Draft Environmental Assessment for Washington, D.C. Optimization of Airspace and Procedures in the Metroplex

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Prepared by:

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1 Introduction

The National Environmental Policy Act of 1969 (NEPA)(42 United States Code [U.S.C.] § 4321 *et seq*.), requires federal agencies to disclose to decision makers and the interested public a clear, accurate description of potential environmental impacts arising from proposed federal actions and reasonable alternatives to those actions. Through NEPA, Congress has directed federal agencies to include environmental factors in their planning and decision making processes and to encourage public involvement in decisions that affect the quality of the human environment. Furthermore, as part of the NEPA process, federal agencies are required to consider the environmental effects of a proposed action, reasonable alternatives to the proposed action, and a no action alternative (analyzing the potential environmental effects of not undertaking the proposed action). The Federal Aviation Administration (FAA) has established a process to ensure compliance with the provisions of NEPA through FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1E).

This Environmental Assessment (EA), prepared in accordance with FAA Order 1050.1E, documents the potential effects to the environment that may result from the optimization of Air Traffic Control (ATC) procedures that would standardize aircraft routing to and from airports. The Proposed Action, the subject of this EA, is referred to as the Optimization of Airspace and Procedures in the Washington D.C. Metroplex or "DC OAPM." The procedures designed as part of the DC OAPM would support arriving and departing aircraft operating under Instrument Flight Rules (IFR) at the study area airports ("the Study Airports"), using currently available technology.

This EA consists of the following chapters and appendices:

- **Chapter 1: Introduction.** Chapter 1 provides basic background information on the air traffic system, the Next Generation Air Transportation System program, performance based navigation including area navigation technology, the FAA's OAPM initiative, and information on the Washington D.C. Metroplex and Study Airports.
- **Chapter 2: Purpose and Need.** Chapter 2 discusses the need (problem) and purpose (goal) for airspace and procedure optimization in the DC Metroplex area and identifies the Proposed Action that is the subject of this EA.
- **Chapter 3: Alternatives.** Chapter 3 discusses the Proposed Action and the No Action Alternatives analyzed as part of the environmental review process.
- **Chapter 4: Affected Environment.** Chapter 4 discusses existing conditions within the DC Metroplex area.
- **Chapter 5: Environmental Consequences.** Chapter 5 discusses the potential environmental impacts associated with the Proposed Action and No Action Alternatives.
- **Appendix A: Agency and Public Coordination.** Appendix A documents agency and public coordination associated with the EA process and includes any comments received during the public review period and responses to these comments.

- **Appendix B: List of Preparers and List of Receiving Parties.** Appendix B lists the preparers of the EA and the local agencies and parties that received a copy of the Draft and Final EA documents.
- **Appendix C: References.** Appendix C lists the references used in the preparation of the EA document.
- **Appendix D: List of Acronyms and Glossary.** Appendix D lists acronyms and provides a glossary of terms used in the EA.
- **Appendix E: Noise.** Appendix E presents information on aircraft noise as well as the general methodology used to analyze noise associated with aviation projects.
- **Appendix F: Section 4(f) Resources.** Appendix F lists all the Section 4(f) resources identified in the General Study Area.
- **Appendix G: Historic and Cultural Resources.** Appendix G lists the historic and cultural resources identified in the General Study Area.
- **Appendix H: Reportable Noise Increases.** Appendix H provides the reportable noise increases associated with the Proposed Action.

1.1 Project Background

On January 16, 2009, the FAA asked the RTCA to create a joint government-industry task force to make recommendations for implementation of Next Generation Air Transportation System (NextGen) operational improvements for the nation's air transportation system.[1] In response, RTCA assembled the NextGen Mid-Term Implementation Task Force (Task Force 5), which included more than 300 members representing commercial airline, general aviation, military, manufacturer, and airport stakeholders.[2] The NextGen Program is discussed in more detail in Section 1.2.4.[3]

On September 9, 2009, RTCA issued the NextGen Mid-Term Implementation Task Force Report, which provided the Task Force 5 recommendations. One of these recommendations suggested that the FAA should undertake planning for the implementation of Performance-Based Navigation (PBN)[4] procedures such as Area Navigation (RNAV) and Required Navigation Performance (RNP) procedures on a Metroplex basis.[5] (RNAV and RNP procedures are further discussed in Section 1.2.4.) Based on this recommendation, the FAA created the OAPM initiative.

[1] RTCA, Inc. Executive Summary of the *NextGen Mid-Term Implementation Task Force Report*, September 9, 2009.

[2] RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance and air traffic management system issues. RTCA functions as a federal advisory committee and includes roughly 400 government, industry and academic organizations from the United States and around the world. Members represent all facets of the aviation community, including government organizations, airlines, airspace users, airport associations, labor unions, and aviation service and equipment suppliers. More information is available at http://www.rtca.org.

[3] RTCA Inc., Executive Summary of the *NextGen Mid-Term Implementation Task Force Report*. September 9, 2009.

[4] Additional information on Performance-Based Navigation is provided on the U.S. Department of Transportation, Federal Aviation Administration's Fact Sheet, "NextGen Goal: Performance-Based Navigation," April 24, 2009 http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=8768 (Accessed April 11, 2012)].

[5] A Metroplex is a geographic area covering several airports, serving major metropolitan areas and a diversity of aviation stakeholders.

The purpose of the OAPM initiative is to optimize air traffic procedures and airspace on a regional scale. This would be accomplished by employing technological advances in navigation such as RNAV while ensuring that aircraft that are not equipped to use RNAV have access to terminal airspace.[6] This approach addresses congestion and other factors that reduce efficiency in busy Metroplex areas and accounts for key operating airports and airspace in the Metroplex. Study Area airports are further discussed in Section 1.4. It also addresses connectivity with other Metroplex areas. The intent is to use the limited airspace as efficiently as possible for congested Metroplex areas.[7]

1.2 Air Traffic Control and the National Airspace System

The following sections are intended to provide the reader with basic background knowledge of air traffic control and the National Airspace System (NAS). A description of the NAS, the role of Air Traffic Control (ATC), the methods used by air traffic controllers to manage the Air Traffic Control system, and the different phases of aircraft flight within the system. Following this discussion, information is provided on the FAA's NextGen program and the OAPM initiative.

1.2.1 National Airspace System

Under the Federal Aviation Act of 1958 (49 USC § 40101 *et seq*.), the FAA is charged with the responsibility for controlling the use of the nation's navigable airspace and regulating civil and military aircraft operations in the interest of maintaining safety and efficiency. To help fulfill this mandate, the FAA established the NAS. Within the NAS, the FAA manages aircraft takeoffs and landings and the flow of aircraft between airports through a system of infrastructure (e.g., air traffic control facilities), people (e.g., air traffic controllers, maintenance, and support personnel), and technology (e.g., radar, communications equipment, ground-based navigational aids (NAVAIDs),[8] etc.) The NAS is governed by various FAA rules and regulations.

The NAS comprises one of the most complex aviation networks in the world. Accordingly, to fulfill its mission, the FAA is continuously reviewing the design of all NAS resources to ensure they are effectively and efficiently managed. When changes are proposed to the NAS, the FAA works to ensure that the changes maintain or enhance system safety and improve efficiency. One way to accomplish this mission is to employ emerging technologies to increase system flexibility and predictability.[9] The FAA Air Traffic Organization (ATO) is the primary organization within the FAA responsible for optimizing airspace and flight procedures used in the NAS. In working to improve the NAS, the FAA must comply with NEPA and other applicable laws and regulations.

[6] Terminal Airspace: an area of airspace defined by boundaries and altitudes assigned to a radar control facility associated with an airport or group of airports. The facility that manages this airspace is referred to as the Terminal Radar Approach Control (TRACON). The boundaries and altitudes are based on factors such as traffic flows, neighboring airports and terrain. The primary traffic flows are arrivals and departures to the airport(s) located within the terminal airspace.

[7] Department of Transportation, Federal Aviation Administration, *FAA Response to Recommendations of the RTCA NextGen Mid-Term Implementation Task Force*. January 2010. Pg. 14.

[8] NAVAIDs are facilities that transmit signals that define key points or routes.

[9] U.S. Department of Transportation, Federal Aviation Administration, Order JO 7400.2G, Change 3, *Procedures for Handling Airspace Matters*, Section 32-3-5(b) "National Airspace Redesign," April 10, 2008

1.2.2 Air Traffic Control within the National Airspace System

The combination of infrastructure, people, and technology used to monitor and guide or direct aircraft within the NAS is referred to collectively as ATC. ATC is responsible for separating aircraft (keeping minimum distances between aircraft) to maintain safety and expedite the flow of traffic operating in the NAS. Air traffic controllers are responsible for providing these air traffic services to aircraft operating in the airspace. This is accomplished through communications with pilots and by using various technologies such as radar.

Aircraft operate under two distinct categories of flight rules: Visual Flight Rules (VFR) and Instrument Flight Rules (IFR).[10] These flight rules generally correspond with two categories of weather conditions: Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC).[11] VMC generally exist during fair to good weather with good visibility. IMC occur during periods when visibility falls to less than three statute miles or the ceiling (the distance from the ground to the bottom layer of clouds when the clouds cover more than 50 percent of the sky) drops to lower than 1,000 feet. Under VFR, pilots are able to fly whatever route they chose and are responsible to "see and avoid" other aircraft and obstacles such as terrain to maintain safe separation. Under IFR ATC is responsible for providing separation from other aircraft and terrain and pilots use cockpit instruments and radar to fly routes specified by ATC and to comply with ATC instructions. Pilots must follow IFR during IMC; however, due to various factors such as the general requirement for aircraft to operate under IFR in Class A airspace (i.e., enroute airspace between 18,000 feet MSL and 60,000 feet MSL)[12], the majority of commercial air traffic operate under IFR regardless of weather conditions.

Based on factors such as aircraft type and weather, air traffic controllers apply criteria to maintain defined minimum distances (referred to as separation) between aircraft.[13] These types of separations include:

- **Vertical or "Altitude" Separation:** separation between aircraft operating at different altitudes;
- **Longitudinal or "In-Trail" Separation:** the separation between two aircraft operating along the same flight route referring to the distance between a lead and a following aircraft; and,
- **Lateral or "Side-to-Side" Separation:** separation between aircraft (left or right side) operating along two separate but nearby flight routes.

Exhibit 1-1 depicts the three dimensions around an aircraft used to determine separation.

For aircraft operating under IFR, air traffic controllers maintain separation by monitoring and, as needed, directing pilots following standard instrument procedures. Standard instrument procedures define the routes along which aircraft operate. These procedures are intended to provide predictable, efficient routes to move aircraft through the airspace in an orderly manner. They also minimize the need for communication between the controller

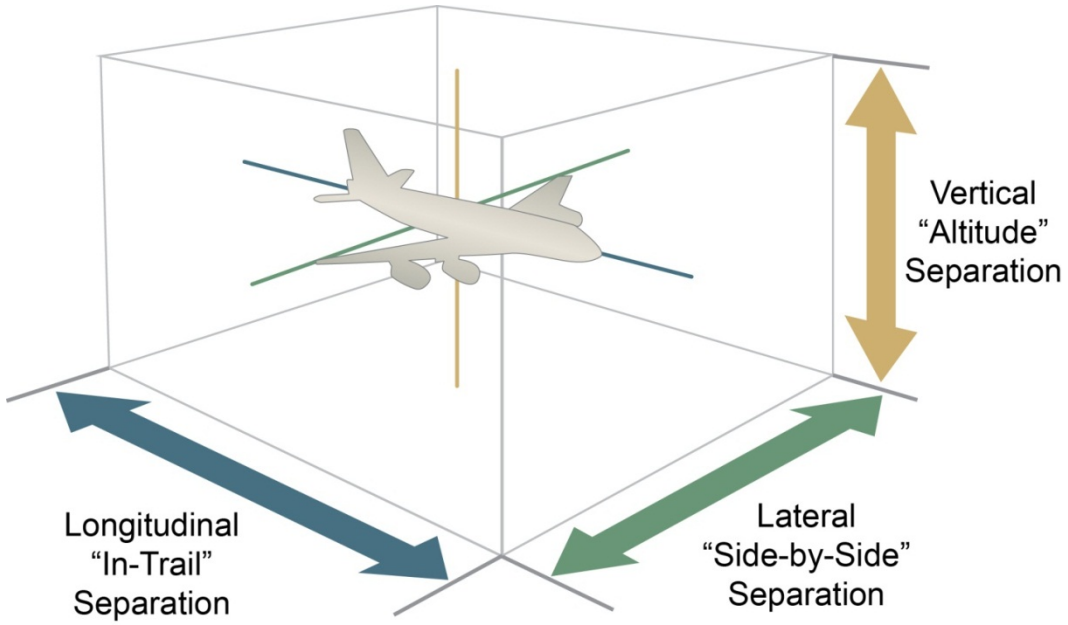
[10] 14 Code of Federal Regulations (C.F.R.) Part 91.

[11] 14 C.F.R. §§ 91.151 through 91.193, "Visual Flight Rules" and "Instrument Flight Rules."

[12] 14 C.F.R. § 91.135.

[13] Defined in FAA Order 7110.65U, *Air Traffic Control*.

Exhibit 1-1 Three Dimensions Around an Aircraft



Source: ATAC Corporation, December 2012.
Prepared by: ATAC Corporation, December 2012.

and pilot as the aircraft operates in the terminal airspace and transitions to and from the enroute airspace. Standard instrument procedures are considered "conventional" if they are based on ground-based NAVAIDs, which provide instrument guidance to a pilot as the aircraft flies over each NAVAID, or if they are based on vectoring, or verbal instructions from an air traffic controller.

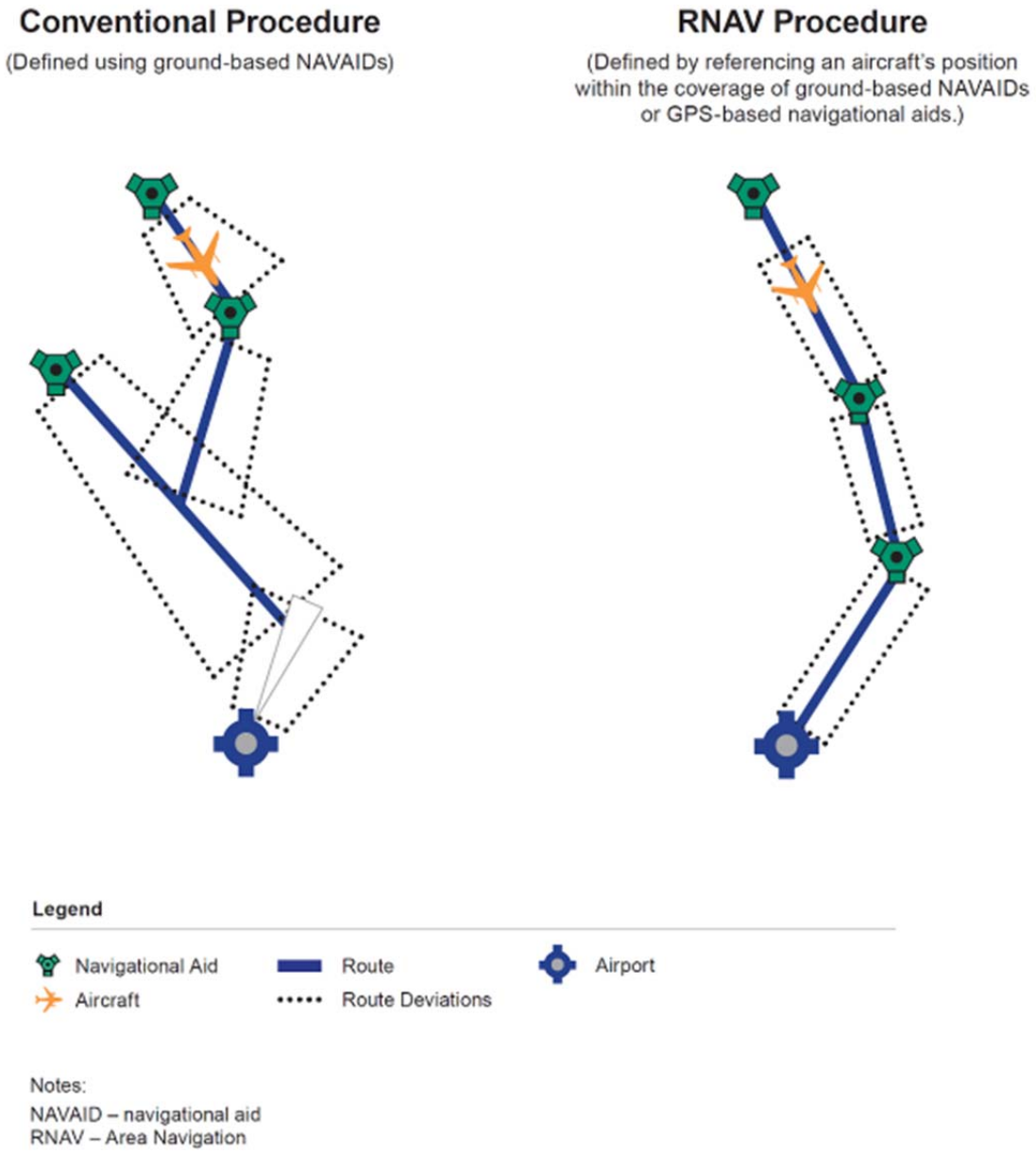
In its effort to modernize the NAS, the FAA is developing standard instrument procedures using new and alternate technologies. A primary technology being applied in this effort is RNAV. RNAV technology allows an RNAV-trained pilot operating an RNAV-equipped aircraft to fly a more direct route based on instrument guidance that references an aircraft's position within the coverage of ground-based NAVAIDs[14] or space-based navigational aids using Global Positioning System (GPS) technology. **Exhibit 1-2** compares an RNAV procedure to a conventional procedure.

If standard instrument procedures in the terminal airspace do not exist or are unable to accommodate demand due to air traffic congestion, ATC must maintain safety within the airspace it controls by using one or a combination of several management tools and coordination techniques. The more frequently this is done, the more complex pilot and controller workload becomes. The management tools and coordination techniques include:

- **Vectoring:** Controllers issue a series of headings to a pilot to route an aircraft. This can increase aircraft flight distance and flight time resulting in increased fuel burn, decreased flight route predictability, and increased air traffic controller/pilot communication requirements and workload.

[14] Ground-based distance measuring equipment (DME) can be used to establish an aircraft's position.

Exhibit 1-2 Comparison of Routes Following Conventional versus RNAV Procedures



Source: U.S. Department of Transportation, Federal Aviation Administration, "Performance-Based Navigation (PBN)" brochure, 2009.
Prepared by: ATAC Corporation, December 2012.

- **Speed Control:** Controllers direct aircraft to reduce or increase aircraft speed. A reduction in speed can increase aircraft flight time resulting in increased fuel burn, decrease flight route predictability, and increase air traffic controller/pilot communication requirements and workload.
- **Hold Pattern/Ground Hold:** Controllers assign aircraft to a holding pattern in the air or hold aircraft on the ground before departure. Holding an aircraft on the ground can result in delays and increased flight time. Assigning an aircraft to a holding

pattern in the air increases flight time resulting in greater fuel burn and air traffic controller/pilot communication requirements and workload.

- **Level-off:** Controllers direct an aircraft to level off during ascent or descent. This can increase flight time and distance, resulting in increased fuel burn, by disrupting a continuous ascent or descent and increasing air traffic controller/pilot communication requirements and workload.
- **Reroute:** Controllers reroute aircraft to terminal airspace entry or exit gates other than the preferred or most direct gate. This can increase flight time, distance, and fuel burn; decrease flight route predictability; and increase air traffic controller/pilot communication requirements, complexity, and workload.
- **Point-out:** Controllers point out, or notify a controller managing an adjacent sector of the proximity of an aircraft to the adjacent sector's boundary (close to one and a half miles from the shared boundary). Point outs can be done verbally or electronically and can result in added complexity to air traffic controller communications and increased workload.

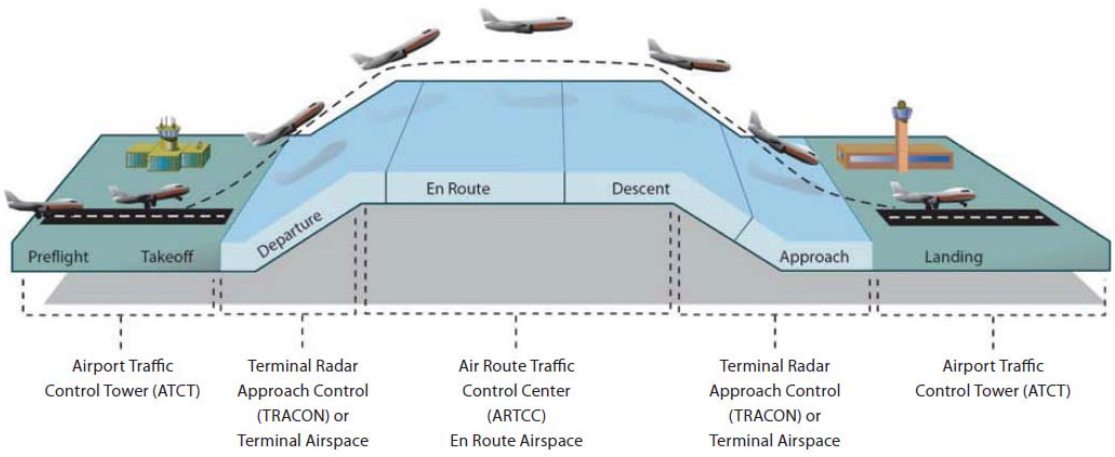
As an aircraft moves from origin to destination, ATC personnel function as a team and transfer control of the aircraft from one controller to the next and from one ATC facility to the next. Overall, managing the flow of departing aircraft (departure flow) tends to be less complicated. For example, if traffic conflicts or weather related issues are anticipated aircraft can be held on the ground to ensure safe management of the airspace. Managing the arrival flow tends to be more complicated because arriving aircraft are already airborne and thus require increased management to maintain a safe airspace environment.

1.2.3 Aircraft Flow within the National Airspace System

An aircraft traveling from airport to airport typically operates through six phases of flight (plus a "preflight" phase.) **Exhibit 1-3** depicts the typical phases of flight for a commercial aircraft. These phases include:

- **Preflight (Flight Planning):** The preflight route planning and checks in preparation for takeoff.
- **Push Back/Taxi/Takeoff:** The transition of an aircraft from push back at the gate to taxiing to an assigned runway and lift off from the runway.
- **Departure:** The in-flight transition of an aircraft from take-off to the enroute phase of flight, during which the aircraft climbs to its assigned cruising altitude following a standard instrument procedure (predefined set of guidance instructions that define a route for a pilot to follow) or a series of verbally issued instructions from an air traffic controller.
- **Enroute:** The generally level segment of flight ("cruising altitude") between the departure and destination airports.
- **Descent:** The in-flight transition of an aircraft from the assigned cruising altitude to the point at which the pilot initiates the approach to a runway at the destination airport.

Exhibit 1-3 Typical Phases of a Commercial Aircraft Flight



Source: United States Department of Transportation, Federal Aviation Administration, Houston Area Air Traffic System, Airspace Redesign, Final Environmental Assessment, Figure 1.1.1-1, March 2008.
Prepared by: ATAC Corporation, December 2012.

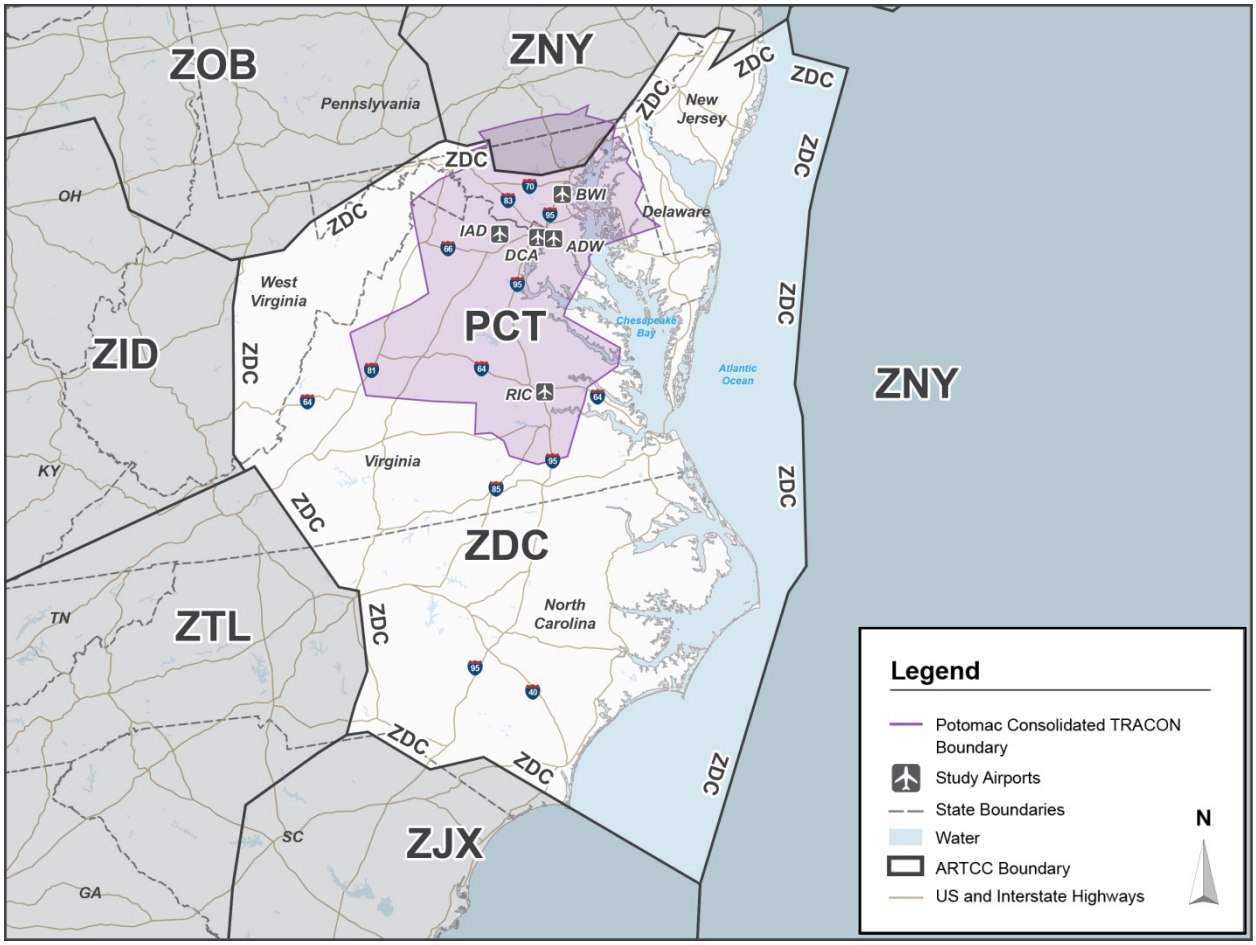
- **Approach:** The segment of flight during which a pilot follows a standard procedure or series of verbal instructions from an air traffic controller to guide the aircraft to the landing runway.
- **Landing:** Touch-down of the aircraft at the destination airport's runway and taxiing from the runway end to the gate or parking position.

1.2.4 Air Traffic Control Facilities

The NAS is organized into three-dimensional areas of navigable airspace (defined by a floor, a ceiling, and a lateral boundary), which are managed by different ATC facilities. These airspace areas are divided into specialized areas, which are further broken down into sectors. Air traffic controllers are assigned to specialized areas within the control of their ATC facility and assigned specific sectors within which they manage the aircraft operating under IFR. The three types of ATC facilities include:

- **Air Traffic Control Tower:** Controllers at an Air Traffic Control Tower (ATCT) located at an airport manage phases of flight associated with an aircraft taking off from and landing at an airport. ATCT typically controls airspace extending from the airport out to a distance of several miles.
- **Terminal Radar Approach Control:** Controllers at a Terminal Radar Approach Control (TRACON) facility manage aircraft as they transition between an airport and the enroute phase of flight. This includes the departure, climb, descent, and approach phases of flights. TRACON controllers are responsible for separating aircraft operating within the terminal airspace sectors. As an aircraft moves from sector to sector, responsibility for management of that aircraft is transferred from controller to controller. The terminal airspace in the DC Metroplex area is referred to as "the Potomac Consolidated TRACON" or "PCT" and is shown on **Exhibit 1-4**.

Exhibit 1-4 Airspace in the DC Metroplex Area



Notes:
PCT – Potomac Consolidated TRACON
ZID – Indianapolis ARTCC
ZTL – Atlanta ARTCC
ZDC – Washington ARTCC
ZNY – New York ARTCC
ZJX – Jacksonville ARTCC
ZOB – Cleveland ARTCC

Sources: National Flight Data Center National Airspace System Resources database, accessed September 16, 2012 (airspace boundaries); National Atlas of the United States of America: U.S. County and State Boundaries; Water Bodies; Bureau of Transportation Statistics: National Transportation Atlas Database; FAA: NFDC Airport and Runway databases; ATAC Corporation: Study Area Boundary
Prepared by: ATAC Corporation, 2012.

- **Air Route Traffic Control Centers:** Controllers at Air Route Traffic Control Centers (ARTCCs or "Centers") manage the flow of traffic to, from, and within the enroute airspace. Enroute airspace includes low-altitude routes called "victor airways", high altitude jet routes called "jet routes" (both defined by a series of ground-based NAVAIDS); low altitude RNAV routes called "T-routes" and high altitude RNAV routes called "Q-routes." The RNAV routes provide a more direct path to a destination airport. **Exhibit 1-4** shows how enroute airspace is delegated to different ARTCCs in the DC Metroplex area. Similar to terminal airspace, enroute airspace is divided into sectors.

The following sections discuss how air traffic controllers at these ATC facilities control the phases of flight for aircraft operating under IFR.

1.2.4.1 Departure Flow

As an aircraft operating under IFR departs a runway and follows its assigned heading, it moves from the ATCT airspace, through the terminal airspace, and into enroute airspace where it proceeds on a specific route or "jet route." Once on a jet route, an aircraft flies along the route until it nears its destination airport.

Within the terminal airspace, TRACON controllers are responsible for controlling aircraft departing from the ATCT airspace to an exit gate. An exit gate represents an area along the boundary between terminal airspace and enroute airspace. Exit gates are generally established near jet routes to better facilitate transfer of aircraft between terminal and enroute airspace. When aircraft pass through the exit gate, control is passed from TRACON to ARTCC controllers as aircraft join a jet route.

To maintain safe distances between aircraft within the terminal airspace, TRACON controllers must maintain separation for departing aircraft (as well as between arriving and departing aircraft). Separation is further discussed in Section 1.2.3.3.

Standard Instrument Departures

Departing aircraft operating under IFR use an instrument procedure called a Standard Instrument Departure (SID). A SID provides pilots with defined lateral and vertical guidance to facilitate safe and predictable navigation from an airport through the terminal airspace to a jet route in the enroute airspace. A SID may be based on vectoring, following a route defined by ground-based NAVAIDs, or a combination of both. This is called a "conventional" SID. Because of the increased precision inherent in RNAV technology, an RNAV SID, which provides GPS-based navigation, defines a more predictable route through the airspace than does a conventional SID.

The portion of a SID that provides a path serving a particular runway at an airport is referred to as a "runway transition." A SID may have several runway transitions serving one or more runways at one or more airports. From the common segment of the route, guidance may then be provided in the SID to one or more jet routes in the enroute airspace. This is referred to as an "enroute transition."

1.2.4.2 Arrival Flow

A pilot will initiate the descent phase of flight within the enroute airspace. During descent, the aircraft will enter the terminal airspace for the destination airport at an entry gate. The entry gate represents a point along the boundary between terminal airspace and enroute airspace. When aircraft pass through the entry gate control of the aircraft is passed from ARTCC to TRACON controllers. To maintain safe distances between aircraft within the terminal airspace, TRACON controllers must maintain the same separation for arriving aircraft as those defined for departing aircraft. Separation is further discussed in Section 1.2.3.3.

Standard Terminal Arrival Routes

Aircraft arriving within the terminal airspace follow an instrument procedure called a Standard Terminal Arrival Route (STAR.) A STAR proceeds from a route in the enroute airspace to the final approach to a runway. The final approach is the segment of flight when an aircraft is aligned with the landing runway and operates along a straight route at a constant rate of descent to the runway (an approximately three or slightly less degree angle).

A STAR can provide full guidance from enroute airspace through a terminal airspace entry gate, to a commonly used segment of the STAR in the terminal airspace, and then to the final approach to one or more runways at one or more airports. Guidance from the enroute airspace to the terminal airspace is called an "enroute transition" and from the common segment of the STAR in the terminal airspace to the final approach to a runway end is called a "runway transition." A STAR can also provide only partial guidance through the terminal airspace and may not include runway transitions.

1.2.4.3 Aircraft Separation

As TRACON controllers manage the flow of aircraft into, out of, and within the terminal airspace, they maintain the following separations between aircraft:

- **Altitude separation (vertical):** when operating below 29,000 feet above mean sea level (MSL),[15] two aircraft on separate routes that cross or converge, must be at least 1,000 feet above/below each other at the point the two routes intersect. When operating above 29,000 feet MSL and below 41,000 feet MSL, the two aircraft must be at least 1,000 feet from each other under reduced vertical separation minima (RVSM).
- **In-Trail separation (longitudinal):** Within a TRACON radar controlled area and within 40 miles of the radar site being used to track the aircraft, the minimum distance between two aircraft on the same route (or in-trail) is three miles. When aircraft are beyond 40 miles from the radar site, the minimum longitudinal separation of aircraft increases to five miles due to radar coverage capabilities.[16] As aircraft proceed further from the radar, ATC must increase departure aircraft separation from three miles to five miles as the aircraft nears the exit gate. To ensure that the minimum five mile separation is maintained, ATC may separate aircraft by as much as seven miles.
- **Side-to-Side separation (lateral):** Similar to in-trail separation, the minimum side-to-side (left or right side of an aircraft) between aircraft in the terminal airspace must be at least three miles within 40 miles of the primary radar site, and at least five miles beyond 40 miles from the primary radar site.

1.2.5 Special Use Airspace

Special Use Airspace (SUA) is airspace with defined boundaries in which certain activities such as military flight training and air-to-ground military exercises must be confined. These areas either restrict other aircraft from entering or restrict the type of aircraft activity allowable within the airspace. There are six types of special use airspace:

- **Prohibited Area:** Prohibited areas contain airspace of defined dimensions within which aircraft are prohibited unless given prior authorization. Such areas are established for security or other reasons associated with the national welfare.
- **Restricted Area:** Restricted areas contain airspace identified by an area within which aircraft, while not wholly prohibited, are subject to restrictions when the area is being used. The area denotes the existence of unusual, often invisible hazards to

[15] Mean Sea Level: elevation (on the ground) or altitude (in the air) of any object, relative to the average sea level measured in 1991 (called the North American Vertical Datum of 1988).

[16] Department of Transportation, Federal Aviation Administration, Order JO 7110.65U, Ch. 5, Sec. 5-5-1. February 9, 2012.

aircraft such as artillery firing, aerial gunnery, or guided missiles. Entering a restricted area without authorization may be extremely hazardous to the aircraft and its occupants. When the area is not being used, control of the airspace is released to the FAA and ATC can use the area for normal operations.

- **Warning Area:** Warning areas are airspace of defined dimensions, extending from three nautical miles (nmi) outward from the coast of the U.S. in which activity may occur that is hazardous to non-participating aircraft. The purpose of warning areas is to warn pilots of potential danger. A warning area may be located over domestic and/or international waters.
- **Military Operating Area:** Military Operating Areas (MOAs) consist of airspace with defined vertical and lateral limits established for the purpose of separating certain military training activities (e.g., air combat tactics, air intercepts, aerobatics, formation training, and low-altitude tactics) from IFR traffic. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic.
- **Alert Areas:** Alert areas are depicted on an aeronautical chart to inform pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity.
- **Controlled Firing Area:** Controlled Firing Areas (CFAs) contain activities which, if not conducted in a controlled environment, could be hazardous to an aircraft not participating in the activity. The distinguishing feature of a CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. This area does not impact or change an aircraft flight path; therefore, it is not depicted on aeronautical charts.

In addition to the six types of SUA described above, the DC Metroplex is subject to the Washington D.C. Metropolitan Area Special Flight Rule Area (DC SFRA) and a Flight Restricted Zone (DC FRZ). The DC SFRA and DC FRZ are areas of airspace where the ready identification, location, and control of aircraft are required in the interest of national security.[17]

1.2.6 Next Generation Air Transportation System

The NextGen program is the FAA's long-term plan to modernize the NAS through evolution from a ground-based system of air traffic control to a GPS-based system of air traffic management.[18] The OAPM initiative's objective is to accomplish this step in the overall process of transitioning to the NextGen system by 2018. A key step in achieving the NextGen ATC system is implementation of PBN procedures, such as RNAV and RNP procedures, which use GPS-based technology and aircraft "auto pilot" and Flight Management System (FMS) capabilities. RNAV and RNP capabilities are now readily available and, PBN can serve as the primary means aircraft use to navigate along a route.

[17] 14 CFR § 93.335.

[18] U.S. Department of Transportation, Federal Aviation Administration's Fact Sheet, "NextGen Goal: Performance-Based Navigation," April 24, 2009. [http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=8768 (Accessed April 11, 2012)].

As of 2011, 92 percent of U.S. scheduled air carriers were equipped for some level of RNAV.[19] The following sections describe PBN procedures in greater detail.

1.2.6.1 RNAV

Exhibit 1-5 shows a comparison of conventional and RNAV procedures. RNAV enables aircraft traveling through terminal and enroute airspace to follow more accurate and better defined, direct flight routes in areas covered by GPS-based navigational aids. This results in predictable routes with fixed locations and altitudes that can be planned ahead of time by the pilot and air traffic control. In addition, fixed routes help maintain segregation between aircraft by providing the ability to separate traffic both vertically and horizontally. As a result, some routes can be shortened and the need for level-offs can be eliminated.

Ground-based NAVAID routing is often limited by issues such as line-of-sight and signal reception accuracy. NAVAIDs such as, VHF Omnidirectional Range (VOR) are affected by terrain and other obstructions that can limit their signal accuracy. Consequently, routes using ground-based NAVAIDS require at least six nmi of clearance on either side of the route's main path to account for potential obstructions. This clearance requirement increases the farther an aircraft is from the VOR. In comparison, RNAV signal accuracy requires only two nmi of clearance on either side of the procedure's main path (called RNAV-1). RNAV procedures can mirror conventional procedures or provide routes within the airspace using satellite technology that were not previously possible with ground-based NAVAIDs. RNAV also provides routes that enable transition routes to multiple runways. These runway transition route options provide more flexibility in managing arrival traffic.

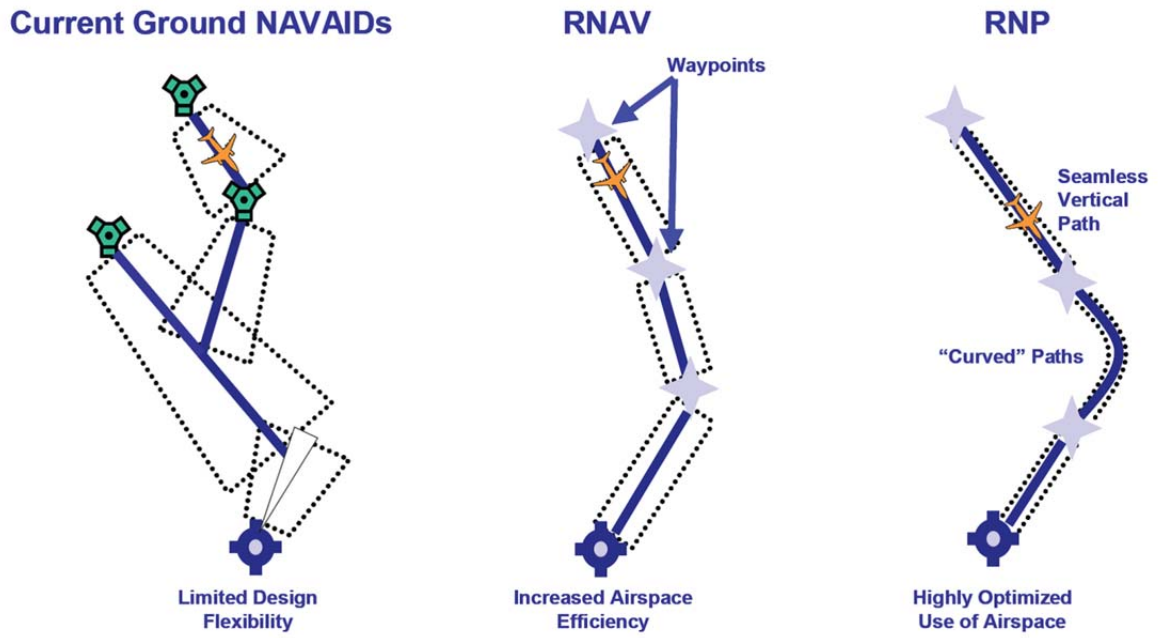
RNAV-based procedures facilitate more efficient design and use of airspace that collectively results in improved access, predictability, and operational efficiency while maintaining or enhancing safety and increasing opportunities to reduce fuel consumption. The predictability of routes following RNAV procedures can reduce the need for controllers to employ management tools, such as vectoring and holding, and therefore, reduce controller and pilot workload and airspace complexity.

1.2.6.2 RNP

RNP is an RNAV procedure that is flown with the addition of an onboard performance monitoring and alerting system. A defining characteristic of an RNP operation is the ability for an RNP capable aircraft navigation system to monitor the accuracy of its navigation (based on the number of GPS satellite signals available to pinpoint the aircraft location) and inform the crew if the required data becomes unavailable. **Exhibit 1-5** compares conventional, RNAV, and RNP procedures and shows how an RNP capable aircraft navigational system provides a more accurate location (down to less than a mile from the intended path) and will follow an exact path, including turns. The enhanced accuracy and predictability makes it possible to implement procedures within a controlled airspace that were not possible under the current air traffic system.

[19] U.S. Department of Transportation, Federal Aviation Administration, *NextGen Implementation Plan-2011*, March 2011, page 12.

Exhibit 1-5 Performance-Based Navigation – Conventional/RNAV/RNP



Source: U.S. Department of Transportation, Federal Aviation Administration. "Performance-Based (PBN) Brochure" October 2009.
Prepared by: ATAC Corporation, 2012.

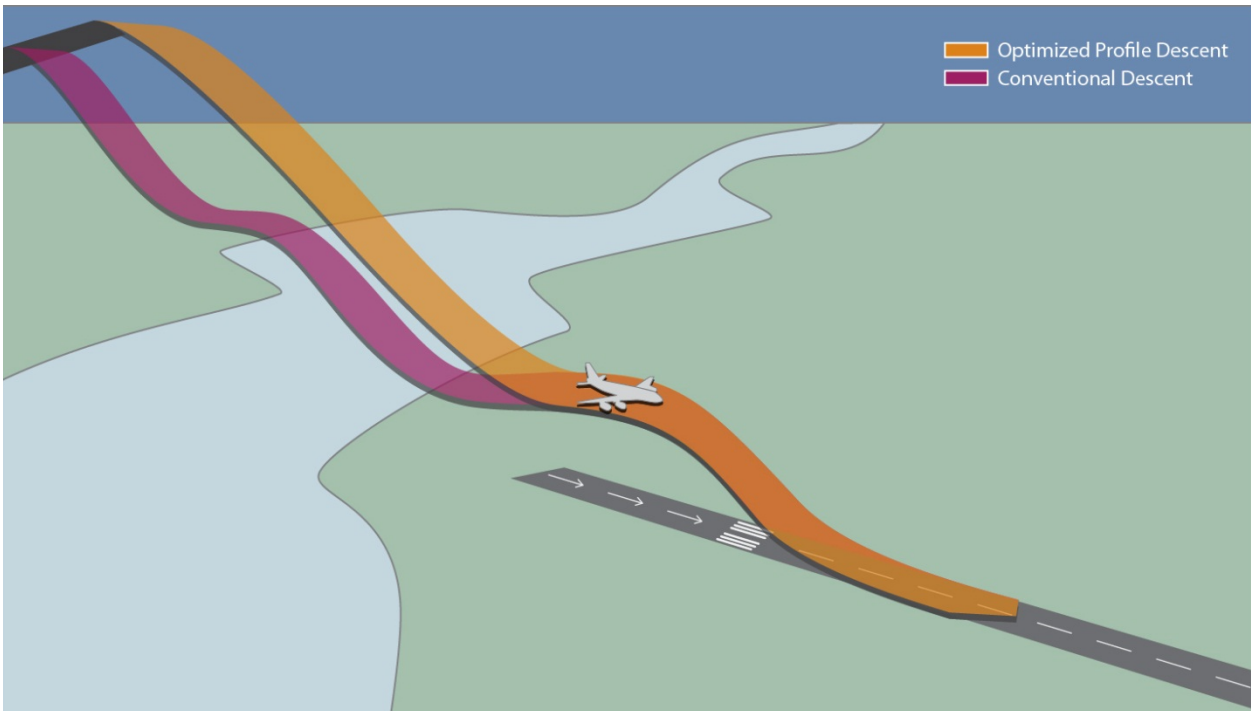
1.2.6.3 Optimized Profile Descent

An Optimized Profile Descent (OPD) is a flight procedure that uses the aircraft FMS to fly continuously from the top of descent to landing without intervening level-off segments. **Exhibit 1-6** illustrates an OPD procedure compared to a conventional descent. Aircraft that fly OPD can maintain higher altitudes and lower thrust for longer periods. This results in lower fuel burn and corresponding reductions in emissions and noise. As level-off segments are eliminated, OPD also reduces the need for communications between controllers and pilots.

1.2.7 The OAPM Initiative

The FAA intends to design and implement RNAV procedures that will take advantage of the readily available technology in the majority of aircraft as part of the OAPM initiative. The OAPM initiative specifically addresses congestion, airports in close geographical proximity, and other limiting factors that reduce efficiency in busy Metroplex airspace. Efficiency is improved by expanding the implementation of RNAV-based standard instrument procedures and connecting the routes defined by the standard instrument procedures to high and low altitude RNAV routes. Efficiency would also be increased taking advantage of RNAV to maximize the use of the limited airspace in congested Metroplex environments.

Exhibit 1-6 Optimized Profile Descent Compared to a Conventional Descent



Source: ATAC Corporation, December 2012.
Prepared by: ATAC Corporation, December 2012.

1.3 The DC Metroplex

The following sections describe the airspace structure and existing standard instrument procedures of the DC Metroplex that would be affected by the DC OAPM project.

1.3.1 DC Metroplex Airspace

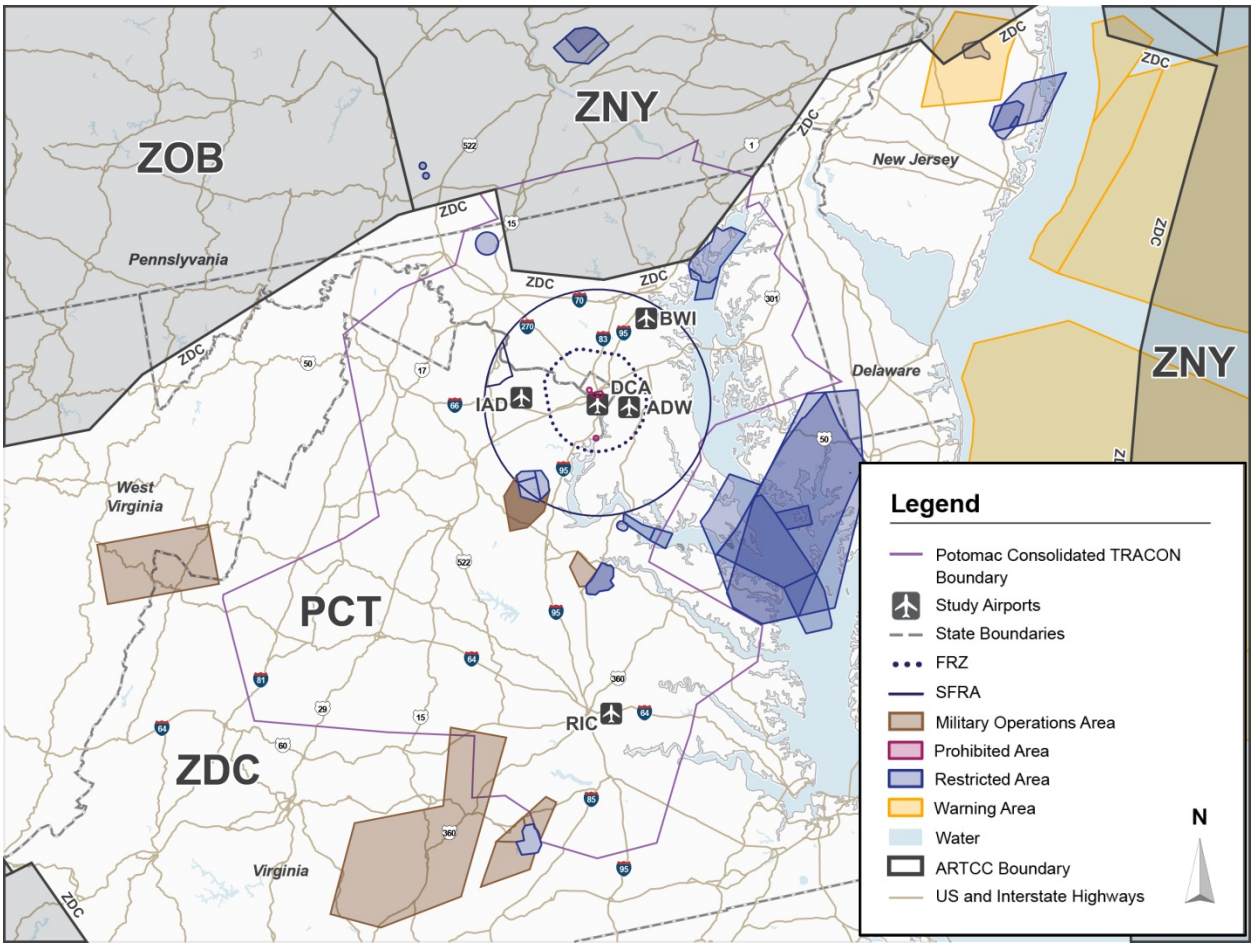
Exhibit 1-4 depicts part of the airspace structure in the DC Metroplex. Air traffic controllers in the PCT TRACON facility control a portion of airspace designated as PCT that is located within the Washington ARTCC (ZDC) and New York ARTCC (ZNY) airspace. Surrounding ARTCC airspace includes Boston (ZBW), Atlanta (ZTL), Indianapolis (ZID), and Jacksonville (ZJX). While PCT airspace is located entirely within the DC Metroplex airspace, the DC Metroplex airspace also includes portions of ZDC enroute airspace.

The lateral boundary of the PCT airspace is irregularly shaped, extending from Ronald Reagan Washington National Airport (KDCA or DCA) to between approximately 28 to 68 nmi to the north, 63 to 113 nmi to the east, 83 to 116 nmi to the south, and 63 to 113 nmi to the west. Excluding airspace delegated to the ATCTs at controlled airports within PCT, PCT controllers currently manage the airspace within these boundaries from the surface to as high as 25,000 feet MSL over the DC Metroplex area and up to 9,000 feet MSL on the outer edges. ZDC controllers manage the airspace above and adjacent to the PCT airspace, and portions of the northeast PCT area adjacent to and above the PCT airspace are managed by ZNY controllers.

1.3.1.1 DC Metroplex SUA

The physical configuration of the PCT airspace is constrained by the close proximity of major airports and the existence of SUA. Four of the six types of SUA are found within the D.C. Metroplex area, primarily reflecting airspace areas and controlled airspace used by the military as delegated by FAA (e.g., Military Operations Area and Restricted Areas). In addition, the DC Metroplex is subject to the DC SFRA and FRZ. **Exhibit 1-7** depicts the boundaries of SUA in proximity to PCT.

Exhibit 1-7 Special Use Airspace



Notes:

PCT – Potomac Consolidated TRACON
ZOB – Cleveland ARTCC
ZDC – Washington ARTCC
ADW – Joint Base Andrews
ZNY – New York ARTCC
BWI – Baltimore/Washington International Thurgood Marshall Airport
DCA – Ronald Reagan Washington National Airport
IAD – Washington Dulles International Airport
RIC – Richmond International Airport

Sources: National Flight Data Center National Airspace System Resources database, accessed September 16, 2012 (airspace boundaries); National Atlas of the United States of America: U.S. County and State Boundaries; Water Bodies; Bureau of Transportation Statistics: National Transportation Atlas Database; FAA: NFDC Airport and Runway databases.

Prepared by: ATAC Corporation, March 2013.

1.3.2 Current STARs and SIDs

As of December 2011, 32 published STARs and SIDs served the airports within the DC Metroplex airspace. Of these, 19 are conventional procedures and 13 are RNAV procedures. Eight of the 13 RNAV procedures provide RNAV guidance from the enroute airspace to a runway final approach. Many of the RNAV STARs currently in place were developed over time as the availability of RNAV-technology in aircraft cockpits increased and RNAV design criteria was improved. Several of these procedures are overlays of conventional procedures designed as part of the Potomac Consolidated TRACON Redesign project.[20] The purpose of that project was to increase efficiency and enhance safety by taking advantage of the benefits of combining the TRACON facilities in the Baltimore-Washington metropolitan area. However, the alternative selected did not include RNAV procedures.

1.4 DC Metroplex Airports

The focus of the proposed DC OAPM project is on the Study Airports which are connected to standard procedures subject to change. **Table 1-1** lists the Study Area airports, their locations, and their runways. **Exhibit 1-8** shows where the airports are located geographically.

Table 1-1 DC Metroplex EA Study Airports (1 of 2)

Airport Name	Code	Location	Runways[1/]
Major Airports			
Dulles International Airport	IAD	Washington D.C.	01L,01C,01R,19L,19C,19R, 12, 30
Ronald Reagan Washington National Airport	DCA	Washington D.C.	01, 04, 15, 19, 22, 33
Baltimore/Washington International/Thurgood Marshall Airport	BWI	Baltimore, MD	04, 10, 15L, 15R, 22, 28, 33L, 33R
Joint Base Andrews	ADW	Camp Springs, MD	01L, 01R, 19L, 19R
Richmond International Airport	RIC	Richmond, VA	02, 07, 16, 20, 25, 34

[20] U.S. Department of Transportation, Federal Aviation Administration, *Record of Decision for the Consolidated Potomac TRACON Airspace Redesign Environmental Impact Study*, June 2001.

Table 1-1 DC Metroplex EA Study Airports (2 of 2)

Airport Name	Code	Location	Runways[1/]
Satellite Airports			
Easton/Newnam Field Airport	ESN	Easton, MD	04, 15, 22, 33
Frederick Municipal Airport	FDK	Frederick, MD	05, 12, 23, 30
Leesburg Executive Airport	JYO	Leesburg, VA	17, 35
Montgomery County Airpark	GAI	Gaithersburg, MD	14, 32
Manassas Regional Airport/Harry P. Davis Field	HEF	Washington D.C.	16L, 16R, 34L, 34R
Eastern West Virginia Regional Airport/Shepherd Field	MRB	Martinsburg, WV	08, 26
Winchester Regional Airport	OKV	Winchester, VA	14, 32
Stafford Regional Airport	RMN	Stafford, VA	15, 33
Martin State Airport	MTN	Baltimore, MD	15, 33

Notes:
1/ A runway can be used in both directions, but is named in each direction separately. Runway number is based on the magnetic direction of the runway (e.g., Runway 09 points to the east direction). The two numbers on either side always differ by 180 degrees. If there is more than one runway pointing in the same direction, each runway number includes an 'L', 'C' or 'R' at the end. This is based on which side a runway is next to another one in the same direction.

Source: Department of Transportation, Federal Aviation Administration. digital-Airport/Facility Directory. September 20, 2012 (http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_afd; accessed October 5, 2012).
Prepared by: ATAC Corporation, October 2012.

1.4.1 Major Study Airports

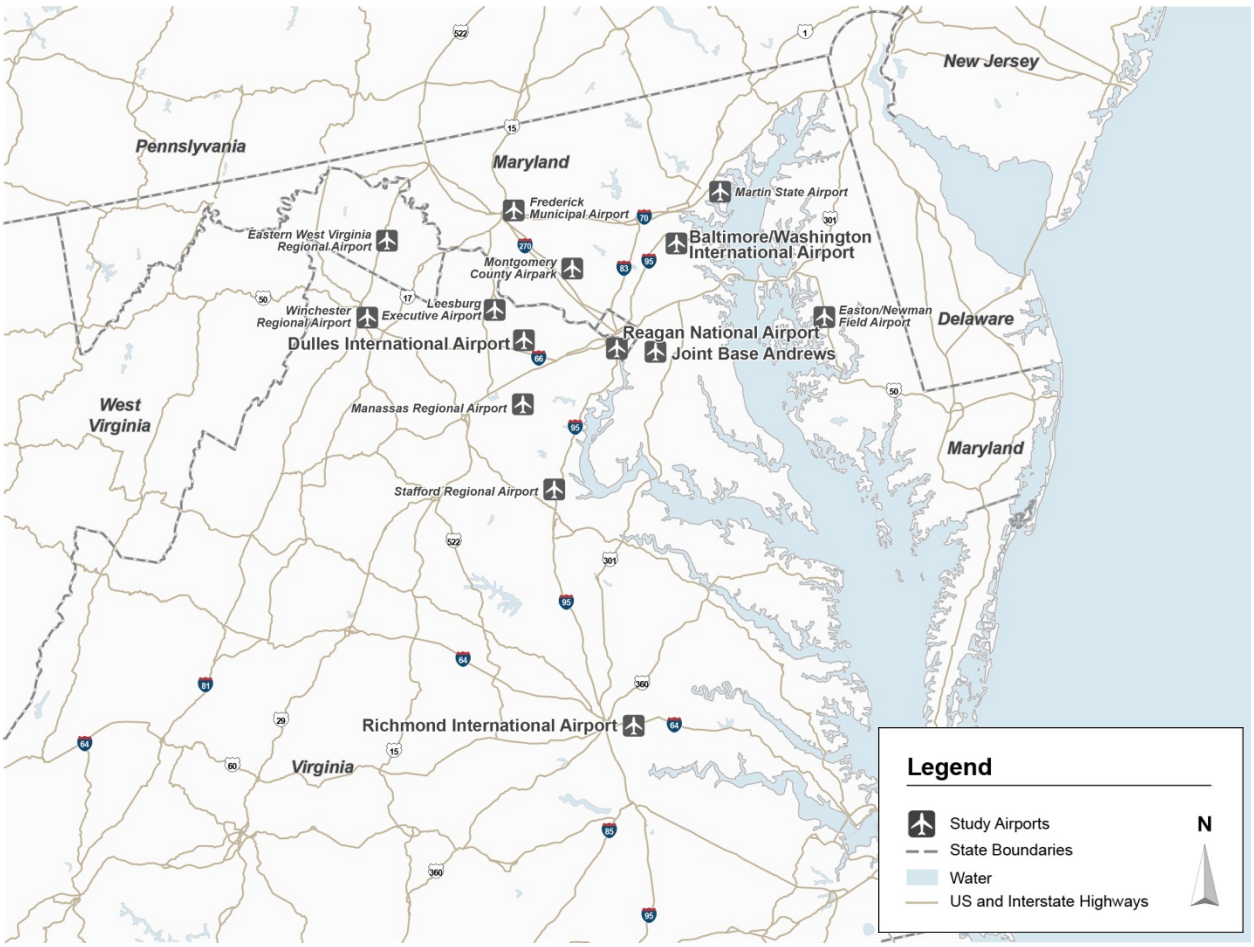
The DC Metroplex airports are divided into major Study Airports and satellite airports. The major Study Airports include the following:

Washington Dulles International Airport (KIAD or IAD) classified as a large-hub primary airport[21] in the National Plan of Integrated Airport Systems (NPIAS), IAD is the primary commercial airport serving the DC Metroplex area.[22] Accordingly, IAD receives scheduled commercial service and accommodates at least one percent of total U.S. enplaned passengers. IAD supports a mix of domestic and international passenger airlines, air cargo carriers, corporate aviation, and general aviation activity. The airport has four runways, described in **Table 1-1**. As of the end of 2011, an aircraft arriving at IAD may be assigned

[21] "Primary airport" means a commercial service airport the Secretary determines to have more than 10,000 passenger boardings each year. (49 U.S.C. § 47102(16).) "Large hub airport" means a commercial service airport that has at least 1.0 percent of the passenger boardings. (49 U.S.C. § 47102(11).)

