



## 5. Alternatives Analysis & Development Plan

The purpose of this chapter is to identify, present, and evaluate various development alternatives for the Beverly Regional Airport (BVY) that are designed to meet projected levels of aviation demand and their associated facility and design requirements over the planning period. The result of that evaluation is a preferred development plan for the Airport that will support its evolution and growth in a manner that enables it to meet its future aviation needs in a safe, efficient, and sustainable way over the 20-year planning period. The preferred development plan is the culmination of the planning process detailed in the previous four chapters and will serve as the basis of the remaining two chapters of the Airport Master Plan (AMP), including the Airport Layout Plan (ALP) drawing set and the implementation plan.

This alternatives analysis utilized the previous chapters of this master plan as well as solicited input from a variety of sources including the project's Planning Advisory Committee (PAC), the Airport Manager and staff, the Airport Commission, the public, airport users and tenants, the FAA, the Massachusetts Department of Transportation (MassDOT) Aeronautics Division, and other interested parties. It examined various development concept alternatives designed to meet the previously identified facility requirements by employing evaluation criteria to select a preferred development plan. Following their identification, each alternative was evaluated on their ability meet demand and provide for future flexibility, while maintaining a safe aviation environment. Additionally, this chapter provides a description of the factors and influences, which form the basis for the Airport's long-term development program.

It should be noted that the FAA encourages airports to consider the "no-build" option as a comparison against the development alternatives that is based on the existing infrastructure. In a no-build alternative, facilities, structures and layout would remain unchanged and the Airport would maintain its current physical conditions and operational patterns.

### 5.1 Development Goals

To assist in conducting the alternatives analysis, several development goals have been identified for purposes of directing the planning effort and establishing continuity in the future development of the Airport. These goals are designed to account for the short-term and long-term Airport needs over a range of important considerations including safety, noise, capital improvements, land use compatibility, financial and economic conditions, public interest and investment, and community recognition and awareness. While all are project-oriented, some goals represent more tangible activities than others; however, all are important and relevant to the future of the Airport. (These goals are designed to augment the AMP study objectives defined in **Chapter 1, Study Introduction and Goals.**) The development goals include the following:

- Accommodate BVY's forecasted demand for aviation activity in a safe and efficient manner by providing necessary airport facilities and services.

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*"The alternatives chapter brings together many different elements of the planning process to identify and evaluate alternatives for meeting the needs of airport users as well as the strategic vision of the airport sponsor. Airports have a wide variety of development options, so an organized approach to identifying and evaluating alternative development options is essential for effective planning."*

- FAA AC 150/5070-6B, Airport Master Plans

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- Provide effective guidance for the future development of BVY through the preparation of a logical development program that presents a realistic vision to meet future aviation-related demand.
- Prepare a plan that enables the Airport to fulfill the mission of facilitating and enhancing local, regional, and national general aviation services by “right-sizing” facilities.
- Conduct an analysis that identifies financially feasible projects that maximize use of available Airport areas while meeting needs of the community.
- Develop future development alternatives based upon the most efficient and cost-effective methods.
- Continue to develop and operate the Airport in a manner that is consistent with local ordinances and codes, federal and state statutes, federal grant assurances, federal agency regulations, and FAA design standards.
- Ensure that Airport development remains compatible with the surrounding community and the environment on and near airport property.
- Preserve the development potential of the Airport beyond the forecasted aviation demand to account for possible future aviation services and facility demand increases resulting from unforeseen economic development initiatives and associated aviation uses.
- Encourage and protect public and private investment in land and facility development near the Airport.
- Sustain and enhance the Airport’s role within the Massachusetts Airport System and the National Airspace System (NAS) as Corporate/Business Airport and a Reliever Airport, respectively.

## 5.2 Evaluation Criteria

To facilitate the selection of a preferred development plan, a set of evaluation criteria have been identified for use in this analysis. Through an assessment that incorporates these criteria, the potential benefits and impacts of the various alternative development scenarios can be compared to aid in the selection process. The criteria used to assist in evaluating development alternatives include, but are not limited to the following:

- **Safety/Operational Factors**

Alternatives were evaluated to determine their ability to safely accommodate future demand for aircraft, vehicles, and other relevant factors based on the specific facility being assessed. This criterion evaluates alternative development concepts based on anticipated improvements to operational safety, capacity, and delay, as well as tenant convenience, and other relevant planning considerations such as their ability to meet or enhance FAA design standards.

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*The Alternatives Analysis is a regimented process by which development options are identified and the final Recommended Plan is established. The Recommended Plan is what is ultimately included on the resulting Airport Layout Plan (ALP).*

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- **Environmental Factors**

A broad evaluation of environmental factors associated with development was part of the review and comparison of alternatives. Relevant environmental factors include those stipulated in FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*. Additional considerations include potential physical impacts to the surrounding area and community.

- **Economic Considerations**

Economic factors include historic infrastructure investment, the remaining useful life of existing airport facilities, anticipated alternative project costs, and property acquisition requirements. These factors provide a basis for comparing the cost-effectiveness and economic ramifications of various development scenarios.

- **Implementation Feasibility**

There are often factors, both direct and indirect, that can impact an airport's ability to implement certain development alternatives. The practicability of constructing a new development is an example of a direct factor. Community and governmental acceptance are examples of less tangible or indirect implementation feasibility dynamics that were considered.

Where appropriate, development alternatives were quantitatively and qualitatively evaluated based on these factors. Positive and negative traits (pros and cons) relative to each alternative were also helpful in comparing them. In addition to these criteria, selected improvements were presented to the Airport and PAC to receive feedback and input on the demand for and preferred location of each facility. The results of this analysis have been used to identify a recommended development plan for satisfying the facility recommendations identified in **Chapter 4, Facility Requirements**.

### 5.3 Airside Development Alternatives

Because all other airport functions relate to and revolve around the basic runway/taxiway geometry, airside development alternatives should be first to be examined and evaluated. While it is essential that the initial development recommendations for the Airport be commensurate with the near-term needs and requirements of the Airport users, the long-term improvement (beyond the 20-year planning period) of the facility should also be considered and planned for to ensure the Airport's capability to accommodate future potential activity levels. Consequently, the main objective of the planning recommendations presented in this section is to identify future development that will result in a runway/taxiway system capable of accommodating forecasted aviation activity levels while preserving potential for unforeseen future development opportunities.

**Chapter 4** examined the ability of the Airport's existing runway/taxiway system to accommodate projected levels of activity at BVY through the 20-year planning period. The findings of that analysis indicated that the existing airfield provides sufficient operational capacity to efficiently accommodate aircraft operational demand over

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*Inclusion of a project on the ALP is not a guarantee of federal funding support. It simply protects airport land and airspace for a project's potential construction.*

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the long term. However, to preserve the Airport's capability to accommodate critical aircraft operational capabilities and future potential activity levels beyond the 20-year planning period, runway/taxiway improvements are recommended on the Ultimate ALP. Within the 20-year planning period, certain airside elements require modification to ensure that the Airport continues to comply with FAA airport design, airspace and safety criteria. Some recommended airfield improvements are intended to enhance the efficiency of aircraft movement on the taxiway system.

The following sections provide overviews of the alternative analyses for several of the airfield infrastructure requirements as reflected in **Table 5-1**. Although these individual analyses are presented separately, it must be understood that they can and do impact each other. Such potential interactions are acknowledged and addressed as appropriate.

