during periods of non-precision and precision instrument weather (see Figure 1.22).

Figure 1.21: Recorded Wind Velocities by FAA Weather Classifications: 1998-2007

Weather Class	Criteria	Recorded Observations	% Occurrence
All Weather	All ceiling and visibility weather conditions	83,121	100.0%
Visual Approach	Ceiling \geq 1,000' and visibility \geq 3 miles	77,943	93.8%
Instrument Meteorological Conditions	Ceiling \geq 200' and \leq 1,000' and Visibility \geq 1/2 mile and \leq 3 miles	4,585	5.5%
Precision	Ceiling \leq 200' and/or visibility \leq 1/2 mile	581	0.7%

Source: NOAA

Figure 1.22: Reported Wind Velocities: RW 15-33 and RW 1-19

Wind Velocity Between:	All-Weather (100%)	Visual Approach (93.8%)	Instrument Meteorological Conditions (5.5%)	Precision Conditions (0.7%)
0-10 knots	65,307 (78.6%)	61,068 (78.3%)	3,730 (81.4%)	503 (86.6%)
11-16 knots	15,217 (18.3%)	14,415 (18.5%)	728 (15.9%)	71 (12.2%)
17-21 knots	2,359 (2.8%)	2,242 (2.9%)	110 (2.4%)	6 (1.0%)
22-41 knots	238 (0.3%)	218 (0.3%)	17 (0.4%)	1 (0.2%)
Total Observations:	83,121	77,943	4,585	581

Source: NOAA

1.9.5 Crosswind Coverage

The FAA suggests that runways have at least 95-percent crosswind coverage. Ideally, a runway should be oriented with the prevailing wind because aircraft performance is typically enhanced by flying the aircraft “into the wind.” Generally, the smaller the aircraft, the more it is affected by cross-wind components. The FAA has established recommended maximum crosswind component velocities for aircraft landing and take-off activities based on aircraft



size. These FAA crosswind component velocities can be found in Figure 1.23 and the results of the wind analysis for BTV are summarized in Figures 1.24, 1.25 and 1.26.

Aircraft Type	Allowable Crosswind Component Velocity
A-I and B-I	10.5 knots
A-II and B-II	13.0 knots
A-III and B-III and C-I through D-I	16.0 knots
A-IV	20.0 knots

Source: FAA AC 150/5300-13

As of 2009, the two-runway system at BTV is of sufficient length and width to accommodate the largest civilian and military aircraft in operation. However, it should also be noted that many smaller Group I and II business and general aviation aircraft use the facility as well. As such, the runway wind coverage analysis focuses on the requirements for Group I aircraft and above. The wind coverage analysis indicates that the existing runways at BTV provide adequate wind coverage for VFR, non-precision IFR and precision IFR weather categories.

Crosswind Component	All-Weather	Visual	Instrument Weather Conditions	Precision Conditions
10.5 knots	95.58%	95.39%	98.40%	99.46%
13.0 knots	98.55%	98.49%	99.37%	99.91%
16.0 knots	99.75%	99.74%	99.81%	100%
20.0 knots	99.97%	99.97%	99.96%	100%

Source: NOAA

Crosswind Component	All-Weather	Visual	Instrument Weather Conditions	Precision Conditions
10.5 knots	95.38%	95.27%	96.83%	98.35%
13.0 knots	97.65%	97.59%	98.47%	99.29%
16.0 knots	99.46%	99.45%	99.60%	99.75%
20.0 knots	99.91%	99.91%	99.94%	99.99%

Source: NOAA



Figure 1.26: Combined Wind Coverage				
Crosswind Component	All-Weather	Visual	Instrument Weather Conditions	Precision Conditions
10.5 knots	98.90%	98.85%	99.68%	99.94%
13.0 knots	99.59%	99.57%	99.85%	100.00%
16.0 knots	99.88%	99.88%	99.92%	100.00%
20.0 knots	99.97%	99.97%	99.97%	100.00%

Source: NOAA

Differences in wind coverage do exist between Runway 15-33 and Runway 1-19, particularly during VFR weather when the wind speeds are below 10 knots, which occurs approximately 78.3-percent of the time during VFR weather. Runway 15-33 has a 10.5 knot crosswind component wind coverage of 95.39-percent whereas Runway 1-19 has wind coverage of 95.27-percent. Combined, the two runways offer 98.85-percent wind coverage for a 10.5 knot crosswind component.