[22] U.S. Department of Transportation, Federal Aviation Administration, *Terminal Area Forecast Summary 2012-2040*. [http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY2012.pdf; accessed May 24, 2013.]

Exhibit 1-8 Study Airport Locations



Sources: National Atlas of the United States of America: U.S. County and State Boundaries; Water Bodies; Bureau of Transportation Statistics: National Transportation Atlas Database; FAA: NFDC Airport and Runway databases; ATAC Corporation: Study Area Boundary

Prepared by: ATAC Corporation, March 2013.

one of four RNAV STARs or one of four conventional STARs. A departing aircraft may be assigned one RNAV SID or one conventional SID.[23]

Ronald Reagan Washington National Airport (KDCA or DCA) is located approximately 21 nmi southeast of IAD and accommodates a mix of commercial, corporate and general aviation activity. DCA is classified as a primary, large-hub airport in the NPIAS.[24] The airport has three runways, described in **Table 1-1**. As of the end of December 2011, DCA IFR arrivals may be assigned one of five RNAV STARs or one conventional STAR

[23] Department of Transportation, Federal Aviation Administration. *digital-Terminal Procedures*. April 5, 2012 [http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_tpp; accessed June 7, 2012.]

[24] U.S. Department of Transportation, Federal Aviation Administration, *Terminal Area Forecast Summary 2012-2040*. [http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY2012.pdf; accessed May 24, 2013.]

depending upon where they enter the terminal airspace. Departing aircraft may be assigned one RNAV SID or one conventional SID.[25]

Baltimore/Washington International Thurgood Marshall Airport (KBWI or BWI) is located approximately 40 nmi northeast of IAD and 26 nmi northeast of DCA. Similar to IAD and DCA, BWI is classified as a primary, large-hub airport under the NPIAS.[26] BWI has four runways, described in **Table 1-1**. As of the end of 2011, BWI arrivals may be assigned one RNAV STAR or one of two conventional STARs. Departing aircraft may be assigned one RNAV SID, or one of two conventional SIDs.[27]

Joint Base Andrews (KADW or ADW) is located approximately 29 nmi southeast of IAD and primarily serves military activity. The airport has two runways, described in **Table 1-1**. As of the end of 2011, arriving IFR aircraft may be assigned to one conventional STAR, depending on where they enter the terminal airspace. Departing aircraft may be assigned one of the three conventional SIDs.[28]

Richmond International Airport (KRIC or RIC) is located approximately 94 nmi south of IAD. RIC is classified as a small-hub[29] airport under the NPIAS.[30] RIC has three runways, described in **Table 1-1**. As of the end of 2011, RIC did not have associated STAR procedures. Departing aircraft may be assigned one of two conventional SIDs.[31]

Approximately 88 percent of all IFR traffic within the DC Metroplex area operates at the major Study Airports. As shown in **Table 1-2**, in 2011, the combined major and satellite Study Airports accommodated 95 percent of all IFR traffic that departed or landed under FAA control in or out of the DC Metroplex area (specifically within the PCT TRACON and ZDC controlled airspace).

1.4.2 Major Study Airport Runway Operating Configurations

The major Study Airports often operate under several different runway operating configurations depending on conditions such as weather, prevailing wind, and air traffic conditions. As a result, it is possible for the runway ends used for arrivals and departures to change several times throughout a day. ATCT controllers at these airports generally use two different runway operating configurations, and each runway operating configuration may designate primary and secondary arrival and departure runway ends for that configuration.

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[25] Department of Transportation, Federal Aviation Administration. *digital-Terminal Procedures*. April 5, 2012 (http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_tpp; accessed June 7, 2012).

[26] U.S. Department of Transportation, Federal Aviation Administration, *Terminal Area Forecast Summary 2012-2040*. [http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY2012.pdf; accessed May 24, 2013.]

[27] Department of Transportation, Federal Aviation Administration. *digital-Terminal Procedures*. April 5, 2012 (http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_tpp; accessed June 7, 2012).

[28] Id.

[29] "small hub airport" means a commercial service airport that has at least 0.05 percent but less than 0.25 percent of the passenger boardings. (49 U.S.C. § 47102(25).)

[30] U.S. Department of Transportation, Federal Aviation Administration, *Terminal Area Forecast Summary 2012-2040*. [http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY2012.pdf; accessed May 24, 2013.]

[31] Department of Transportation, Federal Aviation Administration. *digital-Terminal Procedures*. April 5, 2012 (http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_tpp; accessed June 7, 2012).

Table 1-2 Distribution of 2011 IFR Traffic Among Study Airports in PCT

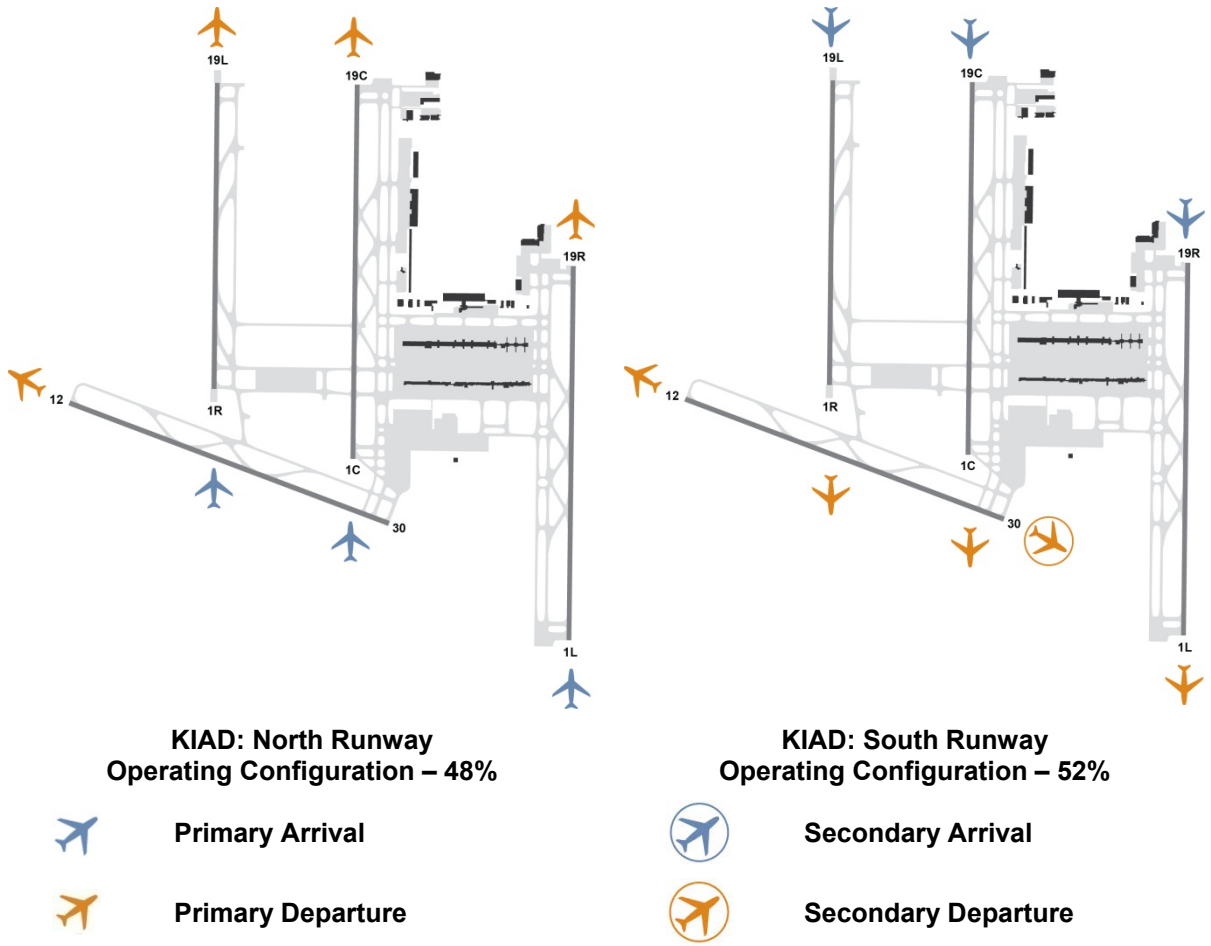
Airport	IFR Operations	Percent of Total Operations
Dulles International Airport (IAD)	359,608	31.1%
Ronald Reagan Washington National Airport (DCA)	282,618	24.4%
Baltimore/Washington International/Thurgood Marshall Airport (BWI)	272,908	23.6%
Richmond International Airport (RIC)	86,435	7.5%
Joint Base Andrews (ADW)	25,641	2.2%
Manassas Regional Airport/Harry P. Davis Field (HEF)	20,072	1.7%
Leesburg Executive Airport (JYO)	11,605	1.0%
Martin State Airport (MTN)	11,366	1.0%
Montgomery County Airpark (GAI)	9,758	0.8%
Frederick Municipal Airport (FDK)	6,570	0.6%
Easton/Newnam Field Airport (ESN)	5,217	0.5%
Eastern West Virginia Regional Airport/Shepherd Field (MRB)	3,616	0.3%
Winchester Regional Airport (OKV)	3,153	0.3%
Stafford Regional Airport (RMN)	2,893	0.2%
Total IFR Operations	1,101,460	95.1%
Total PCT IFR Operations	1,157,617	100.0%

Notes:
(Sorted from Highest IFR Operations to Lowest)

Source: Department of Transportation, Federal Aviation Administration. Operations Network: Tower Counts for KIAD, KDCA, KADW, KRIC, KHEF, and KESN https://aspm.faa.gov/opsnet/sys/Tower.asp (accessed October 5, 2012); Traffic Flow Management System Counts for KFDK, KGAI, KJYO, KMRB, KOKV, and KRMN https://aspm.faa.gov/tfms/sys/Airport.asp (accessed October 5, 2012).
Prepared by: ATAC Corporation, October 2012.

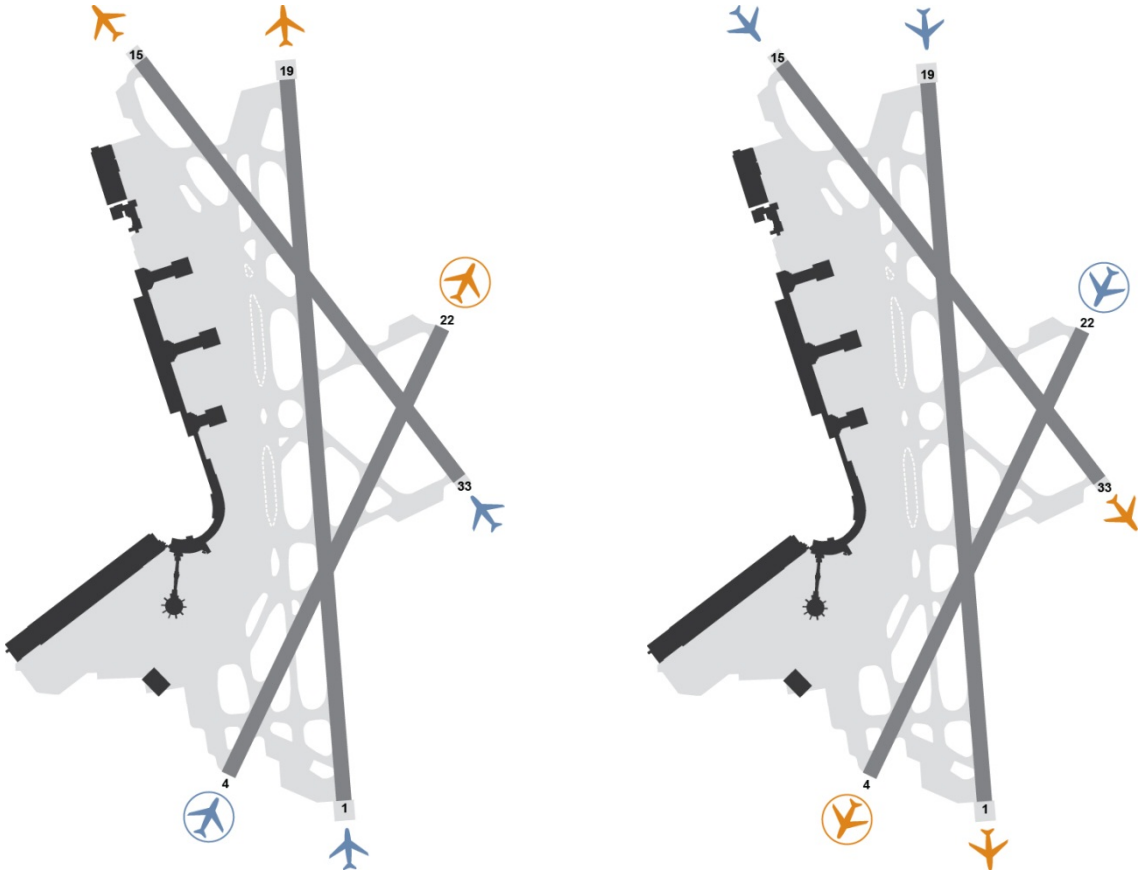
Exhibits 1-9 through **1-13** illustrate the primary runway operating configurations at IAD, DCA, BWI, ADW, and RIC, respectively.

Exhibit 1-9 KIAD Runway Operating Configurations



Source: U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.
Prepared By: ATAC Corporation, December 2012.

Exhibit 1-10 KDCA Runway Operating Configurations



KDCA: North Runway Operating Configuration – 57%

KDCA: South Runway Operating Configuration – 43%

Primary Arrival

Secondary Arrival

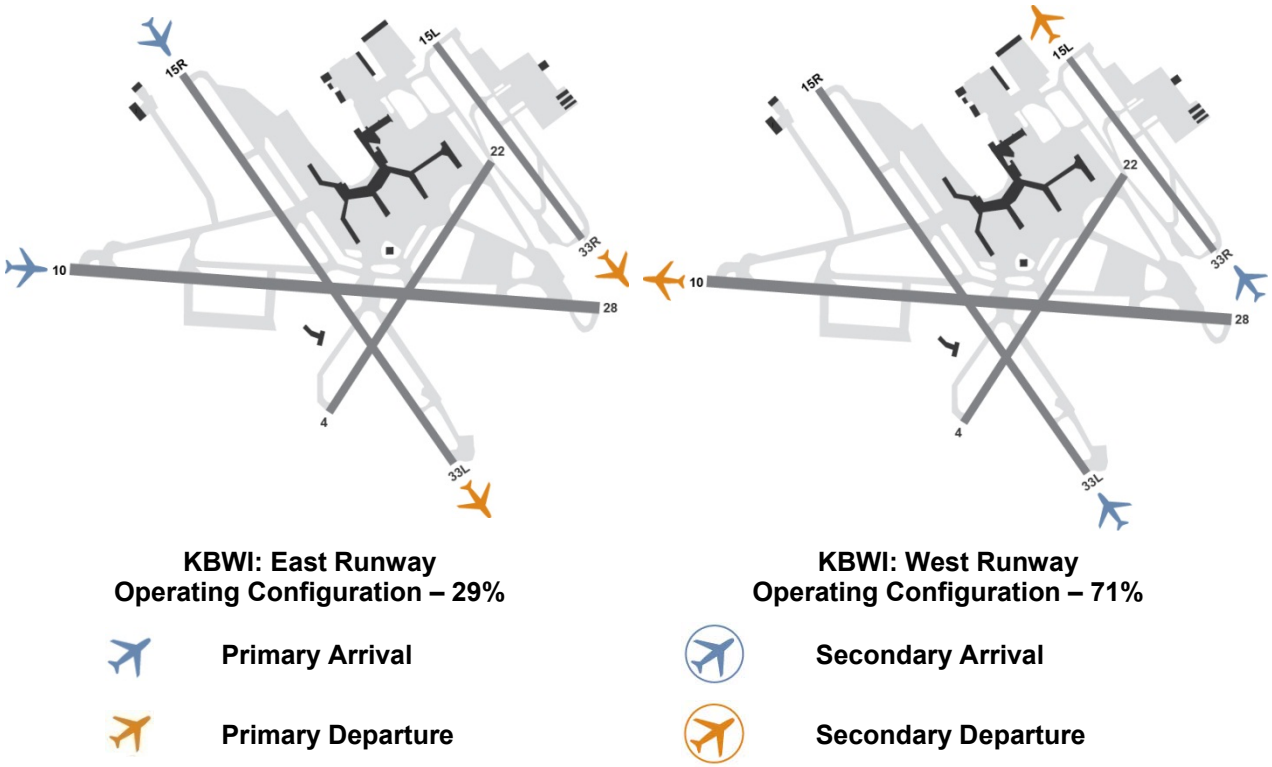
Primary Departure

Secondary Departure

Source: U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.

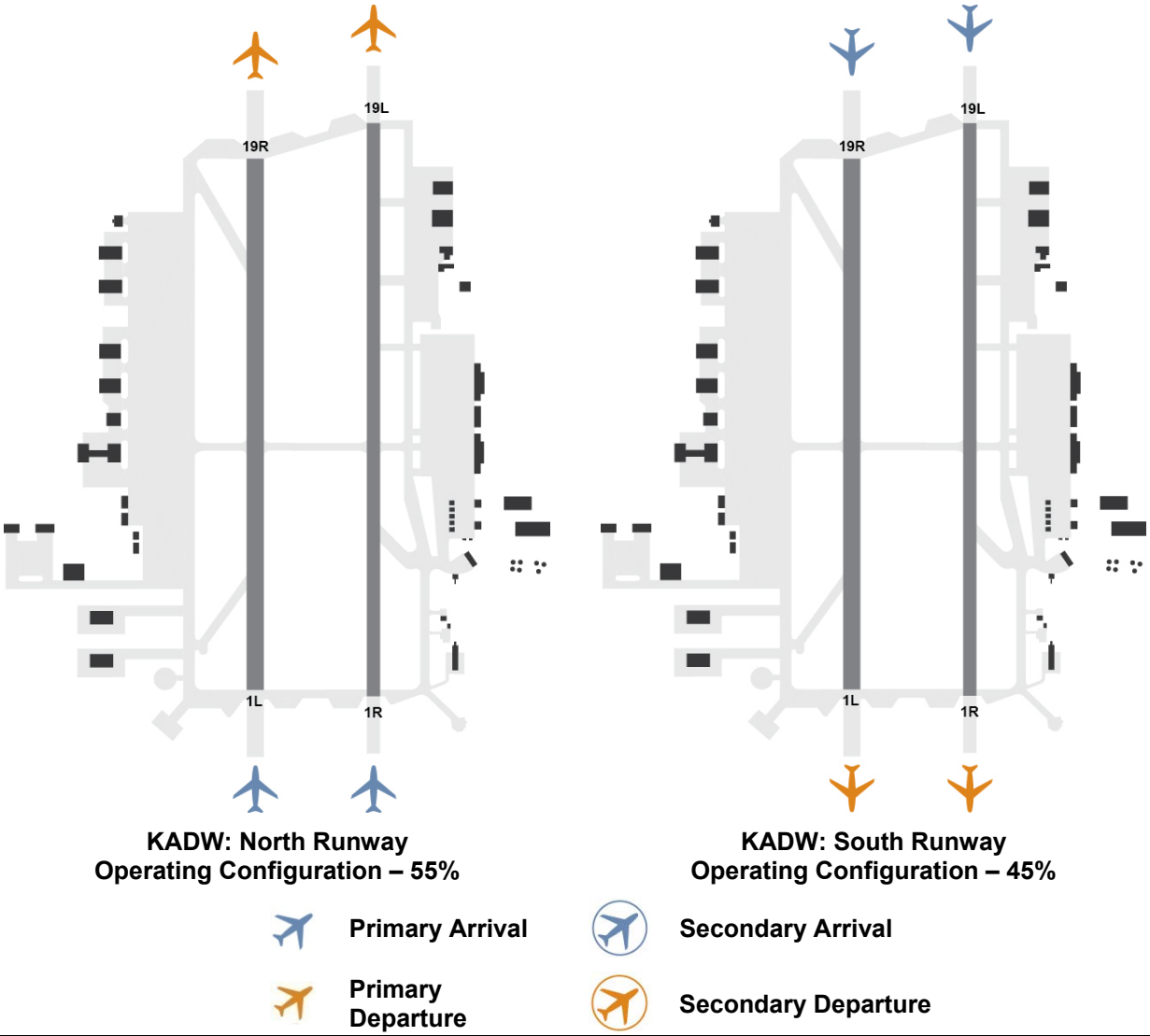
Prepared By: ATAC Corporation, December 2012.

Exhibit 1-11 KBWI Runway Operating Configurations



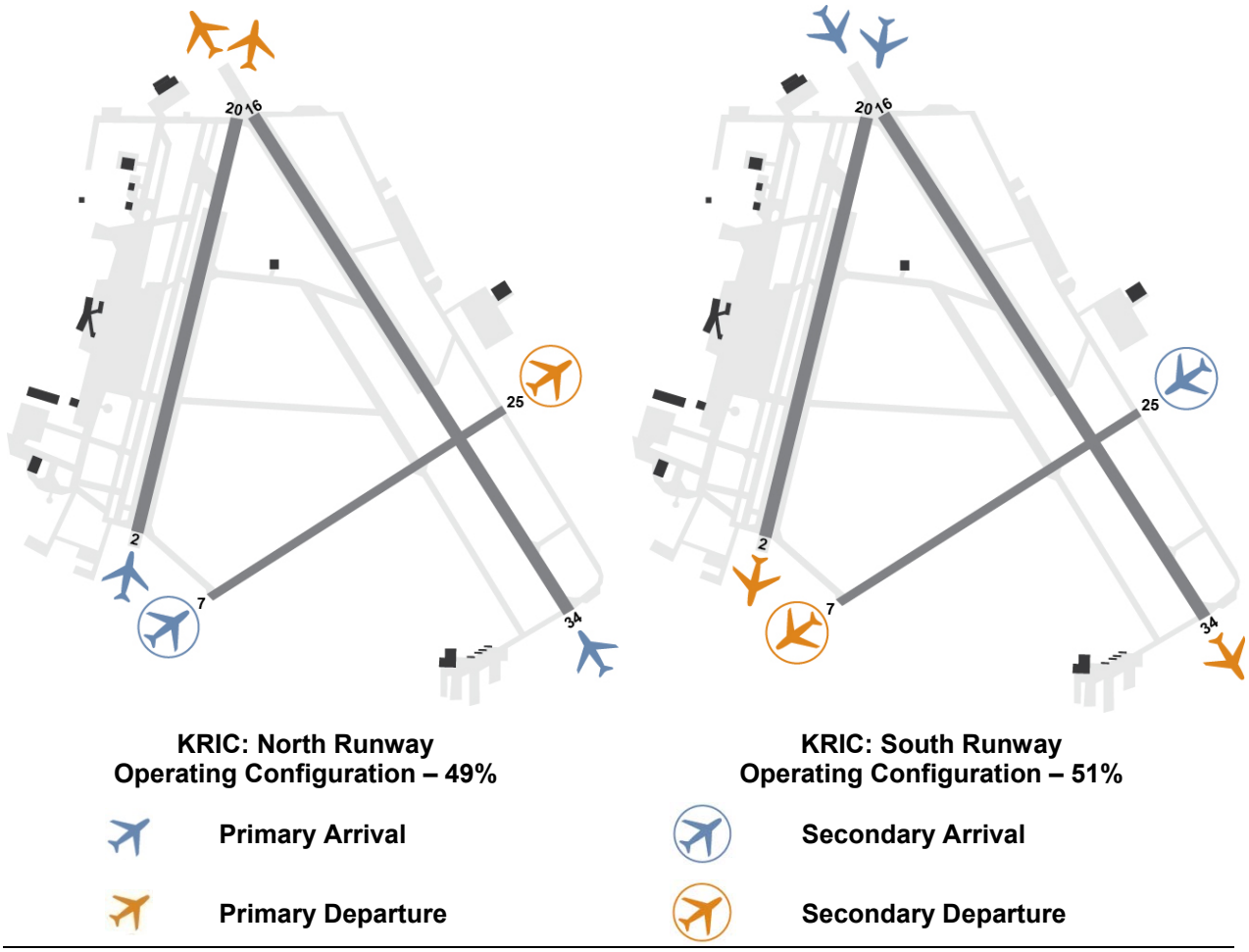
Source: U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.
Prepared By: ATAC Corporation, December 2012.

Exhibit 1-12 KADW Runway Operating Configurations



Source: U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.
Prepared By: ATAC Corporation, December 2012.

Exhibit I-13 KRIC Runway Operating Configurations



Source: U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.
Prepared By: ATAC Corporation, December 2012.

2 Purpose and Need

As discussed in Chapter 1, the FAA Modernization and Reform Act of 2012 ("the Act") was enacted in February 2012 to help modernize the nation's air transportation system. Among other provisions, the Act requires the implementation of performance-based airspace procedure enhancements at 35 of the nation's busiest airports[32] and at any medium or small hub airports located within the same Metroplex area as determined by the FAA Administrator. The Act also requires that all performance-based procedures be certified, published, and implemented by June 30, 2015. Accordingly, the Federal Aviation Administration (FAA) proposes to increase the efficiency of the DC Metroplex airspace through the implementation of area navigation (RNAV) defined Instrument Flight Procedures (IFPs)[33] that improve upon existing, but less efficient ground-based and/or radar vector procedures.[34] The FAA Administrator has decided to implement the DC Metroplex enhancements before the June 30, 2015 deadline.

This EA is being prepared by the FAA to evaluate the potential environmental impacts associated with implementation of RNAV-defined IFPs for the DC Metroplex (Proposed Action). NEPA requires EAs to articulate the purpose of and need for the action being proposed. Identification of the need for an action provides the basis for identification of reasonable alternatives, including the Proposed Action, that can meet the purpose, and therefore, address the need or problem. The following sections discuss the need for and the purpose of the Proposed Action. Following this discussion, the Proposed Action is described in detail.

2.1 The Need for the Proposed Action

In the context of an EA, "need" refers to the problem that the Proposed Action is intended to resolve. The problem in this case is the inefficiency of the existing airspace structure and aircraft flight procedures in the DC Metroplex. This is due to the use of older NAVAID technology when newer RNAV technology is readily available. As described in Chapter 1, a majority of commercial aircraft operating in the DC Metroplex are RNAV equipped; however, most procedures currently used in the DC Metroplex are conventional and rely upon ground-based NAVAIDs. Because conventional procedures cannot provide more predictable controls inherent in RNAV procedures, such as specific speeds or altitudes, controllers use vectoring and speed adjustments to manage traffic. This leads to increased controller and pilot workload. RNAV procedures are free of the lateral and vertical flight path limitations typical of conventional procedures. This inefficient use of available technology impedes FAA's ability to meet one of its primary missions as mandated by Congress – to provide for the efficient use of airspace. Furthermore, as discussed in Section 1.2.6.1, RNAV technology can add efficiency to an air traffic system with enhanced predictability, flexibility, and route segregation.

[32] The 35 airports are identified under the Act as Operational Evolution Partnership (OEP) airports. OEP airports are commercial U.S. airports with significant activity. These airports serve major metropolitan areas and also serve as hubs for airline operations. More than 70 percent of U.S. passengers move through these airports.

[33] Instrument Flight Procedures (IFP) - Instrument flight procedures specify standard routings, maneuvering areas, flight altitudes, and visibility minimums for instrument flight rules (IFR). These procedures include airways, jet routes, off-airway routes, Standard Instrument Approach Procedures (SIAP(s)), Standard Instrument Departure Procedures/ Departure Procedures (SID(s))/ DP(s)), and Standard Terminal Arrival Routes (STAR(s)). (FAA Order 8200.1C *United States Standard Flight Inspection Manual*).

[34] "Procedure" is a predefined set of guidance instructions that define a route for a pilot to follow.

The following sections describe the problem in detail followed by a discussion of the causal factors that have contributed to the problem. A detailed explanation of the technical terms and concepts used in this chapter can be found in Chapter 1, *Background*.

2.1.1 Description of the Problem

Many existing Standard Instrument Departure (SID) and Standard Terminal Arrival Route (STAR) procedures require aircraft to use ground-based NAVAIDs to navigate to and from air carrier and General Aviation (GA) airports in the DC Metroplex. As discussed in Section 1.2.6.1, *RNAV*, conventional procedures are less accurate because of radio signal limitations that can arise between NAVAIDs and aircraft due to factors such as terrain. As a result, ground-based NAVAID procedures require large areas of clearance on either side of a route's main path to account for potential obstructions. Furthermore, conventional procedures are dependent upon where ground-based NAVAIDs are located which can result in less efficient routing. Because conventional procedures are less accurate, the actual location of an aircraft both laterally and vertically, can be less predictable for both ATC and pilots.

The lack of accuracy and predictability requires ATC to use aircraft management tools and coordination techniques such as speed control, level flight segments, and vectoring to guide aircraft. These tools and coordination techniques are further discussed in Section 1.2.2., *Air Traffic Control within the National Airspace System*. Applying these tools and techniques without a more precise means to predict exactly where aircraft are located along an assigned procedure is complex. In most situations, these tools and techniques lead to less efficient aircraft operations and inefficient use of airspace. For example, Air Traffic Control (ATC) may issue instructions requiring an aircraft to level off during climb and descent to prevent conflicts with other aircraft. This leads to increased flight time and distance than would otherwise be necessary. Furthermore, increased communications between controller and pilot may result in less precise flight paths due to the time it takes the controller to issue an instruction to the pilot and for the pilot to read the instruction back to the controller for confirmation before the instruction can be executed. As a result, more airspace must be protected to allow aircraft the latitude to operate leading to less efficient and less flexible operations.

The lack of precision resulting from inefficient use of technology also contributes to reduced available airspace. In addition, the lower levels of predictability and accuracy associated with these procedures require ATC to issue additional instructions to pilots, increasing pilot workload and requiring constant monitoring by ATC. Combined, these factors form the basis for the problem within the DC Metroplex.

The lack of SIDs and STARS based on current RNAV technology adversely affects FAA's ability to efficiently manage available airspace. Therefore, the problem is the inability to provide additional efficiency afforded by RNAV technology. **Table 2-1** presents the number of standard instrument procedures dependent upon conventional navigation (radar vectors or ground-based NAVAIDs), the number of procedures dependent upon RNAV, and the total number of standard instrument procedures, unique and shared.

Table 2-1 Standard Instrument Procedure Counts

Airport	Conventional Procedures	RNAV Procedures	Total Unique (Shared) Standard Procedures
KIAD	CAPITAL EIGHT, DELRO TWO, PHILIPSBURG TWO, SELSINGROVE THREE (COATT FOUR)	STOIC TWO, BARIN ONE, LEGGO TWO, PRTZL THREE (HYPER FOUR, SHNON, ROYIL)	8
KDCA	NATIONAL TWO (IRONS FOUR)	LAZIR THREE, BILIT ONE, CLIPR ONE, OJAAY ONE, SKILS TWO (ELDEE FIVE)	6
KBWI	PALEO THREE, SWANN THREE (NOTTINGHAM SIX, WESTMINSTER FIVE)	TERPZ TWO (RAVNN THREE)	3
KRIC	COLIN FIVE, YEAST ONE	None	2
KADW	ANDREWS ONE, CAMP SPRINGS ONE, MORNINGSIDE ONE, WZZRD TWO (IRONS FOUR)	None (ELDEE FIVE)	4
KESN	None	None	0
KFDK	None	None	0
KGAI	None	None	0
KHEF	ARSENAL TWO (COATT FOUR)	None (HYPER FOUR, SHNON, ROYIL)	1
KJYO	None(COATT FOUR)	None (SHNON, ROYIL)	0
KOKV	None	None (HYPER FOUR)	0
KMRB	TRIXY FOUR	None (HYPER FOUR)	1
KMTN	None (NOTTINGHAM SIX, WESTMINSTER FIVE)	None (RAVNN THREE)	0
KRMN	None	None (HYPER FOUR)	0
Total	15(4)	10(5)	25(9)

Table Notes:
Counts in parentheses represent procedures shared by more than one airport.
Airports
KIAD: Dulles International Airport
KDCA: Ronald Reagan Washington National Airport
KBWI: Baltimore-Washington International Thurgood Marshall Airport
KRIC: Richmond International Airport
KADW: Andrews Air Force Base
KESN: Easton/Newnam Field Airport
KFDK: Frederick Municipal Airport
KGAI: Montgomery County Airpark
KHEF: Manassas Regional Airport
KJYO: Leesburg Executive Airport
KOKV: Winchester Regional Airport
KMRB: Eastern WV Regional Airport/Shepherd Field
KMTN: Martin State Airport
KRMN: Stafford Regional Airport

Source: National Flight Data Center (NFDC), accessed 8/29/2012.
Prepared By: ATAC Corporation, June 2013.

To take full advantage of current RNAV technology, the number of RNAV procedures should be close to the total number of existing procedures. For the DC Metroplex, as of December 2011, there were 34 standard instrument procedures, 44 percent of which were RNAV based (10 unique procedures and five shared procedures). The conventional procedures do not segregate traffic efficiently due to dependence on conventional navigation using ground-based NAVAIDs or a mix of conventional and RNAV navigation. Section 2.1.3 describes the current factors that lead to limited means of providing additional efficiency.

It is important to note that a key design constraint is safety. Any proposed change to a procedure to resolve the problem must not degrade safety, and if possible enhance safety. Current procedures do not include any safety issues because published procedures must meet defined safety criteria; accordingly, the Proposed Action is not being proposed to address any safety issues.

2.1.2 Causal Factors

A problem (or need) is best addressed by examining the circumstances or causal factors that together serve as a foundation for the need. As previously described, the problem for the DC Metroplex is the prevalence of existing SID and STAR procedures dependent on older ground-based NAVAID technology leading to inefficiencies in the DC Metroplex airspace.

The need for the Proposed Action can be better understood and addressed based on the specific factors causing the problem. Addressing the causal factors that lead to the problem will ultimately facilitate development of a reasonable alternative designed to resolve the problem (or meet the purpose).

Three key factors were identified by the DC Metroplex Study Team as causes for the lower level of efficiency in the DC Metroplex:

- Lack of flexibility in the efficient transfer of traffic between the enroute and terminal area airspace;
- Complex converging interactions between arrival and departure flight paths; and,
- Lack of predictable standard routes defined by procedures to/from airport runways to/from enroute airspace.

The following sections describe these three causal factors in detail.

2.1.2.1 Lack of Flexibility for the Efficient Transfer of Traffic Between the Enroute and Terminal Area Airspace

Flexibility allows ATC to plan and adapt to traffic demands, which change frequently within any given hour. Even though flights are scheduled, delays in other regions of the U.S. or severe weather along an aircraft's route may cause aircraft to enter or exit the enroute and terminal area airspace at times other than those previously scheduled. Controllers require options to manage dynamic traffic demand.

Elements such as additional entry and exit points, individual procedures for each Study Airport, and the ability to diverge aircraft (turn aircraft on different headings away from each other) earlier reduces the amount of vectoring needed to merge traffic and maintain safe

separation. These elements also provide additional options when one procedure is too busy to accommodate additional traffic.

The "four corner post" airspace design presents the most efficient way to transfer aircraft to an airport from an entry gate and from an airport to an exit gate. In a typical four-corner post system, aircraft depart the terminal airspace through exit gates to the north, east, south, and west. Aircraft arrive to the terminal airspace through entry gates to the northeast, southeast, southwest, and northwest. However, implementation of a four corner post system in the PCT terminal airspace is restricted by various factors including geographic location, close proximity among airports, runway geometry, traffic demand, and other constraints. Consequently, the transfer control areas for PCT are found in locations that best meet the unique characteristics of the DC Metroplex airspace.

The limited number of terminal airspace entry and exit points serving as offloads and/or separate traffic routes result in gaps in arrival and departure flows to and from Study Airports within the PCT terminal area airspace.[35] For arrivals, the gaps between aircraft on a given procedure are large enough to fit another aircraft. Due to the need to merge flows that could otherwise operate independently with development of the appropriate procedures, the controller is not able to use the existing airspace as efficiently as possible.

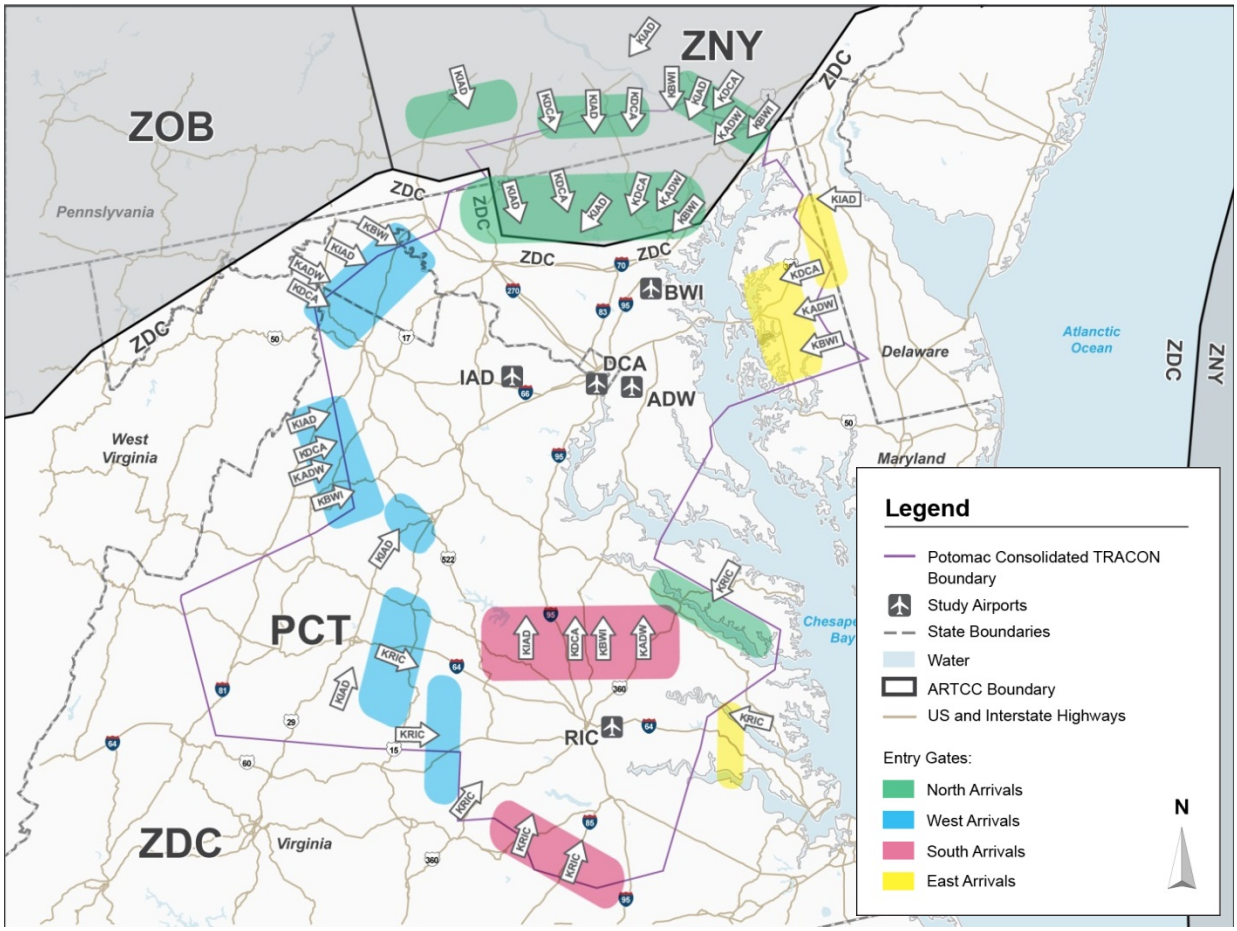
The following sections further discuss flexibility issues specific to the terminal area airspace entry and exit points.

Entry Points

Exhibit 2-1 depicts the entry points where control is transferred from the Centers to the TRACON in the DC Metroplex airspace. These entry points are often shared by aircraft arriving at different Study Airports. **Table 2-2** lists the STAR procedures and associated transition points for the major Study Airports.

[35] Flow: multiple aircraft operations assigned to a procedure that operate along the same route, and includes variation in aircraft location over the ground. A traffic flow is typically defined by several days of radar flight tracks. Traffic flows may also be represented by corridors based on a frequently traveled area characterized by one or more well-traveled routes.

Exhibit 2-1 Terminal Airspace Control Transfer Areas - Arrivals



Notes:

PCT – Potomac Consolidated TRACON	*ZDC – Washington ARTCC*	*ZNY – New York ARTCC*
ZOB – Cleveland ARTCC	*ADW – Joint Base Andrews*	*BWI – Baltimore/Washington International Thurgood Marshall Airport*
DCA – Ronald Reagan Washington National Airport	*IAD – Washington Dulles International Airport*	*RIC – Richmond International Airport*

Source: DC OAPM Metroplex Study Team, 2010
Prepared by: ATAC Corporation, March 2013.

Table 2-2 STAR Arrival Transitions

Arrival Transitions	STAR Procedure	Airport
AIR	EMI5	KBWI
ALB	HYPER4 (RNAV)	KIAD
BAF	HYPER4 (RNAV)	KIAD
BKW	ROYIL2	KIAD
	SHNON2	KIAD
	ELDEE5 (RNAV)	KDCA
	WZRRD2	KDCA
CSN	OTT6	KBWI
	RAVNN3 (RNAV)	KBWI
ESL	ROYIL2	KIAD
	SHNON2	KIAD
FAK	BARIN1 (RNAV)	KIAD
	COATT4	KIAD
	OTT6	KBWI
FQM	LEGGO2 (RNAV)	KIAD
	SEG3	KIAD
HVQ	ROYIL2	KIAD
	SHNON2	KIAD
	ELDEE5 (RNAV)	KDCA
	WZRRD2	KDCA
KEMAN	EMI5	KBWI
LAFLN	BILIT1 (RNAV)	KDCA
LRP	SKILS2 (RNAV)	KDCA
	DELRO2	KIAD
LVZ	LEGGO2 (RNAV)	KIAD
	SEG3	KIAD
MGW	EMI5	KBWI
MXE	CLIPR1 (RNAV)	KDCA
	DELRO2	KIAD
	HYPER4 (RNAV)	KIAD
PARKE	HYPER4 (RNAV)	KIAD
PSB	PSB2	KIAD
	PRTZL3 (RNAV)	KIAD
	SKILS2 (RNAV)	KDCA
RBV	HYPER4 (RNAV)	KIAD
RIC	IRONS4	KDCA
	RAVNN3 (RNAV)	KBWI
	OJAAY1 (RNAV)	KDCA
	OTT6	KBWI
RIDGY	BILIT1 (RNAV)	KDCA
SHAAR	ELDEE5 (RNAV)	KDCA
	WZRRD2	KDCA

Table Notes:
***Bold** indicate shared transitions.*

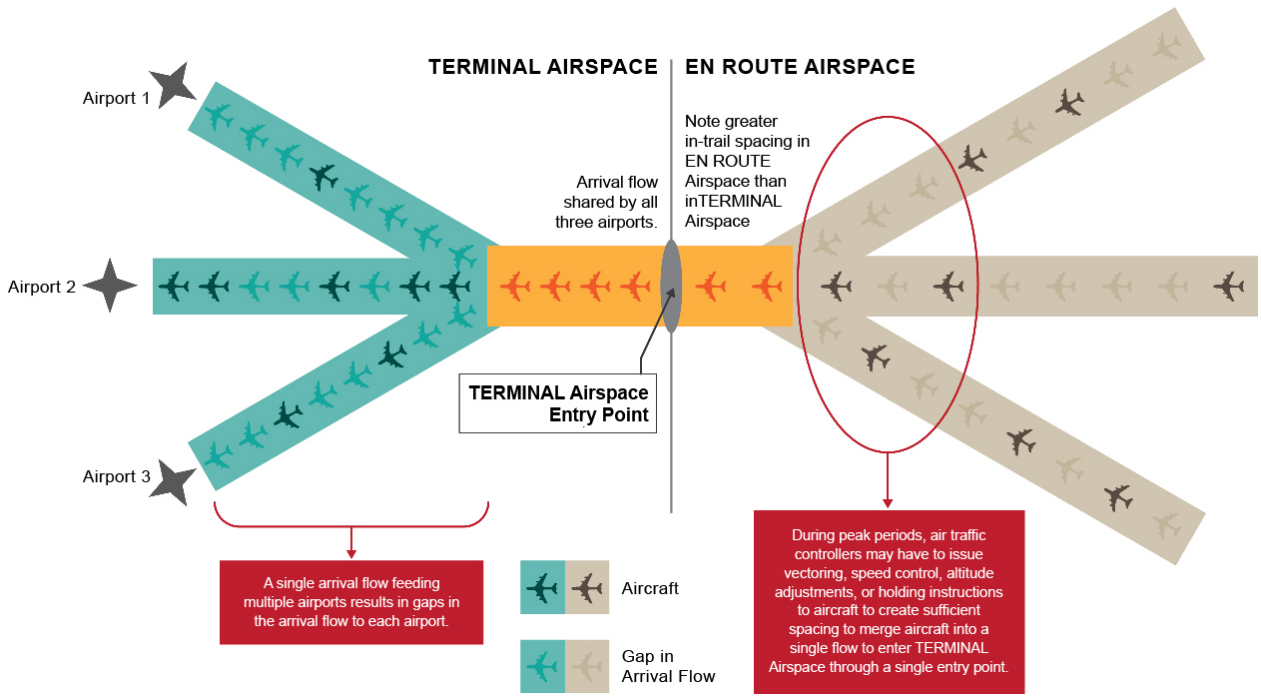
Ground-based NAVAIDS				*Fixes*
ALB: Albany VORTAC	*ESL: Kessel VOR/DME*	*LRP: Lancaster VORTAC*	*PSB: Philipsburg VORTAC*	*KEMAN, LAFLN*
BAF: Barnes VORTAC	*FAK: Flat Rock VORTAC*	*LVZ: Wilkes-Barre VORTAC*	*RBV: Robbinsville VORTAC*	
BKW: Beckley VORTAC	*FQM: Williamsport VOR/DME*	*MGW: Morgantown VORTAC*	*RIC: Richmond VORTAC*	*RIDGY*
CSN: Casanova VORTAC	*HVQ: Charleston VORTAC*	*MXE: Modena VORTAC*		*PARKE, SHAAR*

Source: NFDC, accessed May 31, 2012.
Prepared By: ATAC Corporation, 2012.

The limited number of well-defined entry points results in challenges that affect the efficient management of aircraft traffic. Because of the geographic location of the DC Metroplex area, the majority of aircraft enter the terminal airspace from the west, north, and south. Approximately 45 percent of traffic enters from the west, 25 percent enters from the north, and 17 percent enters from the south.[36] As a result, airspace congestion occurs during periods of high demand at each of these locations. The resulting congestion requires the issuance of air traffic instructions such as vectoring, controlling speed, holding aircraft, leveling off aircraft, or rerouting aircraft to other entry points, which, as described in Section 2.1.1, increases pilot and controller workload, increases complexity for both controllers and pilots, and can result in delays.

Exhibit 2-2 illustrates how aircraft arrivals are sequenced in the enroute airspace and then merged to enter terminal airspace at a single point.

Exhibit 2-2 Illustration of Single Terminal Airspace Entry Point and Single Arrival Flow with Traffic Sequenced to Multiple Airports



Source: Federal Aviation Administration, July 2012.
Prepared by: ATAC Corporation, June 2012.

Aircraft arriving from different enroute flows must be merged into a single arrival flow at an entry point to terminal airspace. This is similar to traffic in multiple freeway lanes merging into one lane which can cause congestion prior to the merge. To maintain safe separation between aircraft, controllers must create sufficient gaps between aircraft along the route to safely line up aircraft from multiple streams. This may require ATC to issue instructions directing a pilot to take actions that can result in slower air traffic and increased congestion. This also results in increased workload for both the controller and pilot. Aircraft destined for each of the Study Airports share standard instrument arrival procedures that enter the

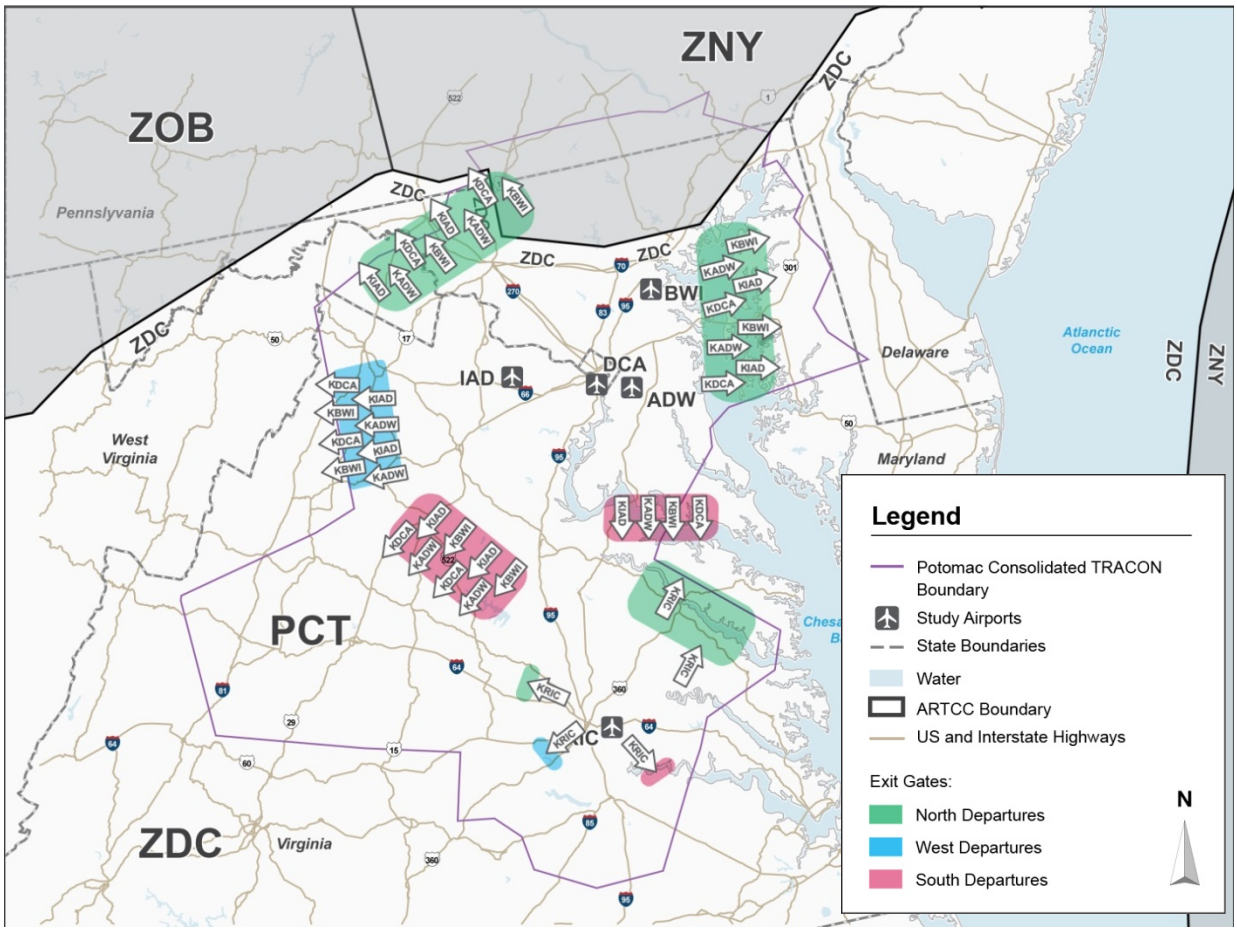
[36] Department of Transportation, Federal Aviation Administration, *OAPM Study Team Final Report, Washington D.C. Metroplex*, March 11, 2011.

terminal airspace on a single arrival flow through one of the entry points. Aircraft are then split from a single arrival flow and issued instructions to the final approaches to the various runways at the different Study Airports. Gaps in the flow to the individual Study Airports can develop after aircraft are sequenced and directed to the final approaches to the respective airport runways.

Exit Points

Exhibit 2-3 depicts the exit points where control is transferred from the TRACON to the ARTCCs for aircraft departing the DC Metroplex airspace.

Exhibit 2-3 Terminal Airspace Control Transfer Areas - Departures



Notes:

PCT – Potomac Consolidated TRACON	*ZDC – Washington ARTCC*	*ZNY – New York ARTCC*
ZOB – Cleveland ARTCC	*ADW – Joint Base Andrews*	*BWI – Baltimore/Washington International Thurgood Marshall Airport*
DCA – Ronald Reagan Washington National Airport	*IAD – Washington Dulles International Airport*	*RIC – Richmond International Airport*

Source: DC OAPM Metroplex Study Team, 2010.
Prepared by: ATAC Corporation, March 2013.

Table 2-3 lists the transitions for each SID that serves the four major study area airports. During peak periods of departure to the west, south, and north, controllers must merge departing aircraft from the Study Airports into single departure flows that pass through the terminal area exit points. Merging departing aircraft into departure flows can lead to delays.

Accordingly, controllers must frequently employ management tools such as holding departing aircraft on the ground before takeoff to control air traffic volume in the surrounding airspace. This directly affects departure efficiency at the Study Airports.

In addition to holding aircraft on the ground, controllers may also assign vectors and level-offs to aircraft during their departure climbs to provide adequate separation as aircraft are gradually merged into a departure route. The need to merge aircraft into departure routes increases the complexity of managing the terminal airspace and can decrease the efficiency of the airspace volume. Vectoring can also increase flight distances and reduce predictability, as aircraft are assigned less direct routes which they must continue to follow as they proceed further away from an airport.

Table 2-3 SID Departure Transitions (1 of 2)

Departure Transitions	SID Procedure	Airport
ACY	PALEO3	KBWI
BUFFR	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	TERPZ2 (RNAV)	KBWI
	CPTAL8	KIAD
COLIN	COLIN5	KRIC
CSN	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	CPTAL8	KIAD
DAILY	STOIC2 (RNAV)	KIAD
	LAZIR2 (RNAV)	KDCA
DQO	SWANN3	KBWI
DRAIK	YEAST1	KRIC
EMI	CPTAL8	KIAD
ENO	PALEO3	KBWI
	CPTAL8	KIAD
FLUKY	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	TERPZ2 (RNAV)	KBWI
GVE	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	CPTAL8	KIAD
GINYA	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
HAFNR	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	TERPZ2 (RNAV)	KBWI
HCM	COLIN5	KRIC
JERES	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	CPTAL8	KIAD
	TERPZ2 (RNAV)	KBWI
LDN	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	TERPZ2 (RNAV)	KBWI
	CPTAL8	KIAD

Table 2-3 SID Departure Transitions (2 of 2)

Departure Transitions	SID Procedure	Airport
LYH	YEAST1	KRIC
MOL	YEAST1	KRIC
MRB	CPTAL8	KIAD
OOD	SWANN3	KBWI
OTT	CPTAL8	KIAD
PALEO	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	STOIC2 (RNAV)	KIAD
PAUKI	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
PXT	COLIN5	KRIC
RAMAY	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	TERPZ2 (RNAV)	KBWI
SANNY	YEAST1	KRIC
SIE	PALEO3	KBWI
SWANN	LAZIR2 (RNAV)	KDCA
	NATNL2	KDCA
	STOIC2 (RNAV)	KIAD
WOOLY	STOIC2 (RNAV)	KIAD
	NATNL2	KDCA

Table Notes:
Bold *indicate shared transitions.*

Ground-based NAVAIDS			*Fixes*		
ACY: Atlantic City VORTAC	*GVE: Gordonsville VORTAC*	*MOL: Montebello VOR/DME*	*BUFFR*	*GINYA*	*RAMAY*
CSN: Casanova VORTAC	*HCM: Harcum VORTAC*	*OOD: Woodstown VORTAC*	*COLIN*	*HAFNR*	*SANNY*
DQO: Dupont VORTAC	*LDN: Linden VORTAC*	*OTT: Nottingham VORTAC*	*DAILY*	*JERES*	*SWANN*
EMI: Westminster VORTAC	*LYH: Lynchburg VORTAC*	*PXT: Patuxent VORTAC*	*DRAIK*	*PALEO*	*WOOLY*
ENO: Smyrna VORTAC	*MRB: Martinsburg VORTAC*	*SIE: Sea Isle VORTAC*	*FLUKY*	*PAUKI*	

Source: NFDC, accessed 05/31/2012.
Prepared By: ATAC Corporation, December 2012.

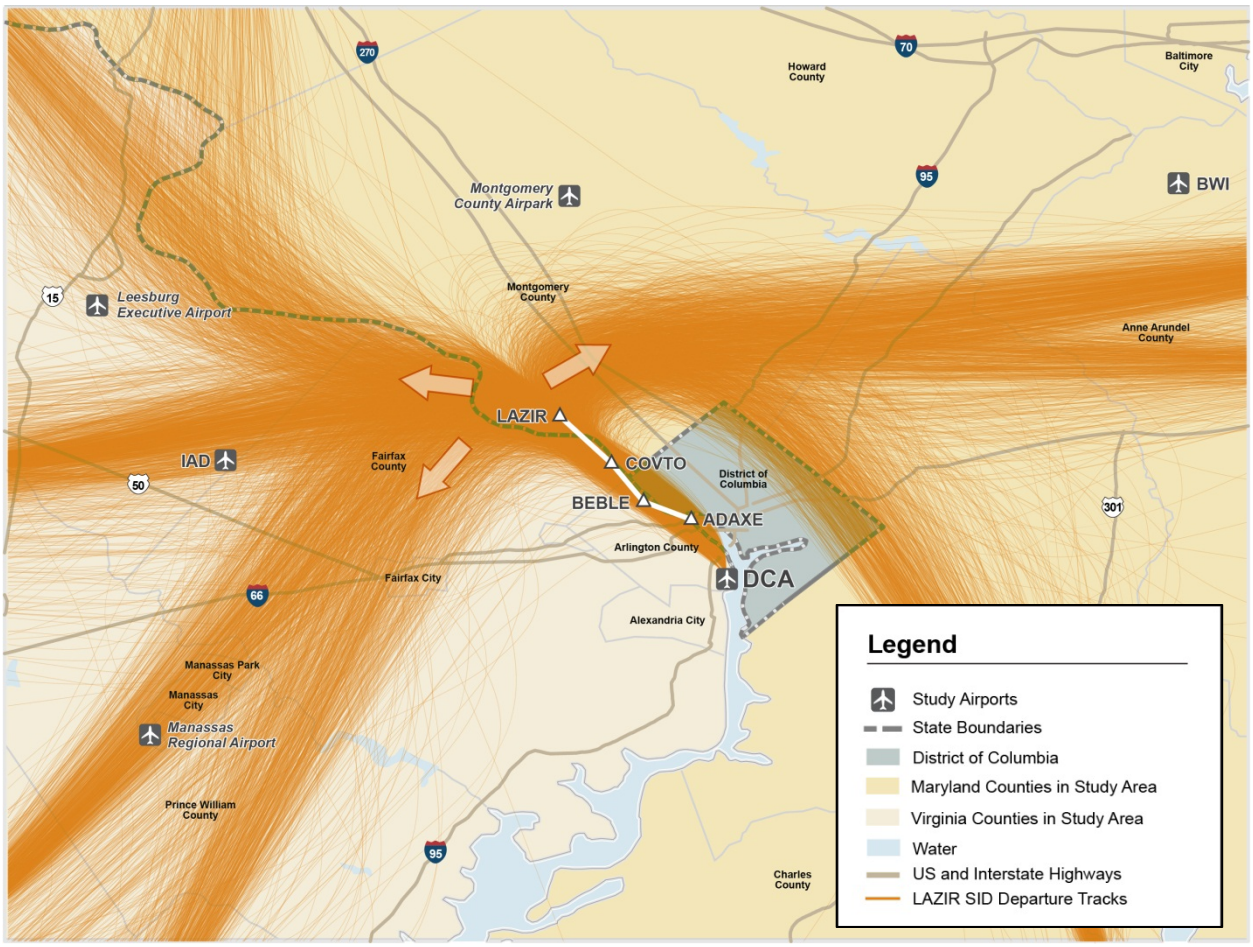
There are several consequences that result from all instrument arrivals and departures to and from the Study Airports using common standard instrument procedures and terminal airspace entry and exit points. These consequences include:

- The need to merge arriving aircraft into a single arrival flow at each entry point can increase flight time and distances.
- Gaps in the final arrival flows do not allow for the formation of a constant stream of aircraft to the Study Airports. This prevents the full use of the potential arrival throughput at the Study Airports.
- Merging aircraft from all Study Airports into single departure streams for each exit point requires controllers to create greater separations between subsequent departures from the same airport than would otherwise be required if the routes were separated or there were only a single airport in operations. Dedicated departure routes for each airport or runway would reduce the needed separation.
- Holding aircraft on the runway to create the necessary gaps in the departure routes leads to departure delays at all Study Airports, especially during peak travel periods. This prevents full use of the potential departure throughput at the Study Airports.