**Table 5-1: Airside Facility Requirements Summary**

Facility	Identified Requirement
Runway	<ul style="list-style-type: none"> <li>- Meet requirements for existing and future design aircraft including additional runway length</li> <li>- Preserve for potential changes associated with an ultimate design aircraft of C-II RDC, including runway width</li> </ul>
Taxiway System	<ul style="list-style-type: none"> <li>- Eliminate antiquated taxiway configurations</li> <li>- Plan for updated taxiway system consistent with current FAA standards and design considerations</li> <li>- Eliminate direct access from aprons to runways</li> <li>- Update fillet standards</li> <li>- Eliminate confusing intersections</li> <li>- Address/resolve FAA-identified "Hot Spots"</li> </ul>
Airfield Pavement	<ul style="list-style-type: none"> <li>- Recondition pavement on apron areas</li> <li>- Plan for potential additional apron on west side</li> </ul>
Airfield Visual Aids	<ul style="list-style-type: none"> <li>- No action required</li> <li>- Upgrade airport lighting to LEDs as able</li> </ul>
Navigation Aids (NAVAIDs)	<ul style="list-style-type: none"> <li>- Add PAPI to Runway 34</li> </ul>
Obstruction Removal	<ul style="list-style-type: none"> <li>- Data to be incorporated into the ALP set</li> </ul>

Source: Aviation

### 5.3.1 Runways

Additionally, it was also acknowledged that very long-term development trends within the region and the aviation industry indicate that BVY, in its capacity as an FAA-defined Reliever Airport for Logan International Airport, may also require additional runway capabilities at some point in the future. It is assumed that this would likely be needed to accommodate increased regional demand for aviation services by newer general aviation aircraft. Since airport stakeholders including BVY, the FAA, and MassDOT all want to protect for that future potential development beyond the 20-year planning period, this Master Plan will include an Ultimate Airport Layout Plan sheet within the resultant ALP set that may reflect these increased runway operational capabilities.

### Runway 16-34

As Beverly Regional Airport's primary runway, Runway 16-34 is the Airport's most critical infrastructure element. The runway is currently 5,001 feet in length and 100 feet in width and has a threshold displacement on the Runway 16 approach end of 239 feet that is based on the approach lighting system. These totals result in available aircraft departure lengths of 5,001 feet for both Runway 16 and Runway 34, an aircraft arrival length for Runway 34 of also 5,001 feet, but a length of 4,762 feet for aircraft arriving on Runway 16. (Note that the critical runway length for aircraft operations is typically based on departures, when aircraft are typically at their heaviest.)

This runway was examined in detail within **Chapter 4** and ultimately determined to be generally adequate to meet BVY's projected operational requirements for the 20-year planning period with the exception of runway length. Regarding length, FAA runway length requirements tables as well as input received from Airport users and tenants have all indicated that the current runway length is minimally acceptable for the existing and future critical design aircraft. Specifically, FAA methodologies have recommended a runway length between 5,739 feet and 7,851 feet, while airport users have stated that they require at least 5,600 feet of runway length for departures to promote safer operations and greater efficiency. Note that Runway 16-34 is also due to be completely reconstructed within the next five years as its condition continues to deteriorate and preventative maintenance is no longer adequate.

Additionally, it was also acknowledged that very long-term development trends within the region and the aviation industry indicate that BVY, in its capacity as an FAA-defined Reliever Airport for Logan International Airport, may also require additional runway capabilities at some point in the future. It is assumed that this would likely be needed to accommodate increased regional demand for aviation services by newer general aviation aircraft (such as those with an RDC of C-II, as discussed in **Chapter 3** and **Chapter 4**). Key airport stakeholders including the BVY Airport Commission, the FAA, and MassDOT are unanimous in their support for the Airport and want to protect for that future potential development that exists beyond the 20-year planning period. Based on that, the following actions have been taken:

- The minimum runway width requirement for a runway with an RDC of B-II is 75 feet. BVY's existing Runway 16-34 is 100 feet wide. To maintain an equivalent level of safety for existing runway operations and to preserve for the longer-term development potential of Runway 16-34 as a possible C-II runway, the FAA and MassDOT have agreed to provide adequate funding to preserve the 100-foot width of Runway 16-34. (Note that this allowance is only being extended to Runway 16-34 since it is BVY's primary runway – it does not include the crosswind Runway 9-27.)
- The Master Plan will also include an Ultimate Airport Layout Plan sheet within the official ALP set that will reflect any these increased runway operational capabilities.

The following sections provide an overview of the alternatives analysis conducted for meeting both existing and future requirements associated with Runway 16-34.



Specifically, the following presents a listing of the general strategies that could be employed for meeting long-term runway needs (note that these are consistent with standard FAA airport planning and environmental compliance requirements). Additionally, any alternatives developed in association with these strategies have been listed and graphical representations included in the following pages.

### **Runway 16-34 Alternative 1: Maintain Existing**

Runway 16-34 is currently 5,001 feet long and 100 feet wide with a threshold displacement on the Runway 16 approach end. Based on the existing and future RDC of B-II, the FAA standard width for this runway is 75 feet. However, as noted above, through coordination with the FAA and MassDOT in association with BVY, the exiting runway width will remain at 100 feet. This is being done to preserve the existing level of safety on the runway, particularly since there appears to be an increasing number of C-II aircraft consistently operating on that runway. It should also be noted that maintaining the existing width could reasonably be viewed as a cost savings measure over the long term in that reducing the runway width to 75 feet only to ultimately restore it to 100 feet would require significant effort and costs associated with the runway base, drainage, electrical, taxiway interfaces, etc.

With respect to runway length, Alternative 1 (see **Figure 5-1**) maintains the current runway envelope including the runway itself and associated design standards (e.g., RSA, ROFA, OFZ, etc.) so that aircraft will continue to have 5,001 feet for departures on both runways and landing on Runway 34. Aircraft landing on Runway 16 will continue to have 4,762 feet available. Note that this alternative does not offer any operational improvements for aircraft with respect to runway departure or arrival lengths despite the FAA recommendation for additional length.

### **Runway 16-34 Alternative 2: Maintain Existing – Increase Departure Length**

Alternative 2 (see **Figure 5-2**) is consistent with Alternative 1 in terms of maintaining the existing width of 100 feet and maintaining the existing runway envelope; however, it offers a slight improvement to the operational capabilities of departing aircraft. In this alternative, the Airport would extend each runway end 300 feet into the area currently occupied by the existing Runway Safety Area. Note that the existing runway envelope (the area encompassing the runway, RSA, ROFA, ROFZ, etc.) would not be increased in size. This potential action would offer the following to BVY:

- The additional runway pavement would only be available for use by departing aircraft. Thus, by FAA measures, aircraft departing on either Runway 16 or Runway 34 would have 5,301 feet available for departure length.
- The runway's existing thresholds would not move; therefore, aircraft arriving on Runway 34 would still have 5,001 feet in length available, while those arriving on Runway 16 would still have 4,762 feet.
- Runway 16-34's existing FAA airport design standards criteria (e.g., RSA, ROFA, RPZ, etc.) would remain unchanged.
- The combination of maintaining existing runway width and increasing departure length would enhance operational safety for the aircraft that

already operate on the runway. It is critical to note that the additional runway departure length would not change the existing or future design aircraft or fleet mix; the additional 300 feet of departure length would not enable another class of general aviation aircraft to operate at BVY that otherwise does not currently operate there.

- The additional runway pavement would enable aircraft to start their departure roll 300 feet further back than their current position. From a practical perspective, this will enable aircraft operational efficiency to improve, as well as altering the existing noise impact signature of the runway. (Note that since Runway 34 is preferred over Runway 16 due to prevailing winds, any noise impact changes to local residential areas should be minimized.)

### Runway 16-34 Alternative 3: Extend Runway; Employ Declared Distances

As detailed in **Chapter 4**, FAA runway length methodology demonstrates a need for Runway 16-34 to have a length between 5,739 feet and 7,851 feet, while airport users have stated that there is a demonstrable need for at least 5,600 feet of runway length for departures. However, there are multiple challenges specifically at BVY associated with the prospect of extending the runway, including the following:

- BVY does not have enough available land to accommodate a full runway extension up to a maximum length of 7,851 feet (the maximum FAA recommended length). Any extension of Runway 16-34 to that degree would have potentially significant impacts to abutting areas, resources, land uses, and other considerations.
- BVY lies in a heavily developed area surrounded by a wide range of existing land uses (including residential areas, schools, industrial areas, etc.) and roadways, as well as being located in parts of three separate municipalities.
- BVY is surrounded by environmental resources including wetlands, flood plains, water resources, etc.
- Any actual runway extension would trigger FAA full compliance requirements with all relevant airport design standards, including complete conformance with RPZ criteria. This would effectively increase the footprint of potential impacts associated with a runway extension.

While many of these limitations could conceivably be addressed and/or mitigated through various actions, those have been deemed by key stakeholders (including BVY, the FAA, and MassDOT) to be unreasonable and impracticable to pursue. Therefore, for the purposes of this alternatives analysis, it was determined that any alternative associated with a runway extension could not physically impact (in terms of property acquisition and/or construction) any residential areas or roads surrounding the Airport. Again, any such impact was deemed to be unreasonable at this time. (Note that it is understood that impacts to surrounding areas can extend beyond direct physical impacts; however, for the purposes of this analysis, those potential factors would have to be specifically addressed in subsequent analyses as required by FAA.)