1.9.6 Approach Availability Analysis

Although crosswind coverage has been determined for each of the weather conditions examined, the total crosswind coverage assumes that all approaches are available during all the weather periods. For VFR and non-precision IFR operations, this assumption of availability is consistent with actual operating conditions. However, this is not true when the operation is being conducted during precision IFR conditions when the pilot is obligated to use the instrumented runway, even though the wind direction could favor another runway. To conduct this analysis, a maximum allowable tailwind of 5 knots was used for the all-weather, VFR and non-precision IFR weather and a maximum allowable tailwind of 3 knots was used for the precision IFR weather. The reduction in tailwind component is based on the assumption that precision IFR operations would occur under wet pavement conditions. The results of this analysis are summarized in **Figure 1.27**. The approach availability results indicate that while Runway 15 offers the best approach for all-weather and VFR weather conditions, Runway 33 offers the best approach for non-precision and precision instrument weather. Runway 19 offers the best approaches under VFR conditions, which then reverses to Runway 1 under instrument weather conditions. Along these lines, it should be noted that Runway 1 currently has non-precision instrument approach procedures while Runway 19 has a visual approach.



Figure 1.27: Approach Availability with 5-kt Tailwind and 20-kt Crosswind Component				
Runway	All-Weather (100%)	VFR (93.8%)	Non-Precision IFR (5.5%)	Precision IFR*(0.7%)
15	75.44%	76.61%	56.86%	54.09%
33	75.33%	74.34%	89.85%	91.13%
1	72.26%	71.12%	88.78%	92.07%
19	80.23%	81.49%	60.03%	58.20%

1.10 PUBLISHED INSTRUMENT APPROACH PROCEDURES

As of the 25 February 2009 United States Government Flight Information Publication U.S. Terminal Procedures, BTV has one published departure procedure and ten published instrument approaches. The minima associated with each of the approaches are presented in **Figure 1.28**. The National Aeronautical Charting Office (NACO) approach plates for BTV can be found in **Appendix B**.

Generally, BTV is well served by the existing approaches, however, some of the precision instrument approaches do not have the full visibility credit or decision height minimums typically associated with precision instrument approach procedures. These “penalties” appear to be due to the presence of obstructions off airport property, namely vegetative penetrations to the precision instrument approach surface to Runway 15, and terrain off of Runway 33. Runway 15-33 has two ILS procedures, one for each end of the runway. The procedure that has the best combined minimums is the straight-in ILS approach to Runway 15. The decision height on Runway 15 is lower than that of Runway 33, and the visibility minimum at decision height for Runway 33 is double that of Runway 15 for Category C and D aircraft.

In addition to the standard ground-based electronic navigational aid approaches, BTV has several global positioning system (GPS) based approaches which offer different levels of precision capability. Each GPS approach is a “standard T” approach which does not require complex turning maneuvers to get the aircraft on the final approach course.

In 2006, two additional precision instrument approach (ILS) procedures for Runways 15 and 33 were established. These are both Hi-ILS procedures which are designed to transition aircraft from the high altitude en route structure to the low altitude portion of an instrument final approach (i.e. ILS/LOC, Vortac or Tacan). They are commonly referred to as “Jet Penetrations” and are mostly used by fast moving, fighter/trainer military jets as they utilize a steeper glidepath and higher approach speeds.