- The need for additional controller-to-pilot communication to issue the variety of instructions required to merge and desegregate the flow of aircraft adds to the workload of both controllers and pilots.
- Options for controllers to re-direct aircraft to avoid bad weather or more efficiently handle sequencing are limited when the pilot does not have the runway in sight due to low visibility.

Exhibit 2-4 shows the multiple routes DCA RNAV departures use for one SID, the LAZIR2 RNAV. Inefficiencies arise as the conventional departure SID for DCA shares the same routes. This procedure does not allow for efficient segregation of the departure routes and requires extensive radar vectoring. This contributes to ATC task complexity and flight path variability. The lack of additional departure procedures also reduces efficiency for aircraft.

Exhibit 2-4 LAZIR2 RNAV SID – DCA



Notes:
BWI – Baltimore/Washington International Thurgood Marshall Airport; DCA – Ronald Reagan Washington National Airport; IAD – Washington Dulles International Airport

Source: DC OAPM Metroplex Study Team, 2010.
Prepared by: ATAC Corporation, March 2013.

2.1.2.2 Complex Converging Interactions Between Arrival and Departure Flight Paths

This section describes three general examples of complex converging interactions between arrival and departure flight routes in the DC Metroplex airspace. The airspace in the DC Metroplex can be very complex, particularly because of the close proximity of three busy commercial service airports (DCA, IAD, and BWI) and the presence of restricted area of airspace such as the Flight Restriction Zone (FRZ) around central Washington D.C. (The FRZ is discussed further in Section 1.2.5, *Special Use Airspace*.) These following three examples are followed by discussion of how these types of interactions function in the DC Metroplex.

1. Many arrival and departure routes converge or cross. This is necessary to move aircraft to an airport from the appropriate entry point and from an airport to the appropriate exit point. To maintain appropriate separation between aircraft, the controller issues altitude assignments that rely on vertical distances of 1,000 feet or more. Crossing routes include level flight segment "bridges" where at key points aircraft stop their descent or climb and level off to allow arrivals or departures to cross and descend or climb away from another aircraft's path. Aircraft may then fly at this altitude until they have moved away from other aircraft crossing the same area.
2. ATC typically splits arrival and departure control responsibilities. Control of aircraft is passed on from one controller to the next as the aircraft progress through airspace. Vertical separation between aircraft arrivals and departures is maintained primarily through defined ceiling and floor altitudes. An arriving aircraft cannot descend until the aircraft is clear of the dimensional airspace reserved for departures. When an aircraft clears one airspace area, it is transferred by a controller to the next airspace area controlled by another controller. During the time between handoff and transfer of control between controllers, aircraft may have to level off until the next controller acknowledges control and the aircraft is able to resume its climb. The amount of time necessary to transfer control may be directly affected by the extent of controller workload.
3. Controllers may need to alert aircraft or another controller responsible for a neighboring airspace sector of the proximity of other aircraft (point-outs). Aircraft must be separated laterally by at least three nautical miles (nmi) within the terminal airspace and generally by at least five nmi in the enroute environment. This is achieved in the terminal environment by keeping an aircraft at least 1.5 nautical miles from the airspace boundary assigned to a specific controller. In the enroute portions of the DC Metroplex airspace, separation is maintained at 2.5 nmi. As conventional navigation is not as accurate as RNAV, two to three nautical mile buffers from the boundary are used to ensure the 1.5 and 2.5 nmi distances are always kept. These accuracy limitations result in areas of unusable airspace.

All the scenarios described above require additional verbal communication between controllers or between controllers and pilots. This can take extra time resulting in unnecessary system complexity and increased pilot and controller workload. In addition,

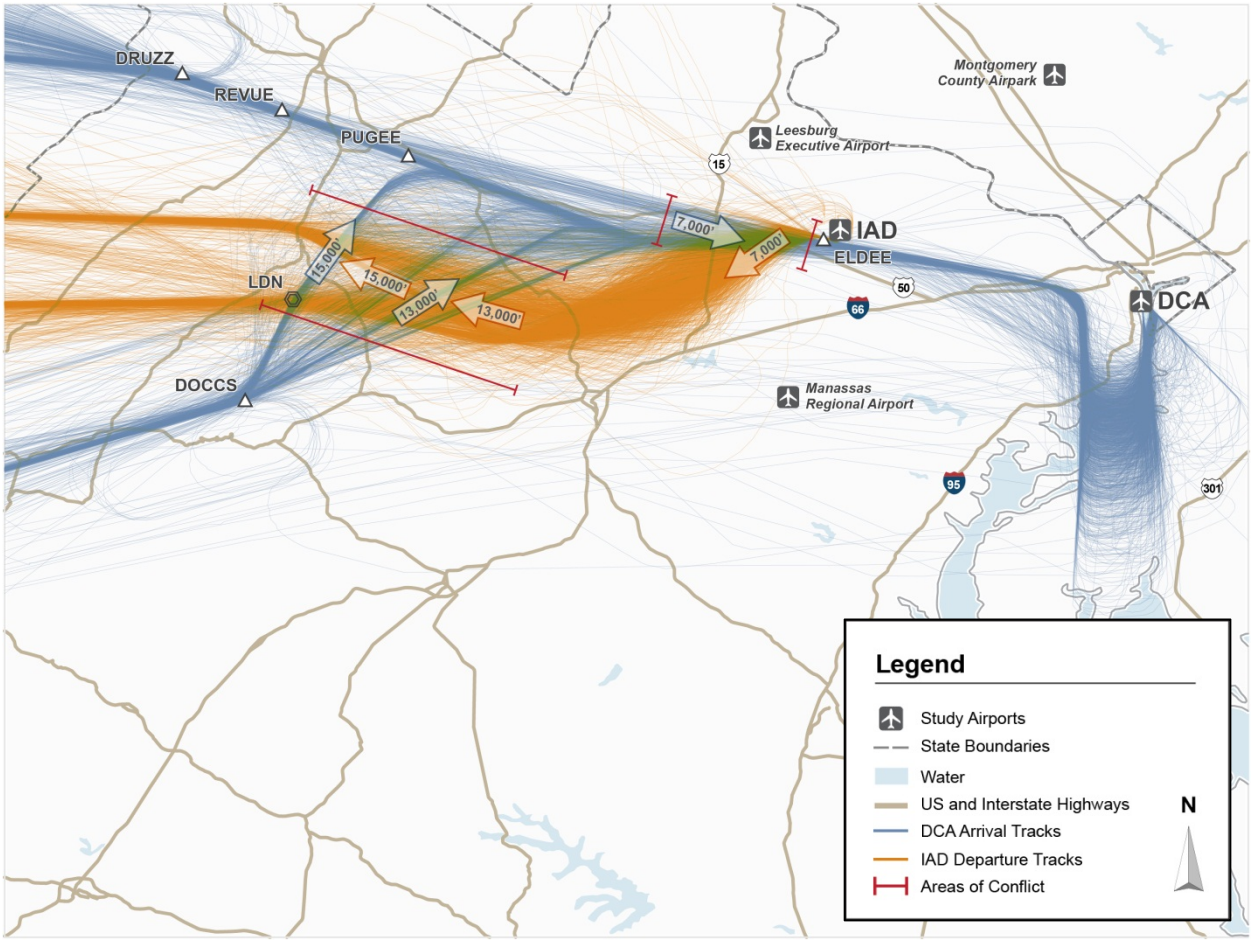
vectoring and level-offs can reduce airspace efficiency and flight efficiency by adding time and distance to flights as aircraft enter/exit to/from the terminal airspace.

The following sections provide two specific examples of how these interactions function within the DC Metroplex area.

West DCA Arrivals (ELDEE 5) and West IAD Departures (CAPITAL 8)

Exhibit 2-5 shows how current arrival routes for DCA (blue flight tracks) cross with several westbound IAD departure routes (orange flight tracks). Due to the altitudes at which aircraft on these routes cross there are several issues that prevent optimized approaches to the airport, including crossing restrictions and leveling off requirements. These issues can result in extended flight time and distance.

Exhibit 2-5 DCA Departures – IAD Arrivals Conflicts



Notes:
IAD – Washington Dulles International Airport
DCA – Ronald Reagan Washington National Airport

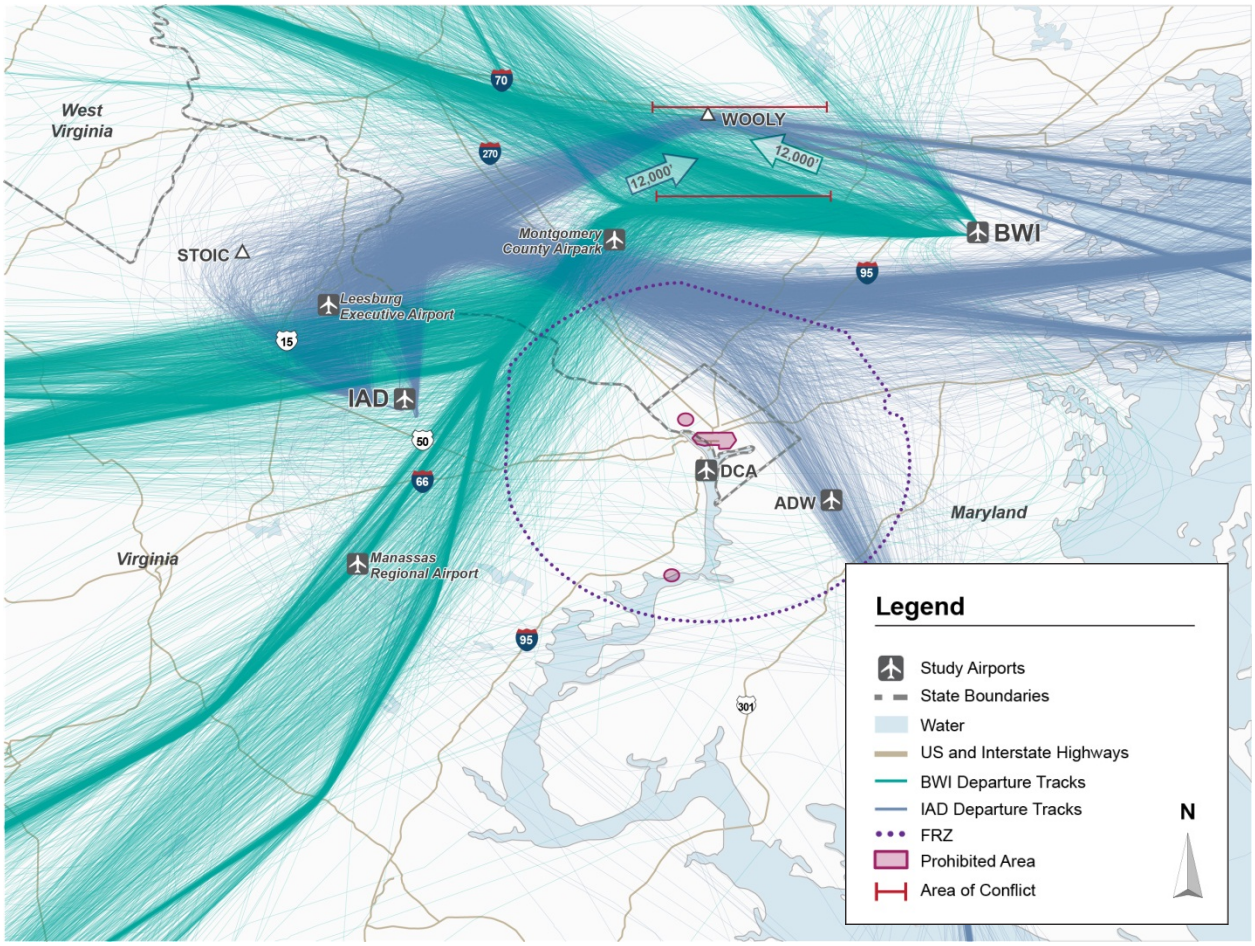
Source: ATAC (PDARS radar data), June 2011.
Prepared by: ATAC Corporation, March 2013.

IAD and BWI Departure Conflicts

The IAD STOIC departure procedure requires that the initial fix be located 15 nmi from the runway complex to ensure avoidance of the Flight Restricted Zone (FRZ) surrounding DCA.

The BWI TERPZ2 departure route conflicts with the IAD STOIC departure route due to this IAD STOIC initial fix location. The DCA SKILS and CLIPR arrival routes also conflict with the IAD STOIC departure route. **Exhibit 2-6** shows where the IAD and BWI departures conflict. **Exhibit 2-7** shows where the DCA and IAD departures conflict. These conflicts can cause level-offs resulting in extended flight time and distance.

Exhibit 2-6 IAD Departure – BWI Departure Conflicts



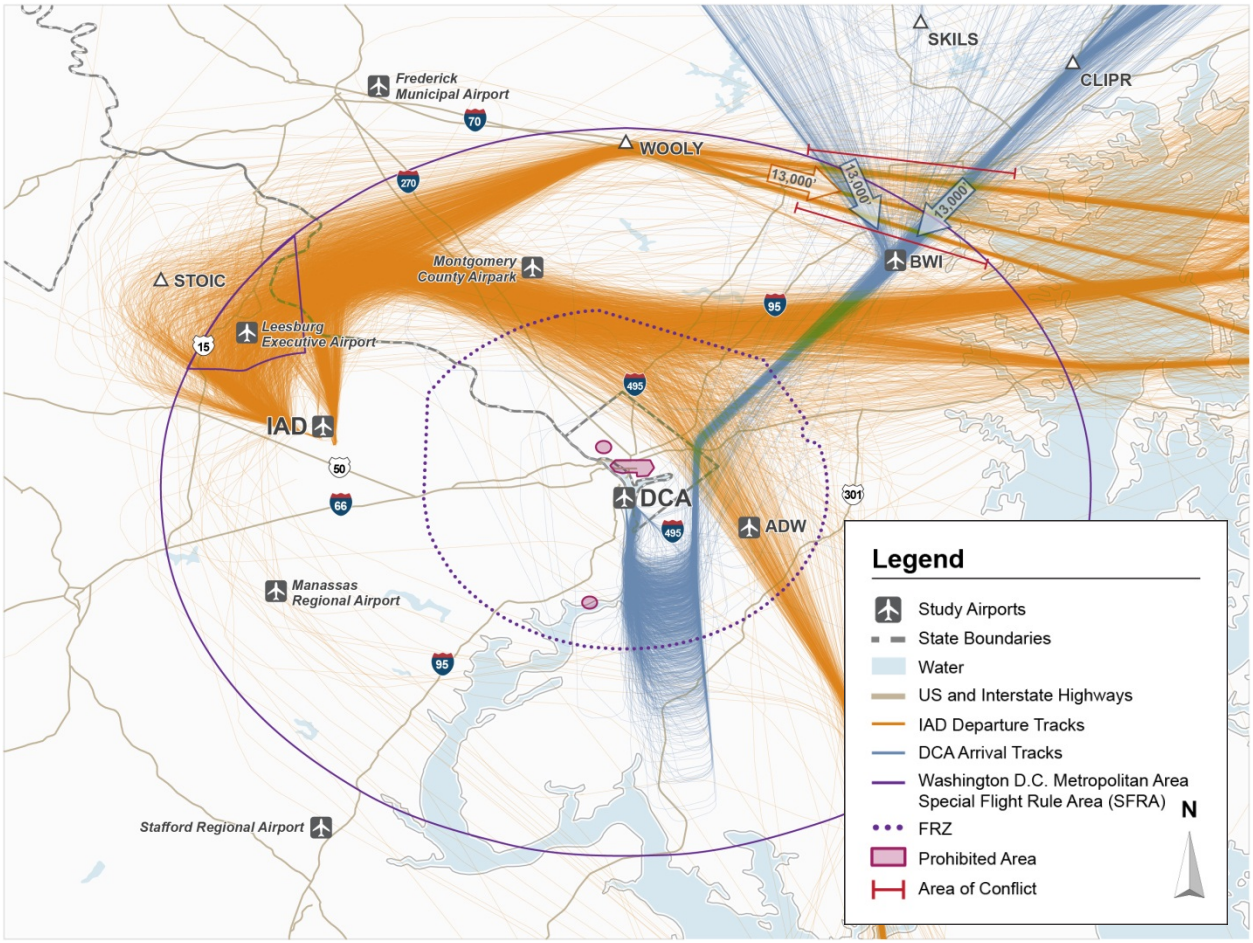
Notes:
ADW – Joint Base Andrews
DCA – Ronald Reagan Washington National Airport
BWI – Baltimore/Washington International Thurgood Marshall Airport
IAD – Washington Dulles International Airport

Source: ATAC (PDARS radar data), June 2011.
Prepared by: ATAC Corporation, March 2013.

2.1.2.3 Lack of Predictable Standard Procedures to/from and in Enroute Airspace

Predictability provides pilots and controllers the ability to know ahead of time how, where, and when an aircraft should be operated along a defined route allowing them to better plan airspace use and the control of aircraft in the given volume of airspace. A predictable route may include expected locations (where), altitudes (where and how high), and speeds (how

Exhibit 2-7 IAD Departure – DCA Departure Conflicts



Notes:
ADW – Joint Base Andrews
DCA – Ronald Reagan Washington National Airport
BWI – Baltimore/Washington International Thurgood Marshall Airport
IAD – Washington Dulles International Airport

Source: ATAC (PDARS radar data), June 2011.
Prepared by: ATAC Corporation, March 2013.

fast and when) at key points. A procedure that provides these elements results in a more predictable route for the pilot and controller.

Aircraft performance and/or piloting technique can vary, and as a result, may also play a factor in reducing predictability. Because conventional procedures are less precise than RNAV procedures and less predictable, controllers will use vectoring as well as instructions governing speed and altitude level-offs to ensure safe vertical and lateral separation between aircraft. As discussed in Section 1.2.6.1, RNAV procedures enable aircraft to follow more accurate and better defined, direct flight routes in areas covered by GPS-based navigational aids. This allows for predictable routes with fixed locations and altitudes that can be planned ahead of time by the pilot and air traffic control. Fixed routes help maintain segregation between aircraft by allowing defined vertical and horizontal separation of traffic. As a result, some routes can be shortened and the need for level-offs can be eliminated. This allows for improved use of the airspace. Therefore, the greater the number of RNAV procedures in a Metroplex the greater the degree of predictability.

Table 2-4 summarizes current availability of conventional and RNAV-based procedures for the four major study airports as of December 2011.

The following sections describe the three areas - ground path, vertical path, and runway transitions - in which conventional procedures in the DC Metroplex result in less predictable air traffic management as compared to RNAV-based procedures. The following sections describe the conditions that reduce predictable air traffic management.

Ground Path

Airports with a significant volume of aircraft operating under Instrument Flight Rules (IFR) need SID and STAR procedures to direct air traffic flows and various runway configurations to achieve optimal efficiency. The intention of SID and STAR procedures is to maintain a predictable flow of aircraft to/from an airport. This is achieved by establishing consistent flight route expectations, reducing the need for communications between controllers and pilots. These procedures also reduce the need to hold aircraft on the ground or in the air, or to make use of other aircraft management tools and coordination techniques to satisfy aircraft separation requirements.

Several STAR and SID procedure designs use ground-based NAVAIDs. As discussed in Section 2.1.1, navigation based on ground-based NAVAIDs can be hindered by line-of-site issues and signal degradation that limits where conventional procedure routes can be located. In addition, because they are less precise, conventional procedures require additional lateral airspace to protect aircraft flying on neighboring routes. Due to these factors, it can be difficult for a non-RNAV equipped aircraft to follow an accurate ground path. The ground path is the track or trace along the surface of the earth directly below the aircraft which represents where the aircraft should be flying. Because these procedures cannot provide more predictable controls such as specific speeds or altitudes, controllers use vectoring and speed adjustments to manage traffic. This leads to increased controller and pilot workload. **Table 2-4** shows the current number of procedures for the five major study airports as of December 2011.

Table 2-4 Existing STAR and SID Procedures for ADW, BWI, DCA, IAD, and RIC (1 of 2)

	Current Procedures			
	Conventional		RNAV	
Airport	**STAR**	**SID**	**STAR**	**SID**
KADW	IRONS FOUR	ANDREWS ONE, CAMP SPRINGS ONE, MORNINGSIDE ONE	None	None
KBWI	NOTTINGHAM SIX, WESTMINSTER FIVE	PALEO THREE, SWANN THREE	RAVNN THREE	TERPZ TWO
KDCA	IRONS FOUR	NATIONAL TWO	BILIT ONE, CLIPR ONE, ELDEE FIVE, OJAAY ONE, SKILS TWO	LAZIR THREE

Table 2-4 Existing STAR and SID Procedures for ADW, BWI, DCA, IAD, and RIC (2 of 2)

	Current Procedures			
	Conventional		RNAV	
Airport	**STAR**	**SID**	**STAR**	**SID**
KIAD	COATT FOUR, DELRO TWO, PHILIPSBURG TWO, ROYIL TWO, SELINSGROVE THREE	CAPITAL EIGHT	BARIN ONE, HYPER FOUR, LEGGO TWO, PRTZL THREE, SHNON TWO	STOIC TWO
KRIC	NONE	COLIN FIVE, YEAST ONE	NONE	NONE

Table Notes:
Procedures listed in table include RNAV SIDs and STARs implemented in 2012.

Source: NFDC, accessed May 31, 2012, April 17, 2013.
Prepared By: ATAC Corporation, April 2013.

Vertical Path

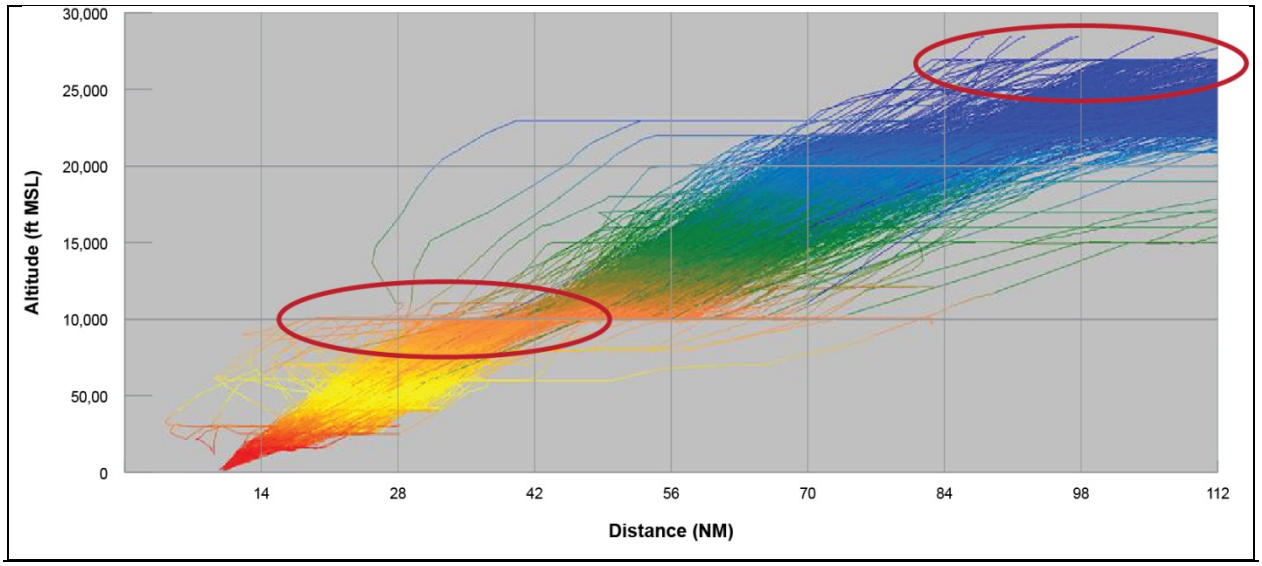
Aircraft climb or descend when instructed by a controller. The point when an aircraft reaches an assigned altitude may vary depending upon a combination of factors, including aircraft performance, weather conditions, and/or piloting technique. Aircraft arriving to or departing from the Study Airports are frequently required to level off during descent/climb to maintain vertical separation from other arriving and departing aircraft. Flight time and distance can be increased for traffic flows with interrupted climbs and descents as the aircraft exit/enter the terminal airspace or transition to/from the runway approach environment. Unpredictable vertical guidance resulting from conflicting traffic leads to increased controller workload and inefficient aircraft operation.

There are routes in the DC Metroplex that require climbing or descending aircraft to level-off to accommodate aircraft crossing above or below. In these instances, aircraft efficiency suffers due to: 1) power variability during leveling-off; 2) power variability in reinitiating the climb or descent; and 3) increased fuel consumption. The level-off in the climb phase typically results in aircraft taking longer to reach the altitude necessary to exit the terminal airspace. During the descent phase, the level-off requires application of thrust for aircraft preparing to land to maintain appropriate approach speeds and altitude. This results in extended fuel burn.

Exhibit 2-8 shows the vertical profile for current DCA/IAD departure flight tracks. Once over the PALEO fix, departures in this area must level-off at 23,000 feet MSL. This location is referred to as “flight level” 230 and abbreviated FL230. The extended level-off is noted by the collection of dark blue flight tracks circled in red. An additional level-off can also be noted at 9,000 feet MSL by the collection of orange flight tracks circled in red. This situation involves additional controller-pilot communications, including additional point-outs.[37] This adds to complexity (e.g., higher controller workload, the number of times controller-to-pilot communication occurs, and inefficient use of aircraft performance capabilities during a descent or climb) and reduces airspace efficiency. Accordingly, the STAR or SID does not offer a predictable route. The procedure does not take full advantage of RNAV capabilities,

[37] While the aircraft is in a climb or descent, controllers may need to alert adjacent aircraft or another controller, who is responsible for a nearby airspace sector, of the proximity of a nearby aircraft. This notification is called a “point-out” and adds to the airspace complexity, because of the communication requirement and time taken to provide the point-out and receive confirmation from the recipient. Reducing point-outs improves efficiency in communications.

Exhibit 2-8 Vertical Arrival Flow Profile Example (DCA/IAD Departures)



Source: ATAC (PDARS radar data), June 2011.
Prepared by: ATAC Corporation, 2012.

including the ability to use the current technology to reduce the complexity of the terminal airspace system and allow for more efficient use of the airspace.

Runway Transitions

As discussed in Section 1.4.3, Study Airports use different runway operating configurations based on factors like weather, wind direction, and the amount and type of air traffic. At a Study Airport with a high level of air traffic, particularly during peak periods, operational efficiency is improved by the availability of STARs for each runway that can be used for the various runway operating configurations. STARs with one or more runway transition route (i.e., the route that leads aircraft to a final approach that typically ends at an Initial Approach Fix) enhance efficiency by minimizing the need for controller-to-pilot communication when aircraft transition to the final approach to the runway from the enroute transition route. The enroute transition route begins in enroute airspace, converging into a single route that ends at a point prior to the runway transition route. Standard instrument arrival procedures also make it easier for controllers to monitor the flow of traffic to the runways and to maintain a constant and predictable routing of aircraft.

Of the 10 RNAV STARs for the major airports in the DC Metroplex, eight include runway transitions to the final approach to a runway end. Including runway transitions in the RNAV STARs can reduce pilot and controller workload, increase flight route predictability, and minimize the need for controller-to-pilot communication. After issuing control instructions to follow an RNAV STAR that contains a runway transition, the controller knows how the pilot will maneuver the aircraft to the final approach. Thus, there is no need for further controller-to-pilot communication unless unusual circumstances arise, such as the need to call out the proximity of other traffic.

Satellite Airports

In addition to issues with existing procedures, system efficiency is affected by the lack of more predictable STAR and SID procedures at DC Metroplex satellite Study Airports. These airports serve as reliever or alternate airports in the event destination airports are

closed due to unexpected conditions such as bad weather. The existing procedures for the satellite Study Airports do not allow for predictable segregation of routes between air traffic arriving to or departing from these Study Airports and the major Study Airports in the DC Metroplex. Specifically, the need for predictable SID and STAR procedures to and from the satellite Study Airports are exemplified by interactions between IAD routes and departures from Leesburg Airport (JYO) and Frederick Municipal Airport (FDK), as well as DCA routes and operations at U.S. Air Force operated Joint Base Andrews (ADW).

2.2 Purpose of the Proposed Action

The purpose (goal) of the Proposed Action is to take advantage of the benefits of performance based navigation by implementing RNAV procedures that will help improve the efficiency of the airspace in the DC Metroplex. Implementing RNAV procedures will also comply with direction issued by Congress in the Modernization and Reform Act of 2012. To meet this goal, the Proposed Action would optimize procedures serving the DC Metroplex Study Airports while maintaining or enhancing safety in accordance with FAA's mandate under federal law. This would be achieved by reducing dependence on ground-based NAVAID technology in favor of more efficient satellite-based navigation, such as RNAV. Specifically, the objectives of the Proposed Action are as follows:

- Improve the flexibility in transitioning traffic between enroute and terminal area airspace and between terminal area airspace area and the runways;
- Improve the segregation of arrivals and departures in terminal area and enroute airspace; and
- Provide RNAV arrival and departure enroute transitional and terminal area airspace procedures for each individual runway with the intent to provide a more predictable ground and vertical path.

Air traffic controller workload and controller-to-pilot communication would be expected to decrease, reducing both workload and airspace complexity. Improvements in arrival and departure segregation among the DC Metroplex Study Airports would reduce the need for vectoring and level flight segments, resulting in shorter, more predictable flows.

Each objective of the Proposed Action is discussed in greater detail below.

2.2.1 Improve Flexibility in Transitioning Aircraft

As discussed in Section 2.1.2.1, the limited number of entry and exit points and associated procedures, constrain the efficiency of the air traffic routes in the terminal and enroute transitional airspace. This results from the need to merge multiple routes prior to arrival to and departure from terminal airspace. One objective of the Proposed Action is to minimize the need for merging by increasing the number of entry/exit points and procedures dedicated to specific Study Airports. This objective can be measured with the following criteria:

- Where possible, increase the number of entry and exit points compared with the No Action Alternative (measured by number of exit/entry points).
- Segregate major Study Airport traffic from other major Study Airport and/or satellite Study Airport traffic to/from Study Airports (measured by count of RNAV STARs and/or SIDs that can be used independently to/from Study Airports).

2.2.2 Segregate Arrivals and Departures

As discussed in Section 2.1.2.2, arrival and departure flight routes frequently cross, converge, or are located within close proximity of each other in some portions of the enroute and terminal airspace. This requires controllers to actively manage the traffic using the tools available to them to ensure that safe vertical and lateral separation between aircraft is maintained. Another objective of the Proposed Action is to implement procedures that would achieve better segregation of arrivals and departures within the terminal airspace. This objective can be measured with the following criterion:

- Where possible, increase the number of RNAV STARs and SIDs compared with the No Action Alternative (measured by total count of RNAV STARs and RNAV SIDs for the DC Metroplex.)

2.2.3 Improve the Predictability of Air Traffic Flow

As discussed in Section 2.1.2.3, current procedures in the DC Metroplex do not take full advantage of RNAV capabilities. RNAV procedures can increase predictability by taking better advantage of aircraft performance capabilities (e.g., speed control and altitude restrictions) and by designing procedures that reflect these capabilities. These enhancements would provide for more predictable, repeatable, and efficient routes than is currently possible with most conventional procedure designs.

In addition, RNAV procedures with runway transitions provide for a more predictable flow of air traffic through the airspace and require less controller-to-controller coordination and controller-to-pilot communications to manage air traffic flows. Additional runway transitions to and from each runway would provide controllers more flexibility to balance demand, maintain runway departure separations, and segregate routes without the need for controller intervention.

This objective can be measured with the following criteria:

- Ensure that the majority of STARs and SIDs to and from the Study Airports are based on RNAV technology (measured by count of RNAV STARs and SIDs for an individual Study Airport);
- Increase the number of runway transitions in the RNAV STARs and SIDs in comparison to the No Action Alternative. (measured by count of procedures that include runway transitions to/from runways); and,

2.3 Criteria Application

The Proposed Action is evaluated to determine how well it meets the purpose and need based on the measurable criteria for each objective described above. The evaluation of alternatives will include the No Action Alternative, under which the existing (2011) air traffic procedures serving the Study Airports would be maintained, along with approved procedure modifications already planned and approved for implementation. The criteria are intended to aid in comparing the Proposed Action Alternative with the No Action Alternative.

2.4 Description of the Proposed Action

The Proposed Action considered in this study would include the implementation of optimized RNAV SID and STAR procedures that would reduce reliance on conventional

procedures. The primary components of the Proposed Action are to the extent possible, redesign standard instrument arrival and departure procedures to more efficiently serve the Study Airports and to improve the flexibility and predictability of air traffic routes. The Proposed Action is described in detail in Chapter 3, *Alternatives*.

Implementation of the Proposed Action would not result in an increase in the number of aircraft operations at the Study Airports. However, inefficiencies in the air traffic routes currently serving the Study Airports would be reduced. The Proposed Action does not involve physical construction of any facilities, such as additional runways or taxiways, and does not require any state or local actions. Therefore, the implementation of the proposed changes to procedures in the DC Metroplex would not require any physical alterations to environmental resources identified in FAA Order 1050.1E.

2.5 Required Federal Actions to Implement Proposed Action

Implementation of the Proposed Action requires the following actions to be taken by the FAA:

- Controller training; and,
- Publication of new or revised STARs, SIDs, and transitions.

2.6 Agency Coordination

On December 19, 2012, the FAA distributed an early notification letter to 437 federal, state, regional, and local officials as well as to 17 tribes. FAA sent the early notification letter to provide notice of the initiation of the EA; request background information related to the EA study area; and to gain an understanding of issues, concern, policies, and/or regulations that may affect the environmental analysis. A subsequent notification letter was sent to an additional 56 federal, state, and local officials on March 25, 2013. The FAA sent the early notification letter to:

1. To advise agencies and tribes of the initiation of the EA study;
2. To request background information regarding the study area established for the EA; and
3. To provide an opportunity to advise the FAA of any issues, concerns, policies or regulations regarding the environmental analysis that will be undertaken in the EA.

Appendix A, *Agency Coordination, Agency Consultation, and Public Involvement*, includes a copy of the early coordination letter (and attachments) as well as a list of the receiving agencies and tribes.

3 Alternatives

The alternative analysis was conducted pursuant to Council on Environmental Quality (CEQ) regulations and Federal Aviation Administration (FAA) guidance provided in FAA Order 1050.1E, Chg. 1, *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1E). This chapter discusses the following topics:

- Alternative Development Process
- Alternatives Overview
- Comparison of Alternatives
- Listing of Federal Laws and Regulations

The technical terms and concepts discussed in this chapter are explained in Chapter 1, *Background*.

3.1 Alternative Development Process

The development of an alternative for the Washington D.C. Optimization of Airspace and Procedures in the Metroplex (DC OAPM) project was a multi-step process that began with the formation of the DC OAPM Study Team (Study Team). The Study Team was charged with defining operational issues in the DC Metroplex and recommending conceptual designs for procedures that would address these issues.[38] The recommended procedures were then provided to the DC OAPM Design and Implementation (D&I) Team. The D&I Team was responsible for designing individual procedures based on the Study Team's recommended conceptual procedures. Each procedure designed by the D&I Team was required to meet several design criteria and the project Purpose and Need. As defined in Chapter 2, the need for the Proposed Action is to address existing DC Metroplex Standard Instrument Departure (SID) and Standard Terminal Arrival Route (STAR) procedures that are not achieving the higher levels of efficiency found in procedures designed to use Area Navigation (RNAV) technology. The FAA rejected individual procedures if, on their own merit, they did not meet the Purpose and Need.

For purposes of the DC OAPM project, the Proposed Action alternative evaluated in this Environmental Assessment (EA) is a package including many individual procedures combined into one alternative. This group of procedures were considered and evaluated in combination with one another to determine whether the alternative may meet the project's Purpose and Need. The FAA considered multiple versions of each air traffic procedure; however, several versions were not carried forward because they failed to meet the objectives established to meet the Purpose of the project.

The following sections describe the alternative development process the FAA used to create a series of procedures that when employed together would add efficiency to the DC Metroplex.

3.1.1 DC OAPM Study Team

In September 2010, the DC OAPM Study Team began work to define operational problems in the DC Metroplex and to identify potential solutions. The Study Team included experts

[38] DC OAPM Metroplex Study Team Final Report, March 2011.

on the Air Traffic Control (ATC) system for the DC Metroplex. The work completed was intended to provide a guide for later design efforts by the D&I Team. The Study Team obtained input from local facilities (e.g., air traffic control [ATC]), airspace users (e.g., pilots), and aviation industry representatives to learn more about the challenges of operating in the DC Metroplex. These meetings helped identify operational challenges related to individual procedures and potential solutions that would increase efficiency. Initially, the Study Team identified 56 issues related to existing procedures in the DC Metroplex. As the Study Team identified additional issues, they were grouped together in generalized categories based on similarity.

The Study Team identified several potential modifications to the arrival/departure procedures to accommodate procedure changes that addressed the issues identified. The modifications proposed were conceptual in nature, and did not include a detailed technical assessment, which was reserved for the D&I Team to conduct.[39]

3.1.2 DC OAPM Design and Implementation Team

Following completion of the Study Team's Final Report in March 2011, the D&I Team began work on the procedure designs. First, the Study Team proposals were prioritized based on complexity, interdependencies with other procedures, and degree of potential benefit to the Metroplex. Second, the D&I Team divided into workgroups to further develop and refine the Study Team proposals into preliminary designs. Finally, the preliminary designs were brought to the whole D&I Team for review and modification, if necessary. In developing the proposed procedures, the D&I Team was responsible for following regulatory and technical guidance as well as meeting criteria and standards in three general categories:

1. **RNAV Design Criteria and Air Traffic Control Regulatory Requirements** - Flight procedure design is subject to requirements found in several FAA Orders, including FAA Order 7100.9D, *Standard Terminal Arrival Program and Procedures*, FAA Order 8260.43A, *Flight Procedures Management Program*, and FAA Order JO 7110.65U, *Air Traffic Control*. The *Guidelines for Implementing Terminal RNAV Procedures*, to be followed in conjunction with the requirements of FAA Order 8260.43A, includes an "18-Step Process" for developing, reviewing, and implementing RNAV procedures. In addition, FAA Order JO 7110.65U includes requirements governing air traffic control procedures, air traffic management, and appropriate technical terminology.
2. **Operational Criteria** – Operational criteria were consistent with the Purpose and Need for the project. This includes increasing efficiency and flexibility, and decreasing complexity in air traffic management. These criteria were measured for all procedures using either a full motion simulator, a stationary simulator, and/or flight training devices. These criteria were also measured for many procedures using real time Human-In-The-Loop Simulations (HITLs). These simulations further validated that operations in the DC Metroplex would not be limited by the proposed procedures. The D&I Team also evaluated each of the procedure designs with full motion aircraft simulators. The simulations helped ensure that aircraft could fly the procedure as designed and that efficiency (e.g., pilot workload) would not be limited by the proposed procedures.

[39] Id.

3. **Safety Factors** – Procedures were subject to evaluation using the FAA's Air Traffic Organization's (ATOs) Safety Management System (SMS). The SMS is the ATO's system for managing the safety of ATC and navigation services in the National Airspace System (NAS). In compliance with SMS requirements, the procedures were evaluated by a Safety Risk Management Panel (SRMP) following a five step process: 1) describe the system; 2) identify the hazards in the system; 3) analyze the risks; 4) assess the risk; and, 5) treat the risk. If a procedure introduced a new hazard or increased the severity and/or likelihood of an existing hazard that is being mitigated, the design was adjusted to reduce the hazard to acceptable levels.

To ensure that procedures included in the Proposed Action were viable, the D&I team undertook validation exercises that further refined the procedures. Over a multi-month period, the D&I Team worked to meet Proposed Final Design milestones at the 25, 50, 75, 90, and 100 percent design levels. To reach each of these milestones, the D&I Team relied on stakeholder input, design solution tools (e.g., design and testing software), and the criteria described above. The combined final procedure designs have been brought forward in this EA as the Proposed Action alternative. The following sections describe the process that was used for two procedures that were carried forward as part of the Proposed Action.

3.1.2.1 Proposed ANTHM STAR

There were four versions of the proposed ANTHM STAR evaluated during the alternative development process. The first version was the Study Team's recommendation. The second version was the initial procedure designed by the D&I Team based on the Study Team recommendation. A third version of the D&I Team's design was prepared that refined the procedure to better meet the criteria described in Section 3.1.2. The final version simplified the procedure by making changes to altitudes at various waypoints along the procedure and simplified the procedure to reduce pilot workload.

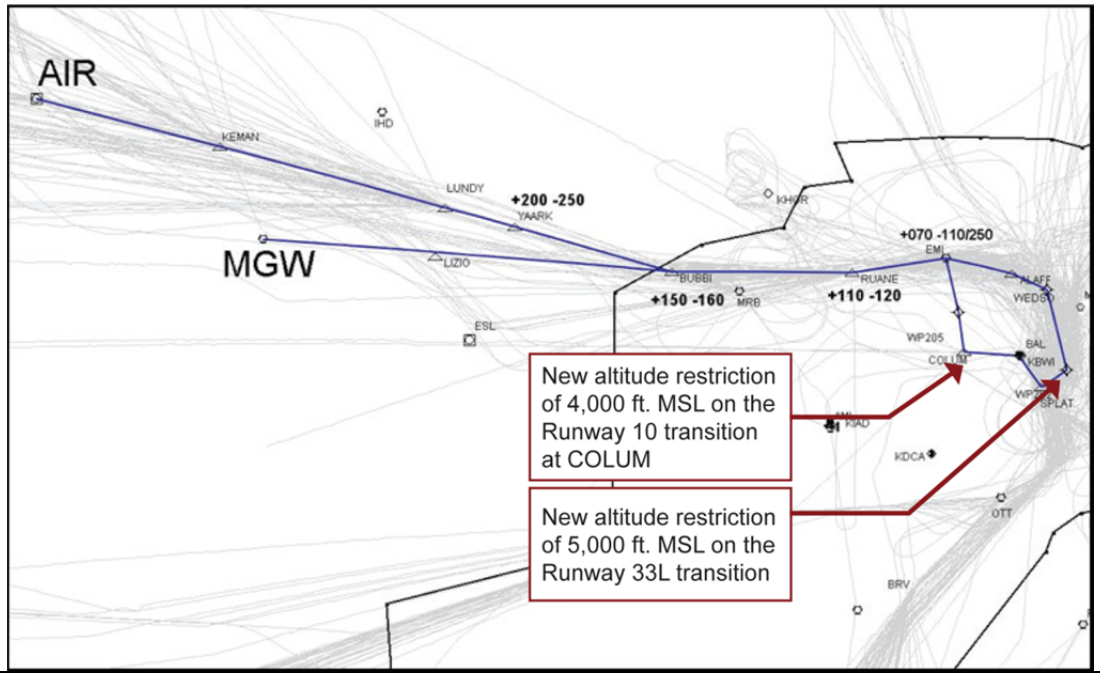
First, the Study Team identified issues with the conventional Westminster (EMI) STAR serving Baltimore-Washington International Airport (BWI). The Study Team determined that the EMI STAR would be more efficient with runway transitions that delivered arriving aircraft closer to the runway along a more predictable flight path. In addition, jet aircraft arriving on the existing procedure level off at the BUBBI Fix at 15,000 feet above mean sea level (MSL) and at the RUANE waypoint at 11,000 feet MSL. These level-offs result in a less efficient trajectory for aircraft flying on this procedure.

The Study Team proposed four recommendations to address the issues identified with the EMI STAR. These recommendations included:

1. Developing a new RNAV STAR based on the existing EMI STAR with modifications to bring arrivals closer to the runway;
2. Add a new altitude restriction of 5,000 feet MSL on the Runway 33L transition west of BWI;
3. Add a new altitude constraint of 4,000 feet MSL on the Runway 10 transition at the COLUM waypoint; and,
4. Incorporate an Optimal Profile Descent (OPD) into BWI for this arrival procedure.

Exhibit 3-1 illustrates the Study Team's recommendations for the EMI STAR.

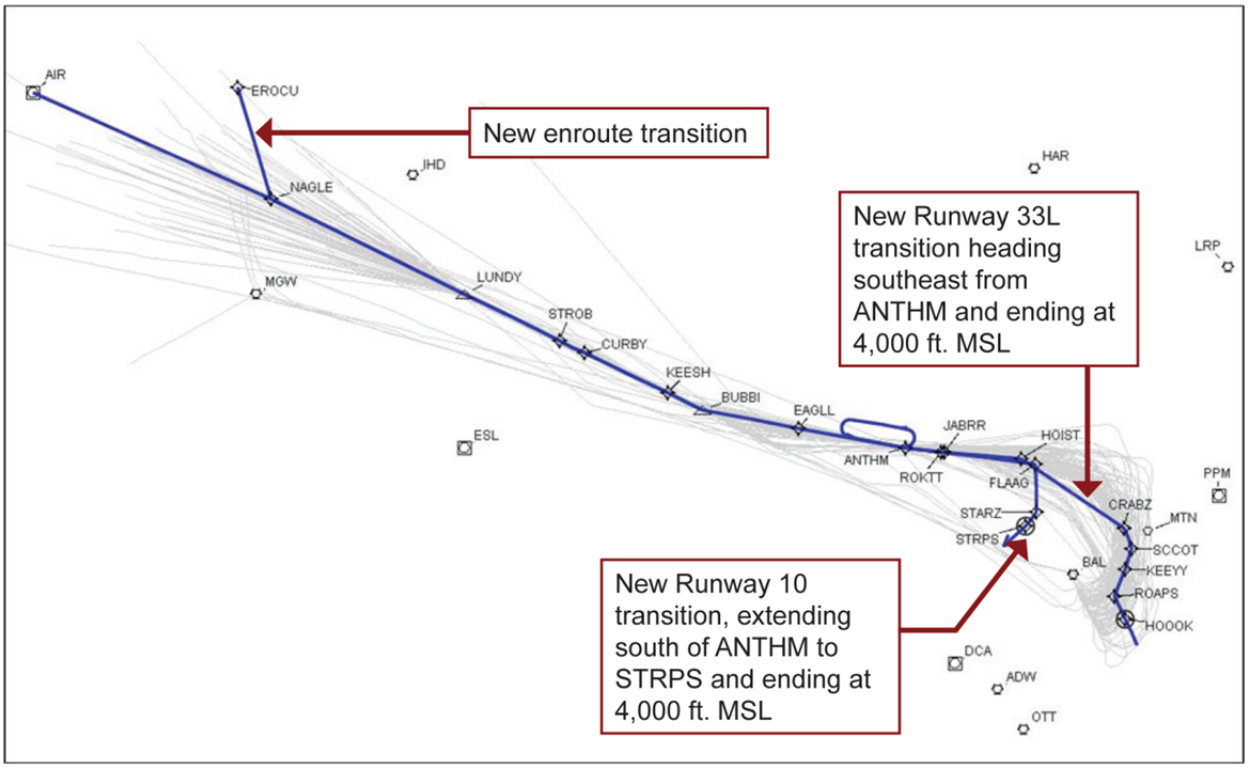
Exhibit 3-1 Study Team Recommended Procedure – EMI STAR



Source: DC OAPM Metroplex Study Team, March 2011.
Prepared by: ATAC Corporation, March 2013.

Based on the Study Team recommendations, the D&I Team proposed the development of a new RNAV STAR called ANTHM that would replace but generally follow the current route of the EMI STAR. **Exhibit 3-2** depicts the first version of the proposed ANTHM STAR. While the ANTHM STAR addresses the Study Team recommendations, the procedure design varies from the design recommended by the Study Team to better meet operational criteria. The Runway 33L transition would be closer to the runway and end at 4,000 feet MSL, instead of 5,000 feet MSL as recommended by the Study Team. In addition, the proposed transition for Runway 33L would proceed to the ANTHM waypoint then turn southeast to allow controllers the flexibility to bring an aircraft into the airport for landing or to sequence them into other arrival flows when necessary. The transition for Runway 33L was changed to avoid potential traffic conflicts with arrivals to Runway 33L on the proposed RAVNN and MIIDY RNAV STARs. The transition was also changed to prevent traffic conflicts with departures from Runway 33R. Similarly, the proposed new transition to Runway 10 is different from the design recommended by the Study Team. Because of potential traffic conflicts with aircraft operating in a neighboring ATC sector, the Runway 10 transition would extend south from the ANTHM waypoint to the STRPS waypoint. This would also give controllers added flexibility in sequencing arrival traffic flows. In addition to the runway transitions, the ANTHM STAR added an enroute transition from the EROCU waypoint to streamline departures from Pittsburgh International Airport.

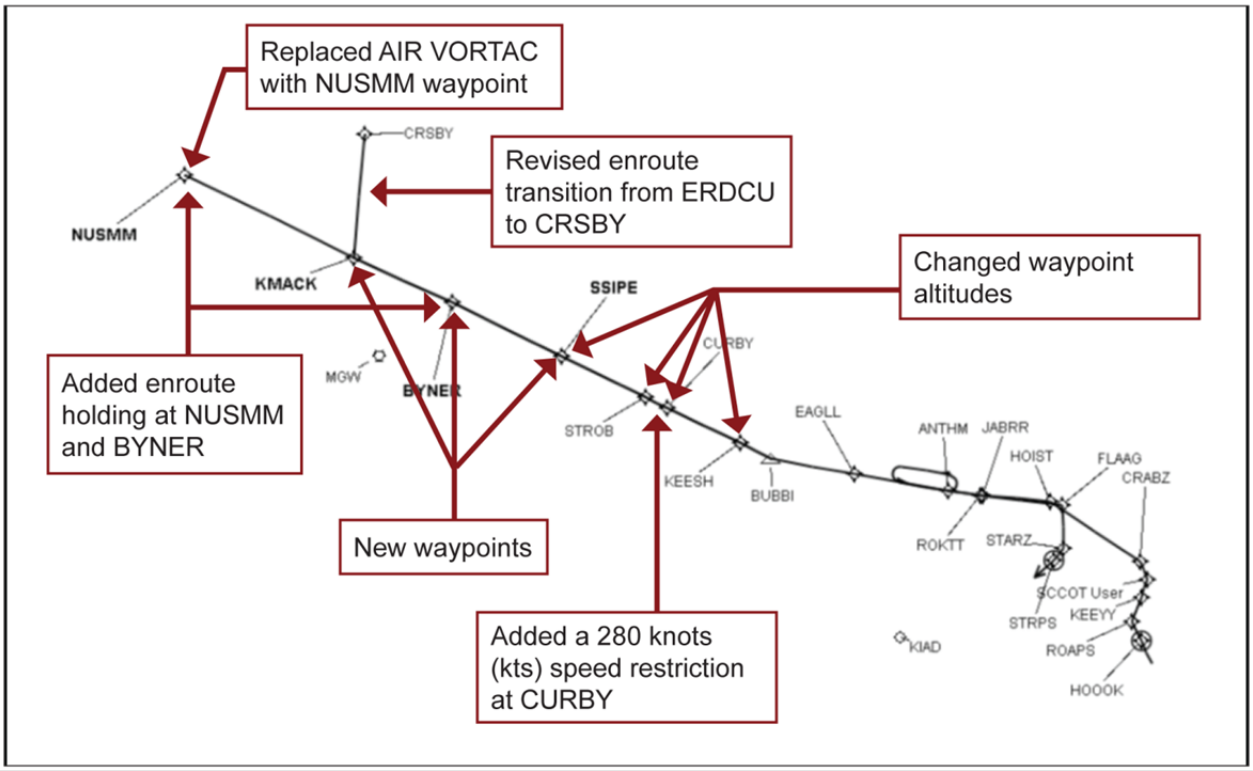
Exhibit 3-2 Proposed Design, First Version – ANTHM RNAV STAR



Source: DC OAPM D&I Team ANTHM RNAV STAR Proposed Final Design Sheet, September 2012.
Prepared by: ATAC Corporation, March 2013.

After completing the first version of this procedure, more changes were made following further evaluation using the criteria described in Section 3.1.2 (e.g., RNAV Design Criteria: design adjustments to meet updated criteria; and Operational Factors: enhanced procedure connectivity between ATC facilities.) **Exhibit 3-3** depicts the second version of the ANTHM STAR. The second version made several changes including adding more waypoints, changing some waypoint altitudes, and replaced the ERDCU enroute transition with the CRSBY enroute transition to improve connectivity with air traffic routes in ZOB airspace. The second version of the procedure is the Proposed Final Design included as part of the Proposed Action Alternative.

Exhibit 3-3 Proposed Design, Second Version – ANTHM RNAV STAR

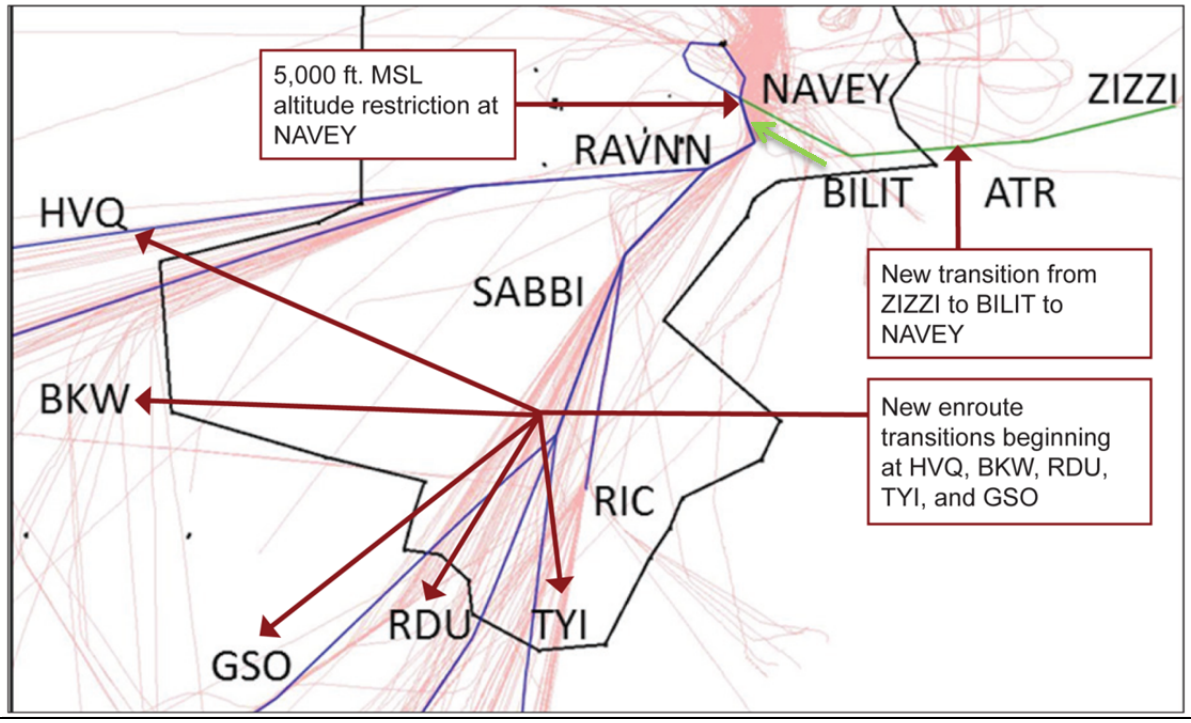


Source: DC OAPM D&I Team ANTHM RNAV STAR Change Control Sheet, October 2012.
Prepared by: ATAC Corporation, March 2013.

3.1.2.2 Proposed MIIDY STAR

The new MIIDY STAR was proposed by the D&I Team to address issues with the existing RAVNN STAR raised by the Study Team. The Study Team found that the RAVNN STAR lacks established transitions for arrivals between the BILIT and NAVEY waypoints. This results in increased complexity for controllers due to the need for increased communications between ATC and pilots. To address this issue, the Study Team recommended that a new transition be added to the RAVNN STAR. The new transition would begin at the ZIZZI waypoint and proceed to the BILIT waypoint and then to the NAVEY waypoint. An altitude restriction of 5,000 feet MSL would be added at the NAVEY waypoint. The Study Team also recommended that enroute transitions be added to the RAVNN STAR with starting points at the HVQ, BKW, GSO, RDU, and TYI ground-based navigational aids (NAVAIDs). **Exhibit 3-4** illustrates the Study Team's recommendations.

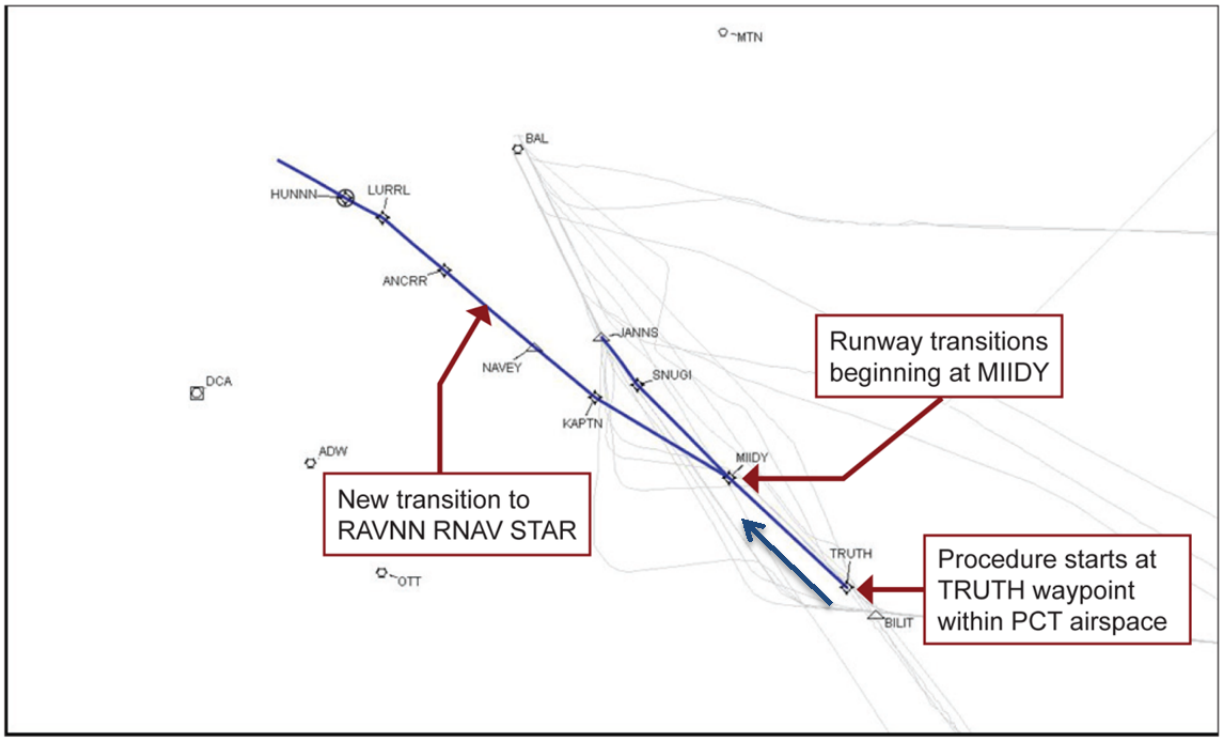
Exhibit 3-4 Study Team Recommended Changes – RAVNN STAR



Source: DC OAPM Metroplex Study Team, 2010
Prepared by: ATAC Corporation, March 2013.

Exhibit 3-5 depicts the first version of the MIIDY STAR developed by the D&I Team based on the Study Team recommendation. The design addresses the first Study Team recommendation by adding a new transition to the RAVNN RNAV STAR. However, this procedure differs from the Study Team recommendation by starting the procedure at the TRUTH waypoint within PCT airspace. Complexity is reduced by keeping the procedure within PCT airspace instead of starting it further east outside of PCT airspace. The D&I Team also added runway transitions that would begin at the MIIDY waypoint. The Runway 15L runway transition would avoid conflict with Runway 15R departure traffic from BWI and traffic arriving on the RAVNN RNAV STAR from the south and west. The Runways 33L and 33R runway transition would give aircraft a more predictable route to join the final approach procedures to the runways.