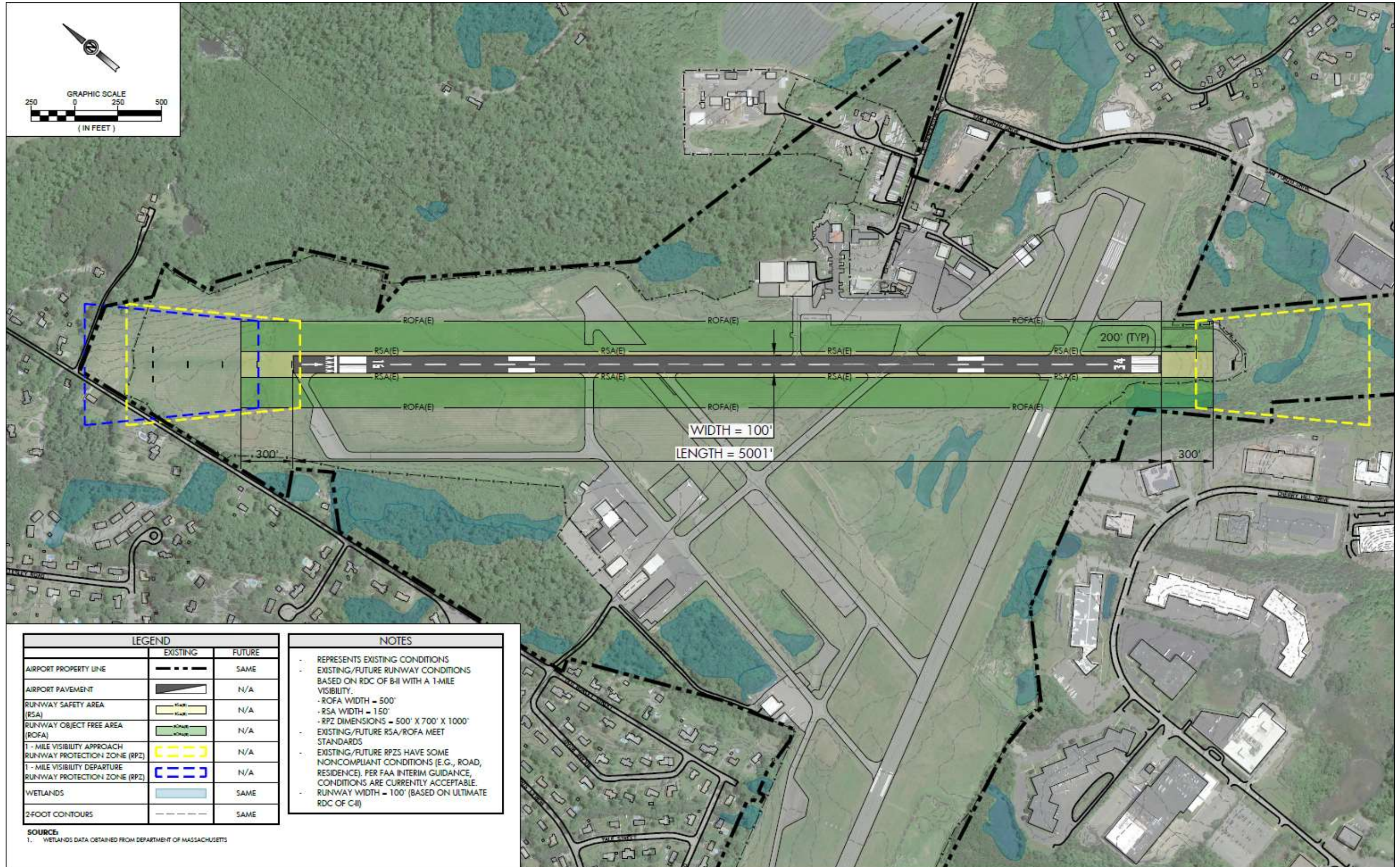
Alternative 3 (see **Figure 5-3**) considers all the information presented above and includes the following elements:



- Extends the Runway 16 approach end of Runway 16-34 to the maximum amount possible without directly impact residences and/or roads while also still ensuring an appropriate taxiway connector is possible. The amount of new runway would be 683 feet.
- The Runway 34 approach end would be extended 300 feet into the area currently occupied by the existing Runway Safety Area. Note that the existing runway envelope on the Runway 34 approach end (the area encompassing the runway, RSA, ROFA, ROFZ, etc.) would not be increased in size. The additional runway length would also only be able to be used by aircraft departing Runway 34. This is the same as Alternative 2.
- Because the Runway 16 approach end is extended, it must meet all FAA airport design criteria, including RPZs that do not allow for public roads or residences. Therefore, to meet these criteria, FAA Declared Distances would have to be applied.
- Through application of Declared Distances, Runway 16 would net the following runway lengths:
  - Accelerated Stop Distance Available (ASDA) = 5,685 feet
  - Landing Distance Available (LAD) = 4,501 feet
  - Takeoff Run Available (TORA) = 5,685 feet
  - Takeoff Distance Available (TODA) = 5,685 feet
- Through application of Declared Distances, Runway 34 would net the following runway lengths:
  - Accelerated Stop Distance Available (ASDA) = 5,828 feet
  - Landing Distance Available (LAD) = 5,529 feet
  - Takeoff Run Available (TORA) = 4,801 feet
  - Takeoff Distance Available (TODA) = 4,801 feet