1.10.1 Runway 1 Approaches

Runway 1 has two published approaches; one using area navigation (RNAV-GPS) and the



second using a Very High Frequency Omni-directional Range (VOR). The approach offering the best minimums to Runway 1 for all categories of aircraft is the RNAV which generally offers a decision height (DH) of between 760-feet amsl and 1,000-feet amsl (or between 425-feet and 665-feet above ground level) depending on the approach procedure used. The non-precision lateral navigation (LNAV) approach procedure offers a decision height of 760-feet amsl for Categories A, B and C aircraft while the circling approach offers a decision height of 840-feet amsl for Category A aircraft which increases to 860-feet from Category B and C aircraft and to 1,000-feet amsl for Category D aircraft.

Minimum visibility at the decision heights also varies by aircraft category. The LNAV RNAV approach to Runway 1 has a visibility minimum of 1 mile for Category A and B aircraft which increases to 1.25-miles for Category C aircraft. The circling RNAV approach to Runway 1 has a visibility minimum of 1 mile for Category A and B aircraft, 1.5 miles for Category C aircraft, and 2 miles for Category D aircraft.

1.10.2 Runway 19 Approaches

There are no published precision or non-precision instrument approaches to Runway 19 at BTV. As such, the approach is considered to be a visual approach. Visual approaches are performed under Visual Meteorological Conditions (VMC) and under Visual Flight Rules (VFR), which means a pilot must have at least a 1,000-foot ceiling and 3 miles visibility.

1.10.3 Runway 15 Approaches

As Runway 15-33 is the primary commercial and military runway, the level of instrumentation on the runway offers several different approaches that ensure the runway, and consequently the airport, are not closed due to weather, except under rare weather conditions.

Runway 15 has five published approach procedures including an ILS approach and two RNAV approaches. One RNAV/GPS-Z provides for a LNAV/VNAV approach procedure. The approach providing the best minimums to Runway 15 for all categories of aircraft is the ILS approach, which offers a decision height (DH) of 526-feet amsl and 1,000-feet amsl (or between 190-feet and 665-feet above ground level) depending on the approach procedure used. There are three procedures that use the ILS approach: a straight-in procedure using the full ILS, a straight-in procedure that uses the localizer only (lateral navigation) and a circling approach. The straight-in ILS procedure offers a decision height of 526-feet amsl (190-feet agl) for all categories of aircraft. Using just the localizer on the approach increases the decision height by 154-feet to 680-feet amsl (345-feet agl). The circling approach offers a decision height of 840-feet amsl for Category A aircraft, 860-feet for Category B and C aircraft and 1,000-feet amsl for Category D aircraft.

The RNAV/VNAV approach procedure associated with the RNAV/GPS-Z approach to Runway 15 provides both horizontal and vertical guidance for aircraft with the appropriate GPS and Wide Area Augmentation System (WAAS) receivers. Theoretically, the RNAV/VNAV approach



procedure could provide minimums down to 200-foot height above threshold and ½-mile visibility (Category I ILS standards). However, the RNAV/GPS-Z approach procedure at BTV does not provide these minimums. Thus, the ILS approach to Runway 15 provides better approach minimums than the RNAV/VNAV approach.

Minimum visibility at the decision heights also varies by aircraft category. Both the straight-in ILS approach and the straight-in localizer approach have a minimum runway visibility range (RVR) value of 2400-feet, or less than 1/2-mile visibility, for Categories A, B, and C. The circling approach has higher minimum visibility at decision height than the other approaches primarily because a circling approach procedure is considered a visual approach. Category A and B aircraft have minimum circling visibility at the decision height of 1-mile while Category C and D aircraft require 1 ½-mile and 2-miles, respectively.