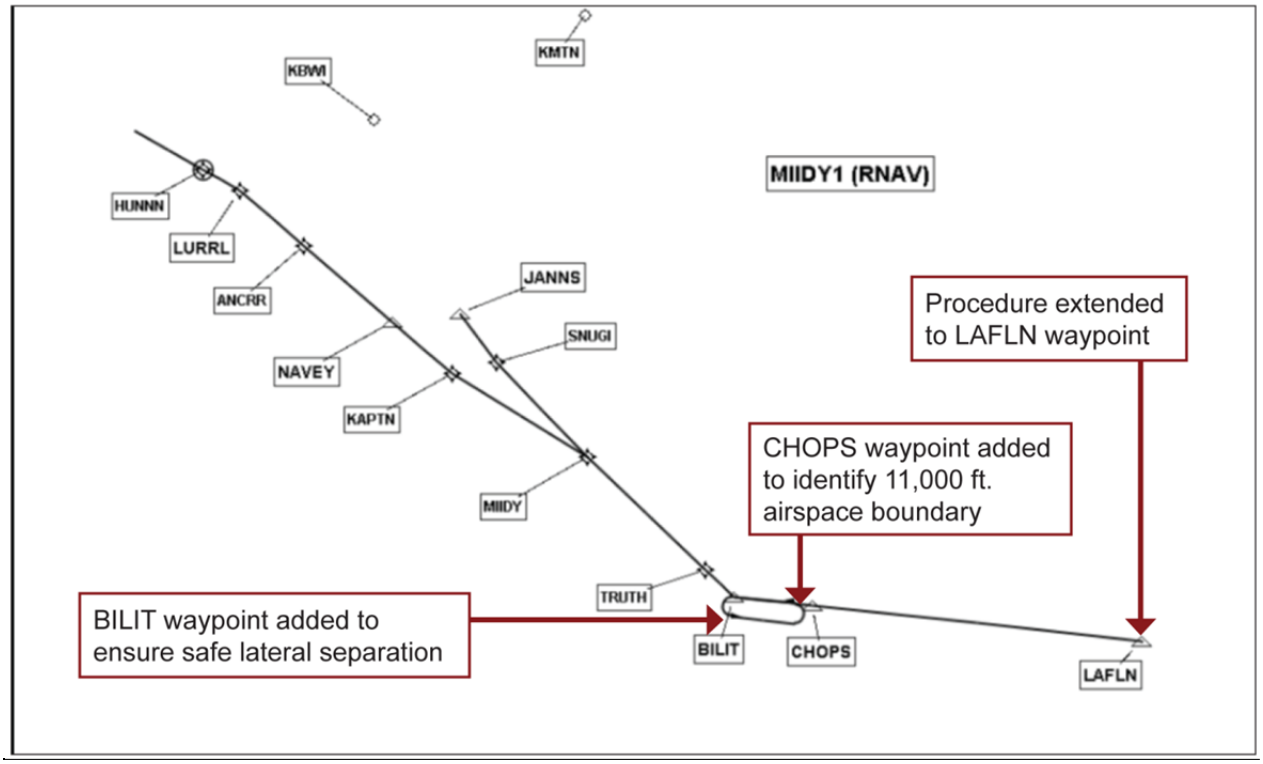
Exhibit 3-5 Proposed Design, First Version – MIIDY STAR



Source: DC OAPM D&I Team MIIDY RNAV STAR Proposed Final Design Sheet, September 2012.
Prepared by: ATAC Corporation, March 2013.

After completing the first version of this procedure, more changes were made following further evaluation using the criteria described in Section 3.1.2 (e.g. Air Traffic Regulations and Requirements: air traffic facility transfers and separation requirements). **Exhibit 3-6** depicts the second version of the MIIDY STAR. The second version extended the procedure to the east to begin at the LAFLN waypoint. This would allow for better automation into PTC airspace from ZDC airspace. In addition, the CHOPS waypoint was added to the procedure to identify an 11,000 foot airspace boundary. Finally, the BILIT waypoint was added to the procedure to ensure safe lateral separation from aircraft operating on adjacent procedures. The second version of the procedure is the Proposed Final Design included as part of the Proposed Action Alternative.

Exhibit 3-6 Proposed Design, Second Version – MIIDY STAR



Source: DC OAPM D&I Team MIIDY RNAV STAR Change Control Sheet, October 2012.
Prepared by: ATAC Corporation, March 2013.

3.2 Alternatives Overview

The following sections discuss the Proposed Action and the No Action Alternative, the alternatives carried forward for analysis in the EA.

3.2.1 No Action Alternative

Under the No Action Alternative, the FAA would keep existing arrival and departure procedures. The air traffic routes in use in the DC Metroplex as of 2011 (representing existing conditions) would generally remain the same. However, the No Action Alternative would include some procedure changes independent of those included in the Proposed Action. This include the implementation of seven new procedures, four serving IAD (GIBBZ ONE, DOCCS ONE, BUNZZ ONE, and RNLDI ONE) and three serving DCA (FRDMM ONE, TRUPS ONE, and NUMMY ONE) that were previously developed and determined to be of independent utility. Four existing procedures (ROYIL, SHNON, ELDEE FIVE, and WZZRD) would be replaced by five of the seven new procedures (GIBBZ ONE, DOCCS ONE, FRDMM ONE, TRUPS ONE, and NUMMY ONE). These changes would be made prior to the Proposed Action to deal with issues not related to this project, and would continue without the Proposed Action procedures.

The factors limiting FAA's ability to increase efficiency are identified in Section 2.1.2. In summary, the factors are:

- Lack of flexibility for the efficient transfer of traffic between the enroute and terminal area airspace;

- Complex converging interactions between arrival and departure flight paths; and
- Lack of predictable standard procedures to/from and in enroute airspace.

3.2.1.1 No Action Alternative Standard Procedures

Table 3-1 lists the names of the No Action Alternative procedures, the procedure type (i.e., SID or STAR), the basis of design (indicated by the type of navigational aid the procedures are based on: NAVAID (shown as VHF Omnidirectional Range [VOR]), RNAV, or radar vectors), and the airports served. In addition, the table includes the number of runway and enroute transitions for each procedure and, where applicable, by airport, and the entry/exit gates served by the procedure. The No Action Alternative includes current procedures, as well as procedures expected to be put into effect prior to implementation of the DC OAPM.

Table 3-1 No Action Alternative SIDs and STARS (1 of 2)

No Action Alternative Procedure	Procedure Type	Basis of Design	Primary Airport Served	Other Study Airports Served	Transitions (enroute/ runway)	Entry/Exit Gate Served
ANDREWS ONE	SID	Radar Vectors	ADW	None	0/1	North
ARSENAL TWO	SID	VOR	HEF	None	6/2	North, West
BARIN ONE	STAR	RNAV	IAD	None	2/1	South
BILIT ONE	STAR	RNAV	DCA	None	2/1	North
BUNZZ ONE[2]	SID	RNAV	IAD	None	1/7	West
CAMP SPRINGS ONE	SID	Radar Vectors	ADW	None	0/2	West, South
CAPITAL EIGHT	SID	Radar Vectors	IAD	None	0/0	North, South, West
CLIPR ONE	STAR	RNAV	DCA	None	1/2	North
COATT FOUR	STAR	VOR	IAD	HEF,JYO	2/0	South
COLIN FIVE	SID	VOR	RIC	None	1/0	West
DELRO TWO	STAR	VOR	IAD	None	2/0	West
DOCCS ONE[2]	STAR	VOR	IAD	JYO	1/2, (1/0)[1]	West
FRDMM ONE[2]	STAR	RNAV	DCA	ADW	1/2, (1/0)[1]	West
GIBBZ ONE[2]	STAR	RNAV	IAD	HEF, JYO	3/2, (3/0)[1]	West
HYPER FOUR	STAR	RNAV	IAD	MRB,OKV, JYO,HEF, RMN	4/1, (4/0)[1]	North
IRONS FOUR	STAR	VOR	ADW	DCA	1/0	South
LAZIR THREE	SID	RNAV to Radar Vectors	DCA	None	1/2	North, South, West
LEGGO TWO	STAR	RNAV	IAD	None	1/0	North
MORNINGSIDE ONE	SID	Radar Vectors	ADW	None	0/2	North, South
NATIONAL TWO	SID	VOR/DME to Radar Vectors	DCA	None	0/0	North
NOTTINGHAM SIX	STAR	VOR	BWI	MTN	3/0	North
NUMMY ONE[2]	STAR	VOR	DCA	ADW	1/2, (1/0)[1]	North
OJAAY ONE	STAR	RNAV	DCA	None	1/1	South
PALEO THREE	SID	VOR	BWI	None	2/0	North
PHILIPSBURG TWO	STAR	VOR	IAD	None	1/0	North
PRTZL THREE	STAR	RNAV	IAD	None	1/0	North

Table 3-1 No Action Alternative SIDs and STARS (2 of 2)

No Action Alternative Procedure	Procedure Type	Basis of Design	Primary Airport Served	Other Study Airports Served	Transitions (enroute/ runway)	Entry/Exit Gate Served
RAVNN THREE	STAR	RNAV	BWI	MTN	2/1, (2/0)1	North
RNLDI ONE[2]	SID	RNAV	IAD	None	1/7	North
SELINSGROVE THREE	STAR	VOR	IAD	None	1/0	North
SKILS TWO	STAR	RNAV	DCA	None	2/2	West, South
STOIC TWO	SID	RNAV	IAD	None	4/0	West
SWANN THREE	SID	VOR	BWI	None	2/0	North
TERPZ TWO	SID	RNAV	BWI	None	6/0	North, South
TRIXY FOUR	SID	VOR	MRB	None	3/2	North, South
TRUPS ONE[2]	STAR	RNAV	DCA	ADW	2/2, (2/0)[1]	West
WESTMINSTER FIVE	STAR	VOR	BWI	MTN	2/0	West, South
YEAST ONE	SID	VOR	RIC	None	3/0	North

Notes:

[1] Indicates enroute and runway transitions for other airports served.
[2] Denotes a procedure previously developed and determined to be of independent utility.

ADW – Joint Base Andrews
BWI – Baltimore/Washington International Thurgood Marshall Airport
DCA – Ronald Reagan Washington National Airport
IAD – Washington Dulles International Airport
HEF – Manassas Regional Airport/Harry P. Davis Field
MTN – Martin State Airport
JYO – Leesburg Executive Airport
GAI – Montgomery County Airpark
MRB – Eastern WV Regional Airport/Shepherd Field
OKV – Winchester Regional Airport
ESN – Easton/Newnam Field Airport
RMN – Stafford Regional Airport
SID – Standard Instrument Departures
n/a – Not Applicable
STAR – Standard Terminal Arrival Route
RNAV – Area Navigation
VOR – VHF Omnidirectional Range

Source: National Flight Data Center National Airspace System Resources database, accessed September 16, 2012.
Prepared by: ATAC Corporation, April 2013.

Under the No Action Alternative, the final approach flows to and initial departure flows from the runways at all the Study Airports are similar to Existing Conditions (2011). However, in some cases the NAVAID used as the basis for the procedure design would differ. For a few airports, the location of landing thresholds on the runways will change as a result of independent projects improving Runway Safety Areas (RSAs).[40] These changes are taken into account in the analysis of impacts associated with the No Action Alternative (See Chapter 5, *Environmental Consequences*.)

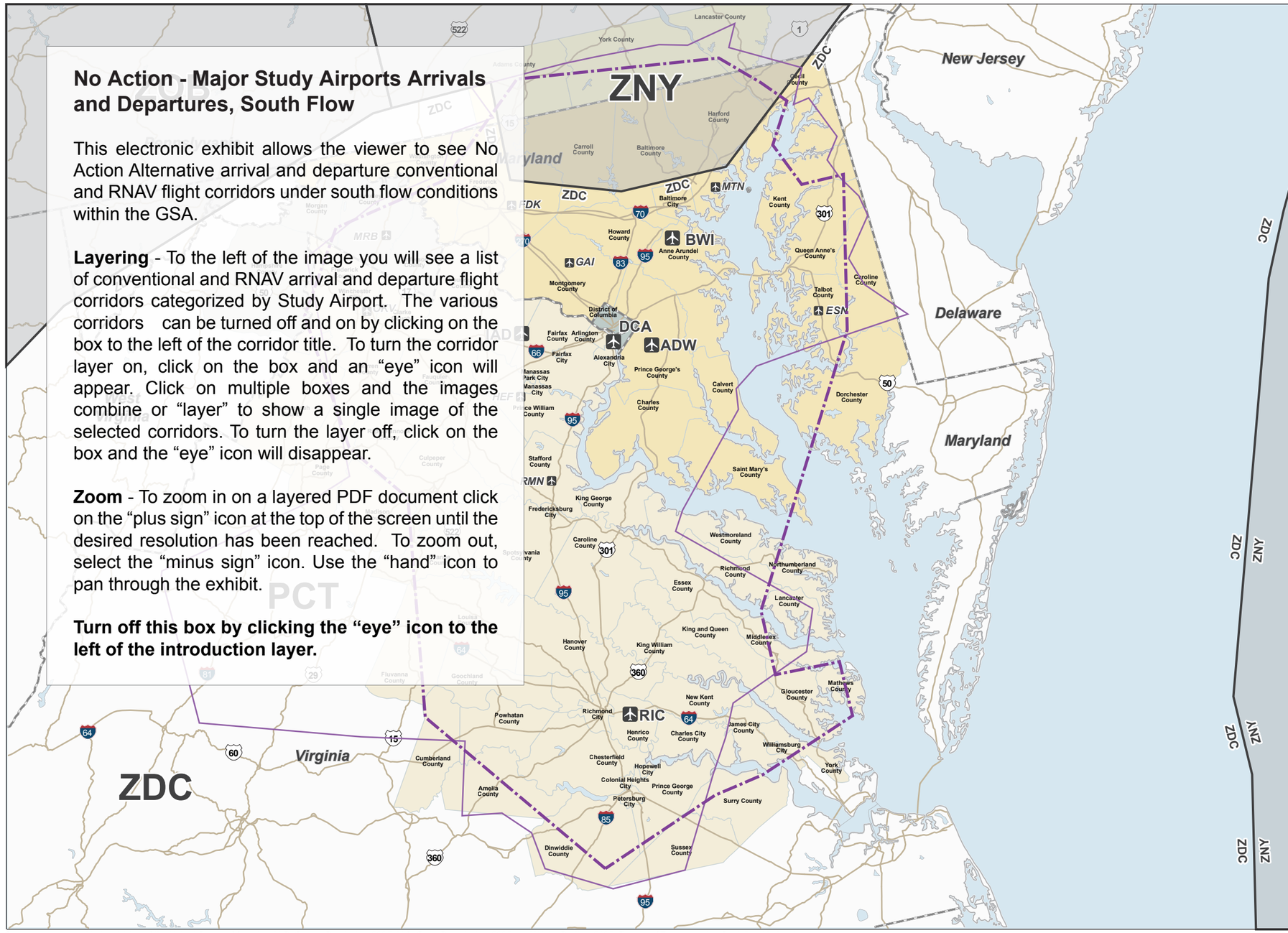
3.2.1.2 Airspace Control Structure under the No Action Alternative

When aircraft depart or arrive on an assigned route in the DC Metroplex, control over the aircraft is transferred between the Washington Air Route Traffic Control Center (ARTCC) (ZDC) or New York ARTCC (ZNY) Centers and the Potomac Consolidated Terminal Radar Approach Control (TRACON) (PCT). The entry and exit gates between the DC Metroplex airspace and the neighboring ZDC and ZNY Centers would remain the same as under Existing Conditions (2011). **Exhibits 2-1** and **2-3** in Chapter 2 depict the locations of the entry and exit gates for the DC Metroplex airspace, respectively. The entry and exit gates associated with each procedure are shown in **Table 3-1**.

[40] FAA Order 5200.8, *Runway Safety Area Program*, requires all federally obligated airports and airports certificated under 14 CFR Part 139 to improve their RSAs, to the extent practicable, to comply with the design standards included in AC 150/5300-13, Airport Design.

Exhibits 3-7 and **3-8** show all arrival and departure flows to the major Study Airports associated with the No Action Alternative during South Flow and North Flow conditions, respectively. Corridors are grouped by procedure type (conventional or RNAV), operation (arrival or departure), and airport. Arrival and departure corridors to/from the satellite Study Airports are shown on **Exhibit 3-9.** Different corridors can be turned on and off on **Exhibits 3-7** through **3-9** by clicking on the boxes that contain the "eye" icon on the left hand side of the exhibit.

Exhibit 3-10 and **Exhibit 3-11** depict the arrival and departure corridors to/from the major Study Airports under South Flow conditions, respectively. Similarly, **Exhibit 3-12** and **Exhibit 3-13** depict the arrival and departure corridors to/from the major Study Airports under North Flow conditions, respectively. **Exhibit 3-14** and **Exhibit 3-15** depict arrivals and departures to the satellite Study Airports, respectively.



No Action - Major Study Airports Arrivals and Departures, South Flow

This electronic exhibit allows the viewer to see No Action Alternative arrival and departure conventional and RNAV flight corridors under south flow conditions within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

Zoom - To zoom in on a layered PDF document click on the "plus sign" icon at the top of the screen until the desired resolution has been reached. To zoom out, select the "minus sign" icon. Use the "hand" icon to pan through the exhibit.

Turn off this box by clicking the "eye" icon to the left of the introduction layer.

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Arrival
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-7

No Action Alternative - Major Study Airports Arrivals and Departures, South Flow

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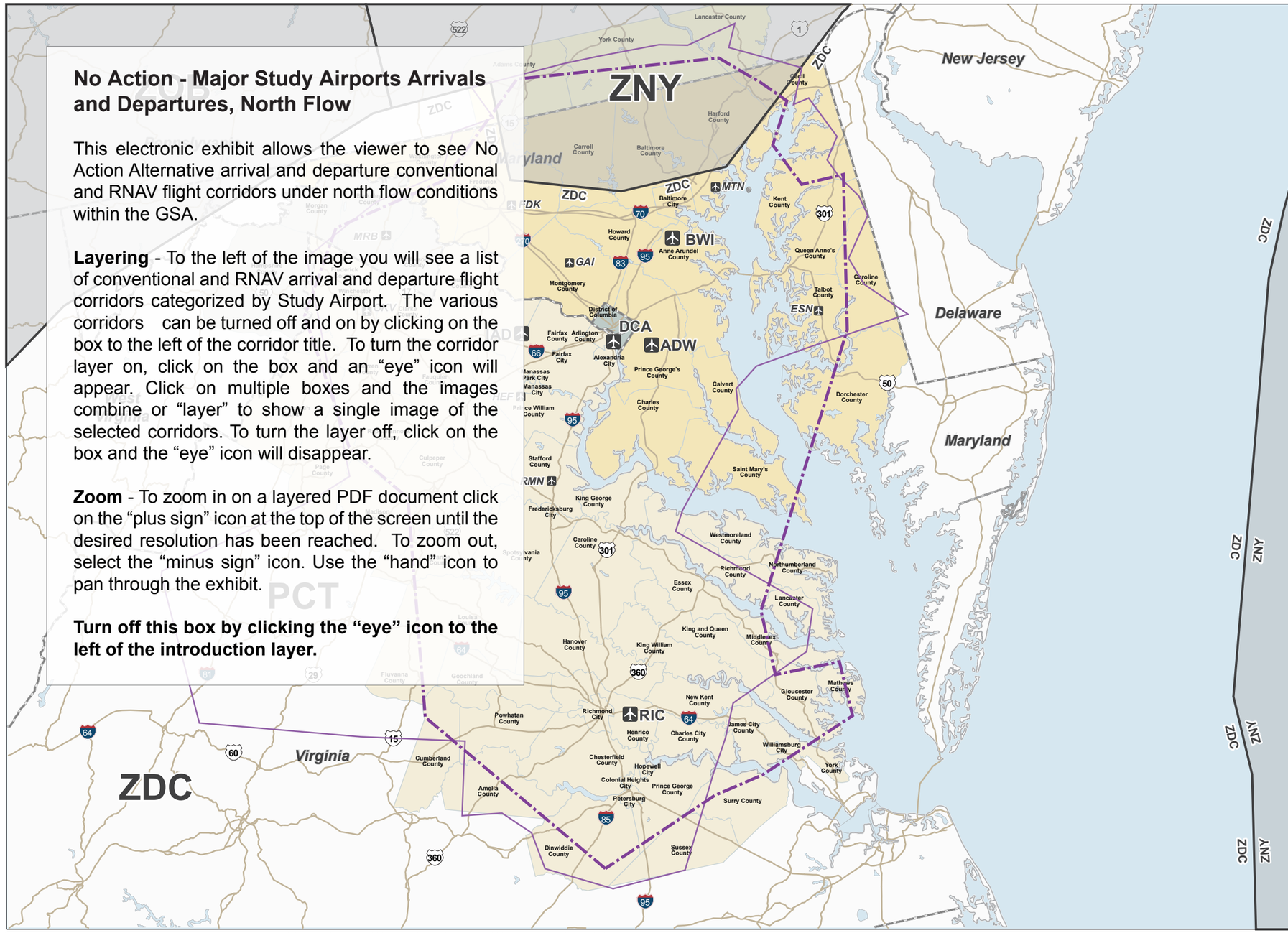

No Action - Major Study Airports Arrivals and Departures, North Flow

This electronic exhibit allows the viewer to see No Action Alternative arrival and departure conventional and RNAV flight corridors under north flow conditions within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

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Turn off this box by clicking the "eye" icon to the left of the introduction layer.

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Arrival
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
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BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-8

No Action Alternative - Major Study Airports Arrivals and Departures, North Flow

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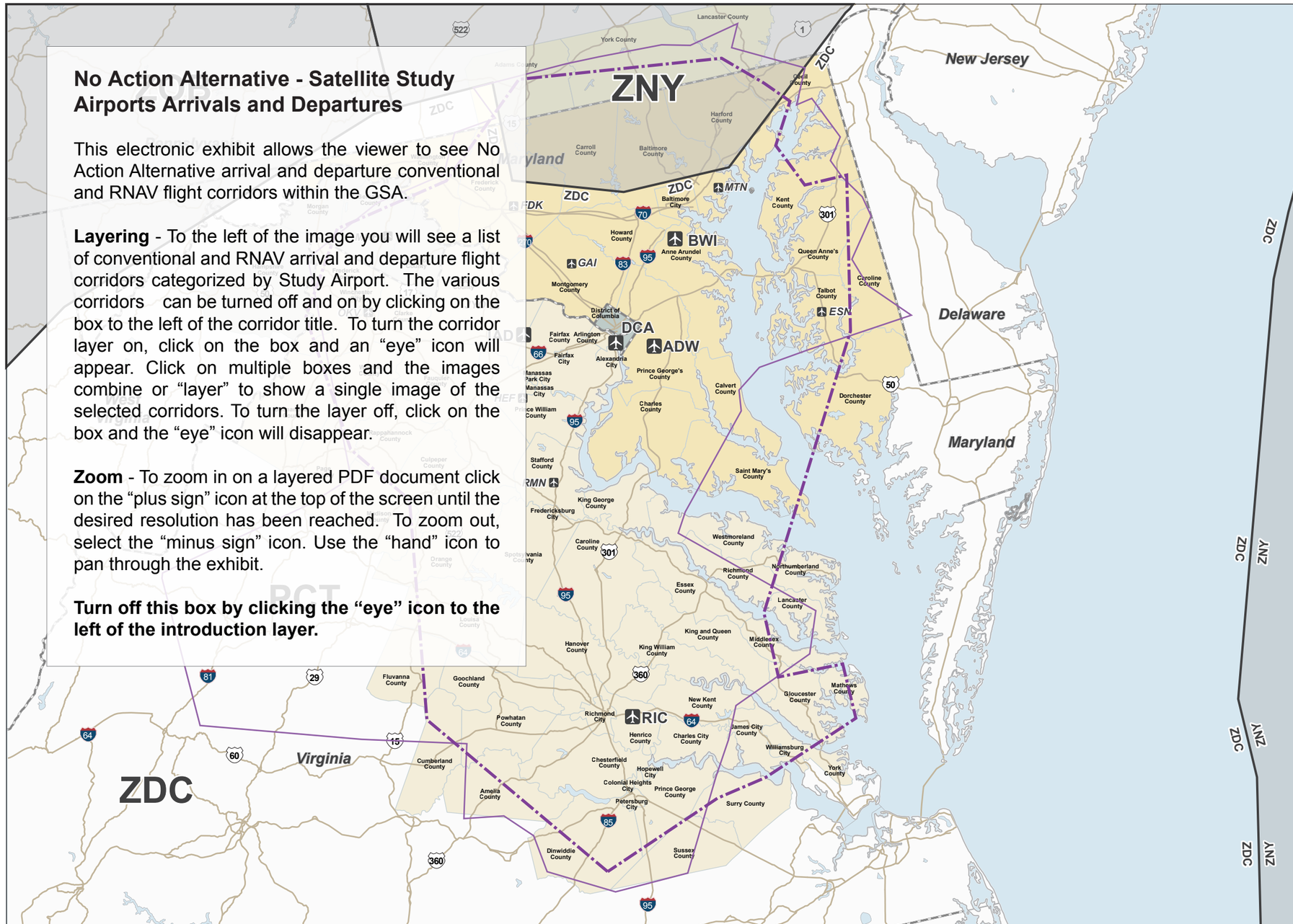

No Action Alternative - Satellite Study Airports Arrivals and Departures

This electronic exhibit allows the viewer to see No Action Alternative arrival and departure conventional and RNAV flight corridors within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

Zoom - To zoom in on a layered PDF document click on the "plus sign" icon at the top of the screen until the desired resolution has been reached. To zoom out, select the "minus sign" icon. Use the "hand" icon to pan through the exhibit.

Turn off this box by clicking the "eye" icon to the left of the introduction layer.

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Arrival
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

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ADW	Joint Base Andrews
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ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-9

No Action Alternative Satellite Study Airports Arrivals and Departures

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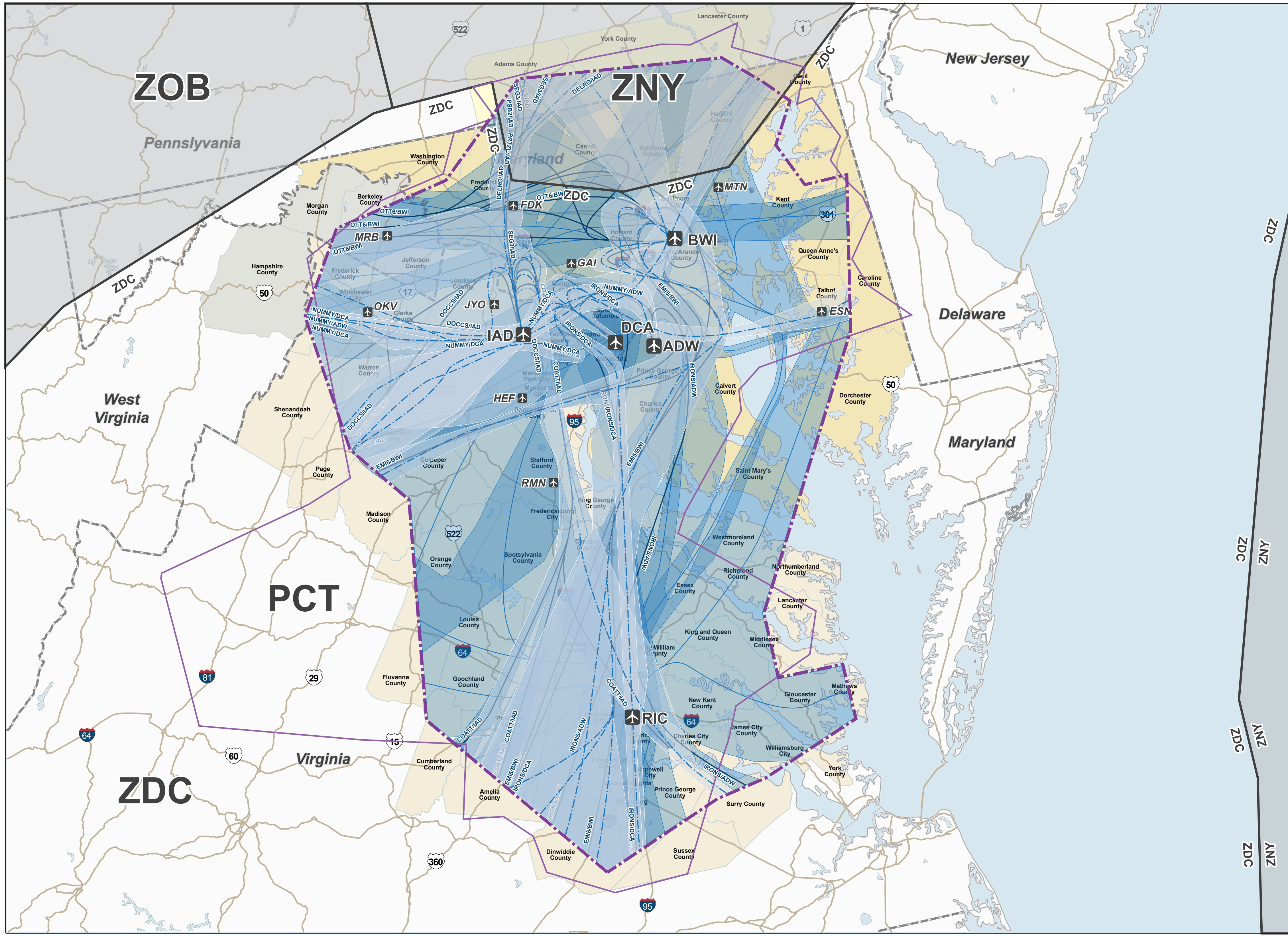

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- RNAV South Arrival
- Radar Vector South Arrival

Notes:

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GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.

Prepared By: ATAC Corporation, February 2013.

Exhibit 3-10

No Action Alternative - Major Study Airports Arrivals, South Flow

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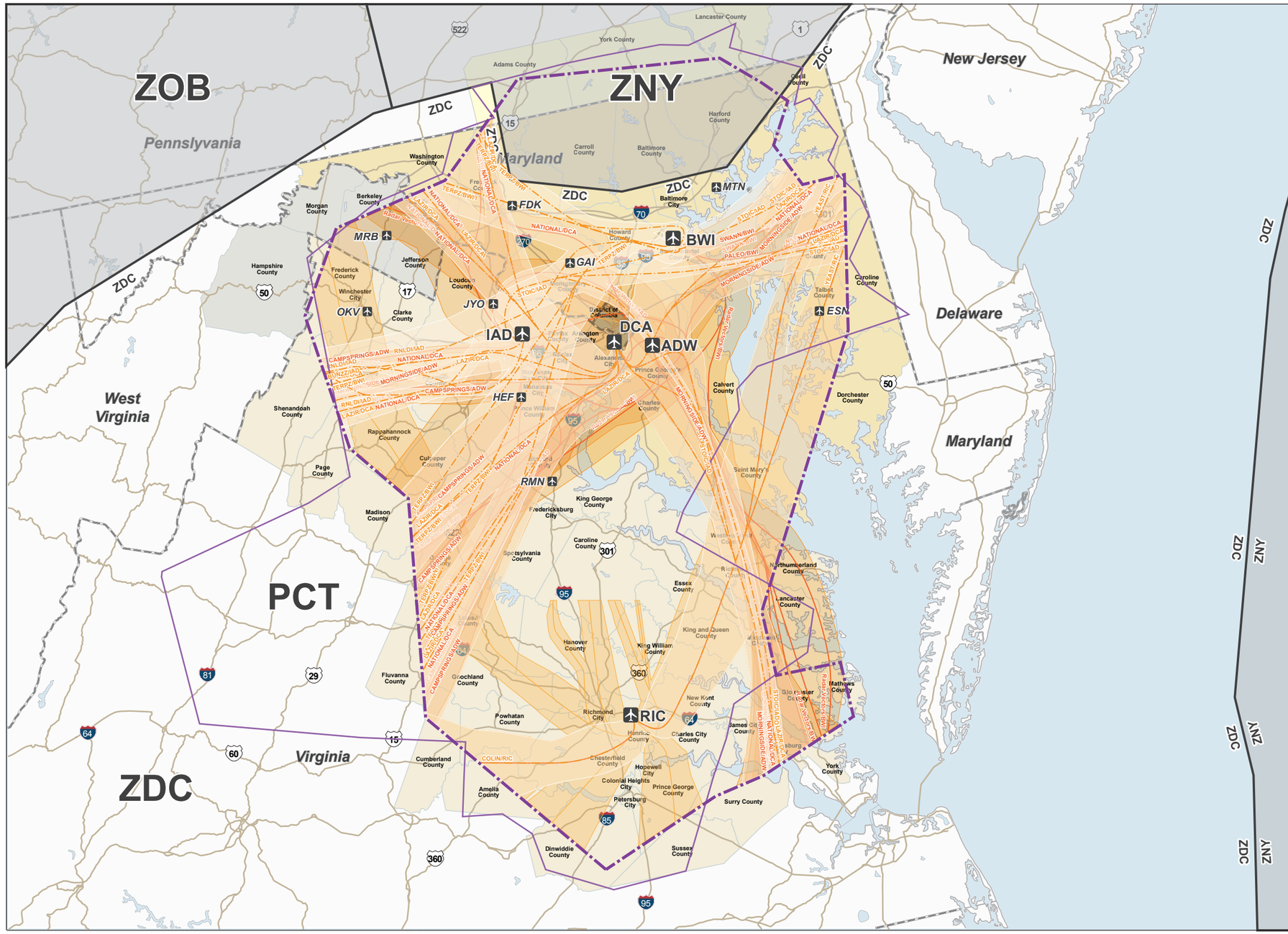

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Departure
- RNAV South Departure
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-11

No Action Alternative - Major Study Airports Departures, South Flow

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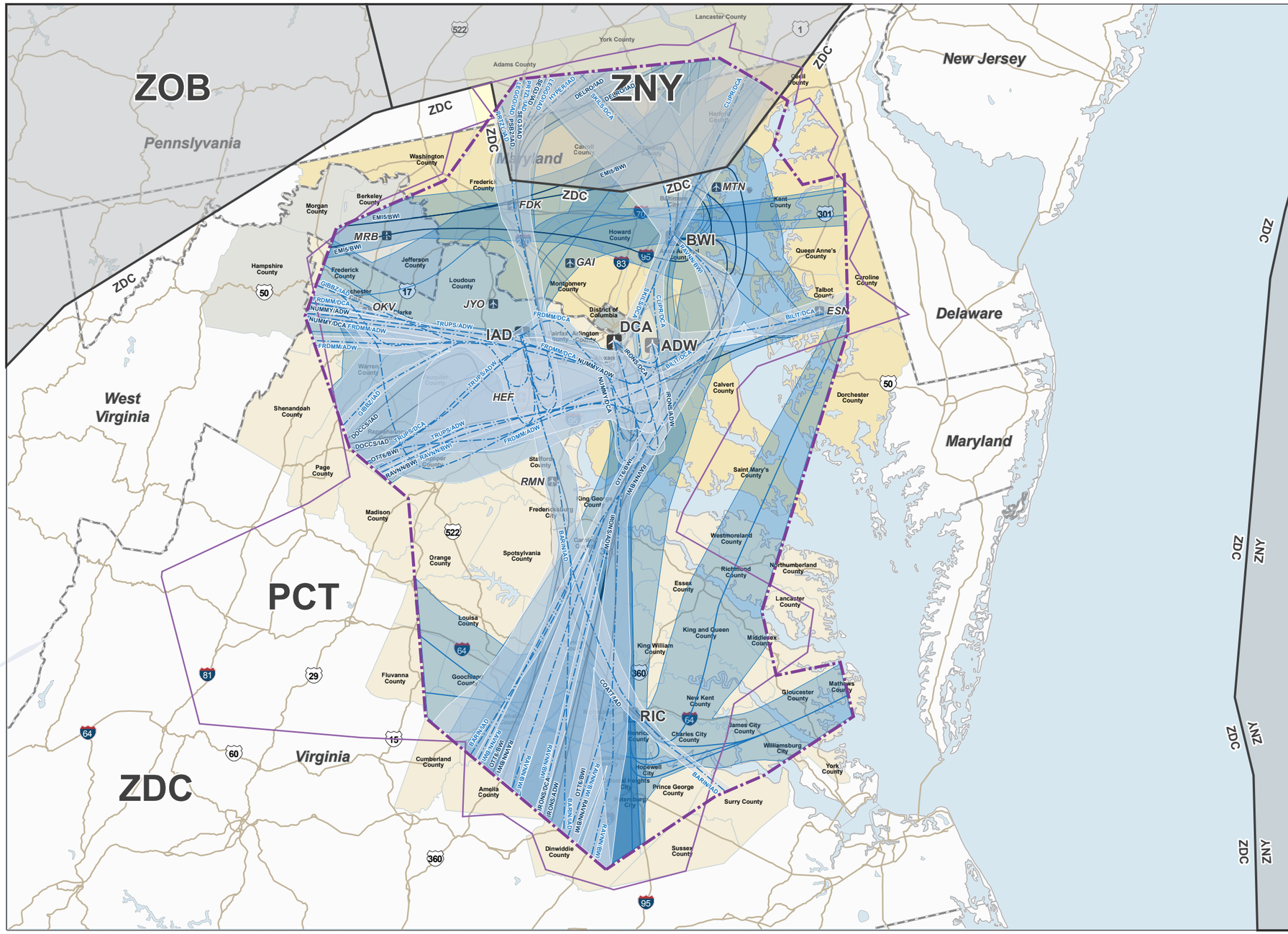

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- RNAV South Arrival
- Radar Vector South Arrival

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
STAR	Standard Terminal Arrival Route
SID	Standard Instrument Departure
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-12

No Action Alternative - Major Study Airports Arrivals, North Flow

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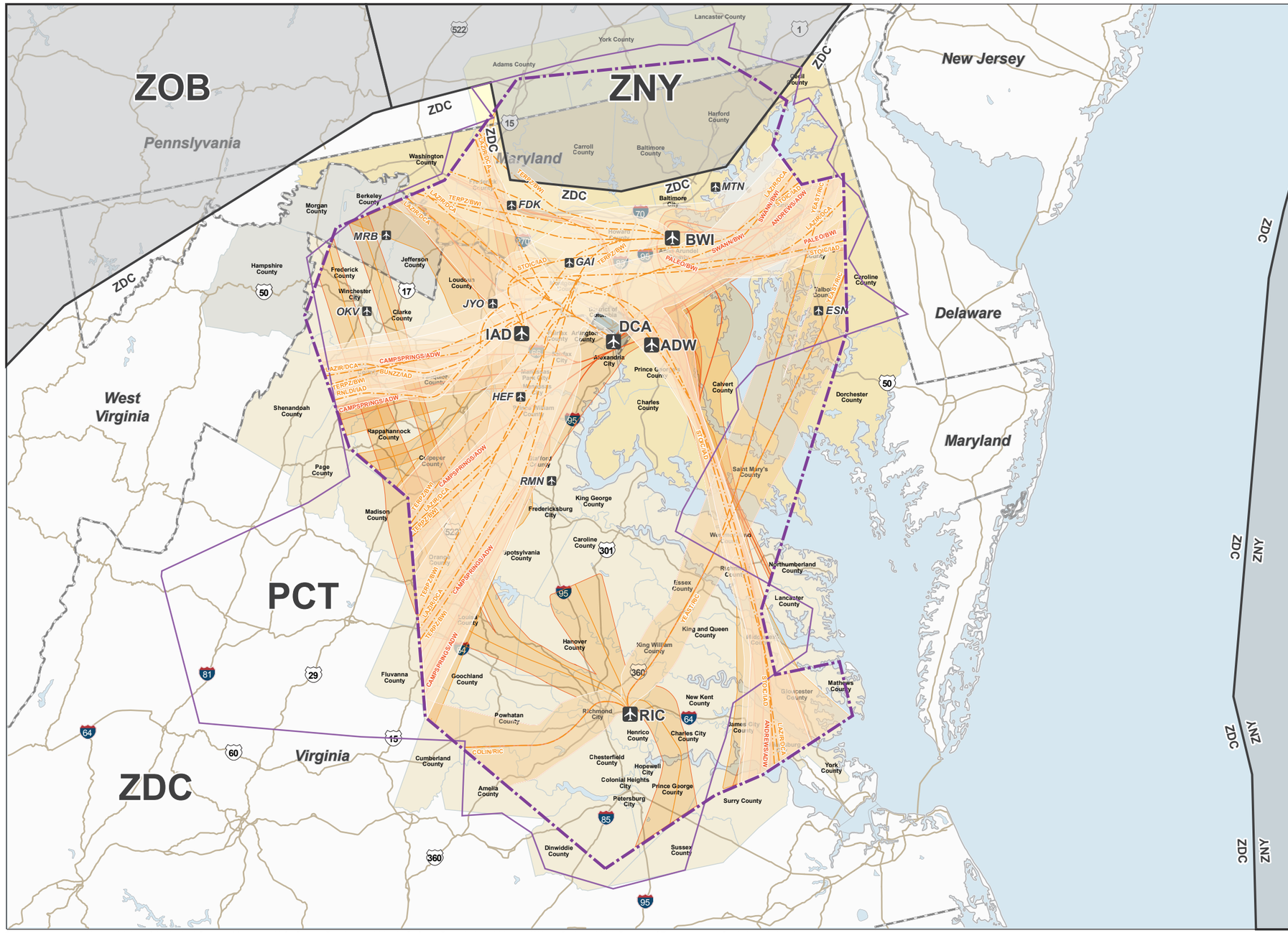

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Departure
- RNAV South Departure
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-13

No Action Alternative - Major Study Airports Departures, North Flow

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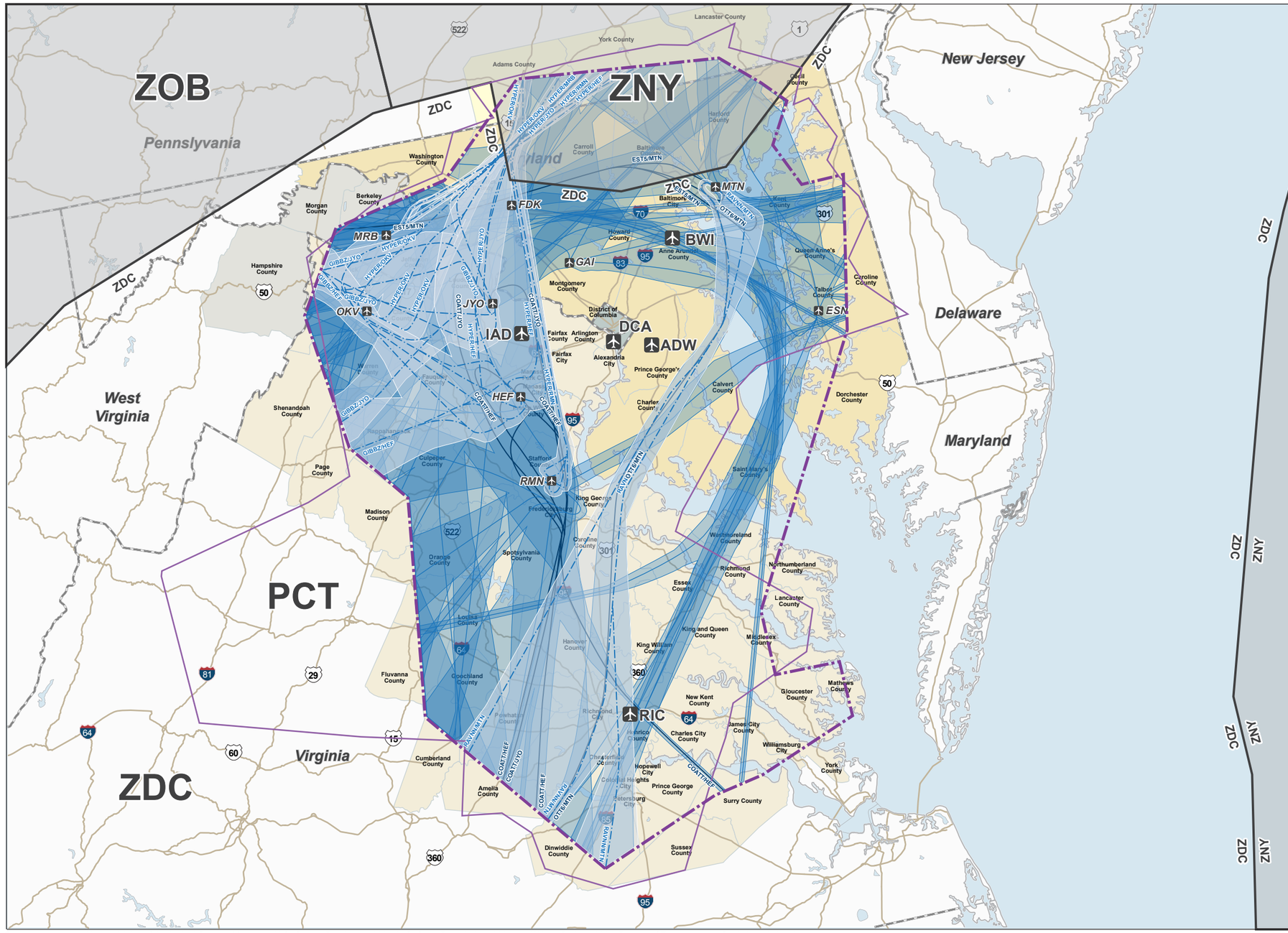

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- RNAV South Arrival
- Radar Vector South Arrival

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Random/Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-14

No Action Alternative
Satellite Study Airports Arrivals

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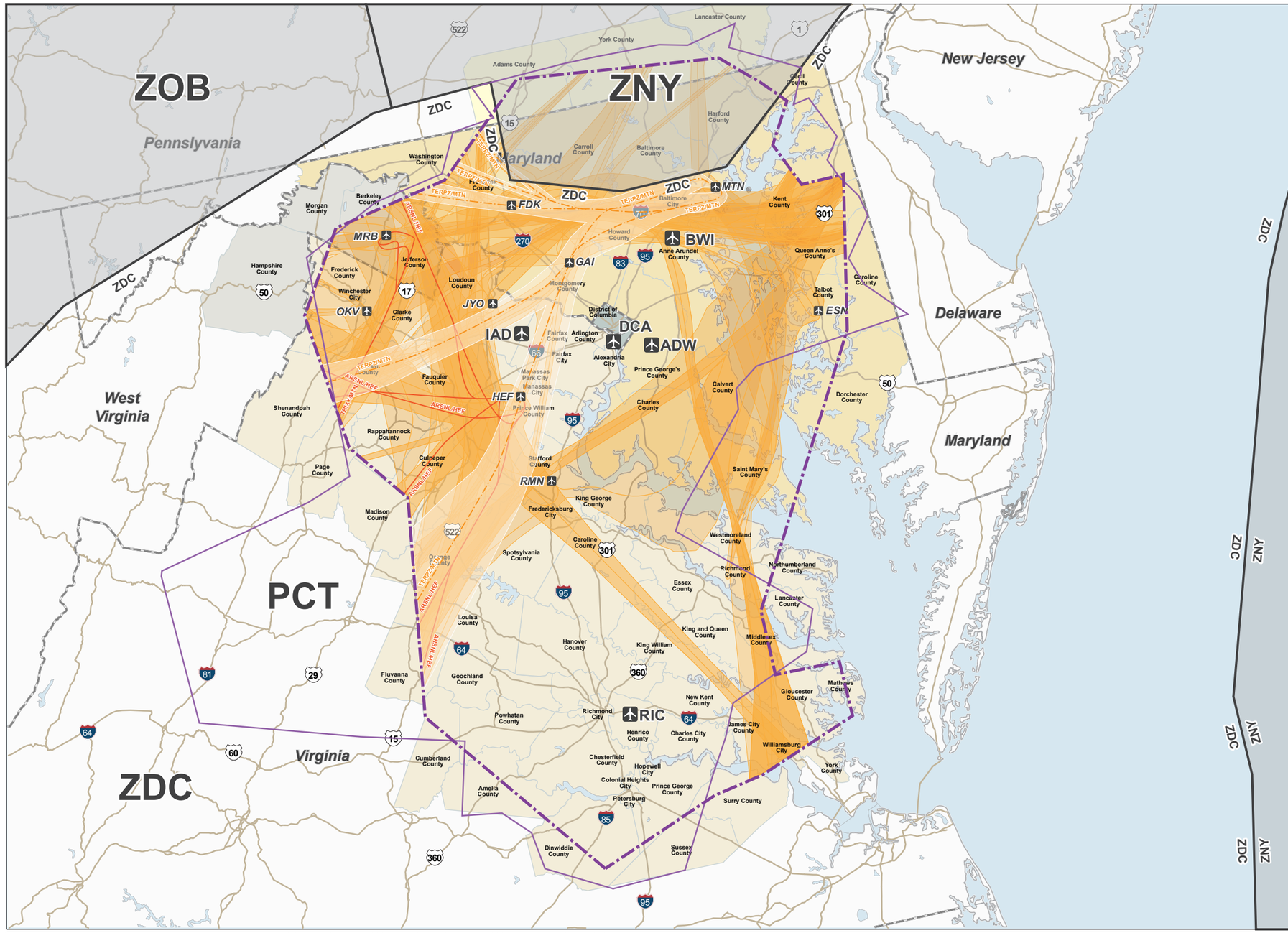

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Departure
- RNAV South Departure
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-15

No Action Alternative
Satellite Study Airports Departures

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3.2.2 Proposed Action Alternative

As discussed in Section 3.1, the Proposed Action includes the combined Proposed Final Designs for all procedures developed by the D&I Team as well as existing procedures that have been carried forward for continued use. This alternative is expected to add efficiency to airspace usage in the DC Metroplex by improving flexibility in transitioning aircraft, segregating arrivals and departures, and improving the predictability of air traffic flows.

The Proposed Action includes 67 procedures: 38 procedures developed by the D&I Team, 22 existing procedures, and seven previously developed procedures identified as having independent utility that have not yet been implemented. In some cases, the D&I Team determined that existing procedures are efficient and a redesign was unnecessary.[41] Of the 38 new procedures developed by the D&I Team, 21 procedures are SIDs and 17 procedures are STARs. Of the 38 procedures developed by the D&I Team, all but one are RNAV. The 22 existing and seven previously developed procedures are also included as part of the No Action Alternative.

Table 3-2 lists the names of the Proposed Action alternatives, the existing procedure the Proposed Action alternative would replace, the procedure type, and the basis of design (indicated by the type of navigational aid the procedures are based on: NAVAID [shown as VOR, RNAV, or radar vectors]). In addition, the table also shows the airports served by the Proposed Action procedures, the number of runway and enroute transitions for each procedure and, where applicable, by airport, and the entry/exit gates served by the procedure. Finally, the table lists intent of the procedure, including the objectives identified under the purpose and need for the project (predictability, flexibility and/ segregation) that each procedure design achieves. New or updated SIDs and STARs are shaded in gray.

Exhibits 3-16 and **3-17** show all arrival and departure flows to the major Study Airports associated with the Proposed Action during South Flow and North Flow conditions, respectively. Corridors are grouped by procedure type (conventional or RNAV), operation (arrival or departure), and airport. Arrival and departure corridors to/from the satellite Study Airports are shown on **Exhibit 3-18.** Different corridors can be turned on and off on **Exhibits 3-16** through **3-18** by clicking on the boxes that contain the “eye” icon on the left hand side of the exhibit.

Exhibit 3-19 and **Exhibit 3-20** depict the arrival and departure corridors to/from the major Study Airports under South Flow conditions, respectively. Similarly, **Exhibit 3-21** and **Exhibit 3-22** depict the arrival and departure corridors to/from the major Study Airports under North Flow conditions, respectively. **Exhibit 3-23** and **Exhibit 3-24** depict arrivals and departures to the satellite Study Airports, respectively.

[41] More information on the procedure designs can be found in *The Design and Implementation Team Final Report for the D.C. Metroplex*, November 2012.

Table 3-2 Proposed Action Alternative Procedures (1 of 4)

Proposed Action Procedure	No Action Alternative Procedure	Procedure Type	Basis of Design	Airport	Other Study Airports Served	Transition (enroute /runway)	Entry/ Exit Gate Served	Objective
ANDREWS ONE	ANDREWS ONE	SID	Radar Vectors	ADW	None	0/1	North	n/a
ANTHM ONE	No Procedure	STAR	RNAV	BWI	None	1/2	West	Predictability
ARSENAL TWO	ARSENAL TWO	SID	VOR	HEF	None	6/2	North, West	n/a
BULRN ONE	No Procedure	SID	RNAV	IAD	None	4/7	West	Segregation, Predictability
BUNZZ ONE	BUNZZ ONE	SID	RNAV	IAD	None	1/7	West	n/a
BUTRZ ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	West	Segregation, Predictability
CAMP SPRINGS ONE	CAMP SPRINGS ONE	SID	Radar Vectors	ADW	None	0/2	West, South	n/a
CAPITAL EIGHT	CAPITAL EIGHT	SID	Radar Vectors	IAD	None	0/0	North, South, West	Overlay of all RNAV SIDs
CAPPS ONE	OJAAY ONE	STAR	RNAV	DCA	None	2/2	South	Segregation, Predictability, Flexibility
CAVLR ONE	BARIN ONE	STAR	RNAV	IAD	None	3/3	South	Flexibility
CLIPR ONE	CLIPR ONE	STAR	RNAV	DCA	None	1/2	North	n/a
COATT FOUR	COATT FOUR	STAR	VOR	IAD	HEF, JYO	2/0	South	Overlay of HOWLL RNAV STAR
COLIN FIVE	COLIN FIVE	SID	VOR	RIC	None	1/0	South	Overlay of LUCYL RNAV SID
CONLE ONE	No Procedure	SID	RNAV	BWI	MTN, GAI	1/8, (1/0)[1]	South	Segregation, Predictability
DEALE ONE	BILIT ONE	STAR	RNAV	DCA	None	2/2	East	Segregation, Predictability
DELRO TWO	DELRO TWO	STAR	VOR	IAD	None	2/0	North	Overlay of HYPER RNAV STAR
DIXIE ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	South	Segregation, Predictability
DOCCS ONE	DOCCS ONE	STAR	VOR	IAD	JYO	1/2, (1/0)[1]	West	Overlay of GIBBZ RNAV STAR
DOCTR ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	North	Segregation, Predictability
DUCXS ONE	No Procedure	STAR	RNAV	RIC	None	2/3	South	Segregation, Predictability

Table 3-2 Proposed Action Alternative Procedures (2 of 4)

Proposed Action Procedure	No Action Alternative Procedure	Procedure Type	Basis of Design	Airport	Other Study Airports Served	Transition (enroute /runway)	Entry/ Exit Gate Served	Objective
FRDMM ONE	FRDMM ONE	STAR	RNAV	DCA	ADW	1/2, (1/0)	West	n/a
FSTER ONE	PHILIPS-BURG TWO	STAR	VOR	IAD	None	0/1	North	Overlay of GRAVZ RNAV STAR
GABBE ONE	No Procedure	SID	RNAV	HEF	None	4/4	South	Segregation, Predictability
GIBBZ ONE	GIBBZ ONE	STAR	RNAV	IAD	HEF, JYO	3/2, (3/0)	West	n/a
GRAVZ ONE	PRETZL THREE	STAR	RNAV	IAD	None	1/6	North	Segregation, Flexibility
HAFNR ONE	LAZIR THREE	SID	RNAV	DCA	None	2/4	South	Segregation, Predictability
HIICH ONE	No Procedure	SID	RNAV	HEF	None	7/4	North, West	Predictability
HORTO ONE	LAZIR THREE	SID	RNAV	DCA	None	3/4	North	Segregation, Predictability
HYPER FIVE	HYPER FOUR	STAR	RNAV	IAD	MRB,OKV, JYO,HEF, RMN	6/5, (6/0)	North	Segregation, Flexibility
IRONS FOUR	IRONS FOUR	STAR	VOR	ADW	DCA	1/0	West	Overlay of CAPPS RNAV STAR
JCOBY ONE	No Procedure	SID	RNAV	IAD	None	1/7	South	Predictability
JERES ONE	No Procedure	SID	RNAV	IAD	None	0/7	North	Predictability
KALLI ONE	YEAST ONE	SID	RNAV	RIC	None	3/6	North	Segregation, Predictability
LAZIR TWO	LAZIR TWO	SID	RNAV to Radar Vectors	DCA	None	1/2	North, South, West	n/a

Table 3-2 Proposed Action Alternative Procedures (3 of 4)

Proposed Action Procedure	No Action Alternative Procedure	Procedure Type	Basis of Design	Airport	Other Study Airports Served	Transition (enroute /runway)	Entry/ Exit Gate Served	Objective
LEGGO TWO	LEGGO TWO	STAR	RNAV	IAD	None	1/0	North	n/a
LINCN ONE	No Procedure	SID	RNAV	ADW	None	0/0	North	Predictability
LUCYL ONE	COLIN FIVE	SID	RNAV	RIC	None	1/6	South	Segregation, Predictability
MCRAY ONE	No Procedure	SID	RNAV	IAD	None	1/7	North	Predictability
MIIDY ONE	No Procedure	STAR	RNAV	BWI	MTN	1/2, (1/0)	East	Segregation, Predictability
MORNING-SIDE ONE	MORNING-SIDE ONE	SID	Radar Vectors	ADW	None	0/2	North, South	n/a
NATIONAL TWO	NATIONAL TWO	SID	VOR/ DME to Radar Vectors	DCA	None	0/0	North	Overlay for all RNAV SIDs
NOTTING-HAM SIX	NOTTING-HAM SIX	STAR	VOR	BWI	MTN	3/0	West	Overlay of RAVNN RNAV STAR
NUMMY ONE	NUMMY ONE	STAR	VOR	DCA	ADW	1/2 (1/0)	West	Overlay of FRDMM RNAV STAR
PALEO THREE	PALEO THREE	SID	VOR	BWI	None	2/0	North	n/a
POOCH ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	South	Segregation, Predictability
POWTN ONE	No Procedure	STAR	RNAV	RIC	None	1/5	South	Segregation, Predictability
PTOMC ONE	No Procedure	SID	RNAV	JYO	None	0/2	North, South, West	Segregation, Predictability
RAVNN FOUR	RAVNN THREE	STAR	RNAV	BWI	MTN	4/2, (4/0)	West	Segregation, Predictability
REBLL ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	North	Segregation, Predictability
RIGNZ ONE	STOIC TWO	SID	RNAV	IAD	None	3/7	North	Segregation, Predictability
RNLDI ONE	RNLDI ONE	SID	RNAV	IAD	None	1/7	North	n/a
SELINS-GROVE THREE	SELINS-GROVE THREE	STAR	VOR	IAD	None	1/0	North	Overlay of LEGGO RNAV STAR
SKILS TWO	SKILS TWO	STAR	RNAV	DCA	None	2/2	North	n/a

Table 3-2 Proposed Action Alternative Procedures (4 of 4)

Proposed Action Procedure	No Action Alternative Procedure	Procedure Type	Basis of Design	Airport	Other Study Airports Served	Transition (enroute /runway)	Entry/ Exit Gate Served	Objective
SOOKI ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	North	Segregation, Predictability
SPIDR ONE	No Procedure	STAR	RNAV	RIC	None	1/6	West	Segregation, Predictability
SPISY ONE	No Procedure	STAR	RNAV	ADW	None	1/2	East	Segregation, Predictability
SWANN THREE	SWANN THREE	SID	VOR	BWI	None	2/0	North	n/a
TERPZ FOUR	TERPZ THREE	SID	RNAV	BWI	MTN, GAI, ESN	8/8, (8/0)	West, North	Segregation, Predictability
TRIXY FOUR	TRIXY FOUR	SID	VOR	MRB	None	3/2	West, North	n/a
TROYZ ONE	No Procedure	STAR	RNAV	BWI	MTN, FDK, GAI	1/2, (1/0)	North	Segregation, Predictability
TRSTN ONE	No Procedure	STAR	RNAV	JYO	HEF, OKV, GAI, MTN, FDK	2/0, (2/0)	South	Segregation, Predictability
TRUPS ONE	TRUPS ONE	STAR	RNAV	DCA	ADW	2/2, (2/0)	West	n/a
VUDOO ONE	No Procedure	STAR	RNAV	ADW	None	2/2	South	Segregation, Predictability
WEST-MINSTER FIVE	WEST-MINSTER FIVE	STAR	VOR	BWI	MTN	2/0	West	n/a
WIGOL ONE	No Procedure	STAR	RNAV	IAD	None	3/1	North	Flexibility
WYNGZ ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	South	Segregation, Predictability
YEAST ONE	YEAST ONE	SID	VOR	RIC	None	3/0	North	Overlay of KALLI RNAV SID

Notes:
1\ Indicates enroute and runway transitions for other airports served.
n/a: Not applicable
New or updated SIDs and STARs are shaded in gray.

ADW – Joint Base Andrews
BWI – Baltimore/Washington International Thurgood Marshall Airport
DCA – Ronald Reagan Washington National Airport
IAD – Washington Dulles International Airport
HEF – Manassas Regional Airport/Harry P. Davis Field
MTN – Martin State Airport
JYO – Leesburg Executive Airport
GAI – Montgomery County Airpark
MRB – Eastern WV Regional Airport/Shepherd Field
OKV – Winchester Regional Airport
ESN – Easton/Newnam Field Airport
RMN – Stafford Regional Airport
SID – Standard Instrument Departures
n/a – Not Applicable
STAR – Standard Terminal Arrival Route
RNAV – Area Navigation
VOR – VHF Omnidirectional Range

Source: Proposed Action procedures based on The Design and Implementation Team Final Report for the Washington D.C. Metroplex, March 2013.
Prepared by: ATAC Corporation, April 2013.