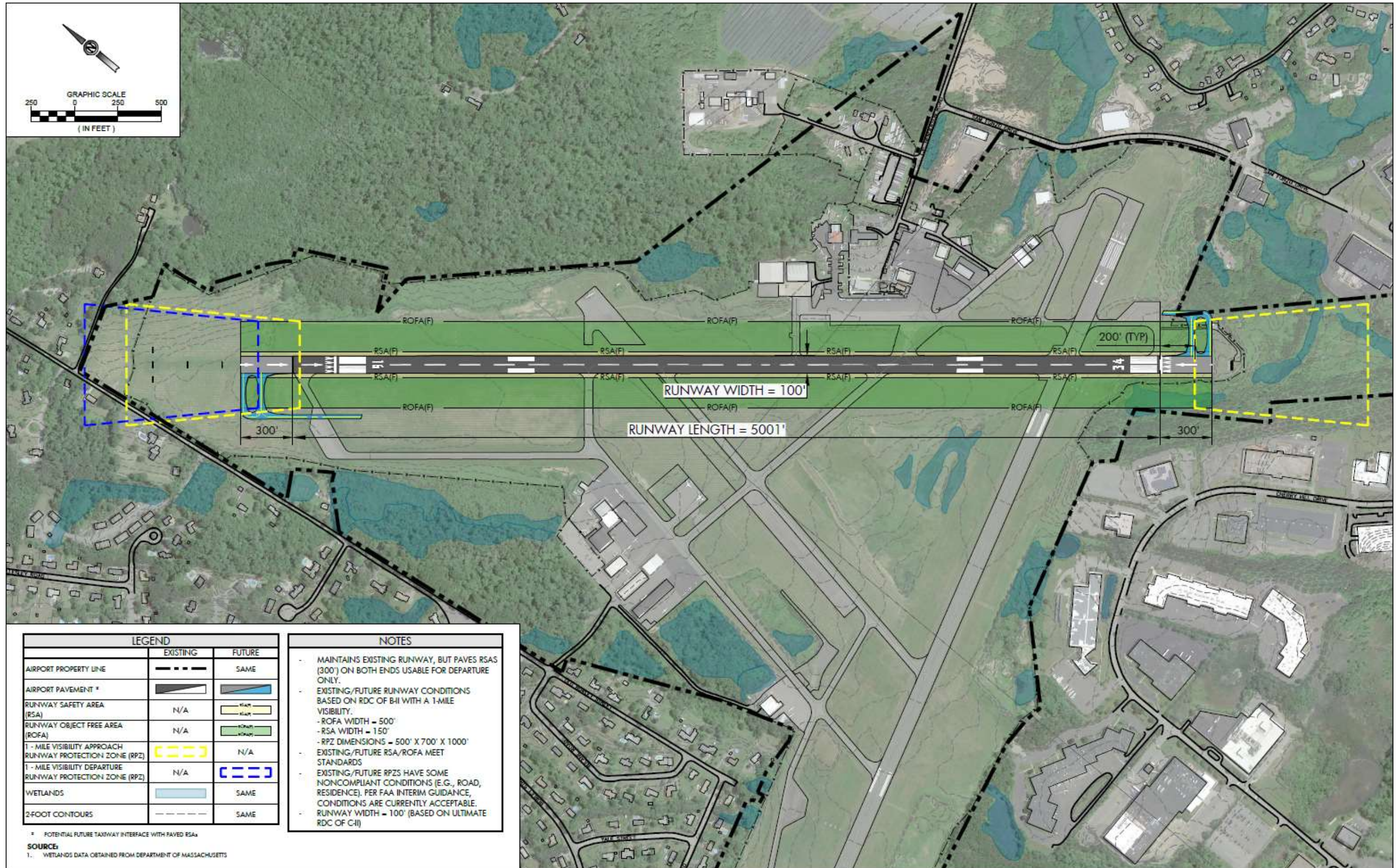


Figure 5-1: Runway 16-34 Alternative 1: Maintain Existing



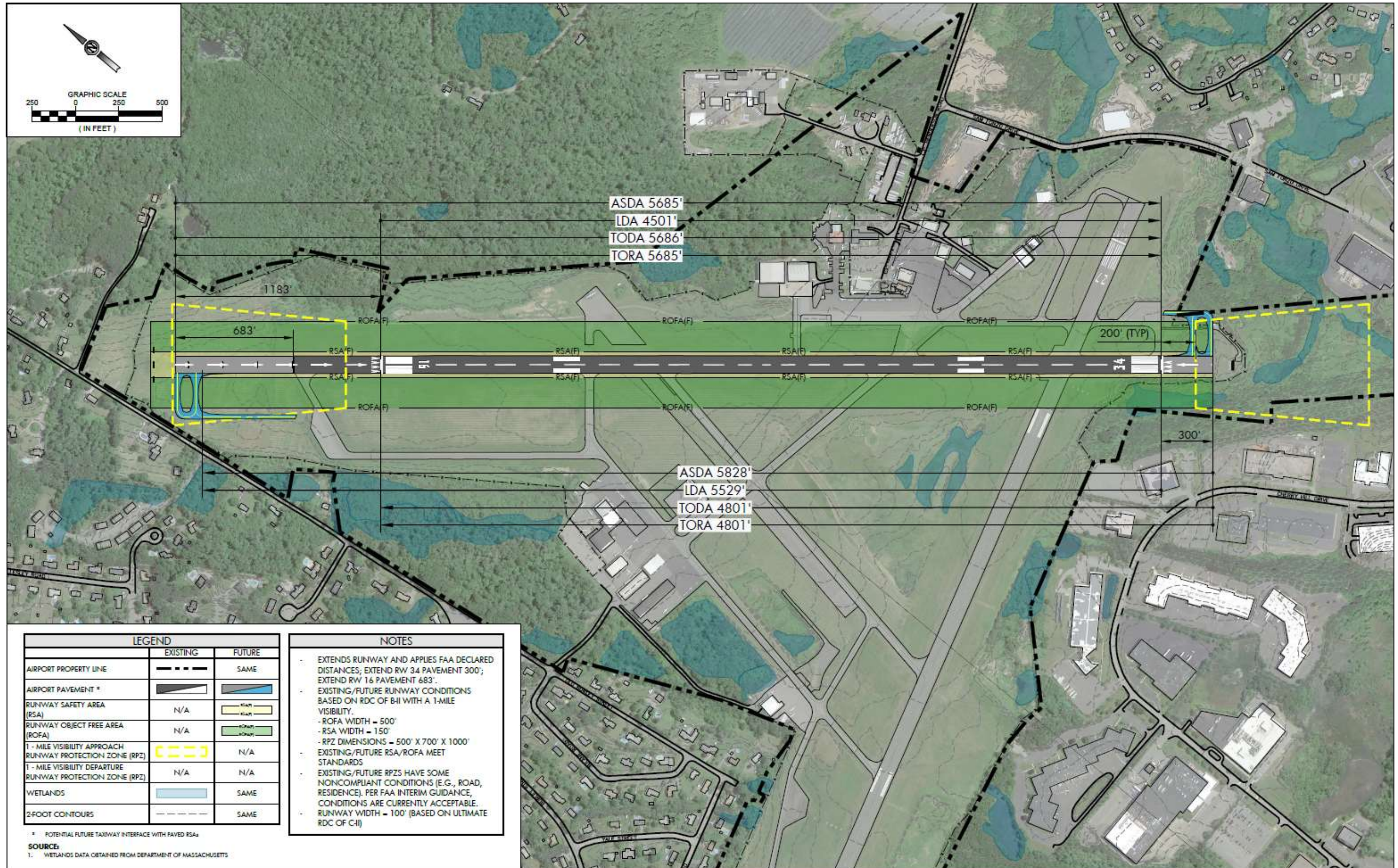
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Figure 5-2: Runway 16-34 Alternative 2: Maintain Existing – Increase Departure Length



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Figure 5-3: Runway 16-34 Alternative 3: Extend Runway; Employ Declared Distances



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As a mechanism to evaluate the alternatives described above, the matrix presented below in **Table 5-2** compares each alternative with respect to the evaluation criterion defined previously in this chapter. To measure the quantitative and qualitative impacts associated with each alternative and rank them accordingly, a value range of 1 to 5 was assigned to each evaluation criterion. A value of 1 represents a negative impact or provides the least benefit; a value of 3 represents no impact or neutral impact; and a value of 5 represents a positive impact or provides more benefit. It must be noted that this evaluation is non-scientific and is based on the subjective opinions of the Project Management Team, including representatives of the Airport Sponsor, the FAA, MassDOT Aeronautics, and the consultant team. These representatives are experts in their respective fields within the aviation industry. For this analysis, the team considered local issues specific to the Beverly Regional Airport, federal and state regulatory requirements and funding considerations, airport engineering and planning factors, environmental compliance and permitting considerations, among others. Thus, while subjective, these opinions are relevant and appropriate.

**Table 5-2: Runway 16-34 Alternatives Evaluation Matrix**

Alternatives	Safety/Operations	Economic	Environmental	Implementation	Total
<b>Alternative A</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>12</b>
Pros	Pavement and future maintenance cost minimized; Baseline cost opinion = \$12.5 M				
Cons	Does not increase effective takeoff length				
<b>Alternative B</b>	<b>4</b>	<b>4</b>	<b>2</b>	<b>5</b>	<b>15</b>
Pros	Achieves longer effective takeoff length with limited additional cost; Cost opinion = \$17.0 M				
Cons	Environmental impacts include minor vegetation removal, limited residential proximity to noise				
<b>Alternative C</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>8</b>
Pros	Achieves longest possible effective takeoff length without direct impacts to residences and roads; Cost opinion = \$22+ M				
Cons	Environmental impacts include significant vegetation removal, significant residential proximity to noise				

Source: Jviation

Note: With respect to the criterion above, 1 = Negative impact/least benefit; 3= No impact/neutral benefit; 5 = Positive impact/most benefit

Based on the scores and pros/cons provided in the evaluation matrix above, the preferred Runway 16-34 alternative has been identified as being Alternative B, which extends each end of the runway by 300 feet while maintaining the current threshold locations. While not achieving the 5,600 feet of departure length requested by local users, it will increase the departure length from 5,001 feet to 5,301 feet which will provide additional benefit to corporate aircraft while also adhering to FAA RPZ guidelines.



### Runway 9-27

Runway 9-27 serves as Beverly Municipal Airport's crosswind runway. It is currently 4,755 feet in length and 100 feet in width and has a threshold displacement on the Runway 27 approach end of 250 feet that is based on controlling obstructions. These totals result in available aircraft departure lengths of 4,755 feet for both Runway 9 and Runway 27, an aircraft arrival length for Runway 9 of 4,755 feet, and an aircraft arrival length for Runway 27 of 4,505 feet.