1.10.4 Runway 33 Approaches

Runway 33 has three published approaches, including an ILS approach and a RNAV/GPS approach. The approach offering the best visibility minimums to Runway 33 is the ILS approach as the RNAV/GPS is basically a standard non-precision instrument approach with horizontal guidance. As a result, the RNAV/GPS lacks the vertical guidance component of a RNAV/VNAV or ground based precision instrument approach which results in higher visibility minimums and decision heights. Similar to the ILS approach to Runway 15, the ILS to Runway 33 has three approach procedures: a straight-in approach using the full ILS, a straight-in approach using the localizer and a circling approach. The straight-in ILS to Runway 33 has a decision height of 535-feet amsl (200-feet above ground level) for Category A and B aircraft which is 9-feet higher than the straight-in ILS to Runway 15. The decision height for Category C and D increases 50-feet to 585-feet amsl (or 250-feet above ground level), which is 59-feet higher than the straight-in ILS approach to Runway 15.

Unlike the straight-in ILS approach, the straight-in localizer approach to Runway 33 has higher decision heights than for the same type approach to Runway 15. The decision height for the straight-in localizer approach to Runway 33 is 820-feet msl, or approximately 485-feet above ground level which is 140-feet higher than the straight-in localizer approach to Runway 15. Presumably, the straight-in localizer approach has a higher decision height due to terrain in the approach and by the procedure not using the vertical guidance offered by the glideslope. The circling approach has similar decision heights as the circling approach to Runway 15. The decision height for the circling approach to Runway 33 is 860-feet amsl or 525-feet above ground level for Categories A, B and C aircraft and 1,000-feet for D aircraft.

The minimum visibility required at decision height for the straight-in ILS is 4,000-feet RVR, or approximately 3/4-mile for Category A and B aircraft and 5,000-feet for Category C and D aircraft. The straight-in localizer approach to Runway 33 has a minimum RVR value of 5,000-feet for Category A and B aircraft, 6,000-feet for Category C aircraft and 1.5-miles for Category D aircraft. The circling approach to Runway 33 has minimum visibility at decision height of 1-



mile for Category A and B aircraft and 1.5-miles for Category C aircraft and 2-miles for Category D aircraft.

Figure 1.28: Published Instrumented Approaches to BTV							
25-Feb-09							
Approach Number	Approach	Type	Runway	Established Minimum Ceiling-Visibility (Feet (AMSL)/RVR-Miles)			
				CAT A	CAT B	CAT C	CAT D
1	RNAV Y	LNAV MDA	15	760/40	760/40	760/40	760/50
		Circling		840-1	860-1	860-1.5	1,000-2
2	RNAV Z	LNAV/VNAV DA	15	660/40	660/40	660/40	660/40
		LNAV MDA		940/40	940/40	940/60	940/1.5
		Circling		940-1.25	940-1.25	940-1.75	1,000-2
3	ILS or LOC/DME	S-ILS 15	15	526/24	526/24	526/24	526/24
		S-LOC 15		680/24	680/24	680/24	680/40
		Circling		840-1	860-1	860-1.5	1,000-2
4	HI-TACAN	S-15	15			900/50	900/60
		Circling				900-1.25	1000-2
5	HI-ILS Z	S-ILS 15	15			576/40	576/40
		S-LOC 15				680/40	680/40
		Circling				860-1.50	1000-2
6	RNAV	LNAV MDA	33	720/50	720/50	720/50	720/50
		Circling		840-1	860-1	860-1.5	1,000-2
7	ILS/DME	S-ILS 33	33	535/40	535/40	585/50	585/50
		S-LOC 33		820/50	820/50	820/60	820-1.5
		Circling		860-1	860-1	860-1.5	1,000-2
8	HI-ILS/DME	S-ILS 33	33			535/40	535/40
		S-LOC 33				740/60	740/60
		Circling				860-1.50	1000-2
9	RNAV	LNAV MDA	1	760-1	760-1	760-1.25	N/A
		Circling		840-1	860-1	860-1.5	1,000-2
10	VOR	S-1	1	820-1	820-1	820-1.25	N/A
		Circling		860-1	860-1	860-1.5	1,000-2

Source: 25 February 2009 United States Government Flight Information Publication: United States Terminal Procedures