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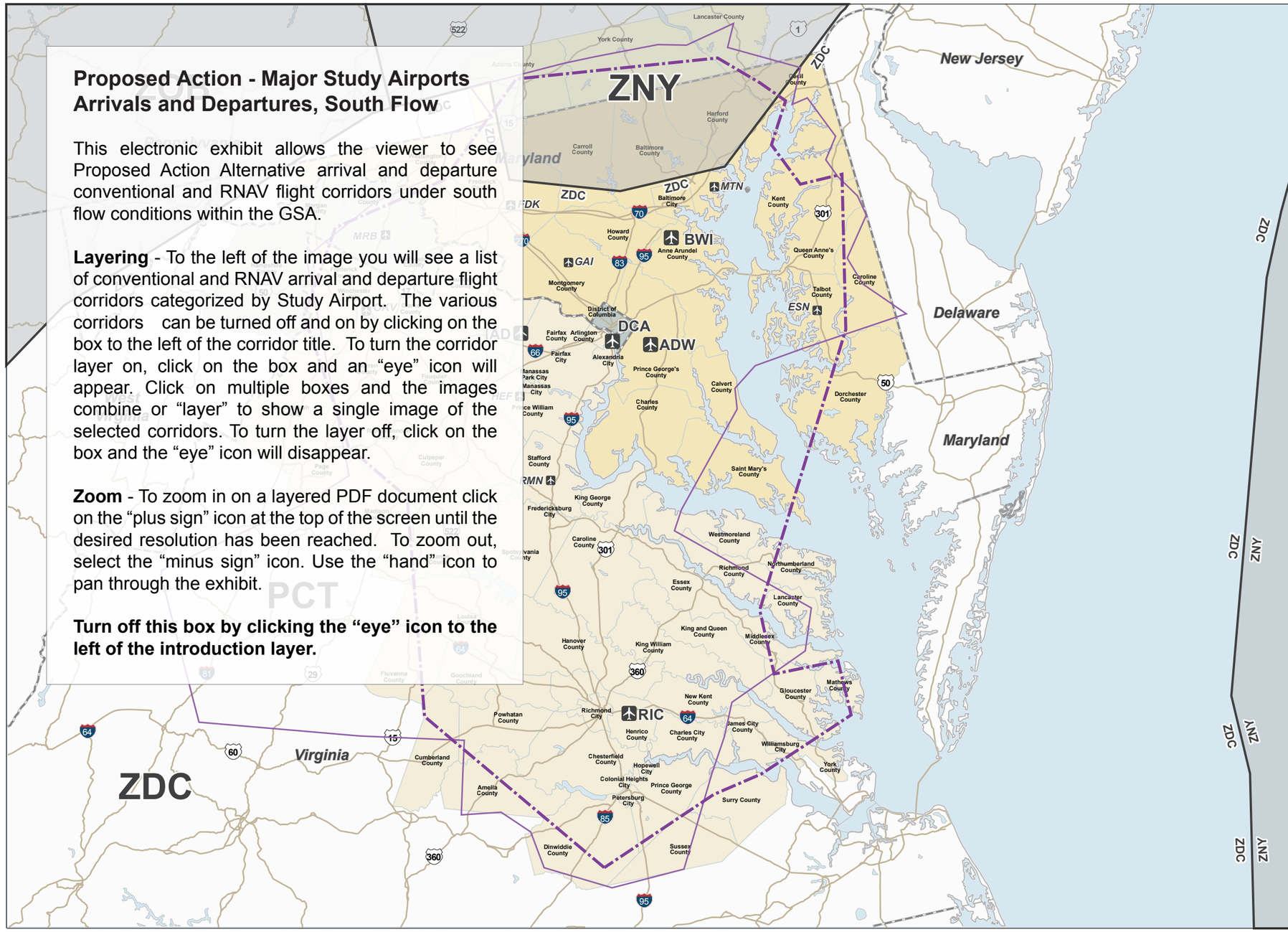

Proposed Action - Major Study Airports Arrivals and Departures, South Flow

This electronic exhibit allows the viewer to see Proposed Action Alternative arrival and departure conventional and RNAV flight corridors under south flow conditions within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

Zoom - To zoom in on a layered PDF document click on the "plus sign" icon at the top of the screen until the desired resolution has been reached. To zoom out, select the "minus sign" icon. Use the "hand" icon to pan through the exhibit.

Turn off this box by clicking the "eye" icon to the left of the introduction layer.

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Arrival
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-16

Proposed Action - Major Study Airports Arrivals and Departures, South Flow

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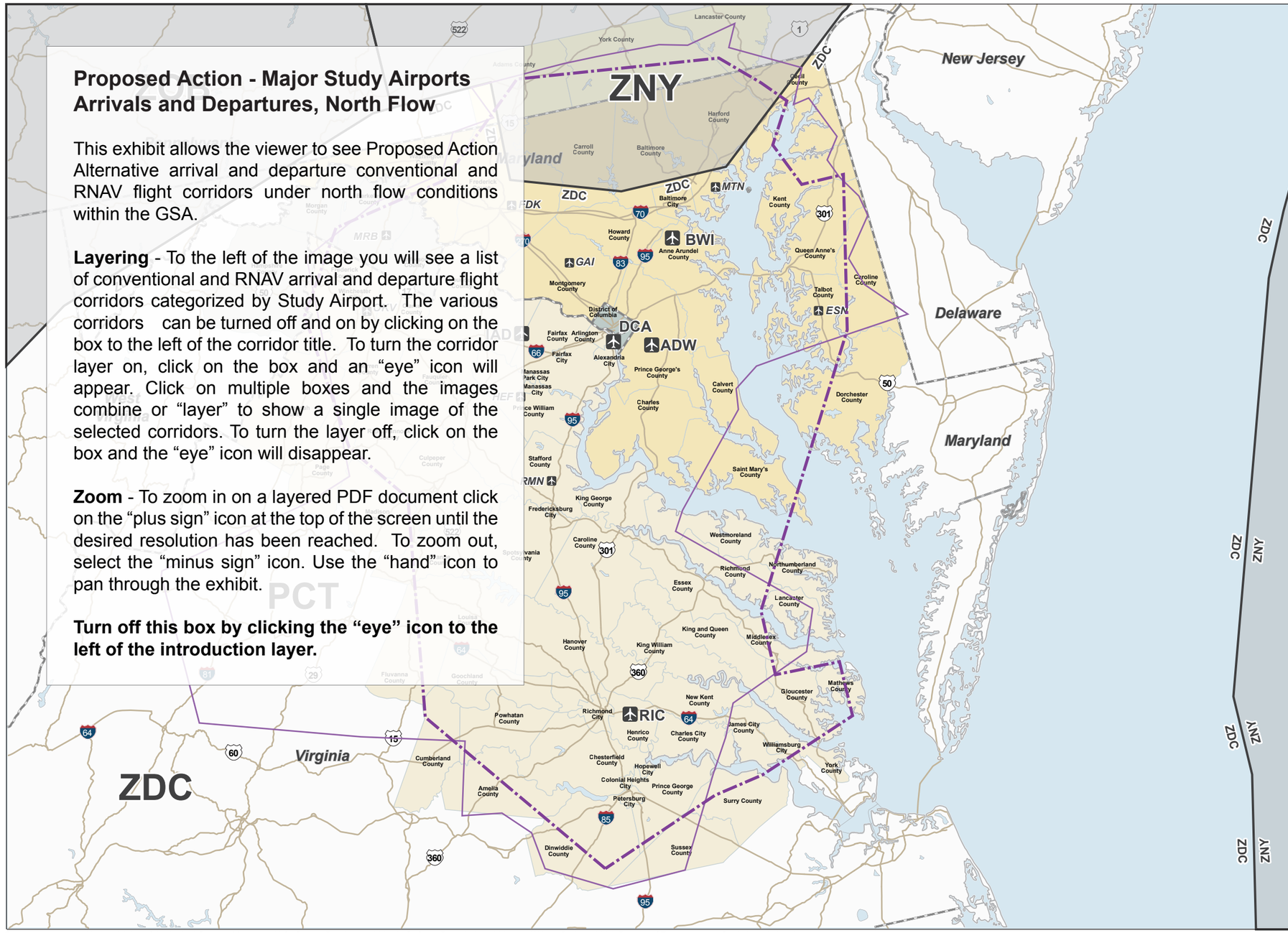

Proposed Action - Major Study Airports Arrivals and Departures, North Flow

This exhibit allows the viewer to see Proposed Action Alternative arrival and departure conventional and RNAV flight corridors under north flow conditions within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

Zoom - To zoom in on a layered PDF document click on the "plus sign" icon at the top of the screen until the desired resolution has been reached. To zoom out, select the "minus sign" icon. Use the "hand" icon to pan through the exhibit.

Turn off this box by clicking the "eye" icon to the left of the introduction layer.

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Departure
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-17

Proposed Action - Major Study Airports Arrivals and Departures, North Flow

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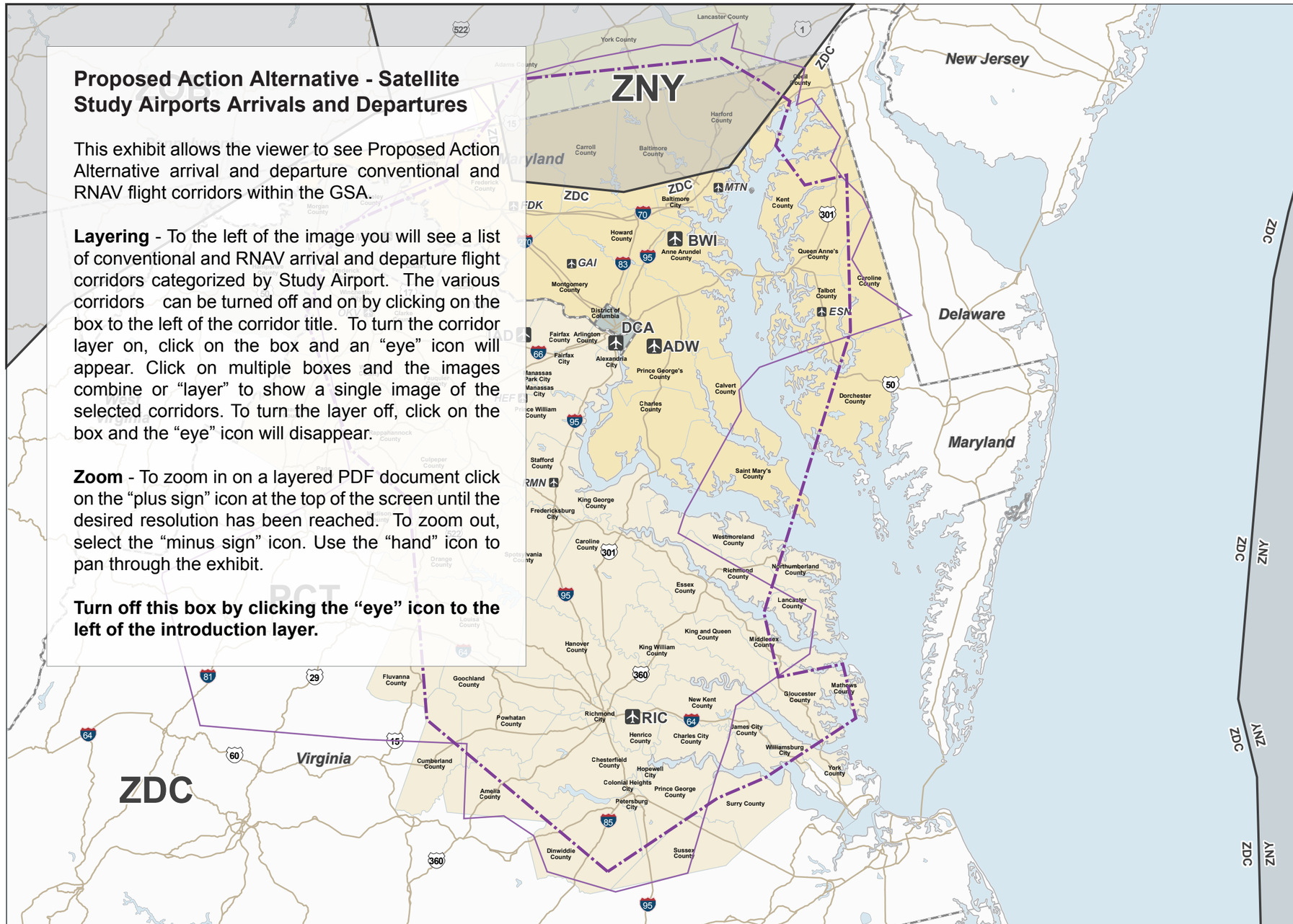

Proposed Action Alternative - Satellite Study Airports Arrivals and Departures

This exhibit allows the viewer to see Proposed Action Alternative arrival and departure conventional and RNAV flight corridors within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

Zoom - To zoom in on a layered PDF document click on the "plus sign" icon at the top of the screen until the desired resolution has been reached. To zoom out, select the "minus sign" icon. Use the "hand" icon to pan through the exhibit.

Turn off this box by clicking the "eye" icon to the left of the introduction layer.

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Arrival
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

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Corridor shading may vary based on layering of corridors.

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OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-18

Proposed Action Satellite Study Airports Arrivals and Departures

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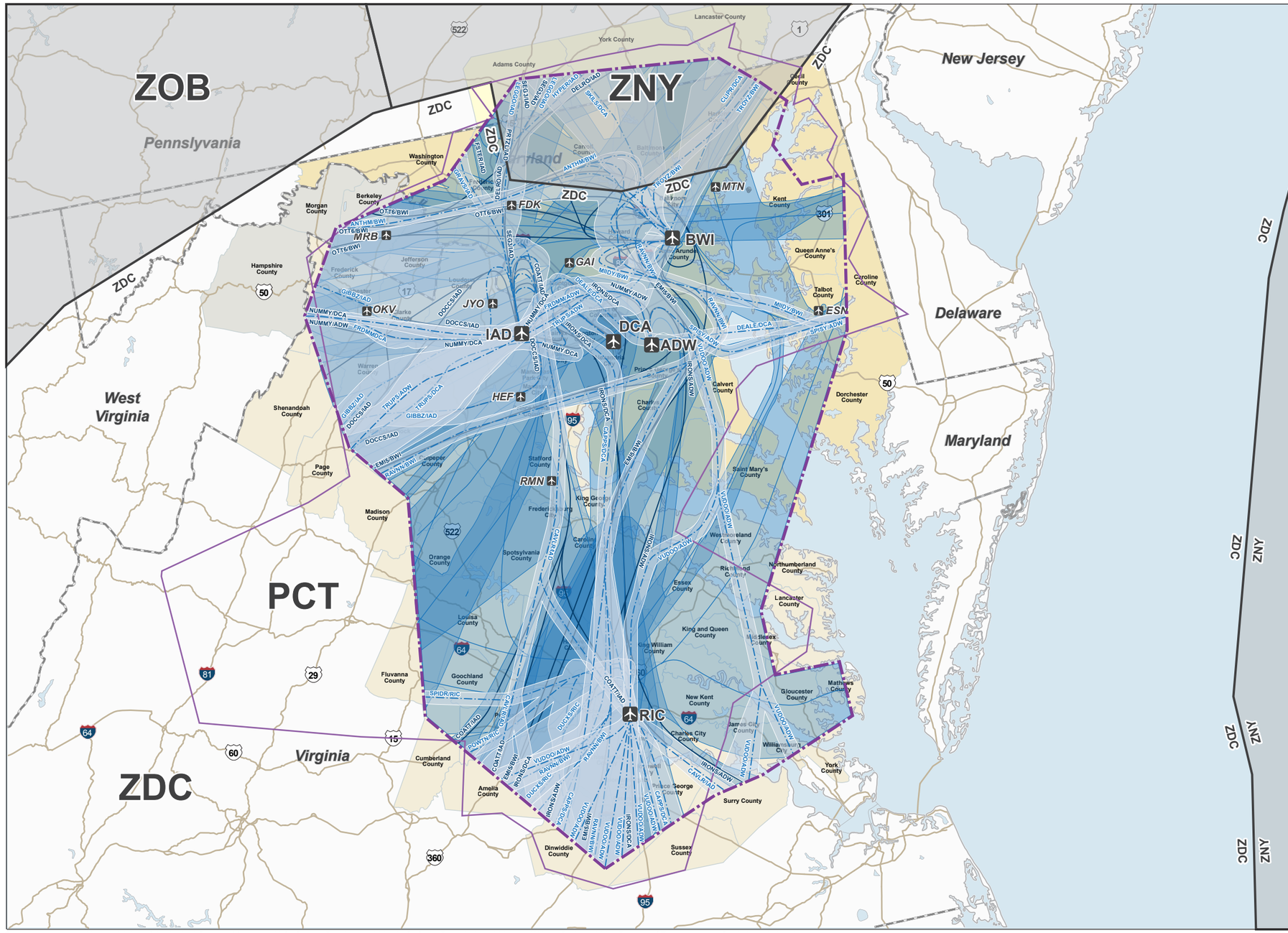

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
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- Water
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- RNAV South Arrival
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OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-19

Proposed Action - Major Study Airports Arrivals, South Flow

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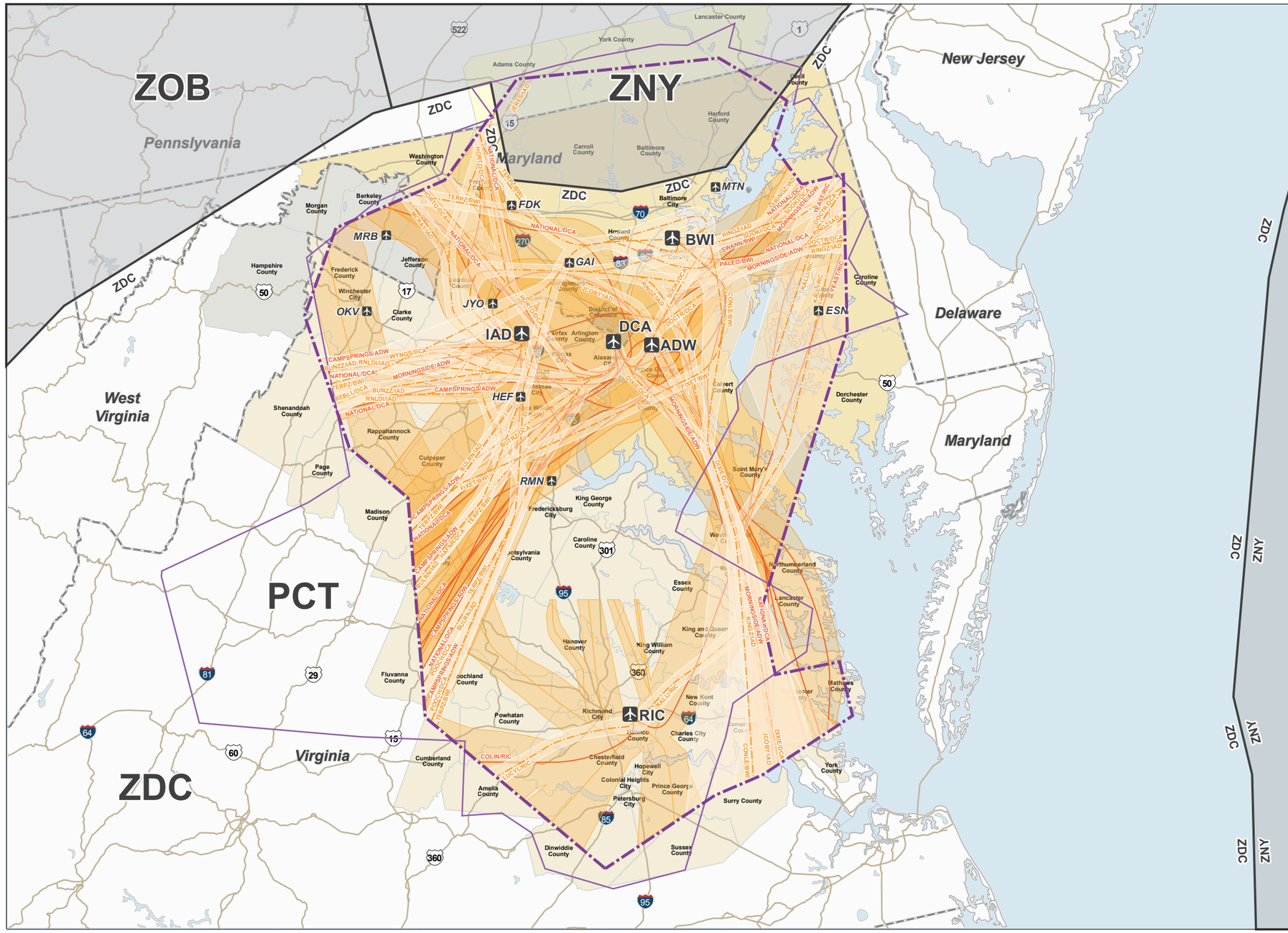

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
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- Virginia County in Study Area
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Projection: Lambert Conformal Conic
Scale: 1,750,000

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Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-20

Proposed Action - Major Study Airports Departures, South Flow

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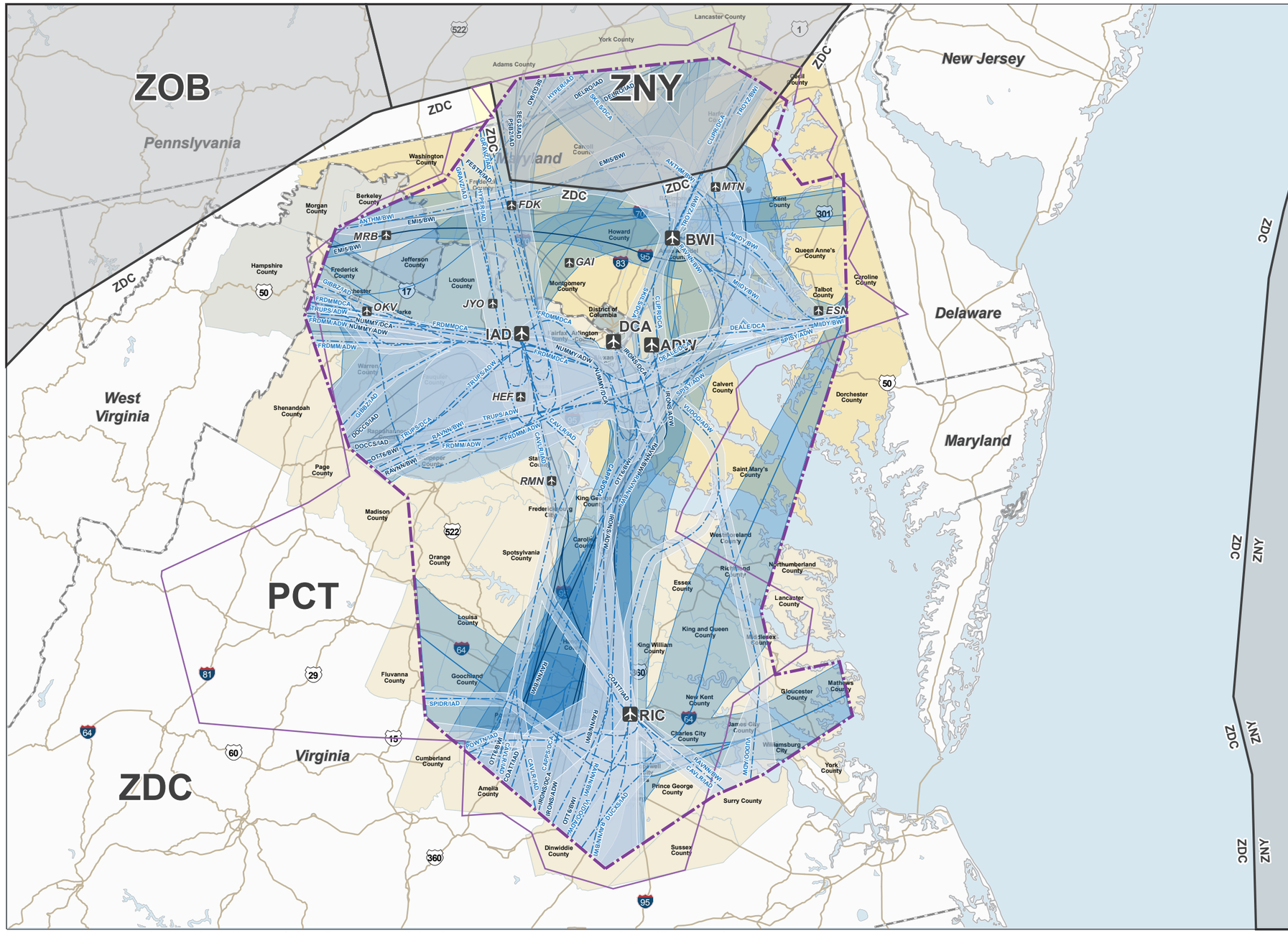

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
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- West Virginia County in Study Area
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Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

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Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-21

Proposed Action - Major Study Airports Arrivals, North Flow

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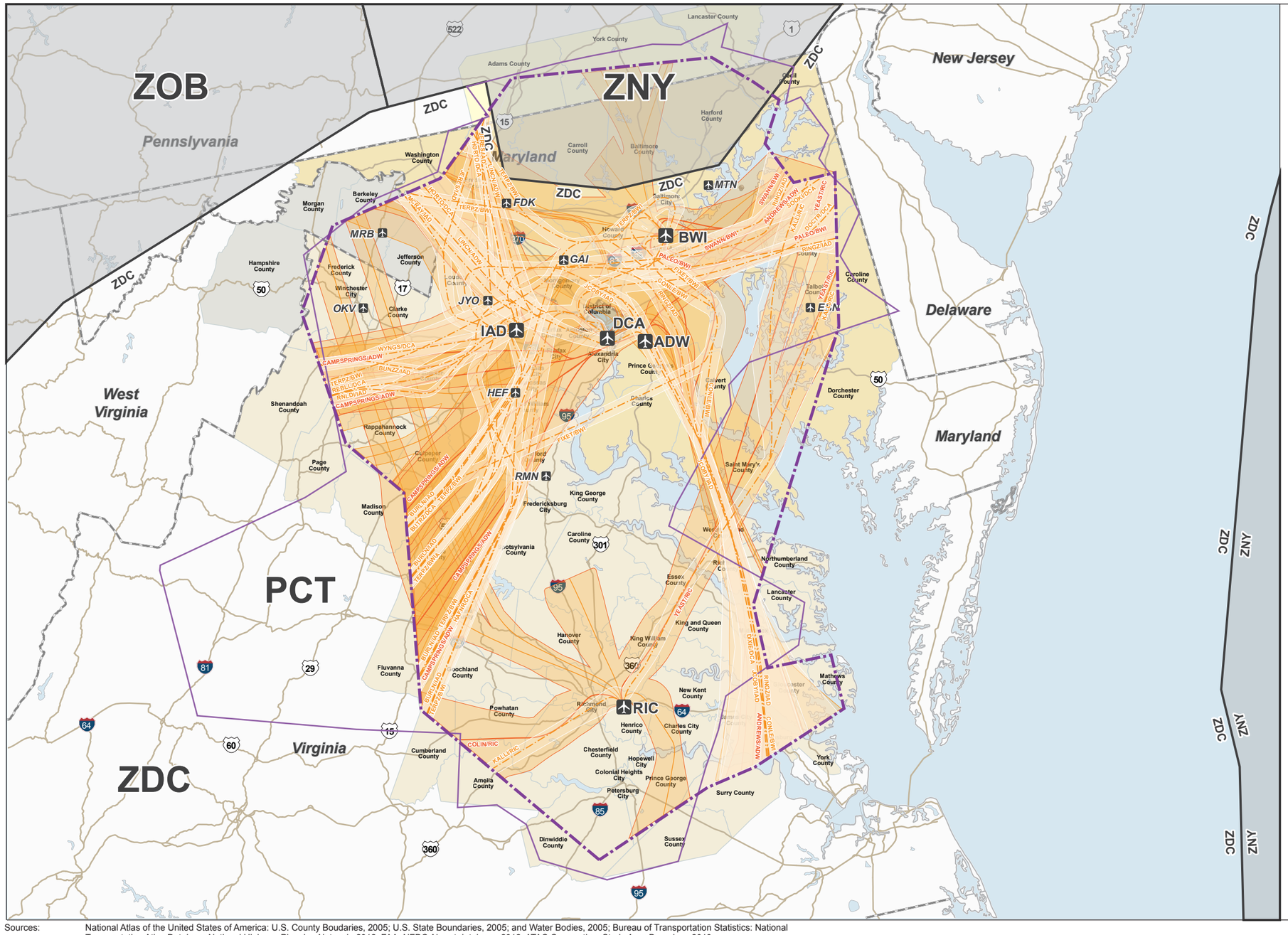

LEGEND

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Scale: 1,750,000

0 40 nm

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Prepared By: ATAC Corporation, February 2013.

Exhibit 3-22

Proposed Action - Major Study Airports Departures, North Flow

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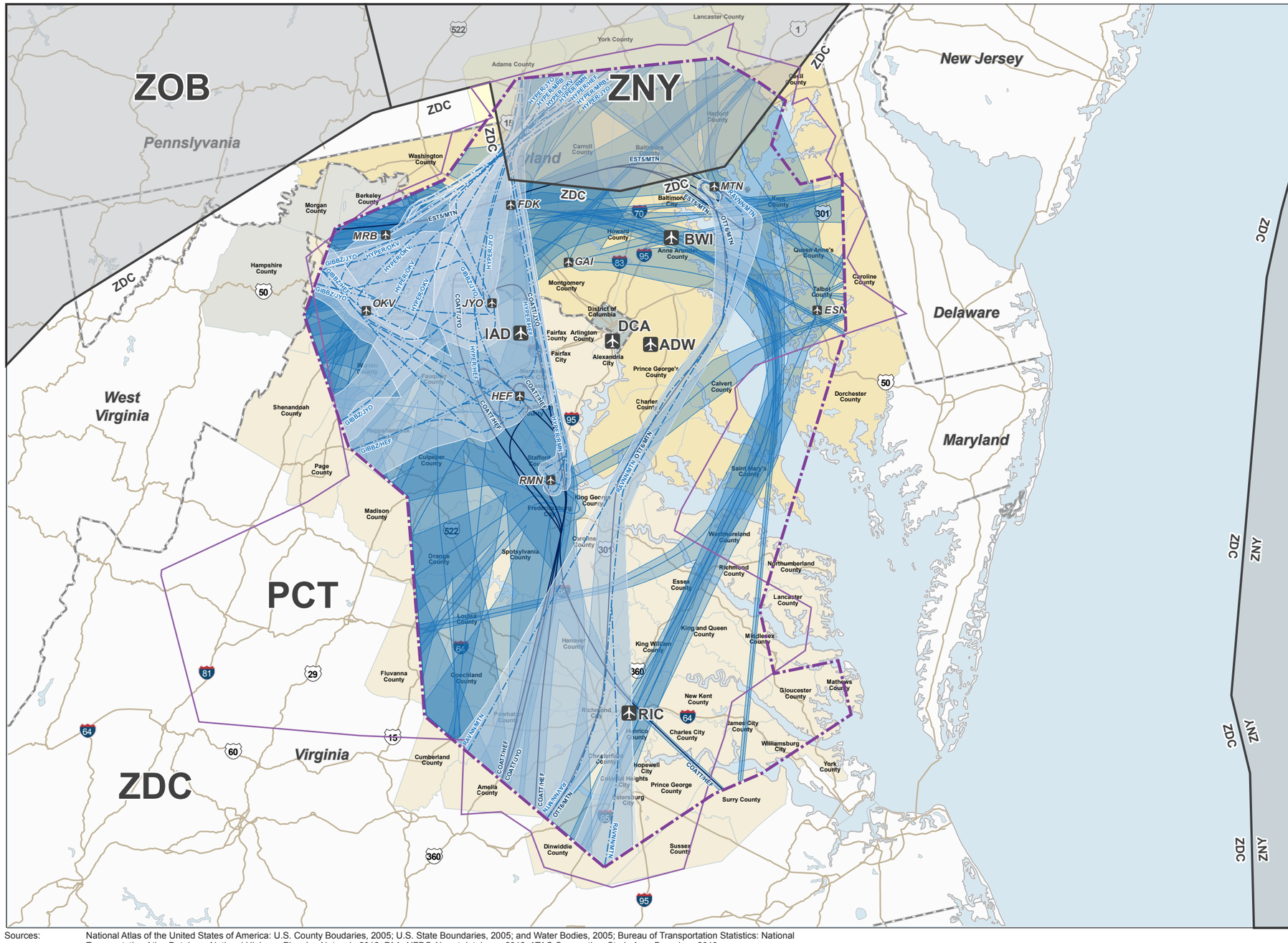

LEGEND

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Scale: 1,750,000

0 40 nm

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Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-23

Proposed Action
Satellite Study Airports Arrivals

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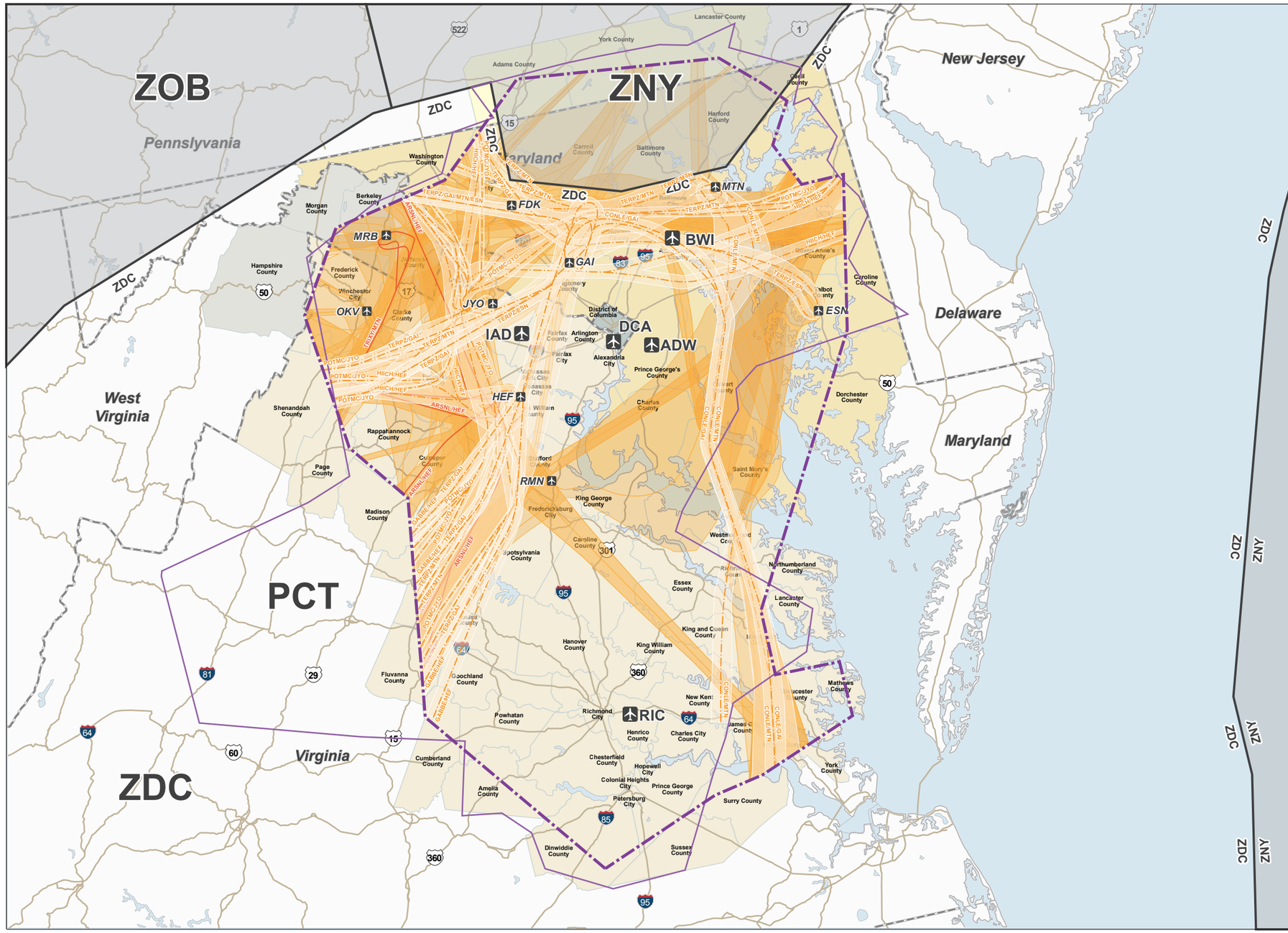

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Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-24

Proposed Action
Satellite Study Airports Departures

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3.3 Summary Comparison of the Proposed Action and No Action Alternative

This section provides a comparative summary between the Proposed Action and No Action Alternative based on the objectives defined in Section 2.2:

- Improve the flexibility in transitioning traffic between enroute and terminal area airspace and between terminal area airspace area and the runways;
- Improve the segregation of arrivals and departures in terminal area and enroute airspace; and
- Provide RNAV arrival and departure enroute transitional and terminal area airspace procedures for each individual runway with the intent to provide a more predictable ground and vertical path.

3.3.1 Improve the Flexibility in Transitioning Aircraft

Section 2.2.1 includes two criteria established to measure the objective to increase the flexibility in transitioning aircraft between the terminal and enroute airspace:

- Where possible, increase the number of entry and exit points compared with the No Action Alternative (measured by number of exit/entry points).
- Segregate major Study Airport traffic from other major Study Airport and/or satellite Study Airport traffic to/from Study Airports (measured by count of RNAV STARs and/or SIDs that can be used independently to/from Study Airports).

The efficient use of the DC Metroplex airspace would be improved by providing additional entry and exit points and segregating airport traffic. **Table 3-3** provides a summary comparison of the Proposed Action and No Action Alternative based on the first criteria defined above. The total number of entry and exit points overall would increase under the Proposed Action as compared to the No Action Alternative.

Therefore, the additional entry/exit points exclusive to some Study Airports indicate that the Proposed Action Alternative would achieve the objective to increase the flexibility in transitioning aircraft between the terminal airspace and the enroute airspace. This would be expected to improve the efficiency of the air traffic routes in the DC Metroplex airspace.

The Proposed Action includes 47 RNAV STARs and SIDs, 37 of which can be used independently to the Study Airports. In comparison, the No Action Alternative includes 17 RNAV procedures, 12 of which can be used independently to the Study Airports. The increased number of independent RNAV STARs and SIDs under the Proposed Action indicates that this alternative would better achieve the objective of improving flexibility in transitioning aircraft within the DC Metroplex airspace.

Table 3-3 Alternatives Evaluation: Provide Flexibility in Transitioning Aircraft

Criteria	No Action Alternative	Proposed Action
Entry Points		
Shared with Other Airports	4	14
Exclusive to IAD	0	0
Exclusive to DCA	0	2
Exclusive to BWI	8	5
Exclusive to RIC	3	2
Exclusive to Satellite Airports	5	7
Total	20	30
Exit Points		
Shared with Other Airports	20	28
Exclusive to IAD	0	1
Exclusive to DCA	0	2
Exclusive to BWI	2	1
Exclusive to Satellite Airports	0	2
Total	22	35

Notes:
Blue shading indicates alternative that achieves desired criteria.

Although the number of exit points exclusive to major airport traffic is the same between the DC Metroplex Optimization and the No Action Alternatives, FAA expects that it would dynamically assign exit points using RNAV SIDs exclusively to each of the airports based on operating conditions and demand. From an operational perspective, the Proposed Action Alternative would provide more efficient use of the exit points compared with the No Action Alternative.

Sources: ATAC Corporation based Design and Implementation Team TARGETS Final Design Package dated October 31, 2012, last updated March 29, 2013.
Prepared by: ATAC Corporation, April 2013.

3.3.2 Segregate Arrival and Departure Flows

In Section 2.2.2 one criterion was established to measure the objective to segregate traffic in portions of the airspace where arrival and departure flows cross, converge, or are within proximity of each other:

- Where possible, increase the number of RNAV STARs and SIDs compared with the No Action Alternative (Measured by total count of RNAV STARs and RNAV SIDs for the DC Metroplex.)

The Proposed Action includes 47 RNAV STARs and SIDs. In comparison, the No Action Alternative includes 17 RNAV procedures. Therefore, the additional RNAV STARs and SIDs included under the Proposed Action indicates that this alternative would achieve the objective better segregating air traffic in the DC Metroplex airspace.

3.3.3 Improve Predictability of Air Traffic Flow

In Section 2.2.3, two criteria were established to measure the objective to improve the predictability of air traffic flow in the DC Metroplex airspace:

- Ensure that the majority of STARs and SIDs to and from the Study Airports are based on RNAV technology (measured by count of RNAV STARs and SIDs for an individual Study Airport);

- Increase the number of runway transitions in the RNAV STARs and SIDs in comparison to the No Action Alternative. (measured by count of procedures that include runway transitions to/from runways); and,

RNAV procedures provide for a predictable flow of air traffic and require less controller-to-controller and controller-to-pilot communications to manage air traffic flows through the airspace. Predictability in the DC Metroplex can be further improved by increasing the number of runway transitions and altitude-controlled points defined in the RNAV STARs and SIDs. An increase in the number and use of routes defined by RNAV procedures, especially those that include runway transitions and/or altitude-controlled points, would be expected to decrease the number of controller-to-controller and controller-to-pilot communications. An increase in the number of runway transitions and procedures with altitude controls defined in the RNAV procedures would be expected to improve air traffic controllers' ability to more effectively serve all of the runways at the Study Airports and balance demand across the DC Metroplex while maintaining a predictable flow of air traffic.

Table 3-4 provides a summary comparison of the percentage of procedures based on RNAV technology under the Proposed Action and No Action Alternative; the total number of routes; and the number of RNAV procedures with altitude controls.

The majority of procedures under both the Proposed Action Alternative would be RNAV STARs and SIDs, representing 70 percent of the total number of procedures compared to 57 percent under the No Action Alternative. Overall, the number of routes that transition from/to an entry/exit gate to/from a runway end for the Proposed Action Alternative would increase over the No Action Alternative. Therefore, the Proposed Action Alternative would be expected to provide more predictability requiring less controller-to-controller and controller-to-pilot communications as compared to the No Action Alternative.

Based on the criteria above, the Proposed Action Alternative would provide a total of 47 RNAV STARs and SIDs in the DC Metroplex airspace compared to the 17 RNAV STARs and SIDs provided in the No Action Alternative. This represents an 176 percent increase in the number of RNAV procedures. With the increased number of predictable routes, the Proposed Action would provide better segregation of arrival and departure flows in comparison to the No Action Alternative.

Table 3-4 Alternatives Evaluation: Improve Predictability of Air Traffic Flow

Criteria	No Action Alternative	Proposed Action
Arrival Procedures		
Number of RNAV STARs	12	22
Total Arrival Procedures	21	31
Percent RNAV STARs of Total	57%	70%
Number of Combinations of Entry Points and Runway Ends Served by Runway Transitions in the RNAV STARs for all Study Airports	45	116
Departure Procedures		
Number of RNAV SIDs	5	25
Total Departure Procedures	16	36
Percent RNAV SIDs of Total	31%	70%
Number of Combinations of Runway Ends and Exit Points Served by Runway Transitions in the RNAV SIDs for all Study Airports	29	183

Notes:
Blue Shading = indicates alternative that achieves desired criteria.

Sources: ATAC Corporation based Design and Implementation Team TARGETS Final Design Package dated October 31, 2012, last updated March 29, 2013.
Prepared by: ATAC Corporation, September 2012.

3.4 Preferred Alternative Determination

Of the two alternatives carried forward for analysis, the Proposed Action would better meet the Purpose and Need for the DC OAPM project based on the criteria discussed above. Therefore, the Proposed Action is the Preferred Alternative. Although it would not meet the Purpose and Need, the No Action Alternative was carried forward, as required by CEQ regulations, to establish a benchmark against which decision makers can compare the magnitude of environmental effects of undertaking the Proposed Action.

3.5 Listing of Federal Laws and Regulations Considered

Table 3-5 lists the relevant federal laws and statutes, Executive Orders, and regulations applicable to the Proposed Action and the No Action Alternative and considered in preparation of this EA.

Table 3-5 List of Federal Laws and Regulations Considered – DC OAPM Project (1 of 3)

Federal Laws and Statutes	Citation
National Environmental Policy Act of 1969	42 U.S.C. § 4321 *et seq*.
Clean Air Act of 1970, as amended	42 U.S.C. § 7401 *et seq.*
Department of Transportation Act of 1966, Section 4(f)	49 U.S.C. § 303(c)
Aviation Safety and Noise Abatement Act of 1979	49 U.S.C. § 47501 *et seq*.
Federal Aviation Act of 1958, as amended	49 U.S.C. § 40101 *et seq*.
Endangered Species Act of 1973	16 U.S.C. § 1531 *et seq*.

Table 3-5 List of Federal Laws and Regulations Considered – DC OAPM Project (2 of 3)

Federal Laws and Statutes	Citation
Fish and Wildlife Coordination Act of 1958	16 U.S.C. § 661 *et seq*.
The Bald and Golden Eagle Protection Act of 1940	16 U.S.C. § 668 *et seq*.
Lacey Act of 1900	16 U.S.C. § 3371 et seq.
Migratory Bird Treaty Act of 1918	16 U.S.C. § 703 *et seq*.
National Historic Preservation Act of 1966, as amended	16 U.S.C. § 470
Archaeological and Historic Preservation Act of 1974, as amended	16 U.S.C. § 469 *et seq*.
American Indian Religious Freedom Act of 1978	42 U.S.C. § 1996
Executive Orders	**Citation**
11593, Protection and Enhancement of the Cultural Environment	36 Federal Register (FR) 8921
12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	59 FR 7629
13045, Protection of Children from Environmental Health Risks and Safety Risks	62 FR 19885
Federal Regulations	**Citation**
Council for Environmental Quality Regulations	40 C.F.R. Part 1500 to Part 1508
General Conformity Regulations	40 C.F.R. Part 93 Subpart B
Protection of Historic Properties Regulations	36 C.F.R. 800
Airport Noise Compatibility Planning Regulations	14 C.F.R. Part 150
Federal Aviation Regulations (FAR) Part 71: Designation of Class A, Class B, Class C, Class D, and Class E Airspace Areas; Airways; Routes; and Reporting Points, December 17, 1991.	41 C.F.R. Part 71

FAA/U.S. Department of Transportation Orders

U.S. DOT Order 5680.1: *Final Order to Address Environmental Justice in Low-Income and Minority Populations*, April 14, 1997.
FAA Order 1050.1E, Chng. 1: *Environmental Impacts: Policies and Procedures*, March 20, 2006.
FAA Order 7100.9D, *Standard Terminal Arrival Program and Procedures*, December 15, 2003.
FAA Order 8260.3B, Change 20, *United States Standard for Terminal Instrument Procedures (TERPS)*, December 7, 2007.
FAA Order 8260.40B, *Flight Management System (FMS) Instrument Procedures Development*, December 31, 1998.
FAA Order 8260.44A, Change 2, *Civil Utilization of Area Navigation (RNAV) Departure Procedures*, November 6, 2006.
FAA Order 8260.46D, *Departure Procedure (DP) Program*, August 20, 2009.
FAA Order 8260.48, *Area Navigation (RNAV) Approach Construction Criteria*, April 8, 1999.
FAA Order 8260.52, *United States Standard for Required Navigation Performance (RNP) Approach Procedures with Special Aircraft and Aircrew Authorization Required (SAAAR)*, June 3, 2005.
FAA Order 8260.54A, *The United States Standard for Area Navigation (RNAV)*, December 7, 2007.
FAA Order JO 7110.65U, Air Traffic Control, February 9, 2012.

Table 3-5 List of Federal Laws and Regulations Considered – DC OAPM Project (3 of 3)

FAA Advisory Circulars
FAA Advisory Circular 150/5020-1: *Noise Control and Compatibility Planning for Airports*, August 5, 1983.
FAA Advisory Circular 150/5200-33B: *Hazardous Wildlife Attractants on or near Airports*, August 28, 2007.
FAA Advisory Circular 36-3H: *Estimated Airplane Noise Levels in A-Weighted Decibels*, April 25, 2002.
U.S. DOT Order 5680.1: *Final Order to Address Environmental Justice in Low-Income and Minority Populations*, April 14, 1997.

Source: ATAC Corporation, January 2013.
Prepared by: ATAC Corporation, January 2013.

4 Affected Environment

This chapter of the environmental assessment (EA) describes the human, physical, and natural environmental conditions that could be affected by the Proposed Action. Specifically, the EA considers effects on the environmental resource categories identified in Appendix A of Federal Aviation Administration (FAA) Order 1050.1E, Chg. 1, *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1E). The potential environmental impacts of the Proposed Action and No Action Alternatives are discussed in Chapter 5, *Environmental Consequences*.

The technical terms and concepts discussed in this chapter are explained in Chapter 1, *Background*.

4.1 General Study Area

To describe existing conditions in the DC Metroplex, the FAA developed a General Study Area. The General Study Area is used to evaluate the potential for environmental impacts under the Proposed Action. Two overall objectives guided the development of the General Study Area:

1. The General Study Area was designed to capture all flight paths identified for the No Action Alternative using 2011 radar data (the latest year of complete data available) and the flight paths designed as part of the Proposed Action up to the point at which 95 percent of departing aircraft are above 10,000 feet AGL and 95 percent of arriving aircraft are above 7,000 feet above ground level (AGL). Paragraph 14.5e of Appendix A to FAA Order 1050.1E, requires consideration of impacts of airspace actions from the surface to 10,000 feet AGL if the study area is larger than the immediate area around an airport or involves more than one airport. Furthermore, policy guidance issued by the FAA Program Director for Air Traffic Airspace Management states that for air traffic project environmental analyses noise impacts should be evaluated for proposed changes in arrival procedures between 3,000 and 7,000 feet AGL and departure procedures between 3,000 and 10,000 feet AGL for large civil jet aircraft weighing over 75,000 pounds.[42]
2. The lateral extent of the General Study Area was concisely defined to focus on areas of air traffic flow.

The following sections describe the data acquired and methodology used to develop the General Study Area.

4.1.1 Data Acquisition to Develop the General Study Area

The General Study Area is based on aircraft arrivals and departures at the Study Airports. **Table 4-1** lists operations by Study Airport and the type of operation. An operation is defined as a takeoff or landing by an aircraft operating under Instrument Flight Rules (IFR).

[42] Department of Transportation, Federal Aviation Administration, *Memorandum Regarding Altitude Cut-Off for National Airspace Redesign (NAR) Environmental Analyses*, September 15, 2003.

Table 4-1 2011 Study Airport Operations by Airport and Category

Airport				2011 Operations		
ID	Name	City	State	Arrivals	Departures	Total
ADW	Joint Base Andrews (U.S. Air Force)	Camp Springs	MD	12,820	12,821	25,641
BWI	Thurgood Marshall Baltimore/Washington International	Baltimore	MD	136,454	136,454	272,908
DCA	Ronald Reagan Washington National	Washington	DC	141,309	141,309	282,618
ESN	Easton/Newnam Field	Easton	MD	2,608	2,609	5,217
FDK	Frederick Muni	Frederick	MD	3,352	3,218	6,570
GAI	Montgomery County Airpark	Gaithersburg	MD	4,767	4,991	9,758
HEF	Manassas Regional/Harry P. Davis Field	Manassas	VA	10,036	10,036	20,072
IAD	Washington Dulles Intl	Washington	DC	179,804	179,804	359,608
JYO	Leesburg Executive	Leesburg	VA	5,757	5,848	11,605
MRB	Eastern WV Regional/Shepherd Field	Martinsburg	WV	1,752	1,864	3,616
MTN	Martin State	Baltimore	MD	5,683	5,683	11,366
OKV	Winchester Regional	Winchester	VA	1,616	1,537	3,153
RIC	Richmond International	Richmond	VA	43,217	43,218	86,435
RMN	Stafford Regional	Stafford	VA	1,537	1,356	2,893
Total				550,712	550,748	1,101,460

Source: US Department of Transportation, Federal Aviation Administration, Air Traffic Activity System (ATADS), Traffic Flow Management System Counts (TFMSC), August 2012.
Prepared by: ATAC Corporation, June 2013.

Aircraft flight altitudes were identified for both the Proposed Action and No Action Alternative using radar data for 2011, the latest full year of data available at the time the analysis was conducted. However, only 282 days of data was used for 2011. The remaining 83 days of data for 2011 was either unavailable due to radar equipment anomalies, operational outages, or extreme weather events that made the data unreliable. The radar data was used to understand existing arrival and departure flight paths for aircraft operating under IFR conditions in the DC Metroplex. An initial study area was identified based on a detailed analysis of the radar data and the topography in the DC Metroplex area. Given the varied terrain west of the Washington, D.C. area, United States Geological Survey (USGS) data were acquired to define ground elevations throughout the General Study Area.

The radar data analysis included an assessment of existing and proposed flight tracks and profiles (altitudes).[43] The radar data obtained to determine the General Study Area and existing noise conditions is further discussed in Section 4.3.1.

4.1.2 Methodology Used to Determine the General Study Area

As discussed in Section 4.1, the parameters for defining the General Study Area are based on the requirements of FAA Order 1050.1E (Appendix A, Paragraph 14.5e) and policy guidance issued by the Program Director for Air Traffic Airspace Management for air traffic project environmental analyses. Accordingly, the General Study Area is a three-dimensional block of airspace designed to capture aircraft operations to and from the Study Airports as they operate at or below 10,000 feet AGL. The lateral dimensions of the General Study Area are defined using 2011 radar data to determine the point at which departing aircraft penetrate the 10,000 feet AGL altitude and arriving aircraft penetrate the

[43] Proposed Action tracks were based on the Terminal Area Route Generations, Evaluation, and Traffic Simulation (TARGETS) design package (June 6, 2012) provided by the FAA Design and Implementation Team.

7,000 feet AGL altitude. Applying these criteria, the General Study Area captures the maximum range of flight tracks where 95 percent of aircraft pass through 10,000 feet AGL ceiling. The outer boundaries of the General Study Area are largely shaped by the 7,000 feet AGL point data for arrivals because the aircraft are travelling at this altitude further away from the Study Airports compared to departures which reach higher altitudes closer in. However, the General Study Area boundary was also shaped by the 10,000 feet AGL points in areas over which departure operations predominate.

Because the General Study Area represents an area between the ground surface up to 10,000 feet AGL, it was necessary to identify ground elevations throughout the DC Metroplex area. This was particularly important as the terrain in this area generally consists of rolling hills with varying surface elevation. Data from the USGS was used to ensure the best representation of terrain conditions below the aircraft flight paths. Areas with high concentrations of air traffic flows were used to focus the General Study Area boundaries and to eliminate areas from the General Study Area with minimal or no aircraft overflights. Similarly, because the surface elevations vary throughout the General Study Area, the top elevation of the General Study Area was established at 10,000 feet AGL above the highest point of elevation on the ground for areas predominately overflown by departures.

Exhibit 4-1 depicts the General Study Area developed for this EA. **Table 4-2** identifies the states and counties that fall within or are intersected by the General Study Area boundary. In total, the District of Columbia and portions of 83 counties in four states fall within the General Study Area.

Table 4-2 States and Counties in the Study Area (1 of 2)

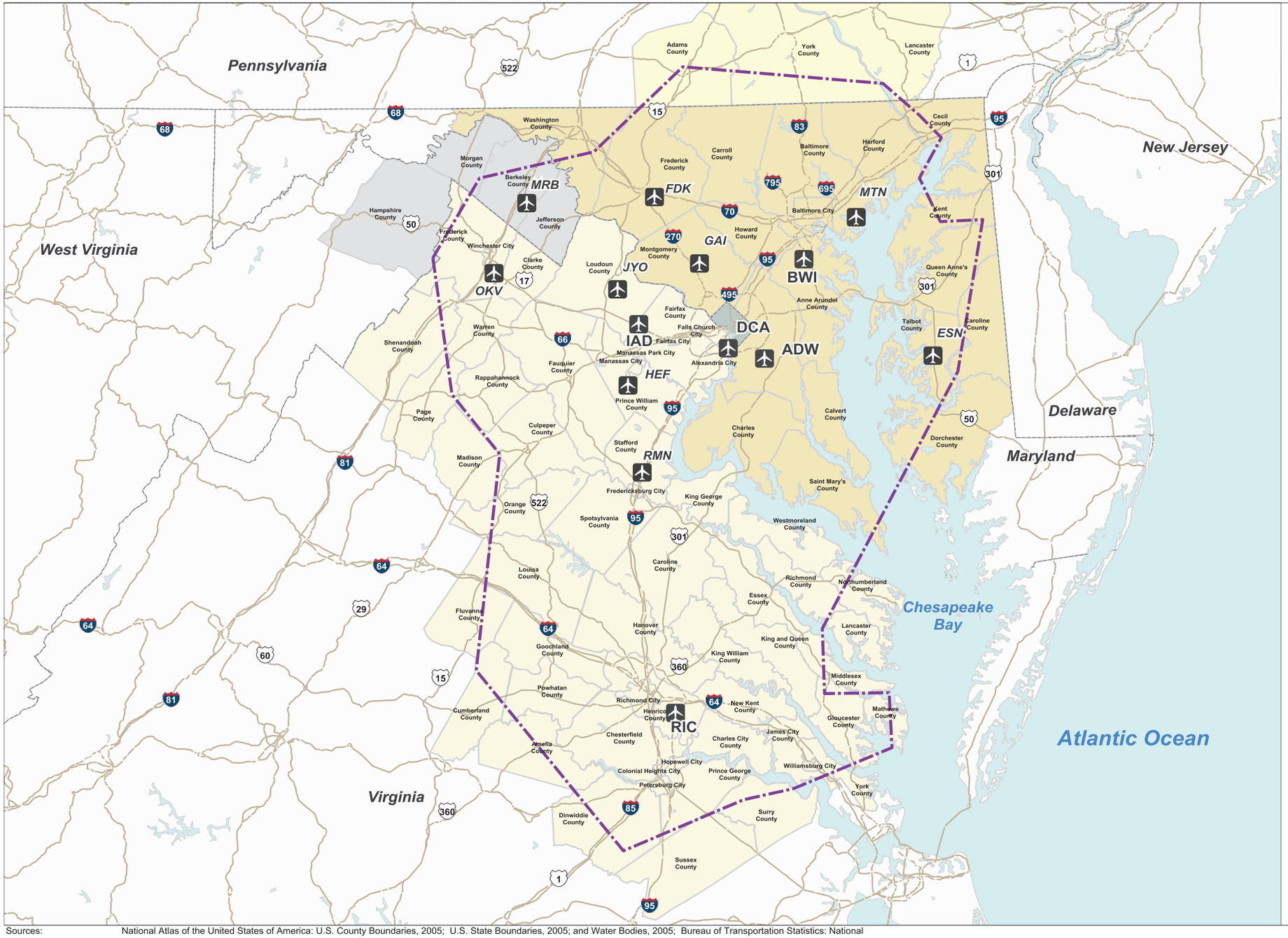
District of Columbia				
There are no counties in the District of Columbia				
Maryland				
Anne Arundel County	Caroline County[1]	Dorchester County[1]	Kent County[1]	Saint Mary's County[1]
Baltimore City	Carroll County	Frederick County[1]	Montgomery County	Talbot County
Baltimore County	Charles County	Harford County	Prince George's County	Washington County[1]
Calvert County	Cecil County[1]	Howard County	Queen Anne's County[1]	

Table 4-2 States and Counties in the Study Area (2 of 2)

Pennsylvania				
Adams County[1]	Lancaster County[1]	York County[1]		
West Virginia				
Berkeley County	Hampshire County[1]	Jefferson County	Morgan County[1]	
Virginia				
Alexandria City	Fairfax City	James City County	New Kent County	Spotsylvania County
Amelia County[1]	Fairfax County	King and Queen County	Northumberland County[1]	Stafford County
Arlington County	Falls Church City	King George County	Orange County	Surry County[1]
Caroline County	Fauquier County	King William County	Page County[1]	Sussex County[1]
Charles City County	Fluvanna County[1]	Lancaster County[1]	Petersburg City	Warren County
Chesterfield County	Frederick County	Loudoun County	Powhatan County	Westmoreland County
Clarke County	Fredericksburg City	Louisa County	Prince George County	Williamsburg City
Colonial Heights City	Gloucester County	Madison County[1]	Prince William County	Winchester City
Culpeper County	Goochland County	Manassas City	Rappahannock County	York County[1]
Cumberland County[1]	Hanover County	Manassas Park City	Richmond City	
Dinwiddie County[1]	Henrico County	Mathews County[1]	Richmond County	
Essex County	Hopewell City	Middlesex County[1]	Shenandoah County[1]	

Notes:
1\ Only a portion of the county falls within the General Study Area

Source: National Atlas of the United States of America: U.S. County Boundaries, 2005; ATAC Corporation, August 2012.
Prepared by: ATAC Corporation, August 2012.



LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-1

General Study Area

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4.2 Resource Categories or Sub-Categories Not Affected

This section discusses the environmental resource categories or sub-categories included in Appendix A of FAA Order 1050.1E that would remain unaffected by the Proposed Action. These resource categories would remain unaffected because the resource either does not exist within the General Study Area or the types of activities associated with the Proposed Action would not affect them. The resource categories or sub-categories are:

- Coastal Resources: The Proposed Action does not involve land acquisition or ground disturbing activities that would affect coastal resources.
- Construction Impacts: The Proposed Action does not involve any construction or ground disturbing activities.
- Farmlands: The Proposed Action would not involve land acquisition or ground disturbance that would have the potential to convert existing farmland to a non-agricultural use.
- Fish, Wildlife and Plants – Fish and Plants sub-categories only: The Proposed Action is generally situated in areas above 3,000 feet AGL and would not involve ground disturbance or other activities that would affect plant or terrestrial animal species.
- Floodplains: The Proposed Action would not be situated in areas that include floodplains.
- Hazardous Materials, Pollution Prevention, and Solid Waste: The Proposed Action would not generate, disturb, transport, or treat hazardous materials.
- Historic, Architectural, Archeological, and Cultural Resources – Archeological and Architectural sub-category only: The Proposed Action would not involve land acquisition or ground disturbing activities that would affect archaeological or architectural resources.
- Light Emissions and Visual Impacts – Light Emissions sub-category only: The Proposed Action does not involve construction of any structures that would introduce new sources of lighting.
- Natural Resources and Energy Supply – Natural Resources sub-category only: The Proposed Action would not require use of unusual natural resources or other materials, or those in short supply.
- Secondary (Induced) Impacts: The Proposed Action would not cause changes in patterns of population movement or growth, public service demands, or business and economic activity. In addition, the Proposed Action does not involve construction or other ground disturbing activities that would involve the relocation of people or businesses. Furthermore, the proposed project does not include the construction of airport facilities that would result in or induce an increase in operational capacity.
- Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks –

- o Socioeconomic Impacts: The Proposed Action would not involve acquisition of real estate, relocation of residents or community businesses, disruption of local traffic patterns, loss in community tax base, or changes to the fabric of the community.
- o Children's Environmental Health and Safety Risks sub-categories: The Proposed Action would not involve products or substances with which a child is likely to be exposed, come into contact, ingest, or use. Furthermore, the Proposed Action would not result in a local increase in emissions that would have the potential to affect children's health. Accordingly, there would be no increase in environmental health and safety risks that could disproportionately affect children.

- Water Quality: The Proposed Action does not involve any ground disturbing activities that would result in an increase in impervious surfaces or affect water quality or ground water.
- Wetlands: The Proposed Action does not involve land acquisition or ground disturbing activities that would affect wetlands.
- Wild and Scenic Rivers: There are no designated Wild and Scenic Rivers located within the General Study Area.

4.3 Potentially Affected Resource Categories or Sub-Categories

This section provides information on the current conditions within the General Study Area for those environmental resource categories or components that the Proposed Action could potentially affect. These environmental resource categories or sub-categories include:

- Noise (Section 4.3.1)
- Compatible Land Use (Section 4.3.2)
- Department of Transportation Act: Section 4(f) Resources (Section 4.3.3)
- Historic, Architectural, Archeological, and Cultural Resources – Historic and Cultural Resources sub-categories only (Section 4.3.4)
- Natural Resources and Energy Supply- Energy Supply sub-category only (aircraft fuel only) (Section 4.3.5)
- Greenhouse Gases and Climate Change (Section 4.3.6)
- Fish, Wildlife, and Plants – Wildlife sub-category only (Section 4.3.7)
- Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks – Environmental Justice sub-category only (Section 4.3.8)
- Air Quality (Section 4.3.9)
- Light Emissions and Visual Impacts – Visual Impacts sub-category only (Section 4.3.10)

The following sections discuss each of the above listed environmental resource categories in detail.

4.3.1 Noise

Aircraft noise is often the most noticeable environmental effect associated with any aviation project. This section discusses guidance and regulations established by the FAA for noise analyses, noise model input development, and existing aircraft noise conditions. Existing conditions are based on year 2011 operations, the most recent full calendar year at the time of this analysis. **Appendix E** provides background information on the physics of sound, the effects of noise on people, and noise metrics. More detailed information related to the noise model input is available upon request (Please see **Appendix C** for contact information).

4.3.1.1 Noise Modeling Methodology

To comply with NEPA requirements, the FAA has developed specific guidance and requirements for the assessment of aircraft noise. This guidance, specified in FAA Order 1050.1E, requires that aircraft noise be analyzed in terms of the yearly Day-Night Average Sound Level (DNL) metric. In practice, this requirement means that DNL is computed for an average annual day (AAD) of operations for the year of interest.

The DNL metric is a single value representing the aircraft sound level over a 24-hour period. DNL includes all of the time-varying sound energy within the period. To represent the greater annoyance caused by a noise event at night, the DNL metric includes a 10-decibel (dB) weighting for noise events occurring between 10:00 P.M. and 6:59 A.M. (nighttime). The nighttime event weighting helps to account for annoyance that would potentially be caused by noise during night time periods when ambient noise levels are lower. The weighting used equates one night flight to 10 day flights. In this EA, for ease of reference, the format DNL 45 is used to represent a noise exposure level of DNL 45 dB. Additional details relating to the emergence of DNL as the metric of choice by FAA are available in **Appendix E**.

In addition to requiring the use of the DNL metric, FAA also requires that aircraft noise be evaluated using one of several authorized computer noise models. FAA Order 1050.1E specifies that one of three noise models should be used for an Environmental Assessment: (1) the Integrated Noise Model (INM), (2) the Heliport Noise Model (HNM), or (3) the Noise Integrated Routing System (NIRS). NIRS is typically used for flight track changes over large areas and at altitudes over 3,000 AGL. Specifically, for the Proposed Action, FAA specifies use of NIRS, Version 7.0b.

For this EA, the FAA conducted a detailed analysis of aircraft operating under IFR conditions in 2011. Although the noise environment around major airports comes almost entirely from jet aircraft operations, the DNL calculations reflect noise from many types of jet and propeller aircraft operations on IFR flight plans that could be affected by the Proposed Action. Most aircraft around major airports operate under IFR to obtain direction on separation from surrounding aircraft from air traffic control (ATC) in these busy areas. Those aircraft operating under Visual Flight Rules (VFR) are unaffected by the Proposed Action.

When operating outside certain categories of controlled airspace, the aircraft operating under VFR described above are not required to be in contact with ATC. Because these aircraft operate at the discretion of the pilot and are often not required to file flight plans, the

FAA has very limited information for these operations. Subsequently, there is no known source for comprehensive route, altitude, aircraft type, and frequency information for these VFR operations in the General Study Area. However, even if complete information were available for VFR operations, the Proposed Action evaluated in the EA would not require any changes to routing or altitudes to accommodate these operations. If they could be modeled, they would use the same flight routes and altitudes under the Proposed Action and No Action Alternative scenarios. Therefore, VFR aircraft were not included in the analysis. Their operations would not be affected by the forecast conditions in 2013 (the first year of implementation) and 2018 (five years after implementation) for both the No Action Alternative and Proposed Action.

NIRS requires a variety of inputs, including local environmental data (e.g., temperature and humidity), runway layout, aircraft operations, runway use, and flight tracks. Accordingly, detailed information on aircraft operations for the Study Airports was assembled for input into NIRS. This includes specific aircraft fleet mix information such as aircraft type, arrival and departure times, and origin/destination airport.

AAD NIRS Operations: A total of 1,438,745 IFR-filed flights from/to the Study Airports were identified through an examination of radar data obtained from the FAA's Performance Data Analysis and Reporting System (PDARS). The PDARS database was queried for the 2011 calendar year for all IFR-filed flights that operated at the study airports within the General Study Area. As described in Section 4.1.1, during this 365 day period, 84 days of data were unusable. The 281 days of usable data span all seasons and runway usage configurations for the Study Airports in the General Study Area. This data was used to develop the AAD fleet mix, time of day (day and night) and runway use input for NIRS. More detailed information related to the NIRS input for Existing Conditions is available upon request (Please see **Appendix C** for contact information).

AAD NIRS Flight Tracks and Climb/Descent Patterns: The PDARS data provided tracks for each flight that occurred within the 281 days of 2011. The data was not only used to define the AAD track locations and use representing a typical flow of traffic, but also the typical climb and descent patterns that occur along each flow. Patterns also include top-of-climb and top-of-descent locations for fuel burn modeling purposes. The tracks were analyzed using proprietary software in order to visualize and analyze the radar data. All the trajectories were "bundled" into a set of tracks representing a flow. The flows comprise all the typical flight routings within the General Study Area for an average annual day. NIRS tracks are then developed based on the group of radar tracks representing each flow.

The NIRS model was used to calculate noise levels for the following specific locations on the ground:

Census Block Centroids: The NIRS model can be used to calculate DNL at the geographic centers (centroids) of census blocks to estimate the population exposed to varying levels of aircraft noise exposure. For this EA, population within the General Study Area was analyzed using 2010 U.S. Census block geometries.[44] A census block is the smallest geographical unit used by the United States Census to collect data. The census block centroid DNL represents the DNL for the total maximum potential population within that census block. Because noise levels are analyzed only at the centroid point and applied to the entire census block area population and because the area represented by each

[44] US Census Bureau, *2010 Tracts and American Community Survey Selected Economic Characteristics*, 2010.

centroid varies depending on the density of population, the actual noise exposure level for individuals will vary from the reported level based on their proximity to the geographic centroid.

Grid Points: The NIRS model can also be used to calculate noise exposure at evenly spaced grid points. For this EA, the General Study Area was covered with a 0.5 nm by 0.5 nm grid for use in identifying DNL within potential Department of Transportation (DOT) Act Section 4(f) resources. These resources are discussed further in Section 4.3.3.

Unique Points: Noise levels at sites of interest too small to be captured in the 0.5 nm grid can also be analyzed using the NIRS model. Such sites include individual Section 4(f) resources that are less than one square nautical mile in area (such as significant public parks), and historic sites (such as individual buildings). See Section 4.3.3 for a discussion of what constitutes a Section 4(f) resource and Section 4.3.4 for a discussion of historic properties in the General Study Area.

In total, noise exposure levels were calculated at 126,316 census block centroids (centroids in the General Study Area that represent areas with population), 3,752 grid points, and 6,697 unique points throughout the General Study Area.

4.3.1.2 Existing Aircraft Noise Exposure

Table 4-3 describes the population exposed to AAD DNL in ranges between DNL 45 dB and 60 dB, DNL 60 dB and 65 dB, and DNL 65 dB and higher. This data is provided to establish a baseline for existing aircraft noise exposure represented by the DNL metric. The information provided refers to DNL only within the General Study Area. **Exhibit 4-2** provides a graphical representation of the 2011 existing condition DNL within the General Study Area. **Exhibit 4-3** provides a closer look at 2011 existing conditions DNL in areas around IAD, FDK, HEF, JYO, MRB, OKV, and RMN. Similarly, **Exhibit 4-4** provides a closer look at 2011 existing conditions DNL in areas around ADW, BWI, DCA, ESN, GAI, and MTN. Finally, **Exhibit 4-5** provides a closer look at 2011 existing conditions DNL at areas around RIC.

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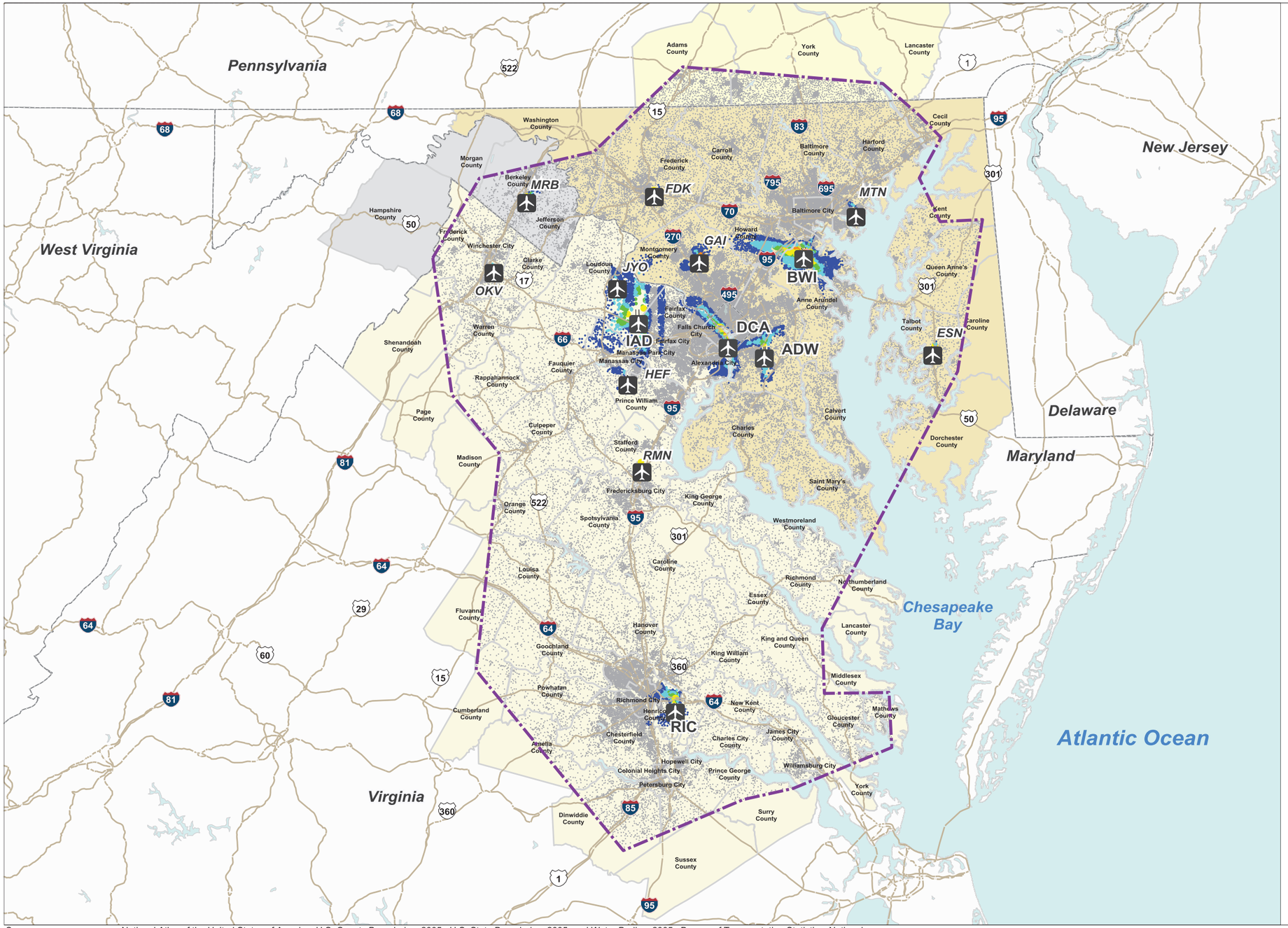

LEGEND

- General Study Area
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Secondary Roads
- Water

Noise Levels (2011)

- <45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 >5 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2012, and Noise Levels, 2013.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-2

2011 Baseline DNL - Noise Exposure by Census Block

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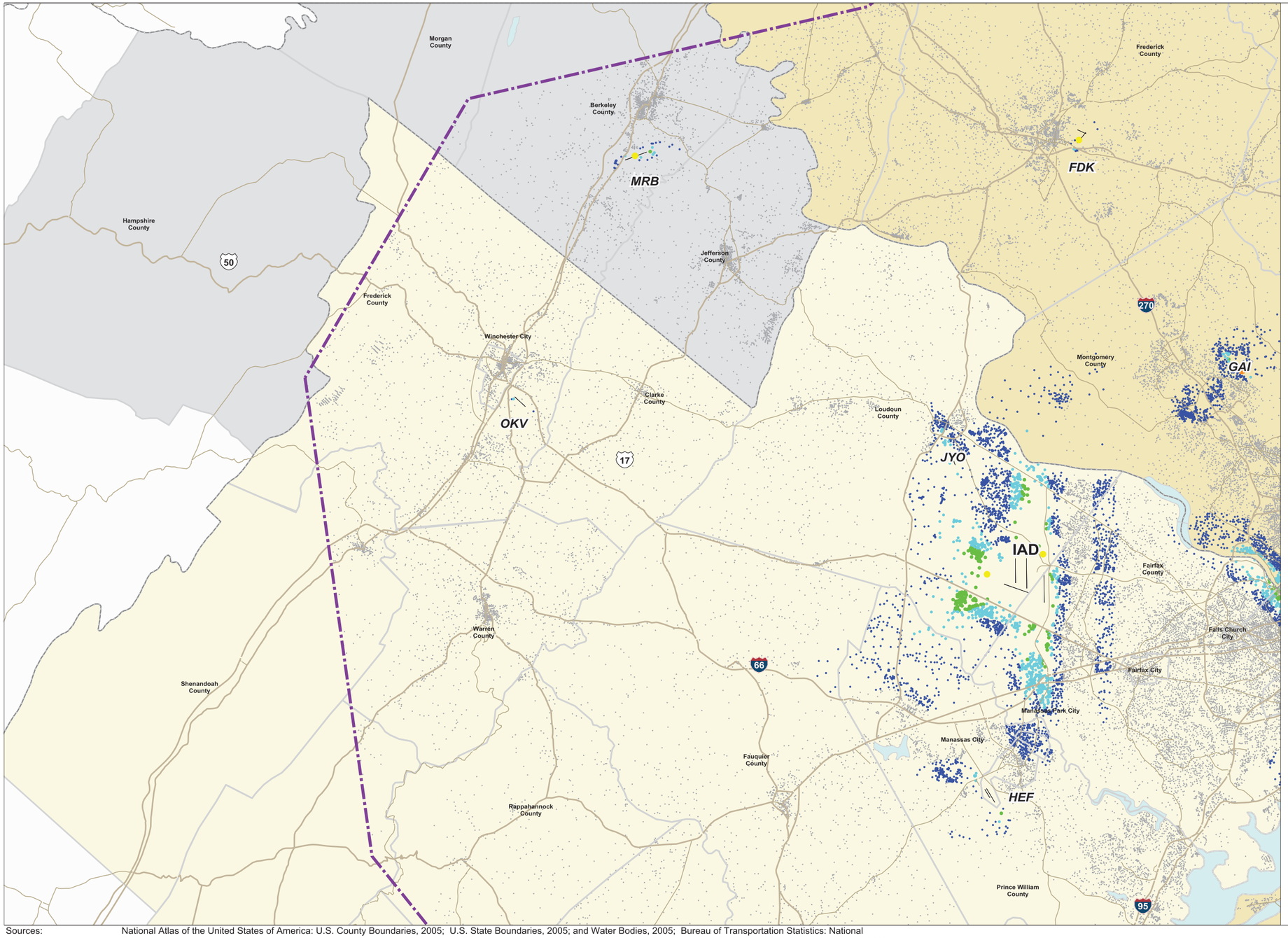

LEGEND

- General Study Area
- Runway
- District of Columbia
- Maryland County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Secondary Roads
- Water

Noise Levels (2011)

- <45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75

Notes:

IAD	Washington Dulles International Airport
FDK	Frederick Municipal Airport
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 500,000

0 10 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2012, and Noise Levels, 2013.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-3

2011 Baseline DNL - Noise Exposure Levels - IAD, FDK, HEF JYO, MRB, OKV, RMN and Environs

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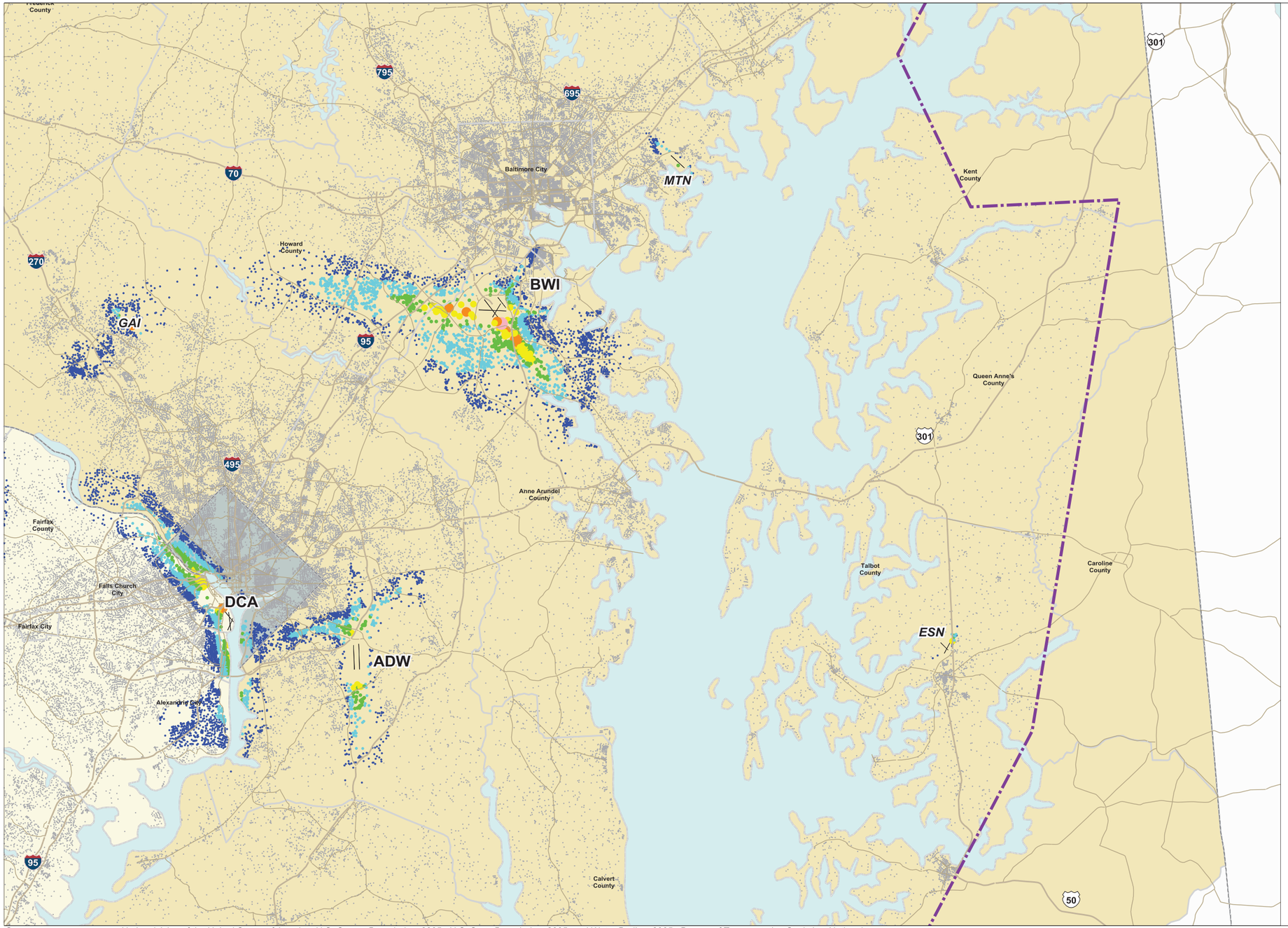

LEGEND

- General Study Area
- Runway
- District of Columbia
- Maryland County in Study Area
- Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Secondary Roads
- Water

Noise Levels (2011)

- <45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75

Notes:

DCA	Ronald Reagan Washington National Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
MTN	Martin State Airport
ESN	Easton/Newnam Field
GAI	Montgomery County Airpark

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 10 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2012, and Noise Levels, 2013.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-4

2011 Baseline DNL - Noise Exposure Levels - ADW, BWI, DCA, ESN, GAI, MTN and Environs

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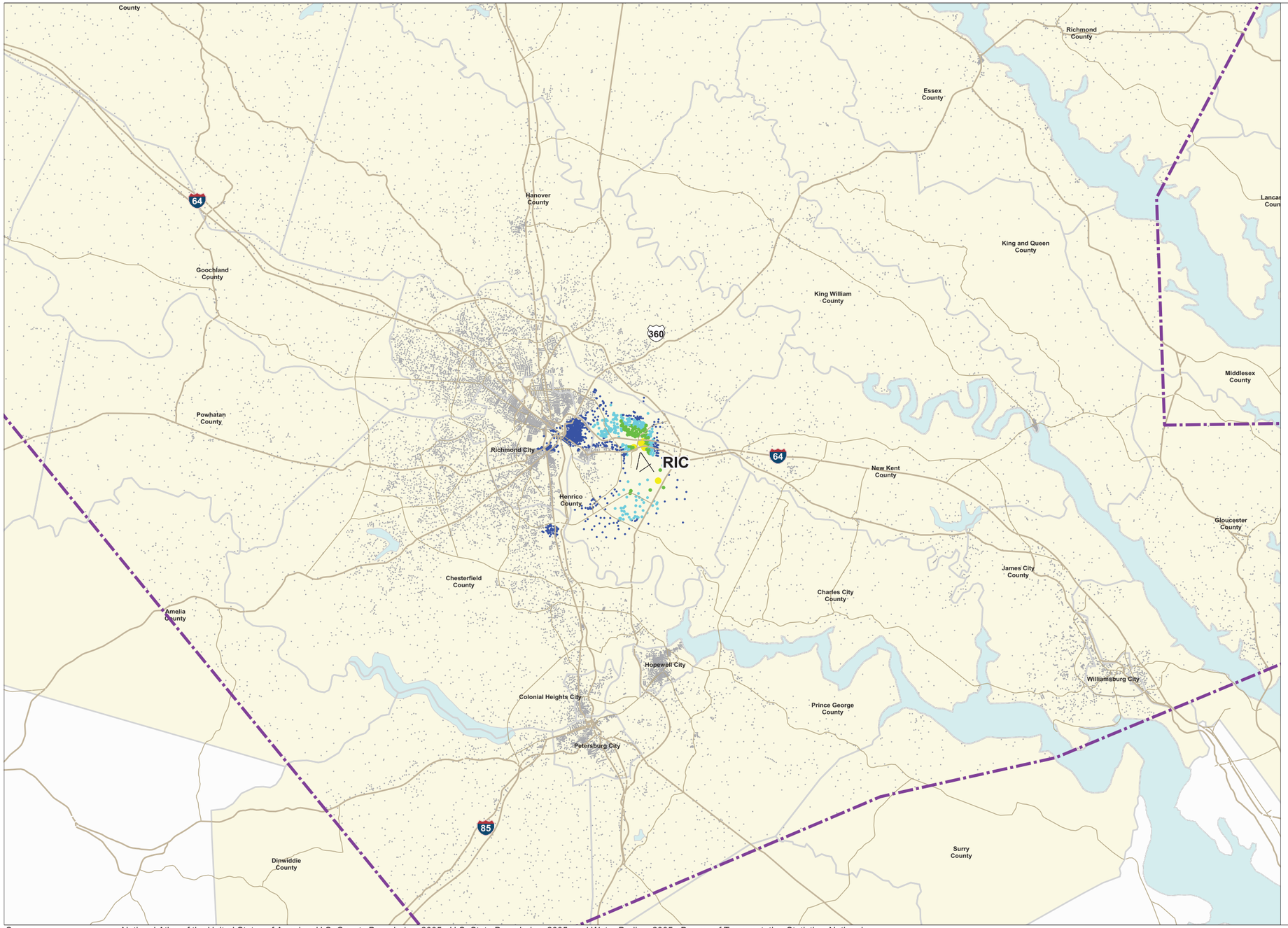

LEGEND

- General Study Area
- Runway
- Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Secondary Roads
- Water

Noise Levels (2011)

- <45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75

Notes:

RIC Richmond International Airport

Projection: Lambert Conformal Conic
Scale: 1:500,000

0 10 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2012, and Noise Levels, 2013.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-5

2011 Baseline DNL - Noise Exposure Levels - RIC and Environs

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Table 4-3 Maximum Population Exposed to Aircraft Noise within the Study Area (2011)

DNL Range (dB)	Population
DNL 45 dB to DNL 60 dB	1,530,673
DNL 60 dB to less than DNL 65 dB	21,417
DNL 65 dB and higher	1,003
Total Above DNL 45 dB	1,533,093

Sources: NIRS Version 7.0b3; US Census Bureau, 2010 Tracts and American Community Survey Selected Economic Characteristics, 2010.
Prepared by: ATAC Corporation, August 2012.

As shown on **Exhibit 4-2**, the higher DNL are generally aligned with study airport primary runways and areas of existing aircraft traffic.

4.3.2 Compatible Land Use

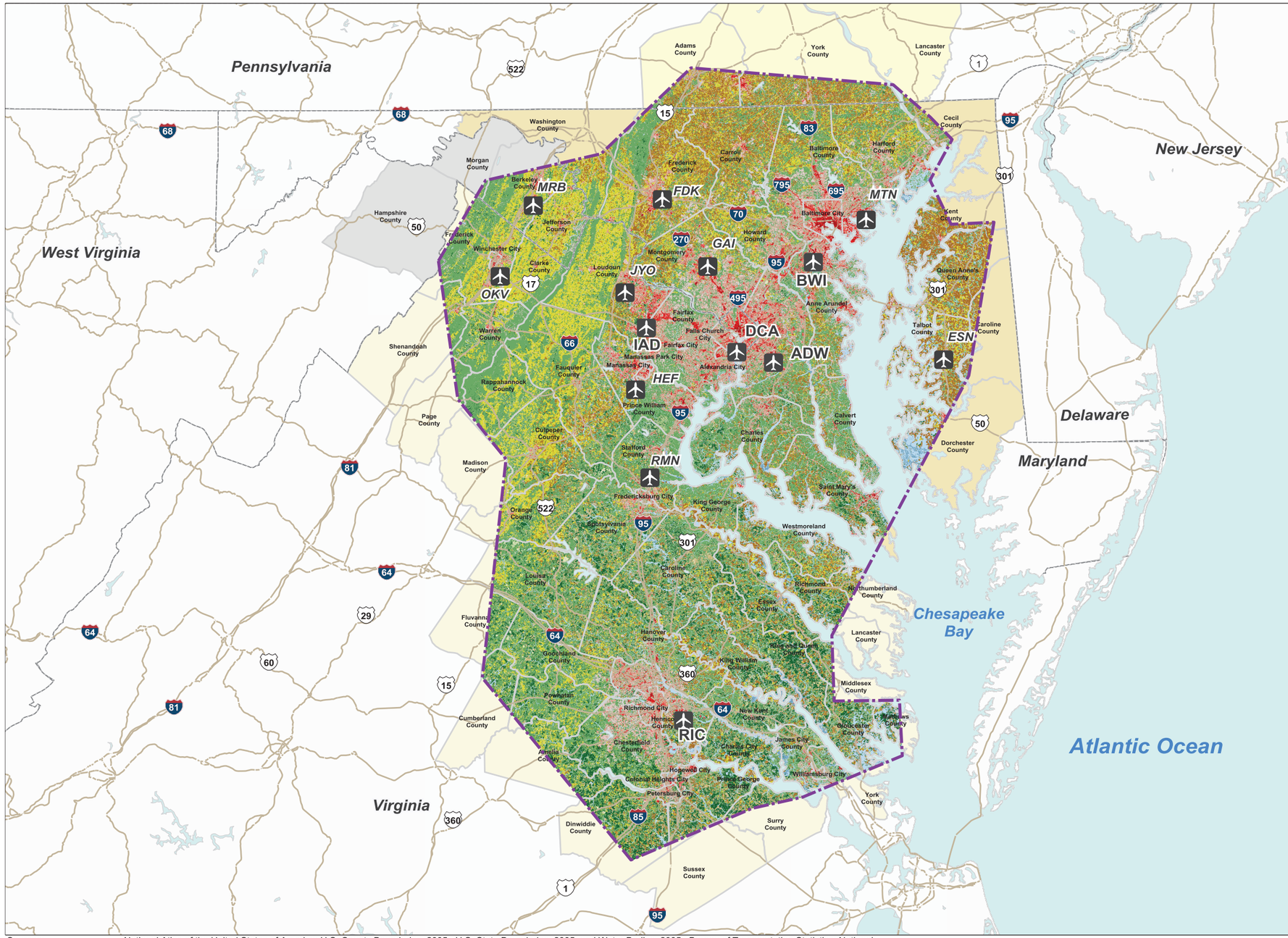
Land coverage data was obtained from the USGS National Land Cover Database 2006 (NLCD 2006). Land coverage classifications located within the General Study Area include:

- **Open Water**—areas of open water, generally with less than 25 percent cover of vegetation or soil.
- **Developed, Open Space**—areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- **Developed, Low Intensity**— areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20 percent to 49 percent of total cover. These areas most commonly include single-family housing units.
- **Developed, Medium Intensity**— areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50 percent to 79 percent of the total cover. These areas most commonly include single-family housing units.
- **Developed, High Intensity**— highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 percent to 100 percent of the total cover.
- **Barren Land**— areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15 percent of total cover.
- **Deciduous Forest**—areas dominated by trees generally greater than five meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
- **Evergreen Forest**—areas dominated by trees generally greater than five meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent

of the tree species maintain their leaves all year. The canopy is never without green foliage.

- **Mixed Forest**— areas dominated by trees generally greater than five meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.
- **Shrub/Scrub**— areas dominated by shrubs; less than five meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.
- **Grasslands/Herbaceous**— areas dominated by gramanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be used for grazing.
- **Hay/Pasture**— areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
- **Cultivated Crops**— areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.
- **Woody Wetlands**— areas where forest or shrub land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Emergent Herbaceous Wetlands**—Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Exhibit 4-6 shows the distribution of land coverage types within the General Study Area. The General Study Area includes numerous large parks, recreational areas, wilderness areas, forests, and other types of resources managed by federal and state agencies. These resources are further discussed in Section 4.3.3.



LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water

National Land Cover Data

- Open Water
- Developed, open space
- Developed, low intensity
- Developed, medium intensity
- Developed, high intensity
- Barren land
- Deciduous forest
- Evergreen forest
- Mixed forest
- Shrub/scrub
- Grassland/herbaceous
- Hay/pasture
- Cultivated crops
- Woody wetlands
- Herbaceous wetlands

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

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Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2012; Multi-Resolution Land Characteristics (MRLC) Consortium: 2006 National Land Cover Database

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-6

Land Coverage in the General Study Area

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4.3.3 Department of Transportation Act, Section 4(f) Resources

Section 4(f) of the DOT Act (codified at 49 U.S.C. § 303(c)), states that, subject to exceptions for *de minimis* impacts:

> …[the] Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a public park; recreation area; or wildlife and waterfowl refuge of national, state, or local significance as determined by the officials having jurisdiction thereof, unless there is no feasible and prudent alternative to the use of such land…and [unless] the project includes all possible planning to minimize harm resulting from the use.

The term "use" includes both physical and indirect or "constructive" impacts to Section 4(f) properties. Direct use is the physical occupation or alteration (direct use) of a Section 4(f) property or any portion of a Section 4(f) property. A "constructive" use does not require direct physical impacts or occupation of a Section 4(f) resource. A constructive use would occur when an action would result in substantial impairment of a resource to the degree that the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished. The determination of use must consider the entire property and not simply the portion of the property being used for a proposed project.

Special consideration is given to parks and natural areas where a quiet setting is a generally recognized purpose and attribute. In these areas the FAA official "…must consult all appropriate Federal, State, and local officials having jurisdiction over the affected Section 4(f) resources when determining whether project-related noise impacts would substantially impair the resource."

Since there is the potential for the Proposed Action to constructively "use" Section 4(f) properties due to noise effects, this section describes the 4(f) resources located within the General Study Area. **Table 4-4** identifies the categories of Section 4(f) properties considered in identifying these resources within the General Study Area, as well as the agencies responsible for managing them. Privately-owned parks, recreation areas, and wildlife refuges are not subject to the Section 4(f) provisions.

Table 4-4 Types of Section 4(f) Resources Considered in the General Study Area (1 of 2)

Section 4(f) Property Type	Responsible Agency/Agencies
Historic Sites (Only those listed on the National Register of Historic Places)	National Park Service, State and Local Agencies
National Forests and Grasslands	U.S. Forest Service
National Historical Park, National Historic Site, and International Historic Site	National Park Service
National Lakeshore	National Park Service
National Memorial	National Park Service
National Military Park, National Battlefield Park, National Battlefield Site, and National Battlefield	National Park Service

Table 4-4 Types of Section 4(f) Resources Considered in the General Study Area (2 of 2)

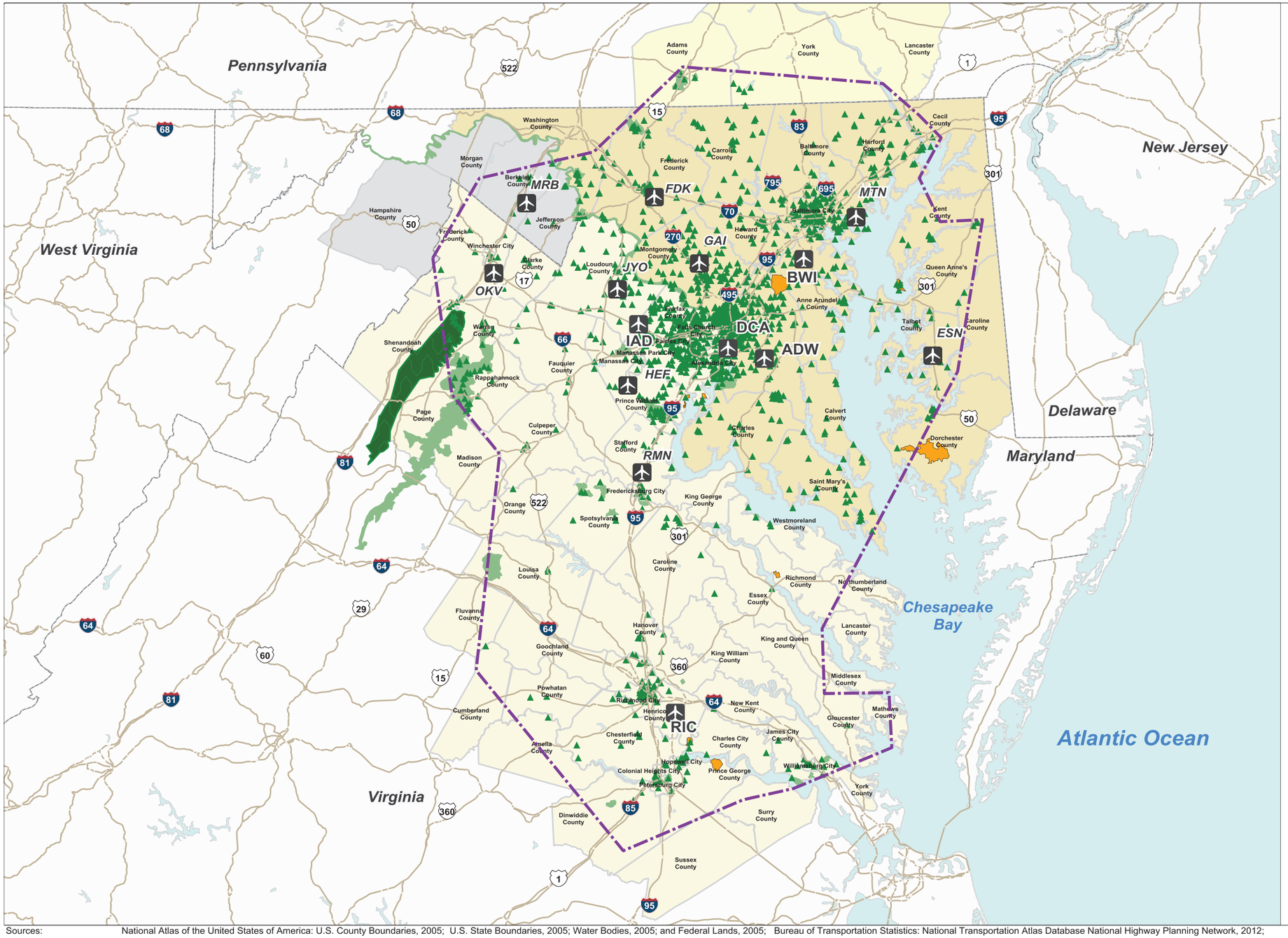
Section 4(f) Property Type	Responsible Agency/Agencies
National Monument	National Park Service, Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service
National Park	National Park Service
National Parkway	National Park Service
National Preserve and National Reserve	National Park Service
National Recreation Area	National Park Service, Bureau of Land Management, U.S. Forest Service
National River and National Wild and Scenic River and Riverway	National Park Service, Bureau of Land Management
National Scenic Trail	National Park Service, Bureau of Land Management
National Seashore	National Park Service
National Wilderness Areas	Bureau of Land Management
Nationally-Recognized Trails	National Park Service
Other Designations (White House, National Mall, etc.)	National Park Service
Significant Regional Parks and Trails	State Agencies
State Parks and Forests	State Agencies
State Wilderness Areas	State Agencies
Local Parks and Recreational Facilities	Local Agencies

Sources: National Park Service, 2013 National Park System Inventory, March 28, 2013; Bureau of Land Management, National Conservation Lands (http://www.blm.gov/wo/st/en/prog/blm_special_areas/NLCS.html); U.S. Fish and Wildlife Service, Marine National Monuments (http://www.fws.gov/marinenationalmonuments/); U.S. Forest Service, Recreational Resources (http://www.fs.fed.us/recreation/).
Prepared by: ATAC Corporation, April 2013.

Many Section 4(f) properties are also subject to the Section 6(f) of the Land and Water Conservation Fund Act of 1965 (LWCF) (16 U.S.C. § 460l–4 *et seq.*).. Section 6(f) states that no public outdoor recreation areas acquired or developed with any LWCF assistance can be converted to non-recreation uses without the approval of the Secretary of the Interior. The Secretary of the Interior may only approve conversions if they are in accordance with the comprehensive statewide outdoor recreation plan and if the converted areas will be replaced with other recreation lands of reasonably equivalent usefulness and location.

4.3.3.1 Section 4(f) Resources in the General Study Area

Data collected from both federal and state sources was used to identify Section 4(f) resources located within the General Study Area. A total of 5,173 Section 4(f) resources were identified within the General Study Area. **Exhibit 4-7** depicts the locations of all potential Section 4(f) resources within the General Study Area, excluding historic and cultural resources. The locations of historic and cultural resources, discussed in Section 4.4, are depicted on **Exhibit 4-8**. **Appendix F** includes a list of the Section 4(f) resources identified in the General Study Area, the type of resource (i.e., federal, state, or local), the state and county in which they are located, site acreage, and DNL under existing conditions.



LEGEND

- General Study Area Boundary
- Study Airport
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- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water

Potential DOT 4(f) Resources

- National Forest
- National Park
- National Recreation Area
- National Wildlife Refuge
- State Parks
- State Forests
- Regional/Local parks
- State Wildlife Refuge/Management Area
- Significant Park/Trail

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
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Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

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Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; Water Bodies, 2005; and Federal Lands, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Geological Survey: Geographic Names Information System (state and local parks/trails), 2013 ; ATAC Corporation: Study Area Boundary, 2012. West Virginia State GIS Technical Center: State Parks, Forests, and Wildlife Management Areas, 2013; Virginia Department of Conservation & Recreation: Public Lands, 2013; Maryland Department of Natural Resources: Protected Lands and Dept. of Natural Resource Lands, 2011; Delaware Geospatial Data Exchange: State Forests, 2006; Pennsylvania Spatial Data Access: State Parks, Forests, Wildlife and Natural Areas, Trails, and Recreation Areas, 2012; National Capital Planning Commission: Parks, Zoos, and Gardens, 1999;

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-7

Section 4(f) Resources in the General Study Area

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4.3.4 Historic, Architectural, Archeological, and Cultural Resources – Historic, Archeological and Cultural Resources Sub-Categories

The National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. § 470, as amended) requires federal agencies to consider the effects of their undertakings on properties listed or eligible for listing in the National Register of Historic Places (NRHP). Compliance requires consultation with the Advisory Council on Historic Preservation, State Historic Preservation Officers (SHPO), and/or the Tribal Historic Preservation Officers (THPO).

It is possible that changes in aircraft flight routes could introduce or increase aircraft routing over historic resources. This could result in potential adverse aircraft noise or visual impacts. Therefore, historic properties in the General Study Area have been identified for this EA. For the purpose of this EA, historic properties are defined as resources that are listed or eligible for listing in the NRHP or relevant SHPO listings, or that have been identified through tribal consultation for values other than their archaeological qualities. As noted in Section 4.2, the Proposed Action does not involve ground disturbance that could potentially impact archaeological resources. Thus, archaeological resources are not further discussed in this EA.

4.3.4.1 Historic and Cultural Resources in the General Study Area

Exhibit 4-8 shows the location of historic and cultural resources identified in the General Study Area. A total of 2,566 NRHP listed properties were identified, including 423 properties in the District of Columbia, 1,045 properties in Maryland, 43 properties in Pennsylvania, 975 properties in Virginia, and 142 properties in West Virginia. These properties are representative of every period in American history and include some of the nation's most important historic and cultural resources. **Appendix G** includes a list of the historic and cultural resources identified in the General Study Area, the state and county in which they are located, and DNL under existing conditions.

4.3.5 Fish, Wildlife, and Plants – Wildlife Sub-Category

This section discusses the existing wildlife resources within the General Study Area. The Proposed Action involves redesign of the airspace (specifically the standard instrument arrival and departure procedures primarily above 3,000 feet AGL and the supporting airspace management structure) serving the Study Airports. Accordingly, the discussion is limited to avian and bat species that may be present within the General Study Area.

4.3.5.1 Threatened and Endangered Species and Migratory Birds

The Endangered Species Act (ESA) of 1973, (16 U.S.C. § 1531 *et seq*. (1973)), requires the evaluation of all federal actions to determine whether a Proposed Action is likely to jeopardize any proposed, threatened, or endangered species or proposed or designated critical habitat. A federal action is one conducted, funded, or permitted by a federal agency. Section 7 of the ESA requires the lead federal agency (in this case the FAA) to consult with the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries to determine whether the proposed federal action would jeopardize the continued existence of any species listed or proposed for listing as threatened or endangered; or result in the destruction or adverse modification of designated or proposed critical habitat. Critical habitat includes areas that will contribute to the

recovery or survival of a listed species. Federal agencies are responsible for determining if an action "may affect" listed species. If so, the federal agency is required to prepare a Biological Assessment (BA) to determine if the action is "likely to adversely affect the species." The potential for federal and state listed avian and bat species was assessed based on agency lists and reports. Data from the USFWS were used to identify potential federally-listed species.

4.3.5.2 Migratory Birds

The Migratory Bird Treaty Act of 1918 (MBTA) (16 U.S.C. §§ 703-712) prohibits, without a permit issued by the USFWS, the taking of any migratory bird and any part, nest, or egg of any such bird. Take under the MBTA is defined as the action or attempt to "pursue, hunt, shoot, capture, collect, or kill." Migratory birds listed under the ESA are managed by the agency staff members who handle compliance with Section 7 of ESA; management of all other migratory birds is overseen by the Migratory Bird Division of ESA. Numerous migratory birds occur in, or migrate through the General Study Area.

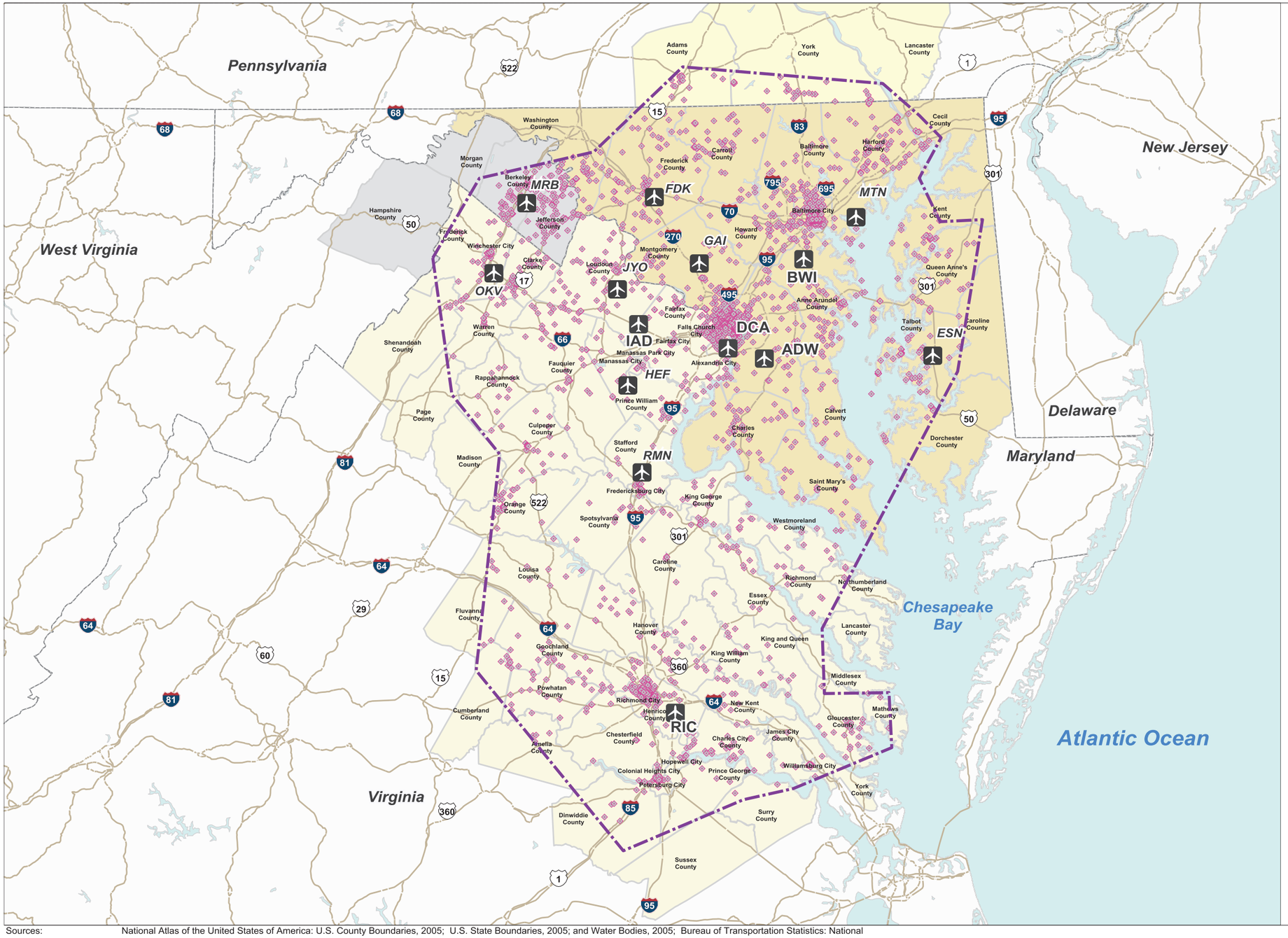
Migration routes may be defined as the various lanes birds travel from their breeding ground to their winter quarters. The actual routes followed by a given migratory bird species differ by variables such as distance traveled, time of starting, flight speed, geographic position and latitude of the breeding, and wintering grounds.

Birds migrate along four main routes or flyways in North America: the Atlantic, the Central, the Mississippi, and the Pacific flyways, which are loosely delineated in these geographic regions. These flyways are not specific lines the birds follow but broad areas through which the birds migrate. The most frequently traveled migration routes conform very closely to major topographical features that lie in the general north-south movement of migratory bird flyways. Therefore, the lanes of heavier concentration in the General Study Area follow principal river valleys and mountain ranges.

As shown on **Exhibit 4-9**, the General Study Area is located within the Atlantic Flyway. The Atlantic Flyway stretches along the East Coast from Puerto Rico and the U.S. Virgin Islands to Canada. The Atlantic Flyway includes multiple primary migration routes throughout these areas and connects to other primary flyway routes. **Table 4-5** lists the avian and bat species of concern that are found within the General Study Area.

Table 4-5 Threatened or Endangered Avian and Bat Species Potentially in the General Study Area (1 of 2)

Status	Species	Type	VA	MD	PA	WV
E	Bat, gray (*Myotis grisescens*)	Bat	X			X
E	Bat, Indiana (*Myotis sodalis*)	Bat	X	X	X	X
E	Bat, Virginia big-eared (Corynorhinus (=*Plecotus*) *townsendii virginianus*)	Bat	X			X
T	Plover, piping except Great Lakes watershed (*Charadrius melodus*)	Avian	X	X		



LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Historic Resources

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
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OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

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Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; National Park Service: National Register of Historic Places, 2012; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-8

Historic and Cultural Resources in the General Study Area

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Table 4-5 Threatened or Endangered Avian and Bat Species Potentially in the General Study Area (2 of 2)

Status	Species	Type	VA	MD	PA	WV
E	Plover, piping Great Lakes watershed (*Charadrius melodus*)	Avian			X	
E	Tern, roseate northeast U.S. nesting pop. (*Sterna dougallii dougallii*)	Avian	X			
E	Woodpecker, red-cockaded (*Picoides borealis*)	Avian	X			

Notes:
VA = Virginia;
MD = Maryland,
PA = Pennsylvania,
WV = West Virginia

Sources: US Fish and Wildlife Service, (http://www.fws.gov/endangered/, Accessed August 2012.)
Prepared by: ATAC Corporation, August 2012.

4.3.5.3 Existing Wildlife Strikes

Media attention to wildlife strikes with aircraft has increased over time. For example, there was substantial media coverage of the emergency forced landing of US Airways Flight 1549 in the Hudson River on January 15, 2009. This emergency landing was due to Canada geese being ingested into both of the aircraft's engines and demonstrates to the public that wildlife strikes are a serious but manageable aviation safety issue. The civil and military aviation communities have long recognized that the threat of aircraft collisions with wildlife is real and increasing. Globally, wildlife strikes have killed more than 229 people and destroyed over 210 aircraft since 1988.[45] Factors that contribute to this threat are an increase in the populations of large birds as well as an increase in air traffic operations by quieter, turbofan-powered aircraft.

Table 4-6 provides a summary of wildlife and avian/bat strikes nationwide between 1990 and 2010.The number of strikes reported annually has increased more than five-fold from the 1,793 strikes in 1990 to 9,622 in 2010 (109,107 for 1990-2010).[46] Prior to the emergency landing of US Airways Flight 1549, there was an average of 20 reported wildlife strikes per day between 2004 and 2008.[47] This increased to an average of 26 reported strikes per day in 2009; a 25-percent increase from 2008. This trend continued through 2010. Birds were involved in 97.2 percent of the strikes, terrestrial mammals in 2.3 percent, bats in 0.4 percent, and reptiles in 0.1 percent.[48] Although the number of reported strikes has steadily increased, the number of reported damaging strikes has actually declined from 765 in 2000 to 573 in 2010.

[45] US Department of Transportation, Federal Aviation Administration, *Wildlife Strikes to Civil Aircraft in the United States, 1990-2010*, Serial Report Number 17, 2011.

[46] Id.

[47] Id.

[48] Id.

Table 4-6 1990-2010 National Wildlife and Avian/Bat Strike Summary

Year	Strikes		
	Avian/Bat	Other Wildlife	Total
1990	1,741	52	1,793
1991	2,255	54	2,309
1992	2,353	74	2,427
1993	2,409	67	2,476
1994	2,468	83	2,551
1995	2,679	92	2,771
1996	2,848	94	2,942
1997	3,351	109	3,460
1998	3,656	118	3,774
2000	5,879	127	6,006
2001	5,644	146	5,790
2002	6,065	134	6,199
2003	5,869	132	6,001
2004	6,428	134	6,562
2005	7,103	139	7,242
2006	7,085	153	7,238
1999	5,007	97	5,104
2007	7,569	183	7,752
2008	7,416	189	7,605
2009	9,239	244	9,483
2010	9,363	259	9,622
Total	106,427	2,680	109,107

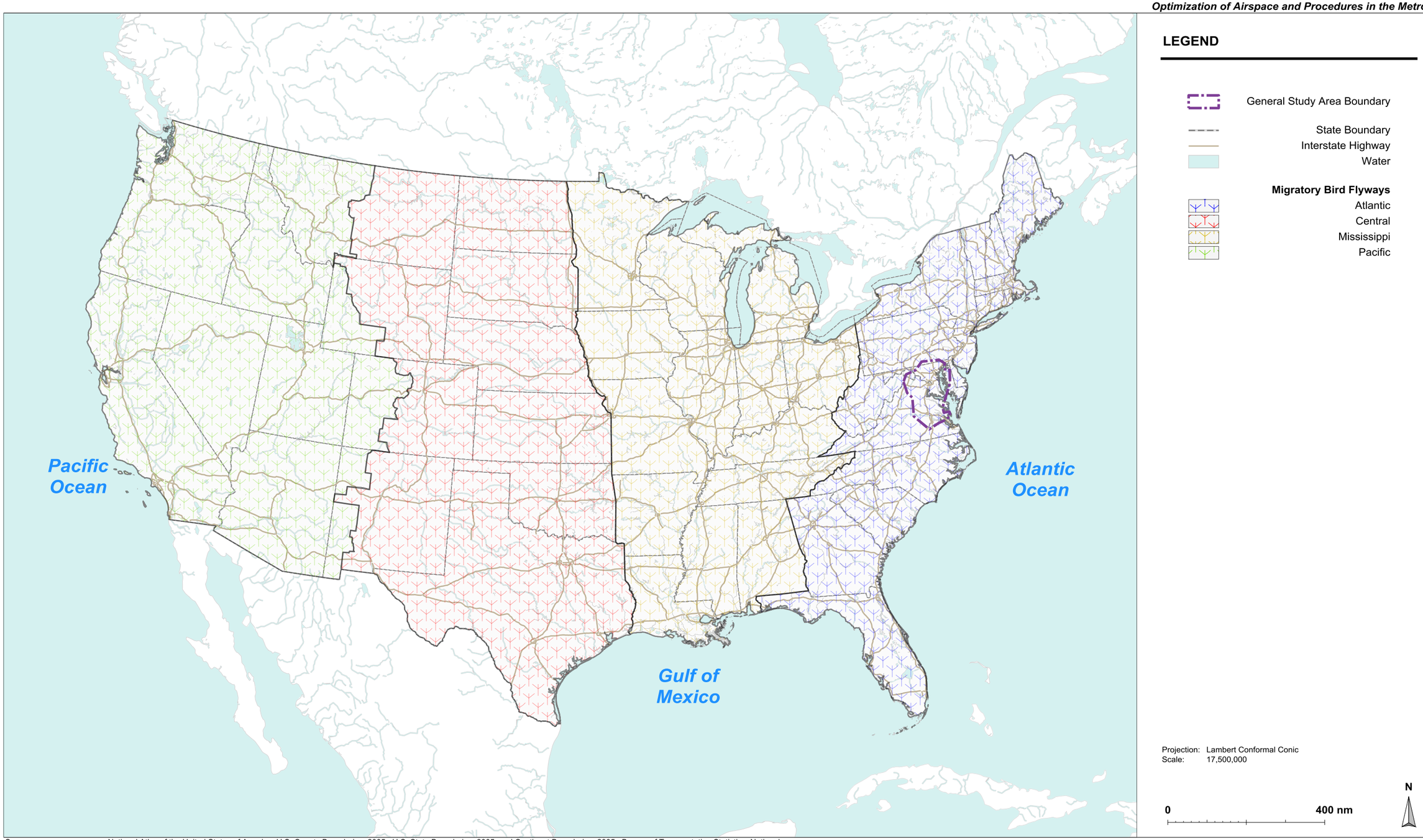
Sources: Wildlife Strikes to Civil Aircraft in the United States, 1990–2010, Serial Report Number 17, US Department of Transportation, Federal Aviation Administration, 2011

Prepared by: ATAC Corporation, August 2012.

The FAA National Wildlife Strike Database states that for commercial and GA aircraft, 72 and 76 percent of bird strikes, respectively, occurred at or below 500 feet AGL.[49] Above 500 feet AGL, the number of strikes declined by 33 percent for each 1,000-foot gain in height for commercial aircraft, and by 41 percent for GA aircraft.[50]

[49] Id.

[50] Id.



Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Continent Boundaries, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; and Hydrology. Manifold Software Ltd: Lakes, Rivers, and Inland Waters, 2007; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-9

The Atlantic Flyway and the General Study Area

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The FAA National Wildlife Strike Database was accessed for the 2011 calendar year to obtain wildlife strike reports for each Study Airport. The Study Airports account for 31.3 percent of the 2011 national wildlife strike total and 31 percent of the avian/bat 2011 national strike total. **Table 4-7** provides a summary of wildlife and avian/bat strikes at each of the study airports as of 2011. Of the 301 avian/bat strikes reported for 2011, 132 included information on the altitude at which the strike took place. Nineteen of the 132 bird strikes reported occurred at altitudes above 3,000 feet.