This runway was also reviewed within **Chapter 4** and ultimately determined to be generally adequate to meet BVY's projected operational requirements for the 20-year planning period except for runway length. Specifically, FAA runway length methodologies recommend a length between 5,493 feet and 6,297 feet; however, input received from Airport users and tenants have all indicated that the current runway length is acceptable for the existing and future critical design aircraft. Additionally, it should be noted that FAA recommends that a crosswind runway be approximately 80% of the length of the primary runway. Applying that 80% standard to the Runway 16-34 alternatives presented above results in a recommended runway length for Runway 9-27 between 4,000 feet and 4,662 feet. Therefore, the existing runway length of 4,755 feet is sufficient for crosswind runway functionality.

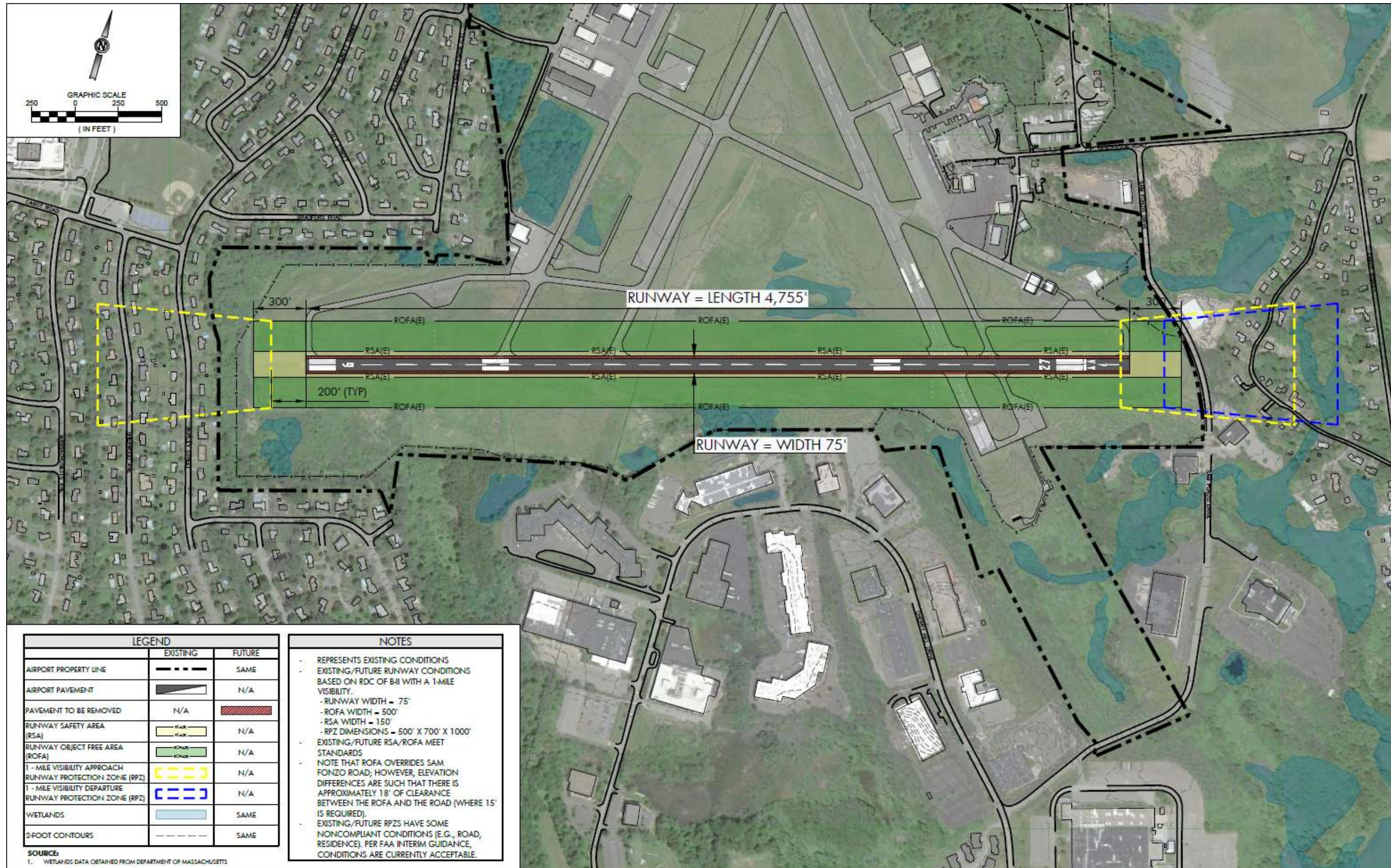
With respect to runway width, the FAA has endorsed Runway 16-34 remaining at a 100-foot width to maintain its existing level of safety and to preserve for the long-term development potential of that runway. It is critical to again note that this was granted since Runway 16-34 is BVY's primary runway. While Runway 9-27 also has an RDC of B-II and has a width of 100 feet, as BVY's crosswind runway, it has not been granted that exception. Therefore, when Runway 9-27 is next reconstructed, unless additional funding outside of FAA and MassDOT can be secured, the width will be reduced to 75 feet in conformance with FAA airport design standards.

Finally, it should be noted that the 250-foot threshold displacement on the approach end to Runway 27 was the result of an obstruction (office building) to that runway's threshold siting criteria. This was documented in FAA Obstruction Evaluation / Airport Airspace Analysis (OE/AAA) 2007-ANE-99-NRA. For the Airport to potentially restore any of that displacement (likely through a combination of obstruction lighting and an adjustment to the PAPI glidepath), it would need to file another aeronautical study. Regardless, even if the Runway 27 threshold were not moved back to the runway end, the landing length for Runway 27 is adequate to meet the needs of the existing and future design aircraft.

See **Figure 5-4** for a graphical depiction of the recommended plan for Runway 9-27.



Figure 5-4: Runway 9-27 Recommended Plan



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### 5.3.2 Taxiways

The Airport's taxiway system should provide for efficient aircraft taxiing that requires minimal changes in aircraft speed and direct routing to and from the runways, terminal area, and aircraft parking areas. Taxiway design principles include:

- Provide each runway with a parallel taxiway or the capability of a parallel taxiway.
- Build taxiways to provide as direct a route as possible, but do not provide direct apron to runway access without a turn.
- Provide bypass capability or multiple access points to runway ends.
- Ensure that taxiways ascribe to the new design criteria detailed in FAA AC 150/5300-13A, *Airport Design*; including updated taxiway fillet design.
- Avoid crossing runways whenever possible.
- Avoid constructing taxiways off the ends of runways.

BVY's present taxiway configuration is generally adequate to serve the present and forecasted levels of operational activity at the Airport; however, many elements of the airfield configuration date back to World War II and do not reflect current design standards and practices. In general, this layout should be modernized to be consistent with current taxiway standards that would ultimately increase safety, efficiency, and sustainability of the Airport. Additionally, there are several specific design considerations that must be addressed and that are reviewed below.