Table 4-7 2011 Study Airports Wildlife and Avian/Bat Strike Summary

	Strikes		
Airport	**Avian/Bat**	**Other Wildlife**	**Total**
ADW	4	0	4
BWI	105	2	107
DCA	50	1	51
ESN	1	0	1
FDK	0	1	1
HEF	11	0	11
IAD	90	6	96
JYO	3	0	3
MTN	1	0	1
OKV	1	0	1
RIC	25	0	25
GAI	0	0	0
RMN	0	0	0
MRB	0	0	0
Total	291	10	301

Source: US Department of Transportation, Federal Aviation Administration, *Wildlife Strike Database* http://wildlife-mitigation.tc.faa.gov/wildlife/database.aspx, Accessed August, 2012
Prepared by: ATAC Corporation, August 2012.

4.3.6 Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks – Environmental Justice Sub-Category

FAA Order 1050.1E, Appendix A, paragraph 16.2b states, “Environmental health risks and safety risks include risks to health or to safety that are attributable to products or substances that a child is likely to come in contact with or ingest, such as air, food, drinking water, recreational waters, soil, or products they might use or be exposed to.” Paragraph 16.2c states, “The principal social impacts to be considered are those associated with relocation or other community disruption, transportation, planned development, and employment.” As indicated in Section 4.2, the Proposed Action does not include land acquisition or ground disturbing activities. In addition, the Proposed Action would not result in an increase in operations that would result in greater emissions that could potentially exacerbate health issues such as asthma in children. Therefore, this section does not address Socioeconomic Impacts or Children’s Environmental, Health, and Safety Risks. This section is limited to a discussion of Environmental Justice as it would pertain to potential aircraft over flight and resultant noise impacts within the airspace of the General Study Area.

Environmental justice analysis considers the potential of the proposed project alternatives to cause disproportionate and adverse effects on low-income or minority populations. The analysis of environmental justice impacts and associated mitigation ensures that no low income or minority population bears a disproportionate burden of effects resulting from the implementation of the preferred alternative.

To help describe environmental justice, this EA relies on the following definition from the U.S. EPA Office of Environmental Justice:

> The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies. Meaningful involvement means that:
>
> (1) people have an opportunity to participate in decisions about activities that may affect their environment and/or health;
>
> (2) the public's contribution can influence the regulatory agency's decision;
>
> (3) their concerns will be considered in the decision making process; and,
>
> (4) the decision makers seek out and facilitate the involvement of those potentially affected.[51]

The socioeconomic and racial characteristics of the population within the General Study Area are based on data from the 2010 U.S. Census. This data was provided for geographical units called census tracts which include over 500 types of demographic information including number of households, number of inhabitants, and percentage of households below the federal poverty level. Census tracts with no populations were not included in the analysis. Because some census tracts were only partially located within the General Study Area, only a portion of the population based on the amount of area within the General Study Area was included. This methodology was used because census tracts are composed of census blocks, which are used by the NIRS noise model to calculate noise impact at the centroid, or geometric center of the block.

Minority and low-income populations were identified using GIS based on information for each census tract within the General Study Area. For the purposes of this environmental justice analysis, minority population census tracts and low- income population census tracts were defined and identified as follows:

- A minority census tract is defined as a tract having a minority population percentage greater than the average minority population percentage of the General Study Area. Based on the 2010 census data, the average percentage of minority population residing in the General Study Area was 43 percent. Therefore, every census tract with a percentage of minority population greater than 43 percent was identified as a

[51] U.S. Environmental Protection Agency, *Environmental Justice: Basic Information*, (http://www.epa.gov/compliance/environmentaljustice/index.html, accessed August 2012.)

census tract of environmental justice concern. **Exhibit 4-10** depicts those areas exceeding the average minority population percentage within the General Study Area. As depicted, census tracts with high concentrations of minority population are located in the urbanized metropolitan cities of Washington, DC, Baltimore, and Richmond.

- A low-income population census tract is defined as a tract having a greater percentage of low-income population than the average percentage of low-income population residing in the General Study Area. Based on the 2010 Poverty Guidelines identified by the Department of Health and Human Services (HHS), the poverty threshold for a household of three persons was set at $18,310 for the 48 contiguous states, and therefore is applicable to the General Study Area. For the purposes of identifying low-income population census tracts, the HHS threshold of $18,310 was used. Based on the 2010 data, the average percentage of low-income population residing in the General Study Area was 6.7 percent. Therefore, every census tract with a percentage of low-income population greater than 6.7 percent was identified as a census tract of environmental justice concern. **Exhibit 4-11** depicts the census tracts with above average populations of low-income households within the General Study Area. As depicted, census tracts with populations of above average percentages of low-income households are located throughout the General Study Area with no discerned geographic relationship.

Census tracts of environmental justice concern are defined as those tracts in which the percentage of minority population and/or the percentage of low-income population are higher than their respective averages of the General Study Area. The combined low income households and minority population data is represented in **Exhibit 4-12** as areas of environmental justice concern. **Exhibit 4-13** provides a closer look at areas of environmental justice concern in locations around IAD, FDK, HEF, JYO, MRB, OKV, and RMN. Similarly, **Exhibit 4-14** provides a closer look at areas of environmental justice concern in locations around ADW, BWI, DCA, ESN, GAI, and MTN. Finally, **Exhibit 4-15** provides a closer look at areas of environmental justice concern in locations around RIC. **Table 4-8** shows the 2010 census data for total population, minority population, and low income population for the General Study Area.

Table 4-8 Selected Populations in the Study Area

State	Study Area Population				
	Total	Minority	% of Total	Low Income	% of Total
District of Columbia	601,723	370,263	61.5%	81,104	13.5%
Maryland	5,229,358	2,311,074	44.2%	309,287	5.9%
Pennsylvania	140,095	7,860	5.6%	6,911	4.9%
Virginia	4,255,267	1,451,325	34.1%	230,850	5.4%
West Virginia	128,293	16,844	13.1%	8,061	6.3%

Source: US Census Bureau, 2010 Tracts and American Community Survey Selected Economic Characteristics, 2010
Prepared by: ATAC Corporation, August 2012.

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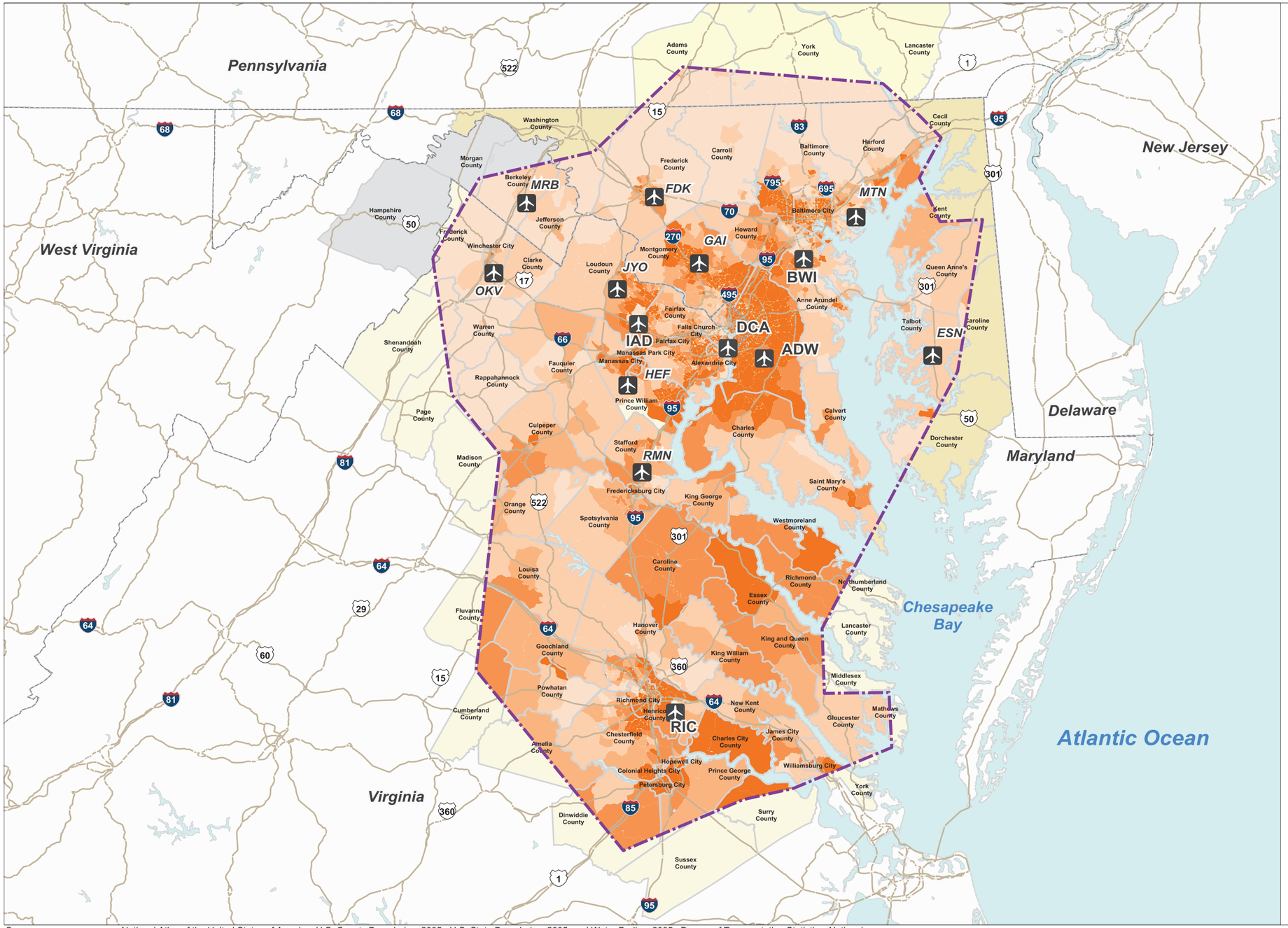

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water

Concentrations of Minority Populations (Percent)

- < 10
- 10 - 20
- 20 - 30
- 30 - 43
- > 43

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Census Bureau: 2010 Tracts and Profile of General Population and Housing Characterisitics; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-10

Minority Populations in the General Study Area

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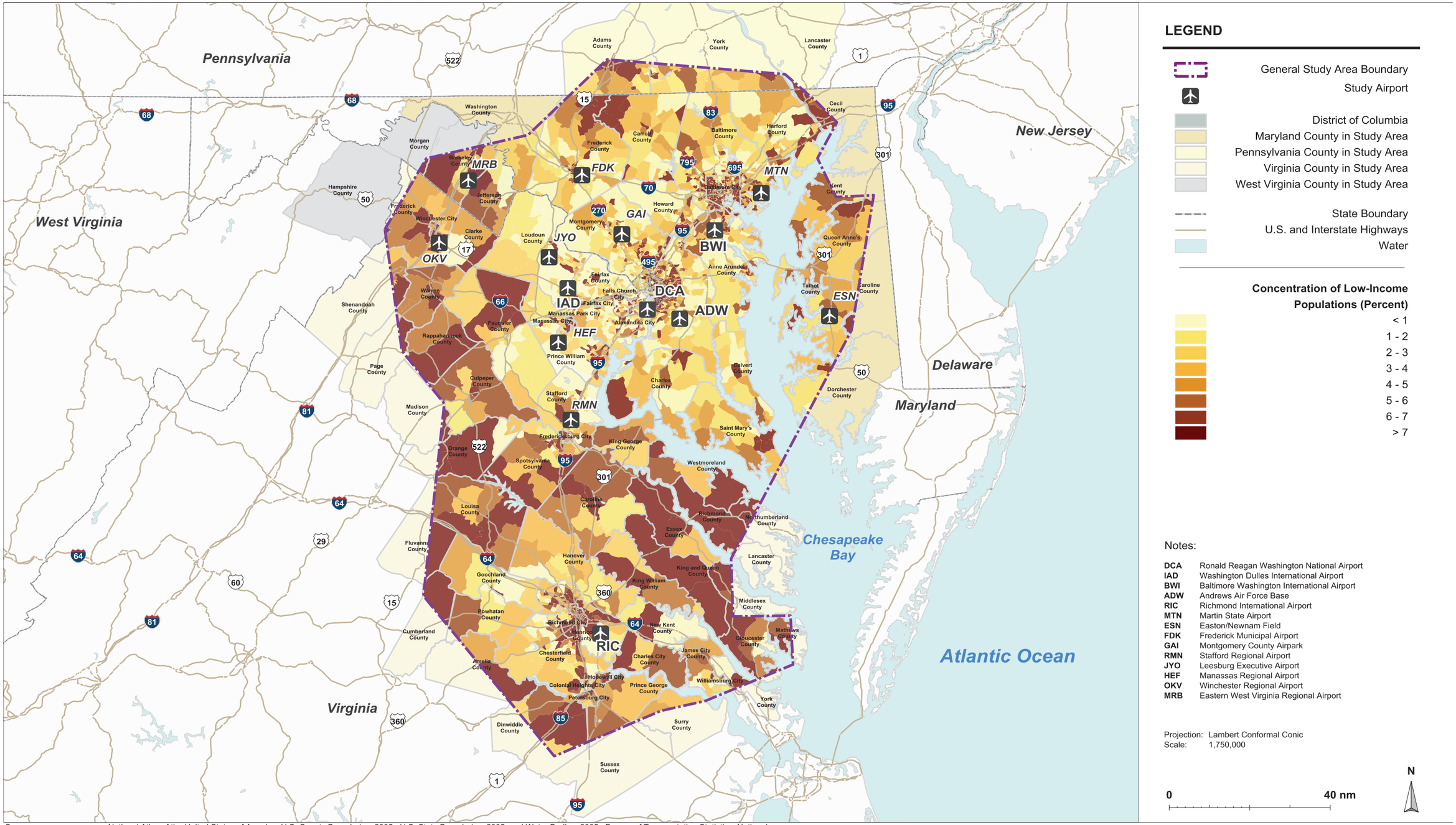

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Census Bureau: 2010 Tracts and American Community Survey Selected Economic Characteristics; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-11

Low-Income Populations in the General Study Area

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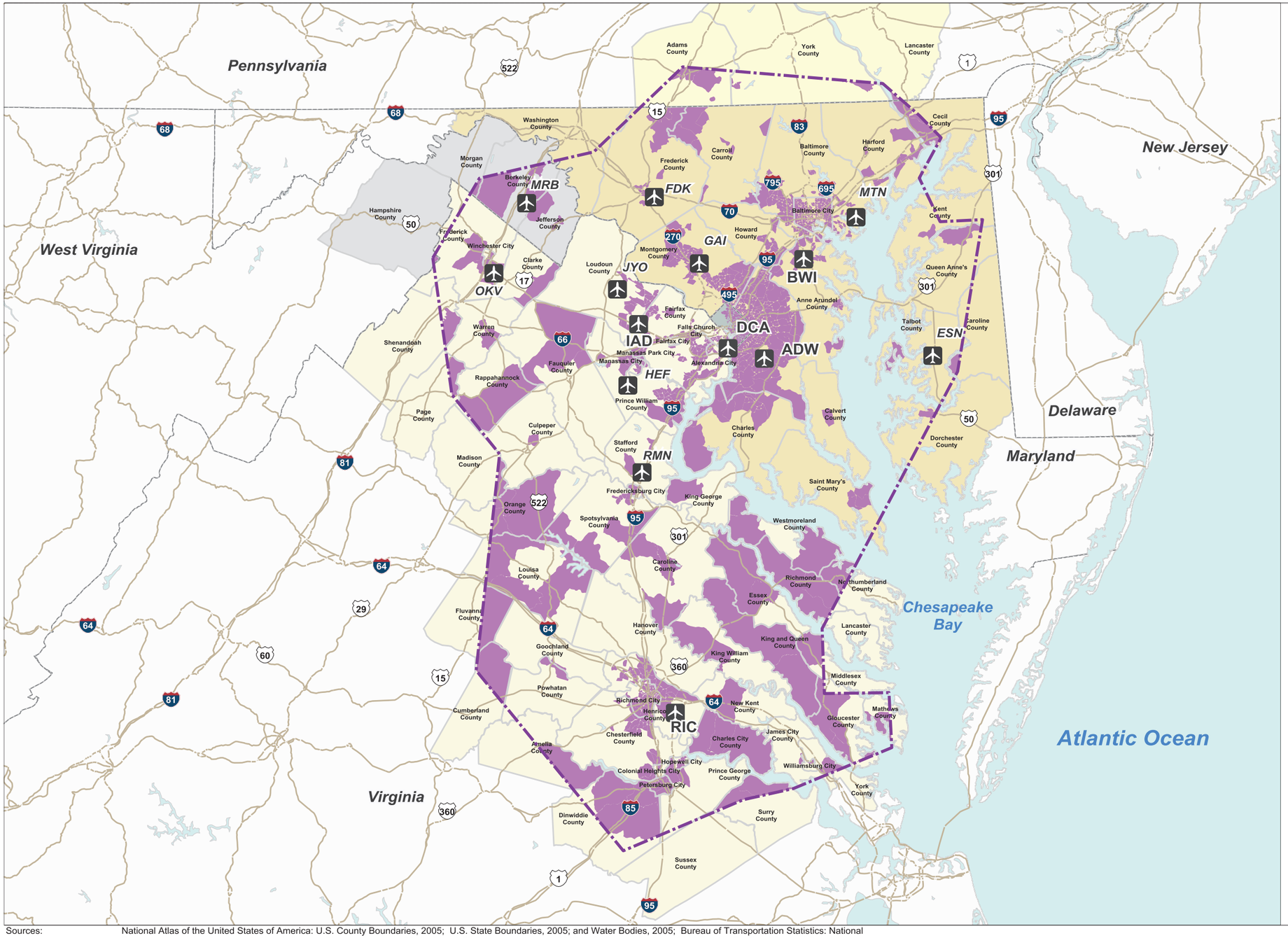

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Environmental Justice Community

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Census Bureau: 2010 Tracts, Profile of General Population and Housing Characterisitics, and American Community Survey Selected Economic Characteristics; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-12

Environmental Justice Communities in the General Study Area

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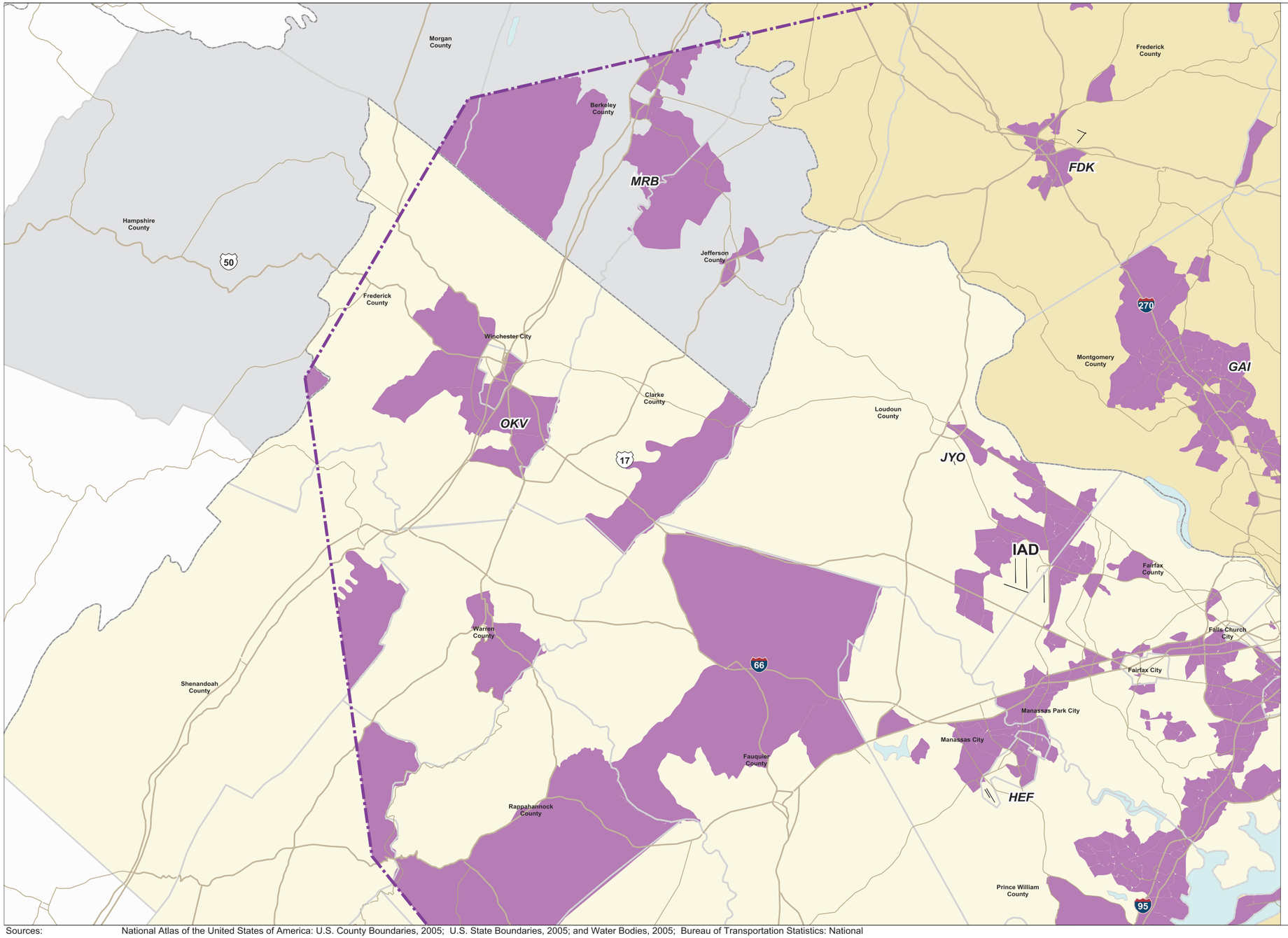

LEGEND

- General Study Area
- Runway
- District of Columbia
- Maryland County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Secondary Roads
- Water
- Environmental Justice Community

Notes:

IAD	Washington Dulles International Airport
FDK	Frederick Municipal Airport
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 10 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Census Bureau: 2010 Tracts, Profile of General Population and Housing Characterisitics, and American Community Survey Selected Economic Characteristics; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-13

Environmental Justice Communities - IAD, FDK, HEF, JYO, MRB, OKV, RMN and Environs

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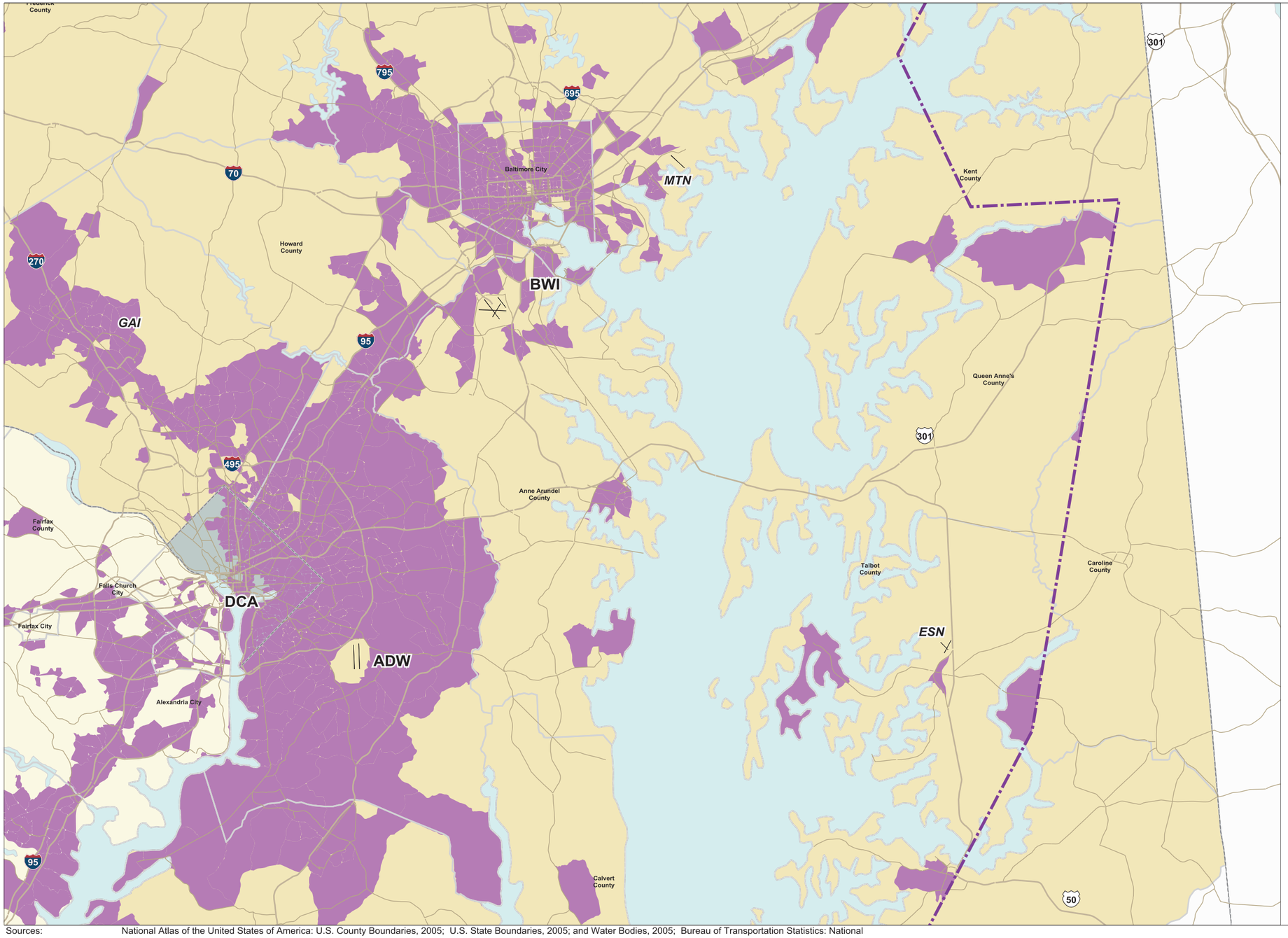

LEGEND

- General Study Area
- Runway
- District of Columbia
- Maryland County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Secondary Roads
- Water
- Environmental Justice Community

Notes:

DCA	Ronald Reagan Washington National Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
MTN	Martin State Airport
ESN	Easton/Newnam Field
GAI	Montgomery County Airpark

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 10 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Census Bureau: 2010 Tracts, Profile of General Population and Housing Characterisitics, and American Community Survey Selected Economic Characteristics; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-14

Environmental Justice Communities - ADW, BWI, DCA, ESN, GAI, MTN and Environs

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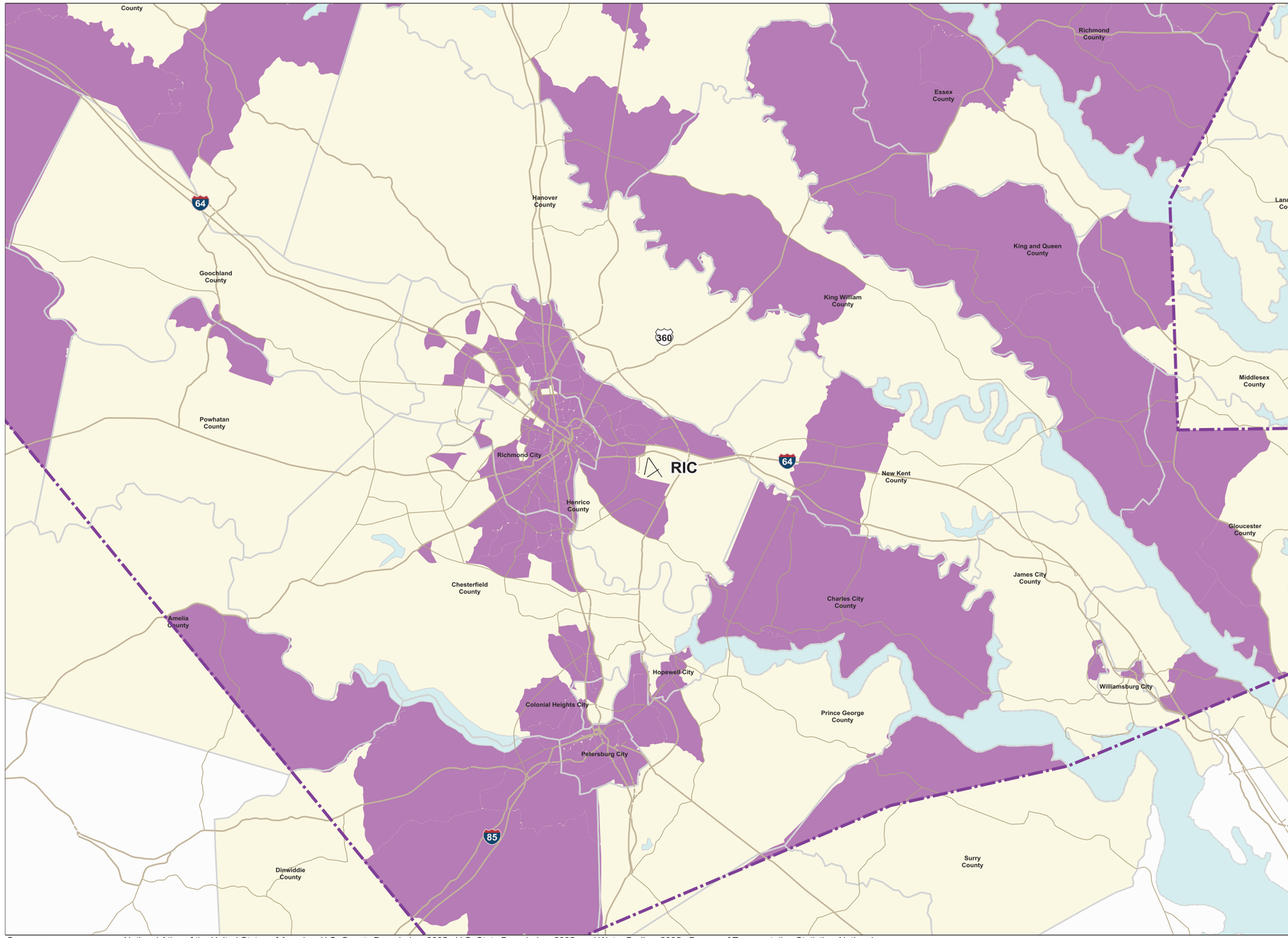

LEGEND

- General Study Area
- Runway
- Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Secondary Roads
- Water
- Environmental Justice Community

Notes:

DCA	Ronald Reagan Washington National Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
MTN	Martin State Airport
ESN	Easton/Newnam Field
GAI	Montgomery County Airpark

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 10 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Census Bureau: 2010 Tracts, Profile of General Population and Housing Characterisitics, and American Community Survey Selected Economic Characteristics; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-15

Environmental Justice Communities -RIC and Environs

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4.3.7 Energy Supply (Aircraft Fuel)

This section describes fuel consumption by IFR aircraft arriving at and departing from the Study Airports. Using the NIRS model, aircraft fuel burn was calculated to estimate aircraft fuel consumption associated with air traffic flows under 2011 existing conditions. NIRS calculates fuel burn using the same input used for calculating noise (See Section 4.3.1.1 for a discussion of NIRS model inputs.) Based on the NIRS calculation, on an annual average day basis, approximately 698,958 gallons of fuel were burned by IFR aircraft arriving at and departing from the study airports.

4.3.8 Air Quality

This section describes air quality conditions within the General Study Area. In the United States, air quality is generally monitored and managed at the county or regional level. The U.S. EPA, pursuant to mandates of the federal Clean Air Act, (42 U.S.C. § 7401 *et seq*. (1970)), has established the National Ambient Air Quality Standards (NAAQS) to protect public health, the environment, and quality of life from the detrimental effects of air pollution. Standards have been established for the following criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), and sulfur dioxide (SO_2). PM standards have been established for inhalable coarse particles ranging in diameter from 2.5 to 10 micrometers (µm) (PM_{10}) and fine particles less than 2.5 µm ($PM_{2.5}$) in diameter.

In accordance with the Clean Air Act Amendments (CAAA) of 1997, (91 Stat. 685, P.L. 95-95), counties and some sub-county geographical areas are classified by the U.S. EPA with regards to their compliance with the NAAQS based on air monitoring data compiled by U.S. EPA and local air quality agencies. An area with air quality at or below the NAAQS is designated as an attainment area. An area with air quality that exceeds the NAAQS is designated as a nonattainment area. Nonattainment areas are further classified as extreme, severe, serious, moderate, and marginal by the extent the NAAQS are exceeded. Areas that have been reclassified from nonattainment to attainment are identified as maintenance areas. An area may be designated as unclassifiable when there is a temporary lack of data on which to base its attainment status. **Table 4-9** identifies those areas within the General Study Area that are in nonattainment or maintenance for one or more criteria pollutants.

Table 4-9 NAAQS Attainment Areas in the General Study Area (1 of 2)

Pollutant	Status	State	County
Ozone (O_3)	Nonattainment	DC	District of Columbia
		MD	Anne Arundel County
		MD	Baltimore City
		MD	Baltimore County
		MD	Calvert County
		MD	Carroll County
		MD	Cecil County

Table 4-9 NAAQS Attainment Areas in the General Study Area (2 of 2)

Pollutant	Status	State	County
		MD	Charles County
		MD	Frederick County
		MD	Harford County
		MD	Howard County
		MD	Montgomery County
		MD	Prince George's County
		PA	Lancaster County
		VA	Alexandria City
		VA	Arlington County
		VA	Fairfax City
		VA	Fairfax County
		VA	Falls Church City
		VA	Loudoun County
		VA	Manassas City
		VA	Manassas Park City
PM2.5	Nonattainment	PA	Lancaster County
		PA	York County
Carbon Monoxide (CO)	Maintenance	DC	District of Columbia
		MD	Montgomery County
		MD	Prince George's County
		VA	Alexandria City
		VA	Arlington County
		VA	Prince William County

Sources: US Environmental Protection Agency *Green Book* [http://www.epa.gov/oaqps001/greenbk/.] Accessed August, 2012.
Prepared by: ATAC Corporation, August 2012.

As noted above, portions of the General Study Area have been designated as being in nonattainment of standards for ozone and $PM_{2.5}$. **Exhibit 4-16** shows those portions of the General Study Area in non-attainment for ozone. **Exhibit 4-17** shows those areas in the General Study Area in non-attainment for $PM_{2.5}$. Finally, **Exhibit 4-18** shows those portions of the General Study Area that have been designated in maintenance for CO. A general description of these three criteria pollutants follows:

Ozone (O_3): Ozone is found in two regions of the Earth's atmosphere – at ground level and in the upper regions of the atmosphere. Both types of ozone have the same chemical composition (O_3). While upper atmospheric ozone protects the earth from the sun's harmful rays, ground level ozone is the main component of smog. Tropospheric, or ground level ozone, is not emitted directly into the air, but is created by chemical reactions between ozone precursors, including oxides of nitrogen (NO_x) and volatile organic compounds (VOCs). Ozone is likely to reach unhealthy levels on hot sunny days in urban environments. Ozone can also be transported long distances by wind. For this reason, even rural areas can experience high ozone levels.

$PM_{2.5}$: PM is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. "Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These

particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industry, automobiles, and aircraft react in the air.

CO: is a colorless, odorless gas emitted from combustion processes. Nationally and, particularly in urban areas, the majority of CO emissions to ambient air come from mobile sources, and to a significantly lesser degree, from stationary fuel combustion, solvents, fires, and industrial processes.

The FAA has determined that aircraft operations at or above the average mixing height of 3,000 feet AGL have a very small effect on pollutant concentrations at ground level.[52] The mixing height represents the height of the completely mixed portion of the atmosphere that begins at the earth's surface and extends to a few thousand feet overhead where the atmosphere becomes fairly stable.[53]

4.3.9 Greenhouse Gases and Climate Change

Greenhouse gases (GHGs) are naturally occurring and man-made gases that trap heat in the earth's atmosphere. These gases include CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). In 2009, based on data provided by the EPA, the General Accounting Office (GAO) reported that domestic aviation contributed approximately three percent of total national carbon dioxide emissions.[54] Similarly, in its 2010 Environmental Report, the International Civil Aviation Organization (ICAO) estimated that aviation accounted for approximately three percent of all global CO_2 emissions resulting from human activity.[55] CO_2 emissions from aircraft are considered to be the primary GHG of concern by the FAA.

In October 2010, the CEQ issued the *Federal GHG Accounting and Reporting Guidance* (Guidance) establishing requirements for federal agencies to calculate and report GHG emissions associated with agency operations. The federal guidance also established a single metric for reporting all GHGs in metric tons (MT) of CO_2 equivalent (CO_2e) or $MTCO_2e$.

For purposes of this EA, total $MTCO_2e$ were calculated using the amount of fuel burned by IFR aircraft arriving and departing from the Study Airports in the General Study Area as estimated by the NIRS model. Fuel burn calculations are discussed in Section 4.3.7, *Energy Supply*. The calculated fuel burn was used to estimate the total MT of CO_2, reported here as $MTCO_2e$. **Table 4-10** presents the total estimated $MTCO_2e$ along with estimates of all national and global emissions of $MTCO_2e$.

[52] Wayson, Roger, and Fleming, Gregg, "Consideration of Air Quality Impacts by Airplane Operations at or Above 3000 feet AGL," Volpe National Transportations Systems Center and FAA Office of Environment & Energy, FAA-AEE-00-01-DTS-34, September 2000. (http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/)

[53] Department of Transportation, Federal Aviation Administration, *Air Quality Procedures For Civilian Airports & Air Force Bases*, April 1997. (http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/media/Handbook.PDF)

[54] United States Congress, U.S. Government Accountability Office, *Aviation and Climate Change. GAO Report to Congressional Committees*, (2009).
(http://www.gao.gov/new.items/d09554.pdf).

[55] Alan Melrose, "European ATM and Climate Adaptation: A Scoping Study," in *ICAO Environmental Report*. (2010).

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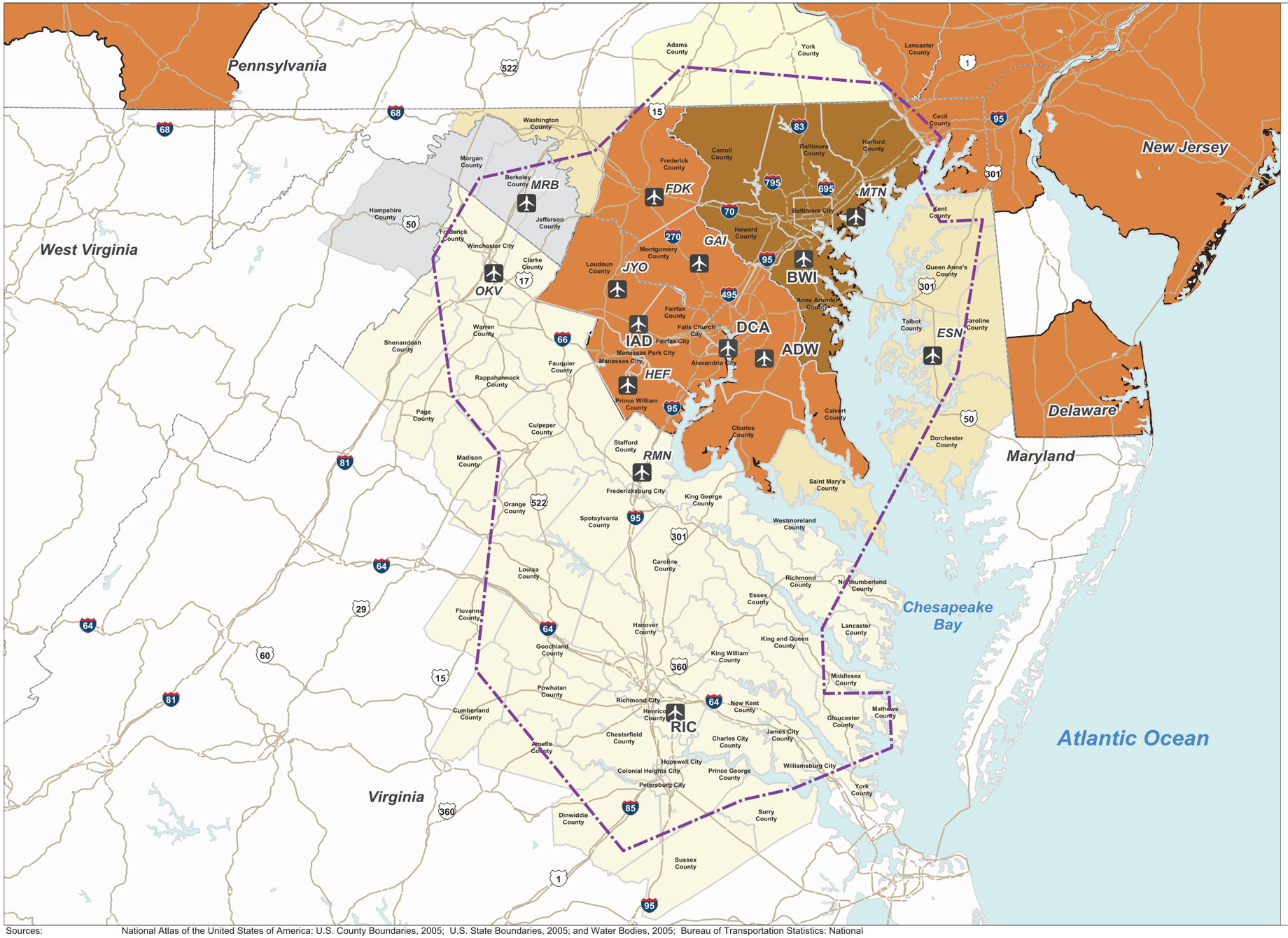

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water

Ozone Nonattainment
- Marginal
- Moderate

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Environmental Protection Agency: The Green Book Nonattainment Areas for Criteria Pollutants; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-16

8-Hour Ozone Nonattainment Areas in the General Study Area

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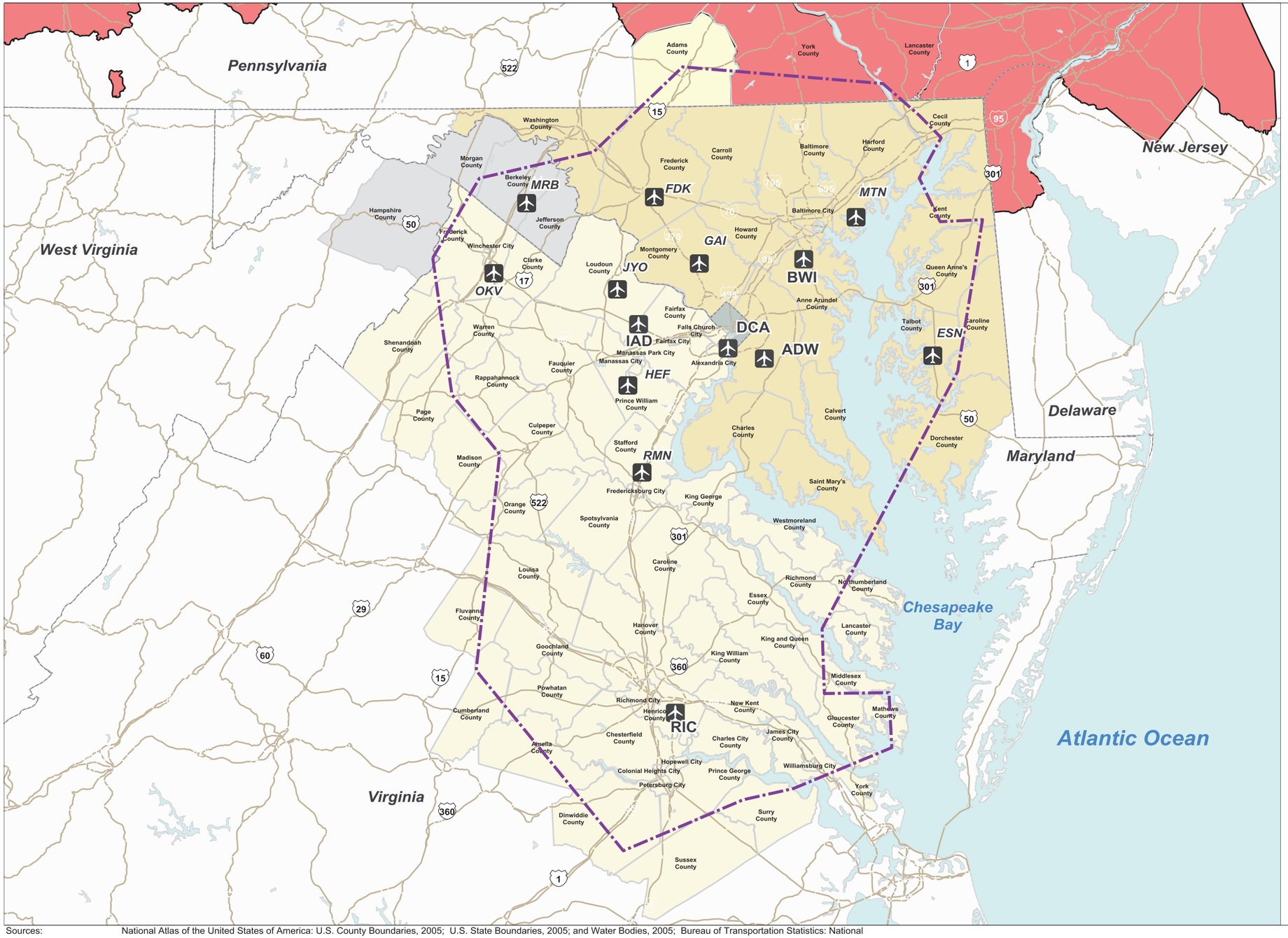

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- PM 2.5 Nonattainment Area

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Environmental Protection Agency: The Green Book Nonattainment Areas for Criteria Pollutants; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-17

PM-2.5 Non-Attainment Areas in the General Study Area

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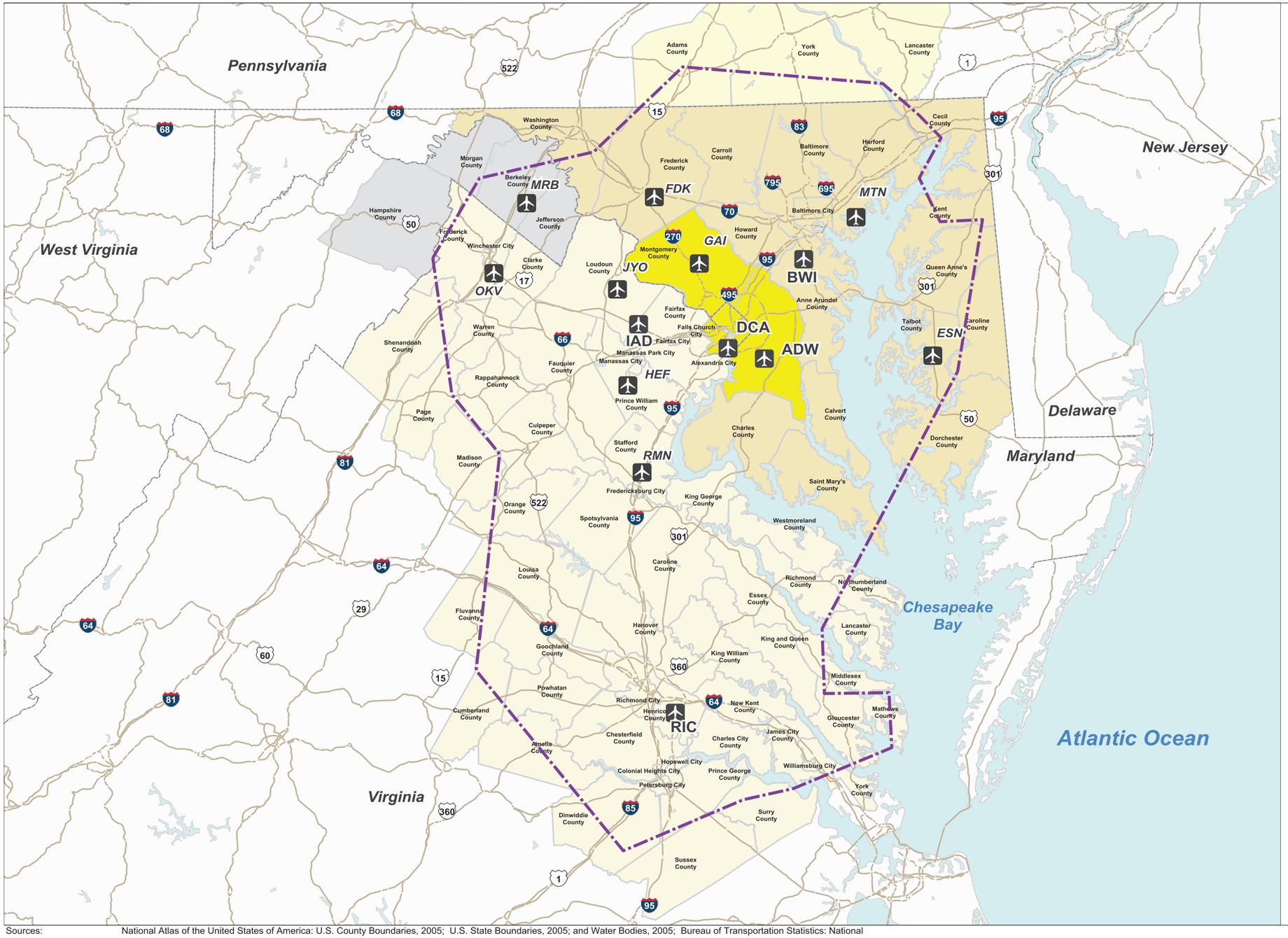

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- CO Maintenance Area

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; U.S. Environmental Protection Agency: The Green Book Nonattainment Areas for Criteria Pollutants; ATAC Corporation: Study Area Boundary, 2012.

Prepared by: ATAC Corporation, June 2013.

Exhibit 4-18

CO Maintenance Areas in the General Study Area

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Table 4-10 DC OAPM CO_2e Estimates (2011)

DC OAPM	National	Global
0.0068 MMT	148 MMT	50,100 MMT[1]

Notes:
1\ 2010 estimate.
MMT=Million Metric Tons

Source: ATAC Corporation, March 2013; U.S. EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011 (EPA 430-R-13-001), April 12, 2013; United Nations Environment Programme, The Emissions Gap Report 2012, November 2012.
Prepared by: ATAC Corporation, April 2013.

4.3.10 Light Emissions and Visual Impact – Visual impact Sub-Category

The General Study Area includes approximately 19,348 square statute miles of developed and undeveloped areas consisting of portions of four states and the District of Columbia, including major urbanized regions. A large number of aircraft operate within the General Study Area and numerous aircraft are regularly visible within General Study Area airspace flying at various altitudes. Aircraft operations include arrivals, departures, and overflights. According to Federal Aviation Regulation (FAR), Section 91.209, all aircraft are required to operate with position lights during the period between sunset and sunrise. These position lights are intended for the safe movement of aircraft and do not produce significant light emissions; however, these lights are often visible from the ground.

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5 Environmental Consequences

This chapter of the Environmental Assessment (EA) discusses the potential environmental impacts that could result from implementation of the Proposed Action and the No Action Alternative on all relevant environmental resource categories described in Appendix A of Federal Aviation Administration (FAA) Order 1050.1E, Change 1 (FAA Order 1050.1E). Both the Proposed Action and No Action Alternative were evaluated under forecasted 2013 conditions, the first year of implementation for the Proposed Action, and under forecasted 2018 conditions, five years after the expected implementation of the Proposed Action. This impact evaluation includes consideration of the direct, indirect, and cumulative effects associated with the Proposed Action and No Action Alternative, as required under FAA Order 1050.1E.

Potential environmental impacts are identified for the environmental resource categories described in Section 4.3. Neither the Proposed Action nor the No Action Alternative would involve land acquisition; physical changes to the environment resulting from ground disturbance or construction activities; changes in patterns of population movement or growth, increases in public service demands, or business and economic activity; or generation, disturbance, transportation, or treatment of hazardous materials. Therefore, neither alternative would be expected to result in impacts to certain environmental resource categories (please see Section 4.2 for a list of excluded categories). The excluded environmental resource categories are not further discussed in this chapter.

Table 5-1 identifies the environmental impact categories analyzed in this EA, the thresholds of significance used to determine the potential for impacts, and a side-by-side comparative summary of the potential environmental impacts resulting from implementation of the Proposed Action and No Action Alternative.

Table 5-1 Summary of Potential Environmental Impacts (1 of 2)

Environmental Impact Category	Threshold of Significance	Impact? 2013	Impact? 2018
Noise	A significant noise impact would occur if analysis shows that the proposed action will cause noise sensitive areas to experience an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure when compared to the no action alternative for the same timeframe.	No	No
Compatible Land Use	A significant noise impact would occur if analysis shows that the proposed action will cause noise sensitive areas to experience an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure when compared to the no action alternative for the same timeframe.	No	No

Table 5-1 Summary of Potential Environmental Impacts (2 of 2)

Environmental Impact Category	Threshold of Significance	2013	2018
Department of Transportation Act, Section 4(f) Resources	A significant impact would occur pursuant to NEPA when a proposed action either involves more than a minimal physical use of a section 4(f) property or is deemed a "constructive use" substantially impairing the 4(f) property, and mitigation measures do not eliminate or reduce the effects of the use below the threshold of significance (e.g., by replacement in kind of a neighborhood park). Substantial impairment would occur when impacts to section 4(f) lands are sufficiently serious that the value of the site in terms of its prior significance and enjoyment are substantially reduced or lost.	No	No
Historic and Cultural Resources	A significant impact would occur when an action adversely affects a protected property and the responsible FAA official determines that the information from the State and/or Tribal Historic Preservation Officer addressing alternatives to avoid adverse effects and mitigation warrant further study	No	No
Wildlife (Avian and Bat Species)	A significant impact to federally-listed threatened and endangered species would occur when the FWS or NMFS determines that the proposed action would be likely to jeopardize the continued existence of the species in question, or would result in the destruction or adverse modification of Federally-designated critical habitat in the affected area. An action need not involve a threat of extinction to federally listed species to meet the NEPA standard of significance. Lesser impacts including impacts on non-listed species could also constitute a significant impact.	No	No
Environmental Justice	A significant impact would occur if there were disproportionately high and adverse human health or environmental effects on minority and low-income populations.	No	No
Energy Supply (Aircraft Fuel)	A significant impact would occur When an action's construction, operation or maintenance would cause demands that would exceed available or future (project year) natural resources or energy supplies and the responsible FAA official determines that additional analysis in an EIS is necessary	No	No
Air Quality	Potentially significant air quality impacts associated with an FAA project or action would be demonstrated by the project or action exceeding one or more of the NAAQS for any of the time periods analyzed.	No	No
Greenhouse Gases and Climate Change	No significance thresholds have been established.	No	No
Visual Impacts	No significance thresholds have been established.	No	No

Source: FAA Order 1050.1E, Chg 1, Appendix A; ATAC Corporation, April 2013.
Prepared By: ATAC Corporation, June 2013.

The following sections describe the impact findings for each environmental resource category, followed by a discussion of potential cumulative impacts. In summary, no significant impacts to any environmental resource category has been identified.

5.1 Noise

This section discusses the analysis of aircraft noise exposure under the Proposed Action and the No Action Alternative under both 2013 and 2018 conditions. This discussion includes identification of the differences in noise exposure between the Proposed Action and the No Action Alternative. This comparison is used to determine if implementation of the Proposed Action would result in significant noise impacts. Additional information on noise metrics and the basics of noise can be found in **Appendix E**. The *DC OAPM Noise Technical Report*, providing detailed information on the noise analysis prepared for the DC OAPM Project is available by request (refer to **Appendix C** for contact information).

5.1.1 Summary of Impacts

Aircraft noise exposure was modeled for both the Proposed Action and the No Action Alternative under 2013 and 2018 conditions. The noise analysis demonstrates that noise exposure resulting from implementation of the Proposed Action would not result in a day-night average sound level (DNL) increase of 1.5 dBA or higher in noise sensitive areas exposed to DNL 65 dB or higher. Therefore, the Proposed Action would not result in significant noise impacts.

5.1.2 Methodology

The noise analysis evaluated noise exposure to communities within the General Study Area generated by aircraft forecasted to be operating under an Instrument Flight Rules (IFR) filed flight plan (IFR-filed) in areas between the surface and up to 10,000 feet above ground level (AGL). IFR-filed aircraft activity was forecasted for the years 2013 and 2018 and used to model conditions under both the Proposed Action and the No Action Alternative. Noise modeling was conducted using the Noise Integrated Routing System (NIRS) Version 6.1, the FAA's noise model for projects involving air traffic changes over broad areas.

If the Proposed Action is approved, FAA expects to begin and complete implementation in 2013; therefore, aircraft noise modeling was completed for 2013 and five years later (2018) as required by FAA Order 1050.1E. Future year noise exposure levels modeled for the Proposed Action and the No Action Alternative were compared to determine whether there is a potential for noise impacts.

Under both 2013 and 2018 conditions, the Proposed Action and the No Action Alternative have the same number and type of aircraft operations. The Proposed Action does not include development or construction of facilities, such as runways or terminal expansions that would be necessary to accommodate an increase in aviation activity; therefore, no additional growth in operations is anticipated. The noise analysis reflects the change in noise exposure resulting from the proposed changes in aircraft routes (i.e., flight tracks) under the Proposed Action compared to the No Action Alternative.

Detailed information on IFR-filed aircraft operations within the General Study Area was assembled for input into NIRS, and included the following:

Average Annual Day IFR-Filed Aircraft Flight Schedules: The IFR-filed aircraft flight schedules identify arrival and departure times, aircraft types, and origin/destination information for an average annual day (AAD) in 2013 and in 2018. The AAD represents all the aircraft operations for every day in a study year divided by 365, the number of days in a year. The AAD does not reflect a particular day, but is meant to represent a typical day over a period of a year. The forecast was based on the FAA's 2012 Terminal Area Forecast (TAF),[56] modified for 2013 and 2018 with additional details using previously identified arrival/departure times, aircraft types, and origin/destination information. For 2013, a total of 3,021 AAD IFR operations were modeled for all Study Airports. For 2018, a total of 3,390 AAD IFR operations were modeled for all Study Airports.

Flight Tracks: The flight tracks used in modeling were based on radar data collected for the existing conditions (2011) noise analysis and information provided by FAA Air Traffic Control (ATC) personnel. Aircraft routings under both the Proposed Action and the No Action Alternative are depicted on **Exhibits 3-7** through **3-24** in Chapter 3, Alternatives. For the Proposed Action, flight tracks were developed from the aircraft procedures created by the DC OAPM Design & Implementation (D&I) Team using the Terminal Area Route Generation, Evaluation, Traffic and Simulation (TARGETS) program. The majority of the No Action Alternative modeled flight tracks are based on the existing conditions noise analysis. The flight tracks for amended or new procedures that are part of the No Action Alternative were modeled based on input from ATC subject matter experts who developed the procedures.

Runway Use: Runway use percentages were identified for all runways at the Study Airports. Forecasted aircraft operations were assigned to particular runways representing operating conditions at the Study Airports under Proposed Action and No Action Alternative conditions. The Proposed Action Alternative was not expected to change runway use patterns at the Study Airports compared to the No Action Alternative.

More detail related to the development of the NIRS model input files is provided in the *DC OAPM Noise Technical Report*, which is available upon request (please see **Appendix C** for contact information).

As discussed in Section 4.3.1.1, the NIRS model was used to compute DNL values for 2013 and 2018 Proposed Action and No Action Alternative conditions at three sets of data points throughout the General Study Area:

1. 222,656 2010 Census block centroids, of (126,316 centroids represent areas with population and the remaining 96,340 centroids represent areas with no population);
2. 4,433 uniform grid points at 0.5-nautical mile intervals on a uniform grid covering the General Study Area and used to calculate DNL values at potential Department of Transportation (DOT) Act, Section 4(f) resources and historic sites; and,
3. 14,395 unique points representing Section 4(f) resources and historic sites too small to be captured in the uniform grid.

[56] Federal Aviation Administration, Terminal Area Forecast (2012)(https://aspm.faa.gov/main/taf.asp)(Accessed March 2013.)

As discussed in Section 4.3.1.1, Section 14, paragraph 14.5e of Appendix A to FAA Order 1050.1E, requires analysis of aircraft noise using the DNL metric. **Table 5-2** provides the criteria used to assess the changes in aircraft noise exposure attributable to the Proposed Action compared with the No Action Alternative. FAA Order 1050.1E describes an increase of DNL 1.5 dB at a noise sensitive land use (e.g., residences, schools, etc.) exposed to aircraft noise of DNL 65 dB or higher under the Proposed Action as a significant impact. For example, an increase from 63.5 dB to 65 dB is considered a significant impact.