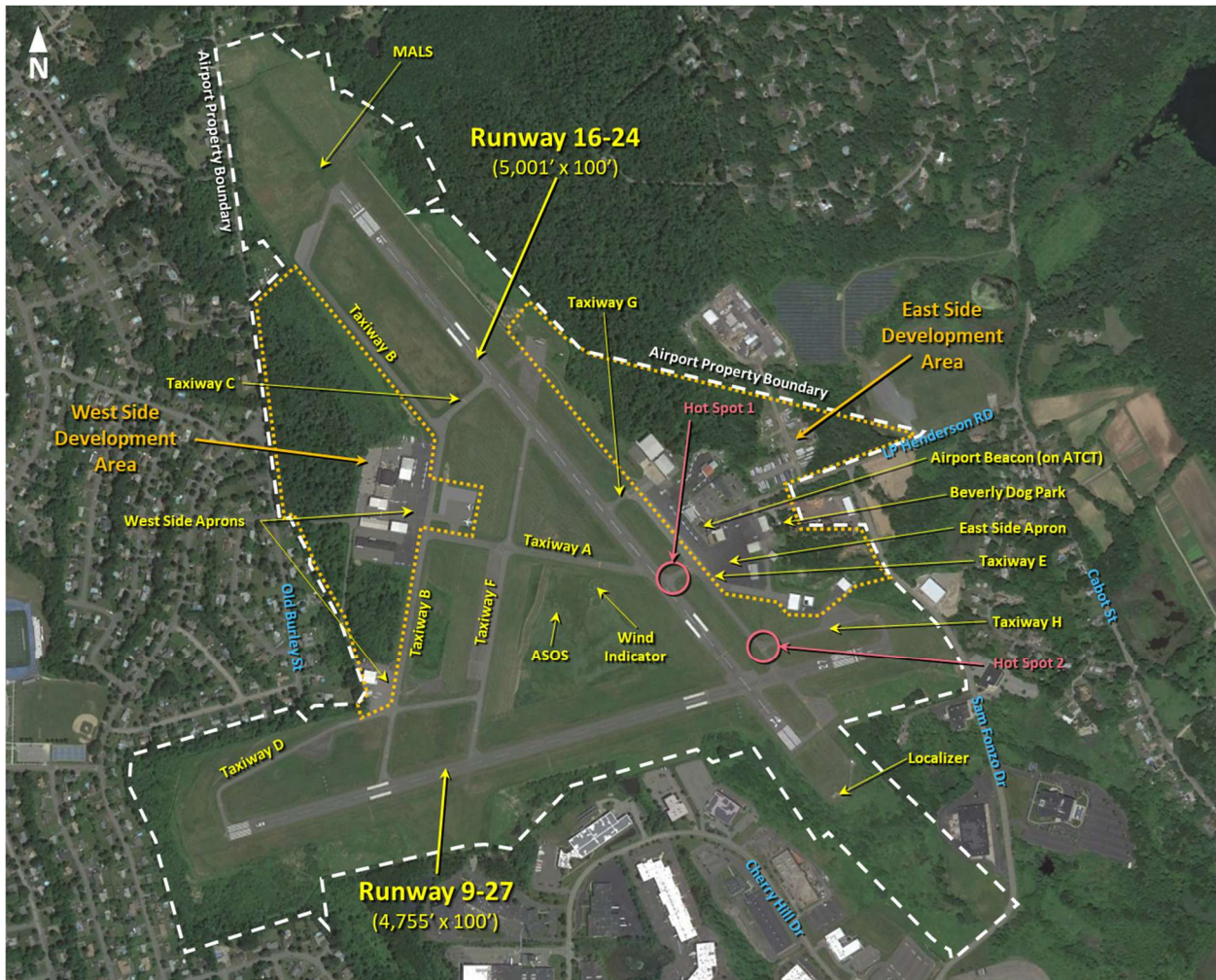
Taxiways should be designed to facilitate the movement of aircraft from a runway to an apron (and vice versa) in an efficient and expeditious manner such that potential conflicts are minimized, and safe operations are promoted. Based on that, taxiway design must be based first on the runway configuration and the landside facility locations, and then on the FAA airport design standards for different groups and categories of aircraft. In general, there is an ideal or optimum taxiway design for every airport and anything that deviates from that ideal standard typically results from a compromise of some sort, often based on existing site conditions, existing infrastructure, cost of reconstruction, etc. Nevertheless, the design of the taxiway system can be strategic for the growth of the airport, and the chosen layout can have a substantial impact on future development.

The taxiway reconfiguration at BVY is crucial for short-term improvements to safety as well as for long term benefits for future development. The current taxiway system is largely based on an airfield configuration that at least in part no longer exists. This has resulted in many taxiways having traits that are now nonstandard (these include varying widths, excessive separations from runways, inconsistent positioning that do not consider current security requirements, acute angle interfaces with other taxiways and runways, etc.). The intersection of these odd-angled taxiways is particularly concerning to FAA and MassDOT in that they can create confusion and potentially hazardous operating conditions -current design standards advocate for the consistent use of taxiways that run parallel to runways and that intersect with them at 90-degree angles.



For BVY's existing taxiway system (see **Figure 5-5**), there are two areas of immediate concern (or "hot spots") that have been identified by the FAA. The direct access provided by Taxiway A to Runway 16-34 from the east ramp is no longer in compliance with standards and given the frequency of its use, could result in an unsafe operational condition. Additionally, the intersection of Taxiway E and Taxiway H requires enhanced pilot awareness since an aircraft taxiing to Runway 27 could miss the turn to Taxiway H and inadvertently enter the Runway 9-27 environment, resulting in a runway incursion. Beyond those hot spots are acute angle taxiway interfaces of Taxiway F on both runways, and Taxiway B on Runway 9-27, excessive runway-taxiway separations on Taxiway B and Taxiway D, and a general need for additional parallel taxiways.

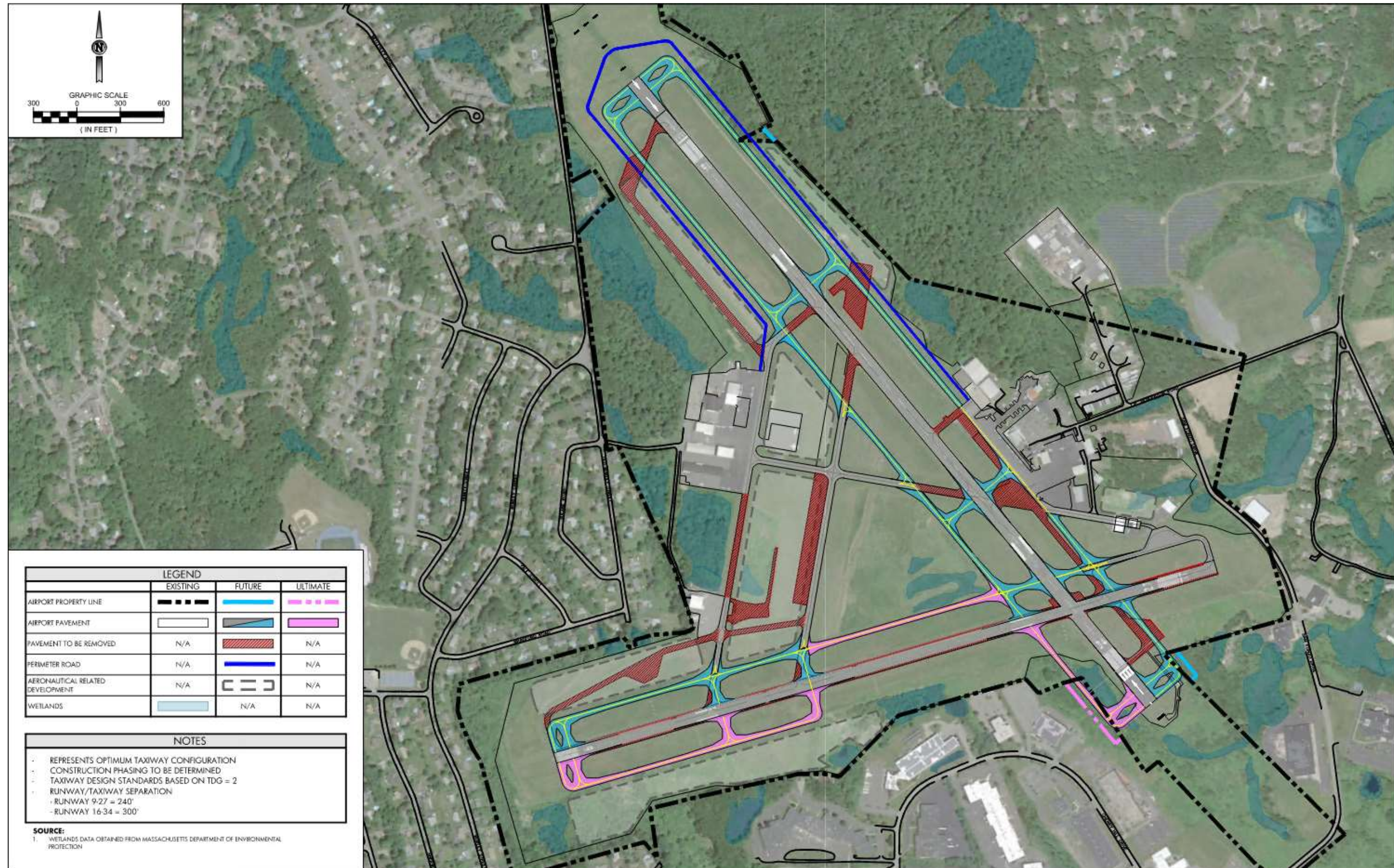
**Figure 5-5: BVY Current Taxiway System**



Source: Jviation

It should also be recognized that a taxiway that runs parallel to a runway generally serves as the foundational element of any taxiway system since they promote the most efficient and safe operations. For BVY, an optimum recommended taxiway plan has been established based on appropriate parallel taxiways (see **Figure 5-6**).