In addition, in response to a recommendation made in 1992 by the Federal Interagency Committee on Noise (FICON), FAA Order 1050.1E also recommends that in instances where there are increases of DNL 1.5 dB or more at noise sensitive locations in areas exposed to aircraft noise of DNL 65 dB and higher, that noise increases of DNL 3 dB or more in areas exposed to aircraft noise between DNL 60 dB and 65 dB should also be evaluated and disclosed. It is important to note that increases of DNL 3 dB in areas exposed to aircraft noise below DNL 65 dB are not considered "significant impacts" but are to be considered in the environmental evaluation of a proposed project.

FAA Order 1050.1E also stipulates that changes in exposure of DNL 5 dB or greater in areas exposed to aircraft noise between DNL 45 dB and 60 dB should be considered for airspace actions, such as changes to air traffic routes. This threshold was established in 1990, following issuance of an FAA noise screening procedure to evaluate whether certain airspace actions above 3,000 feet AGL might increase DNL levels by DNL 5 dB or more. The noise screening procedure was prepared as a result of FAA experience that indicates that increases in noise of DNL 5 dB or more at cumulative levels well below DNL 65 dB could be disturbing to people and become a source of public concern.

Table 5-2 Criteria for Determining Impact of Changes in Aircraft Noise

DNL Noise Exposure Level	Increase in DNL with Proposed Action	Aircraft Noise Exposure Change Consideration
DNL 65 and higher	DNL 1.5 dB or more [1/]	Exceeds Threshold of Significance
DNL 60 to 65	DNL 3.0 dB or more [2/]	Considered When Evaluating Air Traffic Actions
DNL 45 to 60	DNL 5.0 dB or more [3/]	Information Disclosed When Evaluating Air Traffic Actions

Notes:
1/ Source FAA, Order 1050.1E, Appendix A, Paragraph 14.3; Title 14 C.F.R. Part 150.21 (2)(d); and Federal Interagency Committee on Noise, Federal Agency Review of Selected Airport Noise Issues, August 1992.
2/ Source FAA Order 1050.1E, Appendix A, Paragraphs 14.4c and 14.5e; and Federal Interagency Committee on Noise, Federal Agency Review of Selected Airport Noise Issues, August 1992.
3/ Source FAA Order 1050.1E, Appendix A, Paragraph 14.5e.

Source: FAA Order 1050.1E, Appendix A. June 8, 2004.
Prepared By: ATAC Corporation, March 2013.

5.1.3 Potential Impacts – 2013

Table 5-3 summarizes the results of the noise analysis for 2013 conditions. The results indicate that the Proposed Action when compared to the No Action Alternative would not result in a DNL 1.5 dBA or higher increase in noise in sensitive areas exposed to DNL 65 dB or higher. Furthermore, no population would experience a reportable noise increase in areas exposed to DNL between 60 dB and 65 dB. However, a total of 17,445 people, associated with 252 population centroids located west of RIC would experience a DNL 5 dB increase in areas exposed to DNL between 45 dB and 60 dB. This reportable noise

increase is attributable to aircraft operating on the KALLI ONE SID, which includes a level segment for the first waypoint on the procedure that requires aircraft to be at 5,000 feet. The level segment is required to ensure aircraft are safely separated from aircraft operating above KALLI ONE. Not all departures from RIC heading west would remain level over the waypoint. If there are no aircraft present above KALLI ONE, RIC departures would be instructed to continue the climb. The reportable noise increase is associated with those aircraft forecasted to stay level above the first waypoint.

Exhibit 5-1 shows the location of the population centroids that would experience the reportable noise increase under 2013 conditions. Although there is a reportable noise increase in 2013, these results indicate that the Proposed Action would not result in a significant noise exposure impact on population exposed to DNL 65 dB or higher levels under the Proposed Action. Detailed information on the population centroids that would experience a reportable noise increase is provided in **Appendix H**.

Table 5-3 Change in Potential Population Exposed to Aircraft Noise - 2013

DNL Noise Exposure Level Under the Proposed Action	Increase in DNL with the Proposed Action	Population Exposed to Noise that Exceeds the Threshold
DNL 65 and higher	DNL 1.5 dB or greater	0
DNL 60 to 65	DNL 3.0 dB or greater	0
DNL 45 to 60	DNL 5.0 dB or greater	17,445

Source: 2010 U.S. Census (population centroid data), August 2012; ATAC Corporation, April 2013 (NIRS modeling results).
Prepared By: ATAC Corporation, April 2013.

5.1.4 Potential Impacts – 2018

Potential impacts were also evaluated under 2018 conditions for both the Proposed Action and No Action Alternative using the same methodology and criteria employed to analyze impacts under 2013 conditions. **Table 5-4** summarizes the results of the noise change analysis prepared for 2018.

The noise analysis results indicate that the Proposed Action when compared to the No Action Alternative would not result in a DNL 1.5 dBA or higher increase in sensitive areas exposed to DNL 65 dB or higher. In addition, no population would be exposed to reportable noise increases between DNL 60 dB and 65 dB. However, a total of 20,239 people associated with 290 population centroids would experience a DNL 5 dB increase in areas exposed to DNL between 45 dB and 60 dB. All the population centroids with the exception of one are located to the west of RIC. The reportable noise increases for the population centroids located west of RIC are attributable to aircraft operating on the KALLI ONE SID in the same way as described under 2013 conditions.

The reportable noise increase associated with the single centroid located to the east of RIC is attributable to aircraft operating on the LUCYL ONE SID. In particular, the noise increase can be attributed to a shift and concentration of departure traffic to the TEAZZ waypoint, approximately 12 nmi northeast of RIC.

Exhibit 5-2 shows the location of the population centroids that would experience the reportable noise increase. Although there is a reportable noise increase in 2018, these results indicate that the Proposed Action would not result in a significant noise exposure impact on population exposed to DNL 65 dB or higher levels under the Proposed Action.

Detailed information on the population centroids that would experience a reportable noise increase is provided in **Appendix H**.

Table 5-4 Change in Potential Population Exposed to Aircraft Noise - 2018

DNL Noise Exposure Level Under the Proposed Action	Increase in DNL with the Proposed Action	Population Exposed to Noise that Exceeds the Threshold
DNL 65 and higher	DNL 1.5 dB or greater	0
DNL 60 to 65	DNL 3.0 dB or greater	0
DNL 45 to 60	DNL 5.0 dB or greater	20,239

Source: 2010 U.S. Census (population centroid data), August 2012; ATAC Corporation, April 2013 (NIRS modeling results).
Prepared By: ATAC Corporation, April 2013.

5.2 Compatible Land Use

This section discusses potential impacts to compatible land use under the Proposed Action and the No Action Alternative.

5.2.1 Summary of Impacts

Under both the Proposed Action and No Action Alternative, there would be no changes in aircraft noise exposure that would exceed the FAA's significance thresholds for noise impacts on people. Therefore, neither the Proposed Action nor the No Action Alternative would result in compatible land use impacts.

5.2.2 Methodology

Potential impacts to compatible land use were focused on changes in aircraft noise exposure resulting from implementation of the Proposed Action. FAA Order 1050.1E states, "The compatibility of existing and planned land uses in the vicinity of an airport is usually associated with the extent of the airport's noise impacts…. If the noise analysis … concludes that there is no significant impact, a similar conclusion usually may be drawn with respect to compatible land use." (FAA Order 1050.1E, Appendix A, Sec, 4,1.a.) Accordingly, the compatible land use analysis relies on changes in aircraft noise exposure between the Proposed Action and the No Action Alternative (discussed in Section 5.1), as the basis for determining compatible land use impacts within the General Study Area.

5.2.3 Potential Impacts – 2013 and 2018

As stated in Section 5.1, the Proposed Action, when compared with the No Action Alternative, would not result in changes in aircraft noise exposure in 2013 or 2018 that would exceed FAA's significance thresholds. Therefore, the Proposed Action would not result in significant compatible land use impacts.

Under the No Action Alternative, there would be no changes to air traffic routing in the General Study Area and no changes in aircraft noise exposure would be anticipated to occur in either 2013 or 2018. Therefore, the No Action Alternative would not result in significant compatible land use impacts.

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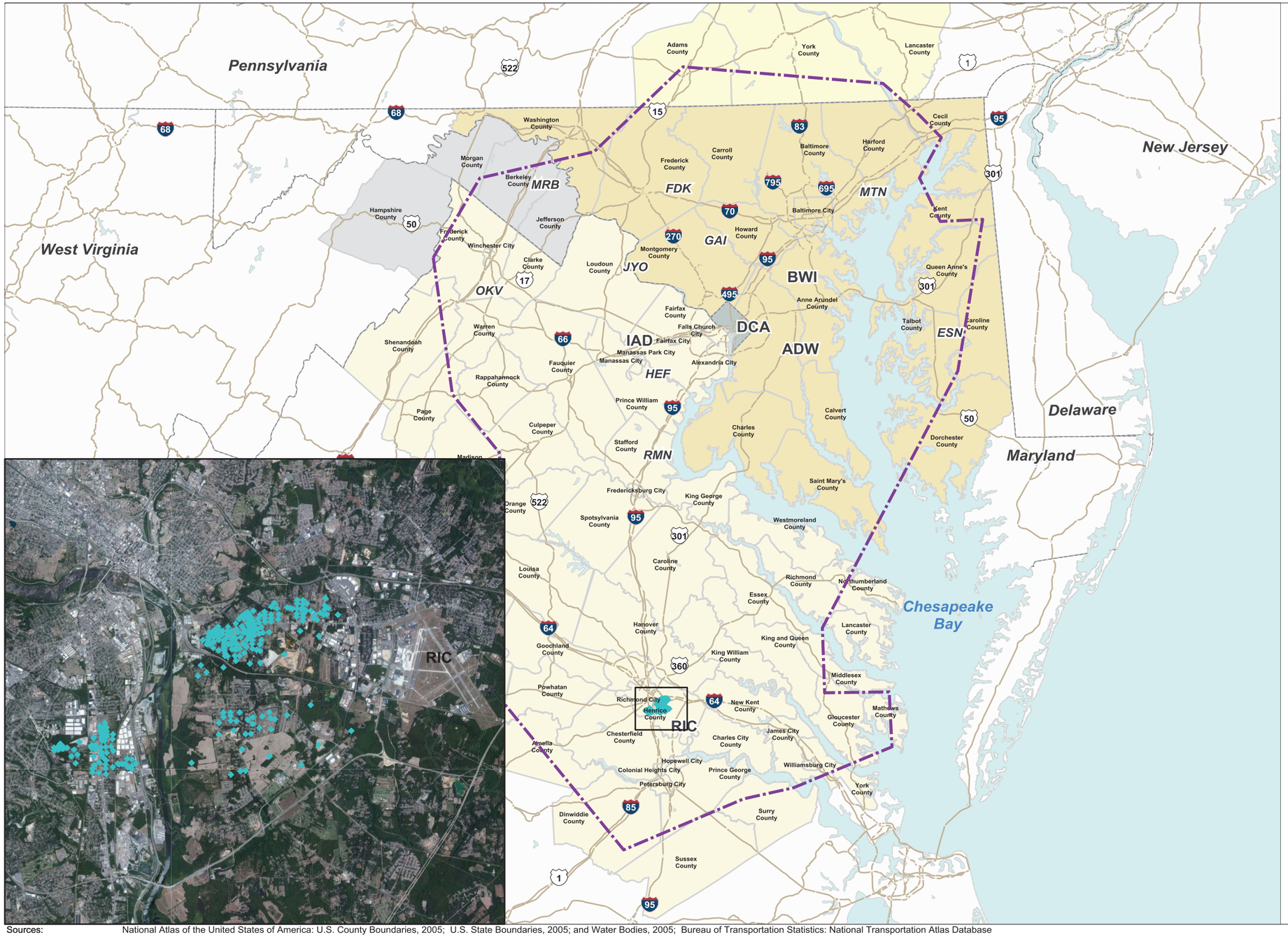

LEGEND

- General Study Area
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Population centroids experiencing a DNL 5.0 dB increase in areas exposed to DNL 45 dB - 60 dB

Notes:
The electronic version of this document is zoomable.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; Virtual Earth: Satellite Imagery, 2013; ATAC Corporation: Study Area Boundary, 2012, and Noise Levels, 2013.
Prepared by: ATAC Corporation, June 2013.

Exhibit 5-1

Change in Potential Population Exposed to Aircraft Noise - 2013

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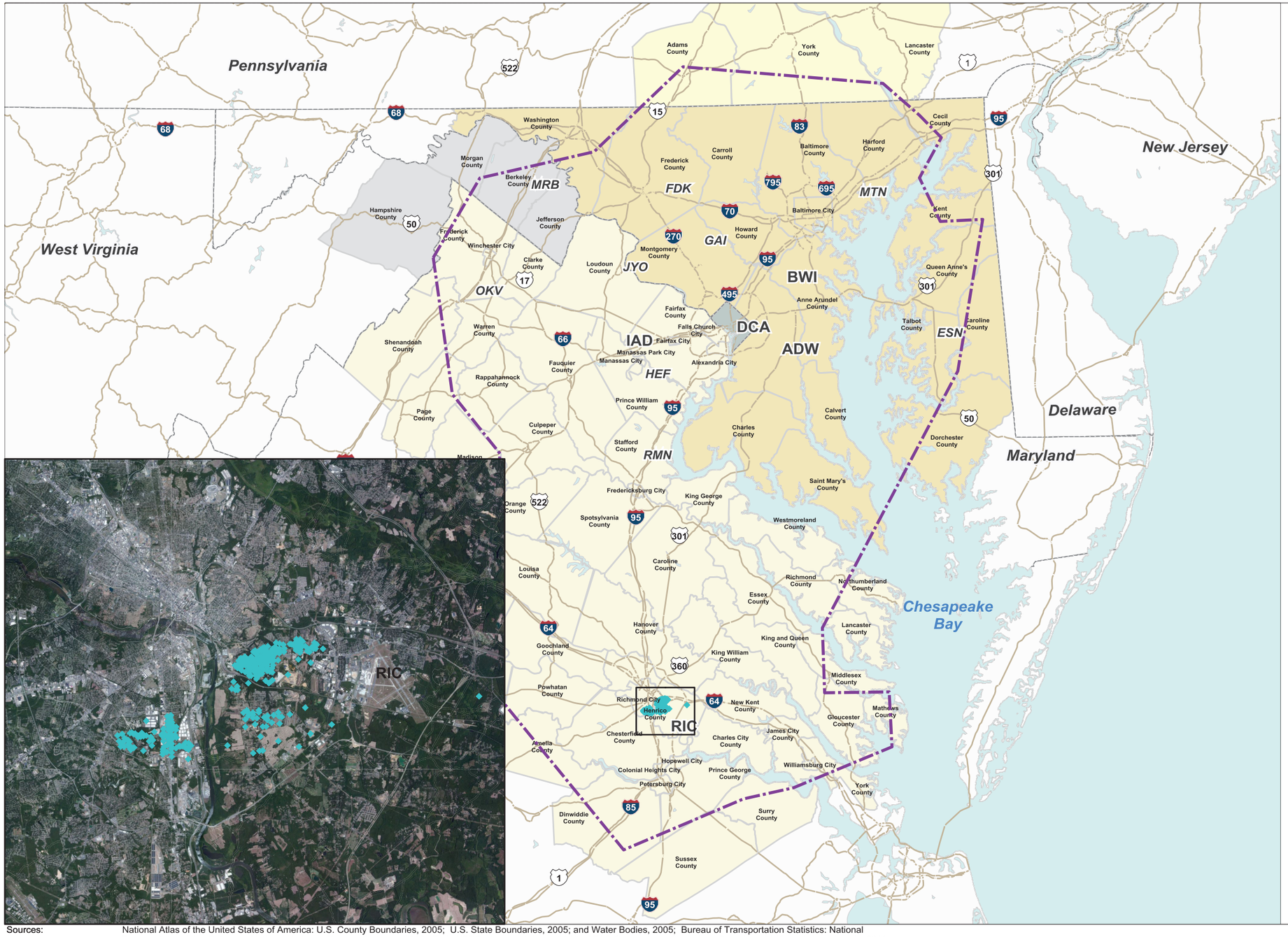

LEGEND

- General Study Area
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Population centroids experiencing a DNL 5.0 dB increase in areas exposed to DNL 45 dB - 60 dB

Notes:
The electronic version of this document is zoomable.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2012, and Noise Levels, 2013.

Prepared by: ATAC Corporation, June 2013.

Exhibit 5-2

Change in Potential Population Exposed to Aircraft Noise - 2018

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5.3 Department of Transportation Act, Section 4(f) Resources

This section discusses potential impacts to Department of Transportation (DOT) Act, Section 4(f) Resources. Section 4(f) resources within the General Study Area are described in Section 4.3.3, and are depicted on **Exhibit 4-4**.

5.3.1 Summary of Impacts

Potential impacts to Section 4(f) were focused on changes in aircraft noise exposure resulting from implementation of the Proposed Action. Under the Proposed Action, the aircraft noise exposure analysis indicates that the Proposed Action would not substantially change the noise environment at any Section 4(f) resource identified within the General Study Area when compared with the No Action Alternative. Therefore, no constructive use of a Section 4(f) resource associated with the Proposed Action would occur and no impacts would be anticipated.

Under the No Action Alternative, no changes in air traffic routes in the General Study Area would occur; therefore, no changes to aircraft noise exposure or aircraft overflight patterns would occur over Section 4(f) resources and no impacts would be anticipated.

5.3.2 Methodology

The FAA evaluates potential effects on Section 4(f) resources in terms of both direct impacts (physical use) and indirect impacts (constructive use). A direct impact would occur as a result of land acquisition, construction, or other ground disturbance activities that would result in physical use of all or a portion of a Section 4(f) property. As land acquisition, construction, or other ground disturbance activities would not occur under either the Proposed Action or the No Action Alternative, neither alternative would have the potential to cause a direct impact to a Section 4(f) resource. Therefore, analysis of potential impacts to Section 4(f) resources is limited to identifying indirect impacts resulting from “constructive use.” A constructive use of a Section 4(f) resource would occur if there is a substantial impairment of the resource to the degree that the activities, features, or attributes of the site that contribute to its significance or enjoyment are substantially diminished. This could occur as a result of both visual and noise impacts. Visual Impacts are further discussed in Section 5.10. As regards aircraft noise, a constructive use would occur should noise levels substantially impair the resource.

Noise exposure levels were calculated for grid points placed at Section 4(f) properties. The grid points used are further discussed in Section 5.1.2. The analysis of potential impacts to Section 4(f) resources considered whether these properties would experience a significant noise increase, when comparing the Proposed Action with the No Action Alternative, using the applicable thresholds shown in **Table 5-2**.

FAA Order 1050.1E requires that additional factors be weighed in determining whether to apply the thresholds listed above in determining the significance of noise impacts on Section 4(f) properties. If a reportable noise increase were to occur, the Section 4(f) properties would be evaluated further to determine if the project-related effects would constitute a constructive use. Further evaluation may include confirming that the property is in fact a Section 4(f) resource as well as identifying the specific attributes for which the property is managed (e.g., for traditional recreational uses or where other noise is very low and a quiet setting is a generally recognized purpose and attribute).

With regard to Land and Water Conservation Fund (LWCF) resources, FAA Order 1050.1E stipulates that replacement satisfactory to the Secretary of the Interior is specifically required for recreation lands aided by the Department of Interior's LWCF in cases where such a resource is "used" by a transportation project. Therefore, these resources are considered as a part of the Section 4(f) impact analysis process.

5.3.3 Potential Impacts – 2013 and 2018

A reportable change in noise level meeting the criteria described in Section 5.3.2 was identified at six grid points representing five Section 4(f) resources. These resources include three local parks/recreational facilities (Davee Gardens Fitness Park, Hickory Hill Community Center, and the Ruffin Road Elementary School Annex) and two historic resources listed on the National Register of Historic Places (NRHP) (Richmond National Cemetery and the Clarke-Palmore House) These facilities are located between three and seven miles west of RIC. The cause for the reportable change in noise is attributable to the KALLI SID for RIC, discussed in greater detail in Sections 5.1.3 and 5.1.4.

Table 5-5 describes the change in DNL at these facilities under the Proposed Action compared to the No Action Alternatives under both 2013 and 2018 conditions. While the difference in noise conditions represent reportable noise increases, FAR Part 150 compatible land use guidelines recognize all land uses as being compatible in areas exposed to DNL 50 dB and below. Therefore, the Proposed Action would not result in a direct or constructive use of potential Section 4(f) resources in 2013 or 2018.

Table 5-5 Summary of Noise Exposure at Potential Section 4(f) Properties (2013 and 2018) (1 of 2)

Year	Property Name	Address	DNL No Action Alternative	DNL Proposed Action	Change
2013	Clarke-Palmore House	904 McCoul St., Richmond, VA 23231	40.4	46.1	5.7
2013	Clarke-Palmore House	904 McCoul St., Richmond, VA 23231	40.1	45.6	5.6
2013	Davee Garden Fitness Park	3412 Ryburn St., Richmond, VA 23234	40.3	46.2	5.8
2013	Hickory Hill Community Center	3000 E. Belt Blvd. Richmond, VA 23224	40.4	45.5	5.1
2013	Richmond National Cemetery	1701 Williamsburg Rd. Richmond, VA 23231	41.9	48.5	6.6
2013	Ruffin Road Elementary School Annex	2001 Ruffin Rd. Richmond, VA 23224	40.0	46.1	6.1
2018	Clarke-Palmore House	904 McCoul St., Richmond, VA 23231	40.5	46.4	5.9
2018	Clarke-Palmore House	904 McCoul St., Richmond, VA 23231	40.2	45.9	5.7

Table 5-5 Summary of Noise Exposure at Potential Section 4(f) Properties (2013 and 2018) (2 of 2)

Year	Property Name	Address	DNL No Action Alternative	DNL Proposed Action	Change
2018	Davee Garden Fitness Park	3412 Ryburn St., Richmond, VA 23234	40.6	46.6	6.00
2018	Hickory Hill Community Center	3000 E. Belt Blvd. Richmond, VA 23224	40.3	46.5	6.2
2018	Richmond National Cemetery	1701 Williamsburg Rd. Richmond, VA 23231	40.5	46.4	5.9
2018	Ruffin Road Elementary School Annex	2001 Ruffin Rd. Richmond, VA 23224	40.2	45.9	5.7

Notes:
Totals may not add up due to rounding.

Source: ATAC Corporation, May 2013 (NIRS modeling results).
Prepared By: ATAC Corporation, June 2013.

Under the No Action Alternative no changes to air traffic routes in the DC Metroplex would occur in either 2013 or 2018 and no effects related to changes in aircraft noise exposure would be anticipated. Therefore, the No Action Alternative would not result in potential impacts to Section 4(f) resources.

5.4 Historic and Cultural Resources

This section discusses the analysis of impacts to historic resources and tribal lands under the Proposed Action and the No Action Alternative. Information on historic resources and tribal lands within the General Study Area is provided in Section 4.3.4. The FAA has initiated consultation with the appropriate State Historic Preservation Officers (SHPOs) and Tribal Historic Preservation Officer (THPOs), as well as relevant local agencies, in accordance with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. § 470 *et seq*.) and the implementing regulations at 36 C.F.R. Part 800.

5.4.1 Summary of Impacts

The aircraft noise exposure analysis indicates that there would be no substantial change to the noise environment at any historic resource or tribal land under the Proposed Action compared with the No Action Alternative. Furthermore, any changes in aircraft traffic patterns are expected to occur at altitudes and distances from viewers that would not substantially impair the view or setting of historic resources or tribal lands. Therefore, no adverse indirect effects to historic resources or tribal lands under the Proposed Action would be anticipated for 2013 or 2018.

Under the No Action Alternative no changes to air traffic routes in the DC Metroplex would occur in either 2013 or 2018 and no changes to aircraft noise exposure or changes in aircraft overflight patterns over historic resources or tribal lands would be anticipated. Therefore, historic resources or tribal lands would not be affected by aircraft noise nor would viewers at historic resources or tribal lands experience visual impacts under the No Action Alternative.

5.4.2 Methodology

The National Historic Preservation Act of 1966 requires the FAA to consider the effects of its undertakings on properties listed or eligible for listing in the NRHP. In assessing whether an undertaking, such as the Proposed Action, affects a property listed or eligible for listing on the NRHP, FAA must consider both direct and indirect effects. Direct effects include the physical removal or alteration of an historic resource. Indirect effects include changes in the environment of the historic resource that could substantially alter the characteristics that made it eligible for listing on the National Register. Such changes could include changes in noise exposure and visual impacts. Visual Impacts are further discussed in Section 5.10.

To assess the potential indirect effects of the Proposed Action on historic resources, an area of potential effect (APE) was defined. Federal regulations define the APE as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.

For purposes of this analysis, the APE was defined as being contiguous with the General Study Area. Potential historic resources were identified within the General Study Area and their locations are shown on **Exhibit 4-5** in Section 4.3.4. No Indian reservations or tribal lands were identified within the General Study Area. Any historic and cultural resources identified as being within the APE would require further evaluation by the FAA to determine if the property may experience a potential adverse effect. For purposes of determining potential adverse effects, noise exposure levels were calculated at points representing these properties.

The analysis of potential impacts to historic resources considers whether these properties would experience a significant noise increase, when comparing the Proposed Action with the No Action Alternative, using the applicable thresholds shown in **Table 5-2**.

Properties exposed to DNL 65 dB or higher under the Proposed Action and an increase of DNL 1.5 dB or higher may be considered to be potentially adversely effected by the project. Formal consultation with the appropriate SHPO/THPO would be conducted to confirm the determination. If reportable increases in noise are detected for properties exposed to DNL between DNL 45 dB and lower than 65 dB, the FAA would consider further whether the increase would result in an adverse effect on historic properties. If the noise analysis indicates a reportable change for the resources, further research and/or survey on the subject property may be conducted to determine if the reportable increase would diminish the integrity of a property's setting for which the setting contributes to historical or cultural significance.

5.4.3 Potential Impacts – 2013 and 2018

A reportable change in noise level meeting the criteria described in Section 5.4.2 was identified at two facilities, the Richmond National Cemetery and the Clarke-Palmore House, depicted on **Exhibit 5-3**. Both resources are listed on the NRHP. **Table 5-6** describes the change in DNL at these facilities under the Proposed Action compared to the No Action Alternative in both 2013 and 2018. The cause for the reportable change in noise is attributable to the KALLI SID for RIC, discussed in greater detail in Sections 5.1.3 and 5.1.4.

Table 5-6 Summary of Noise Exposure at Historic Resources (2013 and 2018)

Year	Property Name	Address	DNL No Action Alternative	DNL Proposed Action	Change
2013	Clarke-Palmore House	904 McCoul St., Richmond, VA 23231	40.4	46.1	5.7
2013	Clarke-Palmore House	904 McCoul St., Richmond, VA 23231	40.1	45.6	5.6
2013	Richmond National Cemetery	1701 Williamsburg Rd. Richmond, VA 23231	41.9	48.5	6.6
2018	Clarke-Palmore House	904 McCoul St., Richmond, VA 23231	40.5	46.4	5.9
2018	Clarke-Palmore House	904 McCoul St., Richmond, VA 23231	40.2	45.9	5.7
2018	Richmond National Cemetery	1701 Williamsburg Rd. Richmond, VA 23231	40.5	46.4	5.9

Notes:
Totals may not add up due to rounding.

Source: ATAC Corporation, May 2013 (NIRS modeling results).
Prepared By: ATAC Corporation, June 2013.

While the DNL levels calculated at these facilities represent reportable noise increases, noise exposure at both these resources would remain below the significance threshold.

The National Register nomination form for the Richmond National Cemetery identifies the facility as being eligible for listing due to its historic role as a Civil War Era cemetery and for its historic architecture. Similarly, the National Register nomination form for the Clarke-Palmore House identifies the facility as being eligible for listing due to its historic architecture. The reportable noise increase calculated for these facilities would not affect these attributes. Furthermore, analysis indicates that both the Richmond National Cemetery and the Clarke-Palmore house are situated in a residential area within an urbanized environment exposed to typical noise levels associated with human activity (e.g., automobile traffic). Accordingly, any increase in noise associated with the Proposed Action would be unlikely to diminish the integrity of the property's setting in a historical or cultural context. Therefore, the Proposed Action would not result in an adverse effect to Historic and Cultural Resources in either 2013 or 2018.

Under the No Action Alternative no changes to air traffic routes in the DC Metroplex would occur in either 2013 or 2018 and no effects related to changes in aircraft noise exposure would be anticipated. Therefore, the No Action Alternative would not result in impacts to cultural resources.

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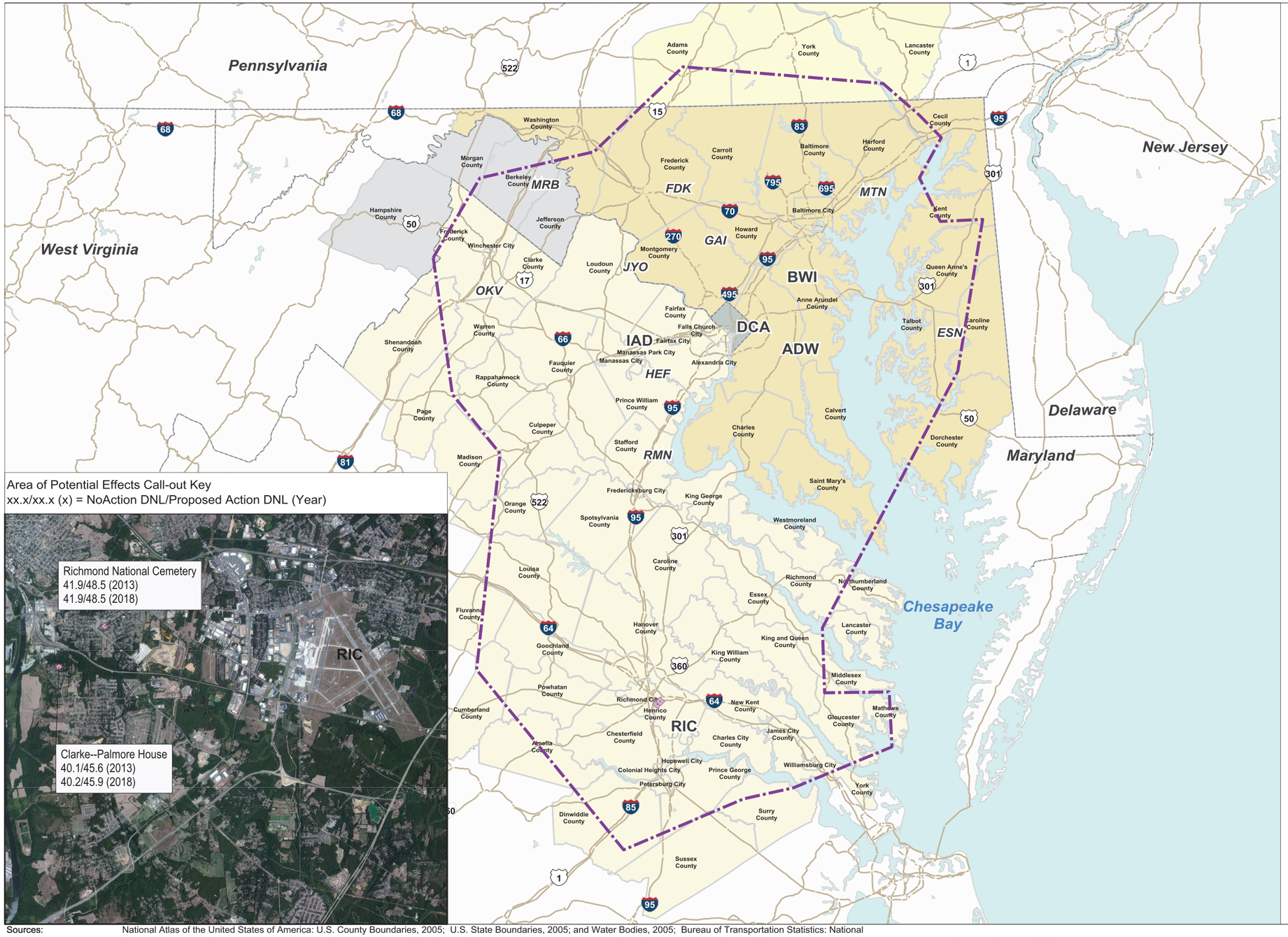

LEGEND

- Area of Potential Effects
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Historic Resource
  (Richmond National Cemetery)
  (Clarke - Palmore House)

Notes:

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore Washington International Airport
ADW	Andrews Air Force Base
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport
OKV	Winchester Regional Airport
MRB	Eastern West Virginia Regional Airport

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boundaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; Virtual Earth: Satellite Imagery, 2013; ATAC Corporation: Study Area Boundary/Area of Potential Effects, 2012/2013.

Prepared by: ATAC Corporation, June 2013.

Exhibit 5-3

Historical, Architectural, and Cultural Resources - Area of Potential Effects

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5.5 Wildlife (Avian and Bat Species)

This section discusses the analysis of potential impacts to avian and bat species under the Proposed Action and the No Action Alternative.

5.5.1 Summary of Impacts

The greatest potential for impacts to wildlife species would result from wildlife strikes on avian and bat species at altitudes below 3,000 feet AGL. Changes to air traffic flows under the Proposed Action would primarily occur above 3,000 feet AGL and operation levels would remain the same as the No Action Alternative; therefore, there would be no significant impacts to avian and bat species under the Proposed Action compared with the No Action Alternative.

The No Action Alternative would not involve changes to air traffic flows, land acquisition, construction, or other ground disturbance activities; therefore, no impacts to fish, wildlife, or plants would occur.

5.5.2 Methodology

The FAA's Wildlife Strike Database is the best information available for assessing potential impacts of aircraft on wildlife. Strike reports over the past 22 years aggregated nationally as well as for individual airports are available from the database to understand existing conditions. Strike reports are comparable to known information on the presence of specific species of concern to corroborate the reports.

This analysis involved a review of arrival and departure flight tracks for the Study Airports under both the Proposed Action and No Action Alternative. Additionally, the altitude of flight tracks above and below 3,000 feet AGL were reviewed, because research has documented that 90 percent of all wildlife strikes nationwide occur below 3,000 feet AGL.[57] The FAA compared modifications in flight procedures to the occurrence of species and populations of concern to assess if existing wildlife strike reports might change under the Proposed Action.

5.5.3 Potential Impacts – 2013 and 2018

Since 1990, the FAA has compiled reports of wildlife strikes with aircraft. The information is available to the public through the National Wildlife Strikes Database and through an analysis provided in an annually issued report. The Wildlife Strike Database reports 133,159 wildlife strikes nationally over a 22-year period between 1990 and 2011.[58] Of the records that indicate the type of animal involved in the strike incident, birds represent 97.1 percent of all strikes.[59] Of those records, 92 percent of the strikes occurred below 3,000 feet AGL.[60] The Wildlife Strike Database reports that gulls have the highest occurrence of strikes (16 percent), followed by doves/pigeons (15 percent).[61]

[57] U.S. Department of Transportation, Federal Aviation Administration, *FAA Wildlife Strike Database* (http://www.faa.gov/airports/airport_safety/wildlife/database/)(Accesed March 15, 2013; last accessed April 25, 2013.)

[58] Id.

[59] Id.

[60] Id.

[61] Id.

The Wildlife Strike Database provides strike information that is reportable by airport, including species struck, height of strike, and type and extent of aircraft damage. **Table 5-7** provides a summary of wildlife strikes reported by Study Airport between 1990 and April 2013. In total, 3,100 records provide strike altitude for incidents involving birds and bats. Of these, a total of 2,812 reported strikes (91 percent of all strike records) occurred at altitudes below 3,000 feet. As discussed above, 1,169 of the strikes reported from the Study Airports included species identification.

The Migratory Bird Treaty Act of 1918 (MBTA), (16 U.S.C. §§ 703–712) protects all the bird species identified in these reports. Furthermore, state and federal laws protect listed endangered and threatened species. The U.S. Fish and Wildlife Service identifies seven federally-listed bird and bat species in Maryland, Pennsylvania, Virginia, and West Virginia. These species include the Gray Bat (*Myotis grisescens*), the Indiana Bat (*Myotis sodalis*), the Virginia big-eared Bat (*Corynorhinus (=Plecotus) townsendii virginianus*), the Piping Plover (*Charadrius melodus*), the Roseate Tern (*Sterna dougallii dougallii*), and the Red-cockaded Woodpecker (*Picoides borealis*). None of these species were identified in strike reports for the Study Airports. However, strike reports for Study Airport in the State of Maryland identified two state-listed species associated with strikes: Peregrine falcon (*Falco peregrinus anatum*) (one report) and the upland sandpiper (*Bartramia longicauda*) (three reports).

The number of aircraft operations between the Proposed Action and No Action Alternative would be the same. Therefore, the assessment of the potential impacts focuses on changes to flight paths and the potential for impact due to wildlife strikes. As shown in **Table 5-7**, only nine percent of bird/bat strikes (288 records) were at altitudes above 3,000 feet AGL. The decline in the number of strike reported above 3,000 feet AGL indicates that there is less likelihood of bird/bat strikes at these altitudes. Under the Proposed Action, the majority of changes to proposed flight paths would occur above 3,000 feet AGL and no significant changes to arrival and departure corridors below 3,000 feet AGL would be expected. In addition, under the Proposed Action, the FAA anticipates increased use of the narrower arrival and departure corridors associated with the RNAV procedures. As narrower corridors would reduce the area in which RNAV equipped aircraft operate, the Proposed Action would not be expected to result in increased impacts to avian and bat species when compared to the No Action Alternative. Therefore, there would be no significant impacts to bird or bat species.

The No Action Alternative would not involve changes to air traffic flows, land acquisition, construction, or other ground disturbance activities; therefore, no impacts to avian and bat species would occur.

Table 5-7 FAA Wildlife Strike Database Records for Study Airports by Altitude (1990 – 2013)

Type of Strike[1]	Airport	3,000 ft. AGL or less	>3,000 ft. AGL to ≤ 10,000 ft. AGL	Greater than 10,000 ft. AGL	Total
Identified Bird and Bat Species					
	ADW	6	0	0	6
	BWI	332	10	0	342
	DCA	329	8	0	337
	ESN	4	0	0	4
	FDK	7	0	0	7
	GAI	2	0	0	2
	HEF	30	0	0	30
	IAD	307	10	1	318
	JYO	2	0	0	2
	MRB	21	0	0	21
	MTN	16	0	0	16
	OKV	0	0	0	0
	RIC	82	2	0	84
Total		1,138	30	1	1,169
Unknown Bird and Bat Species					
	ADW	6	0	0	6
	BWI	500	102	2	604
	DCA	340	37	1	378
	ESN	3	0	0	3
	FDK	4	0	0	4
	GAI	0	0	0	0
	HEF	24	0	0	24
	IAD	609	99	4	712
	JYO	8	1	0	9
	MRB	30	0	0	30
	MTN	20	0	0	20
	OKV	1	0	0	1
	RIC	129	10	1	140
Total		1,674	249	8	1,931
Grand Total		2,812	279	9	3,100
Percentage		91%	9%	<1%	100%

Notes:
[1] Includes both unknown and identified species.
The table does not include 1,438 strike reports that did not report altitudes.
Percentages may not add up due to rounding.

Source: U.S. Department of Transportation, Federal Aviation Administration, *FAA Wildlife Strike Database* (http://wildlife-mitigation.tc.faa.gov/wildlife/default.aspx) (accessed March 14, 2013, last accessed April 25, 2013).
Prepared by: ATAC Corporation, June 2013.

5.6 Environmental Justice

This section presents a summary of the analysis of environmental justice impacts under the Proposed Action and the No Action Alternative.

5.6.1 Summary of Impacts

Neither the Proposed Action nor the No Action Alternative would displace people or businesses; therefore, implementation of the Proposed Action and No Action Alternative would not result in direct impacts in this category.

No areas within the General Study Area would experience a significant impact related to a change in DNL exposure to people (refer to Section 5.1); therefore, no disproportionately high and adverse effects to children, minority populations, or low-income populations would occur under either the Proposed Action or the No Action Alternative.

5.6.2 Methodology

Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires that federal agencies include environmental justice as part of their mission by identifying and addressing as appropriate, the potential for disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations, low-income populations, and Native American tribes. Environmental justice applies to all environmental resources. Therefore, a disproportionately high and adverse human health or environmental effect on minority and low-income populations may represent a significant impact.

5.6.3 Potential Impacts – 2013 and 2018

Under the Proposed Action, neither people nor businesses would be displaced. As discussed in Section 5.1, under the Proposed Action, no census block centroids in the General Study Area would experience a change in noise exposure in 2013 or 2018 that exceeds any of FAA's thresholds defining significant noise impacts on people. Therefore, no adverse direct or indirect effects would occur to any environmental justice populations within the General Study Area under the Proposed Action for 2013 and 2018.

Under the No Action Alternative, neither people nor businesses would be displaced. Furthermore, air traffic routes would not change and there would be no change in aircraft noise exposure in 2013 or 2018 that could result in an indirect impact. Therefore, the No Action Alternative would not result in disproportionately high and adverse human health or environmental effects on minority and low- income populations.

5.7 Energy Supply (Aircraft Fuel)

This section discusses whether changes in the movement of aircraft would result in measurable effects on local energy supplies under the Proposed Action and the No Action Alternative.

5.7.1 Summary of Impacts

The Proposed Action would involve changes to air traffic flows; however, the optimized air traffic routes under the Proposed Action would improve route efficiency and would be expected to reduce aircraft fuel consumption overall. Therefore, the Proposed Action would not result in the depletion of local supplies of energy.

The No Action Alternative would not involve changes to air traffic flows, construction, or other ground disturbance activities; therefore, the No Action Alternative would not result in the depletion of local energy supplies.

5.7.2 Methodology

The Proposed Action would not change the number of aircraft operations relative to the No Action Alternative, but it would involve changes to air traffic flows during the departure, descent, and approach phases of flight. These changes affect both the route an aircraft may follow as well as its climb-out and descent profiles. This in turn may directly affect aircraft fuel burn (or fuel expended). Aircraft fuel burn is considered a proxy for determining whether the Proposed Action would have a measurable effect on local energy supplies when compared with the No Action Alternative.

In addition to calculating aircraft noise exposure, the FAA's NIRS noise model calculates aircraft-related fuel burn (e.g., AAD flight schedules, flight tracks, and runway use). See Section 5.1.2 for further discussion on NIRS input data. Determining the difference in fuel burn between alternatives can be used as an indicator of changes in fuel consumption resulting from implementation of the Proposed Action when compared with the No Action Alternative.

5.7.3 Potential Impacts – 2013 and 2018

Table 5-8 presents the results of the fuel burn analysis for the Proposed Action and No Action Alternative. Compared with the No Action Alternative, the Proposed Action would result in a decrease in total metric tons of aircraft fuel burned: 20.93 fewer metric tons in 2013 and 23.73 fewer metric tons in 2018. Therefore, there would be no significant impact to energy supply.

Table 5-8 Energy Consumption Comparison

	2013		2018	
	No Action Alternative	**Proposed Action**	**No Action Alternative**	**Proposed Action**
Fuel Burn (MT)	2,302.10	2,281.17	2,607.77	2,584.03
Volume Change (MT) (Proposed Action – No Action Alternative)		-20.93		-23.73
Percent Change from No Action Alternative		-0.91%		-0.91%

Note:
MT: Metric Ton

Source: ATAC Corporation, March 2013 (NIRS modeling results).
Prepared by: ATAC Corporation, April 2013.

5.8 Air Quality

This section discusses the analysis of air quality impacts under the Proposed Action and the No Action Alternative.

5.8.1 Summary of Impacts

The Proposed Action when compared to the No Action Alternative would result in a decrease in emissions due to a reduction in fuel burn and is presumed to conform to State Implementation Plans (SIP) for Maryland, Virginia, Pennsylvania, and the District of Columbia, the jurisdictions that fall within the General Study Area. Accordingly, implementation would not cause or contribute to a new violation of the National Ambient Air Quality Standards (NAAQS). Therefore, air quality impacts arising from implementation of the Proposed Action would not be anticipated.

The No Action Alternative would not result in a change in the number of aircraft operations or air traffic routes; therefore, no impacts to air quality would be anticipated.

5.8.2 Methodology

Typically, significant air quality impacts would be identified if an action would result in the exceedance of one or more of the NAAQS for any time period analyzed.[62] Section 176(c) of The Clean Air Act (CAA) requires that federal actions conform to the appropriate SIP in order to attain the air quality goals identified in the CAA. However, a conformity determination is not required if the emissions caused by a federal action would be less than [the] *de minimis* levels established in regulations issued by EPA.[63] FAA Order 1050.1E provides that further analysis for NEPA purposes is normally not required where emissions do not exceed EPA's *de minimis* thresholds.[64] The EPA regulations identify certain actions that would not exceed these thresholds, including ATC activities and adoption of approach, departure, and enroute procedures for aircraft operations above the mixing height specified in the applicable SIP (or 3,000 feet AGL in places without an established mixing height). In addition, the EPA regulations allow federal agencies to identify specific actions as "presumed to conform" (PTC) to the applicable SIP.[65] In a notice published in the Federal Register, the FAA has identified several actions that "will not exceed the applicable *de minimis* emissions levels" and are therefore presumed to conform, including ATC activities and adoption of approach, departure, and enroute procedures for air operations.[66] The FAA's PTC notice explains that aircraft emissions above the mixing height do not have an effect on pollution concentrations at ground level. The notice also specifically notes that changes in air traffic procedures above 1,500 ft. AGL and below the mixing height "would have little if any effect on emissions and ground concentrations."[67]

5.8.3 Potential Impacts – 2013 and 2018

Under the Proposed Action a decrease in fuel burn would be anticipated compared to the No Action Alternative. Therefore, no further air quality analysis is necessary and a conformity determination is not required.

The No Action Alternative would not result in a change in the number of aircraft operations or air traffic routes; therefore, no impacts to air quality would be anticipated.

[62] FAA Order 1050.1E, Chg.1, App. A, sec. 2.3.
[63] 40 C.F.R. § 93.153(b).
[64] FAA Order 1050.1E, Chg. 1, App. A, sec. 2.1c.
[65] Id at 93.153(f).
[66] U.S. National Archives and Records Administration, "Federal Presumed to Conform Actions Under General Conformity," Federal Register 72, no. 145 (July 20, 2007): 41565-41580.
[67] Id.

5.9 Climate

This section discusses greenhouse gas (GHG) emissions and effects to the climate as they relate to the Proposed Action and the No Action Alternative.

5.9.1 Summary of Impacts

Fuel burn would decrease under the Proposed Action compared to the No Action Alternative (see Section 5.8) and no significant project-related effects on climate are anticipated.

5.9.2 Methodology

In accordance with FAA guidance, estimated CO_2 emissions were calculated from the amount of fuel burned under the No Action Alternative and the decreased fuel burn projected for the Proposed Action in 2013 and 2018 (see Section 5.8). The resulting CO_2 emissions were then calculated as CO_2e.

5.9.3 Potential Impacts – 2013 and 2018

Table 5-9 shows project-related CO_2e emissions. In 2013, the Proposed Action would produce approximately 7,197.10 metric tons (MT) of CO_2e and the No Action Alternative would produce approximately 7,263.13 MT of CO_2e. This represents a reduction of 66.03 MT of CO_2e or 0.91 percent under the Proposed Action when compared to the No Action Alternative. Similarly, in 2018, the Proposed Action would produce approximately 8,152.62 MT of CO_2e and the No Action Alternative would produce approximately 8,227.50 MT of CO_2e. This represents a reduction of 74.88 MT of CO_2e or 0.91 percent under the Proposed Action when compared to the No Action Alternative. Therefore, no increase in GHGs would result from implementation of the Proposed Action when compared to the No Action Alternative and no impacts would be anticipated.

Table 5-9 CO_2e Emissions - 2013 and 2018

	2013		2018	
	No Action Alternative	**Proposed Action**	**No Action Alternative**	**Proposed Action**
CO_2e Emissions (MT)	7,263.13	7,197.10	8,227.50	8,152.62
Volume Change (MT)		-66.03		-74.88
(Proposed Action – No Action Alternative)		-0.91%		-0.91%

Note:
CO2e: Carbon Dioxide Equivalent

Source: ATAC Corporation, April 2013 (NIRS modeling results).
Prepared by: ATAC Corporation, April 2013.

5.10 Visual Impacts

This section discusses the analysis of visual impacts under the Proposed Action and the No Action Alternative.

5.10.1 Summary of Impacts

As stated in Section 5.1, implementation of the Proposed Action would not increase the number of aircraft operations at the Study Airports compared with the No Action Alternative. Changes in aircraft traffic patterns under the Proposed Action are expected to be at altitudes and distances sufficiently removed from viewers that visual impacts would not be anticipated.

Under the No Action Alternative, no changes in air traffic routes would occur and no changes in aircraft overflight patterns would be expected. Therefore, the No Action Alternative would not result in visual impacts.

5.10.2 Methodology

As discussed in FAA Order 1050.1E, Appendix A, Section 12.2b, visual, or aesthetic, impacts are difficult to define and evaluate because of the subjectivity involved. Aesthetic impacts deal more broadly with the extent that the project contrasts with the existing environment and whether the difference is considered objectionable by the agency responsible for the location in which the project is set. Visual impacts are normally related to the disturbance of the aesthetic integrity of an area caused by development, construction, or demolition, and thus, do not typically apply to airspace changes.

To evaluate the potential for indirect impacts resulting from changes in aircraft routings and visual intrusion, the general altitudes at which aircraft route changes occur beyond the immediate airport environs, which experience overflights on a routine basis, are considered to evaluate the potential for visual impacts.

5.10.3 Potential Impacts – 2013 and 2018

According to FAA Order 1050.1E, Appendix A, the visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not be assumed to constitute an adverse impact. Changes in aircraft routes associated with the Proposed Action would generally occur at altitudes above 3,000 feet AGL; therefore, the visual sight of aircraft and aircraft lights would not be considered intrusive. Consequently, the Proposed Action would not result in significant visual impacts. Air traffic routes under the No Action Alternative would not change, and therefore, would not result in changes in light emissions to people on the ground, so no significant impacts relating to light emissions would occur. Accordingly, significant visual impacts resulting from the Proposed Action or the No Action Alternative would not be anticipated.

5.11 Cumulative Impacts

Consideration of cumulative impacts applies to the impacts resulting from the implementation of the Proposed Action with other actions. CEQ regulations define cumulative impact as the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of the agency, federal or nonfederal, undertaking such actions and state that cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

5.11.1 Summary of Impacts

The implementation of the Proposed Action when considered with other past, present, and reasonably foreseeable future actions would not be expected to result in significant cumulative impacts.

5.11.2 Methodology

Projects within the vicinity of the Study Airports were reviewed to evaluate the potential for cumulative impacts. A list of potential projects proposed on or near the Study Airports is provided in **Table 5-10**. Due to the nature of the resources affected by the Proposed Action, only projects with direct or indirect effects on aviation within the General Study Area were considered.

Potential impacts related to implementation of the Proposed Action, although demonstrated to not be significant in the preceding sections of this chapter fell into one category:

- Aircraft Noise—Effects related to changes in aircraft noise exposure, including potential impacts on populations in the General Study Area, compatible land use, potential Section 4(f) resources, historic and cultural resources.

Other categories of impacts considered in this EA, but demonstrated to not affect the resource, include:

- Fuel Burn—The Proposed Action results in lower quantities of fuel burned and correspondingly lower amounts air pollutants and greenhouse gases emitted; therefore, the Proposed Action would not cumulatively contribute to potential effects on energy use, air pollutants emitted, and greenhouse gases emitted of other past, present, and reasonably foreseeable future projects.
- Avian and Bat Species—The Proposed Action is not expected to result in a change in the occurrence of wildlife strikes; therefore, the Proposed Action would not cumulatively contribute to potential effects on avian and bat species of other past, present, and reasonably foreseeable future projects.
- Other Categories—As the Proposed Action would not involve land acquisition or other shifts in population or communities, physical changes such as ground disturbance or facility development, or construction activities, it would not affect the other environmental resource categories specified in FAA Order 1050.1E, as listed in the introduction to this Chapter.

Therefore, only other past, present, and reasonably foreseeable proposed projects with the potential for impacts related to changes in aircraft noise exposure were considered. The projects identified in **Table 5-10** were evaluated for their potential to collectively, with the Proposed Action, contribute to significant noise impacts affecting population, Section 4(f) resources, and historic and cultural properties.

5.11.3 Potential Impacts – 2013 and 2018

For each of the relevant past, present, and reasonably foreseeable future projects identified by the FAA, **Table 5-10** presents a summary of the potential for cumulative effects. Additional discussion of potential cumulative impacts, by environmental resource category, follows the table.

Table 5-10 Past, Present, and Reasonably Foreseeable Future Actions (1 of 5)

Airport Runway Related Projects		
Project	**Description**	**Cumulative Effects Analysis**
DCA-Construct Runway Safety Area for Runways 01/19	This project involves bringing the RSA for Runway 01/19 into compliance with FAA guidelines. This project extends the Runway 01 landing threshold 300 feet south and relocating the approach lights for Runway 01 caused by the extension.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on March 17, 2010. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
DCA-Construct Runway Safety Area for Runways 04/22	This project involves bringing the RSA for Runway 04/22 into compliance with FAA guidelines. This project extends Runway 04 end pavement 460 feet and the landing threshold 260 feet to the southwest; shifts Runway 22 end 371 feet southwest; and install EMAS at the end of Runway 22. Approach aids are relocated as a result of the new runway end locations.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 4, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
DCA-Construct Runway Safety Area for Runways 15/33	This project involves bringing the RSA for Runway 15/33 into compliance with FAA guidelines. The project shifts Runway 15/33 270 feet to the southeast along its centerline, and install EMAS at the end of Runway 15 and relocated end of Runway 33. Approach aids are relocated as a result of the new runway end locations.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 4, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
IAD – Runway Status Lights	This project involves installing status lights at major runway and taxiway intersections. It is planned to be completed by 2013.	

Table 5-10 Past, Present, and Reasonably Foreseeable Future Actions (2 of 5)

Airport Runway Related Projects		
Project	**Description**	**Cumulative Effects Analysis**
BWI – Proposed Airport Improvements – Runway 15R/33L RSA Improvements	This project involves bringing the RSA for Runway 15R/33L into compliance with FAA guidelines. Runway 15R landing threshold is displaced 300 ft. Runway 33L landing threshold is displaced 500 feet. Approach aids are relocated as a result of the new runway end locations.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 25, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
BWI – Proposed Airport Improvements – Runway 10/28 RSA Improvements	This project involves bringing the RSA for Runway 10/28 into compliance with FAA guidelines. The Runway 28 Localizer is located within the RSA on the Runway 10 approach. The localizer is proposed to be located 1,010 feet from the runway threshold to outside of the RSA.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 25, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
BWI – Proposed Airport Improvements – Runway 10 Glide Slope	Runway 10 Glide Slope needs to be relocated to provide a standard separation from the runway centerline (currently 399 feet from the runway centerline). The proposed Runway 10 Glide Slope would be relocated approximately 420 feet from the runway centerline outside of the ROFA.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 25, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
BWI – Proposed Airport Improvements – Runway 15R Glide Slope	The proposed Runway 15R Glide Slope would be relocated approximately 280 feet from the existing location which results in a distance of 1,109 feet from the relocated landing threshold to meet RSA requirements. The Runway 33R glide slope is planned to be relocated 681 feet south of its current location in order to be clear of the Runway Object Free Area.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 25, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.

Table 5-10 Past, Present, and Reasonably Foreseeable Future Actions (3 of 5)

Airport Runway Related Projects		
Project	**Description**	**Cumulative Effects Analysis**
BWI – Proposed Airport Improvements – Runway 15L/33R RSA Improvements	Visibility minimums for an instrument approach is increased to ¾ statute mile or greater to reduce RSA area requirements. The Runway 33R Localizer (located on the Runway 15L end) is located within the RSA limits and must be relocated to outside the RSA (approximately 600 feet from the end of the runway) to meet current FAA design standards. Similar to Runway 33R, Runway 15L Localizer is located within the proposed RSA limits and must be relocated to outside the RSA to meet current FAA design standards.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 25, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
BWI – Proposed Airport Improvements – Runway 28 Glide Slope	The Runway 28 Glide Slope needs to be relocated to provide a standard separation from the runway centerline. The existing Glide Slope is currently located on the left side of the Runway 28 approach within the ROFA approximately 375 feet from the runway centerline. The proposed Glide Slope antenna would be located 35 feet from its current location at a total of 410 feet from the runway centerline.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 25, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
BWI – Proposed Airport Improvements – Runway 10/28 Mid-Point RVR	The existing Runway 10-28 mid-point RVR is located within the ROFA and, as such, does not meet current FAA design standards. The existing mid-point RVR would be relocated to outside of the ROFA.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 25, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
BWI – Proposed Airport Improvements – Runway 04/22 Conversion to a Taxiway	Runway 4-22 is planned to be converted to a Group V taxiway to serve the other commercial service runways.	This project received a Finding of No Significant Impact (FONSI) Record of Decision (ROD) on April 25, 2012. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.

Table 5-10 Past, Present, and Reasonably Foreseeable Future Actions (4 of 5)

Airport Runway Related Projects		
Project	**Description**	**Cumulative Effects Analysis**
HEF – Runway 16L/34R 500 feet Extension	This project involves bringing the RSA for Runway 16L/34R into compliance with FAA guidelines. This project extends the end of Runway 34R 500 feet to the south; widen existing bridges supporting Runway 16L/34R and Taxiway B to the required width of the RSA and Taxiway Safety Area (TSA); install new localizer antenna 2,000 feet south of the existing Runway 16L/34R landing threshold on the extended runway centerline; install medium intensity approach light system (MALSR) on the Runway 24R end; and relocate Runway 24R Precision Approach Path Indicator (PAPI).	This project received a Finding of No Significant Impact (FONSI) on July 10, 2009. The environmental analysis prepared for this project found no significant noise impacts, no significant impacts to Section 4(f) resources, and no adverse effects to historic resources. No significant cumulative impacts are anticipated with the Proposed Action.
ESN – Five Year Capital Improvement Program for Easton/Newman Field Airport	Runway 04 end would be extended 1,896 south with an 800' displaced landing threshold, and Runway 22 would be relocated 1,000 ft. As a result, the PAPI for both runway ends will be relocated. The project also includes a MALSR for the Runway 04 approach.	No environmental documentation for the runway relocation was located. However, the airport is located in a largely rural, agricultural setting and the runway is being relocated away from its current location near residential development. Accordingly, it is assumed that the proposed action would not result in increased noise exposure to sensitive land uses. No significant cumulative impacts are anticipated with the Proposed Action.

Table 5-10 Past, Present, and Reasonably Foreseeable Future Actions (5 of 5)

Airspace Related Projects		
Project	**Description**	**Cumulative Effects Analysis**
GIBBZ ONE (RNAV) STAR DOCCS ONE STAR RNLDI ONE (RNAV) SID BUNZZ ONE (RNAV) SID	Changes to arrival and departure procedures serving IAD.	The procedures were categorically excluded on May 29, 2012. GIBBZ, DOCCS, and BUNZZ are included as part of the Proposed Action and No Action Alternative. No noise impacts are anticipated. No significant cumulative impacts are anticipated with the Proposed Action.
FRDMM ONE (RNAV) STAR TRUPS ONE (RNAV) STAR NUMMY ONE STAR	Changes to arrival procedures serving DCA.	The procedures were categorically excluded on May 29, 2012. All three are included as part of the Proposed Action and No Action Alternative. No noise impacts are anticipated. No significant cumulative impacts are anticipated with the Proposed Action.

Source: Federal Aviation Administration, 2012, 2013.
Prepared by: ATAC Corporation, March 2013.

5.11.3.1 Potential Cumulative Noise Impacts

Noise and noise-related impacts include changes in noise exposure for populations, compatible land use, potential Section 4(f) resources, historic properties, and tribal lands. Implementation of the Proposed Action would not result in significant changes in noise exposure, as discussed in Section 5.1. Excluding one project identified in **Table 5-10**, environmental documentation completed for all the cumulative projects identified no significant noise impacts. No environmental documentation was available for the ESN Five Year Capital Improvement Program for Easton/Newman Field Airport which includes relocation of a runway and associated NAVAIDs. However, as ESN is situated in a rural, largely agricultural environment and the runway would be moved away from existing residential development, no noise impacts associated with that project would be anticipated. Therefore, none of the past, present, and reasonably foreseeable projects identified in **Table 5-10** have the potential to cumulatively contribute to the noise impacts of the Proposed Action and they would not be expected to contribute to changes in noise exposure that would cumulatively result in significant impacts.