Figure 5-6: BVY Recommended Optimum Taxiway System



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There are a variety of important considerations to recognize in relation to this recommended taxiway plan.

- The plan as shown reflects recommended development for both Runway 16-34 and Runway 9-27 as presented earlier in this chapter. If those recommended plans for the runways were to change, this taxiway plan would likewise have to be adjusted.
- This taxiway plan is consistent with FAA airport design standards as well as industry design protocols and conventions. It is based on parallel taxiways located with appropriate separations to runways, eliminates acute angle taxiway-runway entrances of concern, relocates runway crossings to the outer third of both runways, eliminates direct runway access from the aprons, and eliminates runup pads on taxiways in lieu of bypass taxiways. It also addresses the existing FAA hot spots.
- The plan does not include proposed construction phasing (see below) but does show three taxiway elements as occurring in the ultimate (i.e., beyond the 20-year planning period) condition to preserve for that potential eventuality. It also shows likely property acquisition requirements in both the future and ultimate conditions; these are relatively limited in scope. (It is critical to note that this plan has not been vetted for permit-ability including potential environmental concerns. Those would have to be addressed on an individual basis for each taxiway construction project.)
- The plan shows existing pavement to be eventually removed, including parts of existing taxiways (including most of existing Taxiway B) as well as other old pavements, many of which date back to World War II. An estimated 586,000 square feet of pavement is planned for removal.
- The progressive implementation of this plan will result in additional areas on the Airport being made available for future development that could include new hangars and apron areas. These potentials exist on both the east side and the west side of BVY, as well as possibly south of Runway 9-27. (Note that none of these potential areas have been vetted for permit-ability including potential environmental concerns.)
- Based on discussions with BVY, FAA, and MassDOT, and as discussed previously, there is a desire to anticipate the potential eventual migration of Runway 16-34 from an RDC of B-II to an RDC of C-II beyond the planning period. Similar to the rationale related to maintaining the Runway 16-34 width at the C-II standard of 100 feet, the runway-taxiway separation requirements for parallel taxiways associated with Runway 16-34 will be established at the C-II standard of 300 feet to protect for that potential eventuality. The runway-taxiway separation associated with Runway 9-27 will remain at the RDC B-II standard of 240 feet.

### *Taxiway Construction Priorities*

The recommended taxiway plan reflects the optimum taxiway configuration for BVY; however, it is also understood that the transition to this configuration will be a progressive one due to practical limitations associated with cost and other priorities on the Airport. Through discussions with BVY and other stakeholders, it is understood



that addressing the existing FAA hot spots as well as eliminating the acute angle access points to the runways are the highest priorities, since they are directly related to operational safety improvements. Addressing these issues would make the Airport easier to navigate and reduce potential confusion; thus, these should be prioritized in the first phase of development. As reflected in **Figure 5-6** and described in BVY's 2018 Airfield Geometry Study, subsequent phases of taxiway design improvements and realignment should focus on the construction of appropriate parallel taxiways within the planning period. Of highest priority would be the relocation and construction of Taxiway B from the Runway 16 approach end to existing Taxiways C, F, and A. This action would not only eliminate three acute angle entry points to Runway 16-34 but would also potentially make airport areas available for redevelopment.

The relocation and construction of Taxiway E on the east side of Runway 16-34 to both runway approach ends is also a high priority. The BVY air traffic control tower has repeatedly expressed concern about aircraft operating from the east side of the Airport and departing on Runway 16 since this activity necessitates the crossing of an active runway. Beyond these priorities, the extension of Taxiway E would have to be constructed in association with the proposed paving of the Runway 16 safety area. The realignment of Taxiway D as well as the partial closure of Taxiway B would also provide opportunities for the Airport to redevelop existing properties. Other taxiway development, including the potential for a new partial parallel taxiway on the south side of Runway 9-27, can be constructed as demand warrants and funding is made available.

### **5.3.3 Aprons**

As areas potentially become available on the airport for development/redevelopment due to relocation of taxiways, it is anticipated that existing aprons may need to be reoriented and new aprons constructed to meet individual demands. The exact configurations of any potential new pavement shall be subject to change as development plans evolve. Note that the eastern ramp will also be subject to some replacement of existing pavement in poor condition, as well as new apron space to accommodate future development. Areas of potential development or redeveloped hangar will be illustrated on the ALP set created as part of this Airport Master Plan.

### **5.3.4 Airfield Pavement Strength and Maintenance**

Addressed in the previous chapter, runway and taxiway pavement strengths are designed not only to withstand the loads of the heaviest aircraft expected to use the Airport, but also to be able to withstand the repetitive loads of the entire range of aircraft expected to use the pavement over the planning period. Pavement strengths for BVY's critical airfield areas include the following:

- Runway 16-34: 30,000 lbs. (Single Wheel or SW), 55,000 lbs. (Dual Wheel or DW), 103,000 lbs. (Double Tandem or DT)
- Runway 09-27: 30,000 lbs. (SW), 114,000 lbs. (DW), 180,000 lbs. (DT)
- Taxiways: variable



With the design aircraft having been identified as a Cessna Citation Latitude (a dual-wheel aircraft with a maximum takeoff weight of 30,800 lbs.), the current runway pavement strengths have been deemed to be sufficient for the 20-year planning period. The Airport should also review the strength of taxiways that are planned to be preserved to ensure that they will meet the standards set by the newly constructed taxiways that will feed into them, since aircraft require appropriate pavement strength on taxiways as well as runways to operate at an airport.

As discussed in **Chapter 4**, there are sections of the ramp that are in poor condition as well as runway and taxiway sections that will require rehabilitation or reconstruction. Appropriate pavement maintenance is critical to ensure the operational and financial sustainability of any airport. Because of the significant financial commitment required to maintain pavement, it is critical that an airport establish a long-term preservation and maintenance plan. This plan will consist of annual inspections, regular crack sealing, and ultimate pavement rehabilitation or reconstruction no sooner than 20 years after the pavement's last rehabilitation or reconstruction (the 20-year requirement is current FAA policy). BVY's current pavement age and the anticipated year of its next reconstruction is included in **Table 5-3**. Specific recommendations will be incorporated into the BVY CIP in **Chapter 7**.

**Table 5-3 - Major Pavement Rehabilitation Schedule**

Pavement Area	Year of Last Construction and/or Rehabilitation	Year of Earliest Scheduled Construction and/or Rehabilitation
Runway 16-34	Construct: 1985/2005	2025
Runway 9-27	Construct: 2009	2029
Taxiway A	Construct: 1995	2015*
Taxiway B	Construct: 1980	2000*
Taxiway C	Construct: 1985	2005
Taxiway D	Construct: 1987/1999/2009	2007*/2019*/2029
Taxiway E	Construct: 2005/2009/2012	2025/2029/2032
Taxiway F	Construct: 2009	2029
Taxiway G	Construct: 2012	2032
Taxiway H	Construct: 2009	2029
East Side Aprons (near Buildings 50, 52, 46; Hangars 2, 3, 5)	2007/2012	2027/2032
East Side Aprons (near Building 47; Hangar 47)	1947	1967*
East Side Aprons (near Hangar 49)	1963/1969/1987	1983*/1989*/2007*
West Side Aprons (near Hangar 4)	1995	2015*
West Side Aprons (near TW B)	2014	2034
West Side Aprons (near Hangar 7)	2012	2032
West Side Aprons (north of Hangar 9)	2003	2023
West Side Aprons (north of Hangar 14)	2004	2024
West Side Aprons (north of Building 10)	1950	1970*

\*These areas are eligible for pavement rehabilitation/reconstruction.  
Source: Aviation, Airport Administration



Runway 16-34 is scheduled to be rehabilitated/reconstructed in the near term. During the upcoming rehabilitation, it would be reasonable for BVY to consider the potential of strengthening Runway 16-34 to 60,000 pounds (DW), which would be sufficient for the runway to accommodate most Group C aircraft. As described in **Chapter 3**, while BVY’s design aircraft will remain a B-II, it is understood that C-II aircraft are operating on the runway in growing numbers. Based on the understanding that the Airport’s design aircraft could eventually evolve to a C-II, it would be prudent for the Airport to consider increasing the strength capacity of Runway 16-34 as a measure to both increase its usability for Group C aircraft, and as a long-term cost savings measure to help preserve its longevity. (Note that Runway 9-27 would not need to be strengthened as it generally experiences fewer operations by larger aircraft.)

Beyond the planning period or at the time of other pavement reconstruction, BVY should review its pavement requirements and consider potential strengthening options. Greater weight-bearing capacities would be consistent with its status as a general aviation reliever airport in combination with industry trends towards larger and heavier aircraft.

**5.3.5 Airfield Visual Aids**

As discussed in **Chapter 4**, Runway 16-34 and Runway 9-27 are equipped with Medium Intensity Runway Lights (MIRL) and Runway 16 has a nonstandard Medium Intensity Approach Lighting System (MALS). Additionally, Runway 34 is equipped with Runway End Identifier Lights (REILs) which are high intensity white strobe lights located on each side of the runway threshold to enable rapid identification of the runway threshold particularly at night and during periods of poor visibility. **Table 5-4** summarizes these and other runway lighting features at BVY.

**Table 5-4 - BVY Runway Lighting**

Lighting	Runway 16	Runway 34	Runway 9	Runway 27
Approach Lighting	MALS	-	-	-
Runway Edge Lighting	MIRL	MIRL	MIRL	MIRL
Centerline Lights	-	-	-	-
Visual Approach Slope Indicator (VGSI)	PAPI-4 (Left)	-	PAPI-4 (Left)	PAPI-4 (Left)
Other Lighting	-	REILs	-	-

Source: FAA 5010.

If each end of Runway 16-34 is extended 300 feet, additional runway edge lighting will be required. However, since the existing threshold locations would not be relocated in the recommended plan, only limited segments of those systems would have to be modified. Additional REILs and PAPIs should be added to appropriate runway ends and located consistent with airport design standards.

BVY has Medium Intensity Taxiway Light (MITL) systems installed along the edge of all taxiways to help guide aircraft between runway and apron areas. It is recommended that the same be used for newly constructed taxiways to maintain continuity and safe conditions between existing and new infrastructure.

Finally, it is also recommended that all airfield lighting be progressively converted to current light-emitting diode (LED) technology to promote energy efficiency and environmental/financial sustainability.

### 5.3.6 Automated Surface Observation System (ASOS)

BVY is equipped with an Automated Surface Observation System (ASOS) for the reporting of weather conditions at the Airport. It is currently located in the center of the airport property. However, it happens to lie within the Taxiway Object Free Area (TOFA) and Taxiway Safety Area (TSA) of the planned full-parallel to Runway 16-34 that would replace Taxiway B. Because of this, the ASOS will need to be relocated when this project is commenced. A nearby location that meets siting requirements with respect to future conditions will be illustrated on the ALP.

### 5.3.7 NAVAIDS/Approaches

It was identified in the facility requirements chapter that BVY may benefit from improved or lower approach minimums, particularly on the heavily utilized Runway 16-34. For Runway 34, the current RNAV GPS approach for all aircraft categories allows for a decision altitude of 382 feet (280 feet AGL) with 1-mile visibility. Runway 16 has a decision altitude of 357 feet (250 feet AGL) with 1-mile visibility. Reducing visibility minimums to  $\frac{3}{4}$  miles would be helpful in enhancing accessibility during inclement weather.

Unfortunately, implementing lower approach minimums for Runway 16-34 would mean an increase in the size of the associated RPZs. Currently, Runway 16-34 with the 1-mile visibility approach has an RPZ that measures 500 feet (inner width) by 700 feet (outer width) by 1,000 feet (length). Lowering approach visibility minimums to  $\frac{3}{4}$ -mile would require that RPZ size to increase to 1,000 feet (inner width) by 1,510 feet (outer width) by 1,700 feet (length). This would also require adherence to Interim FAA guidance related to RPZs, which would likely present substantial impacts to incompatible objects and land uses within that expanded RPZ such as buildings (homes and businesses) or roadways. Because of this and other airspace considerations, it is not practicable to reduce the approach minimums beyond their existing conditions.

It should also be recognized that Runway 16 is equipped with a localizer. This is an older type of ground-based NAVAID that provides lateral guidance for aircraft through a specific type of instrument approach. However, with the advent of GPS approaches that provide better approach minimums, that now comprise nearly all instrument approaches at BVY, and that do not require ground-based NAVAIDs, the practical need for this type of equipment is shrinking. While the localizer does provide some capabilities and redundancies for older aircraft that are not equipped with GPS instruments, its lack of use combined with the increasing difficulties and costs of maintaining this aging equipment warrants the localizer's ultimate decommissioning and removal during the planning period.



### **5.3.8 Other Visual Aids**

Additional visual aids and instrumentation at BVY assist pilots in arriving or departing. The Airport's segmented circle and integrated wind cone provides pilots with traffic pattern and wind direction/velocity information. This equipment is centrally located in the middle of the airfield. As with the ASOS, taxiway redevelopment may call for the relocation of the segmented circle to avoid conflict with TOFA requirements. The ALP will show a recommended location that meets segmented circle siting requirements for the future condition.

Signage provides essential guidance to identify items and locations on an airport. Airfield signage gives pilots visual guidance information for all phases of movement on the airfield. BVY is equipped with FAA-compliant signs that include instruction, location, direction, destination, and information signs. These signs will be adapted to the recommended airfield layout.

### **5.3.9 Airspace Obstructions**

According to the 5010 Master Record, runway obstructions at BVY are as follows:

#### **Runway 16**

There are 32-foot trees, 1,000 feet from the Runway 16 end, 125 feet to the right of the centerline, requiring 25:1 slope to clear, or a 30:1 slope with respect to the Runway's displaced threshold.

#### **Runway 34**

There are no obstructions listed for Runway 34.

#### **Runway 9**

There is a 15-foot tree, 300 feet from the Runway 9 end and 150 feet left of the centerline, requiring a 6:1 slope to clear.

#### **Runway 27**

There are 22-foot trees, 396 feet from the Runway 27 end, 125 feet to the right of the centerline, requiring an 8:1 slope to clear, or a 50:1 slope with respect to the displaced threshold.

Note that more objects and obstructions were observed through the surveying effort associated with this Master Plan. The obstructions noted above as well as those discovered during the surveying effort are illustrated on the ALP set with a recommended disposition provided.

## 5.4 Landside & Airport Support Facilities

This section identifies development concepts and alternatives to address BVY's existing and future needs for landside and airport support facilities within the 20-year planning period. The following sections provide overviews of the alternative analyses for several of the landside infrastructure requirements as reflected in **Table 5-5**.

**Table 5-5 - Landside & Airport Support Facility Requirements Summary**

Facility	Identified Requirement
Terminal/Administration Buildings	– No action required
Aircraft Hangar Requirements	– Preserve and prepare for T-hangar development – Preserve and prepare for medium and large corporate hangar development
Aircraft Parking Aprons	– Preserve and prepare for additional apron space as growth occurs
Landside Access and Parking Requirements	– Improve way-finding signage from major streets
Airport Security	– Maintain vigilance; no immediate action required
Airport Perimeter Road	– Construct airport perimeter road
Fuel Storage Requirements	– No intermediate action required; possible long-term Jet-A expansion
Deicing Facilities	– No action required
SRE/Airfield Maintenance Facilities	– Expand SRE/Airfield maintenance building capacity
Airport Equipment	– Replace SRE and maintenance vehicles as they reach their useful life, as reflected on CIP.
Utilities	– No intermediate action required; potential long-term expansion may be required with hangar development – Establish and maintain a utility infrastructure master plan

Source: Aviation

### 5.4.1 East Side Development Area

BVY's East Side Development Area has historically been the center of small general aviation operations at the Airport and will continue to serve in this role into the future. Because this area is already well established and developed, future changes will likely be minimal, but nonetheless, there are potential opportunities to redevelop some areas, expand airport support structures, and add several hangars (see **Figure 5-7**). It should be noted that this area has a variety of grade issues and environmental considerations that would have to be individually addressed to pursue such development. In general, potential development opportunities on the East Side include the following:

- Construction of three future hangars immediately north of Hangar 2. Note that this would likely result in the loss of up to 11 existing marked tiedowns.
- Construction of a future hangar near existing Hangar 11.
- Construction of a future hangar near existing Hangar 15.
- Construction of three future hangars on top of the site of existing Building 45. These would also require the construction of a taxiway in front of existing Building/Hangar 47. This would also result in the loss of up to 36 automobile

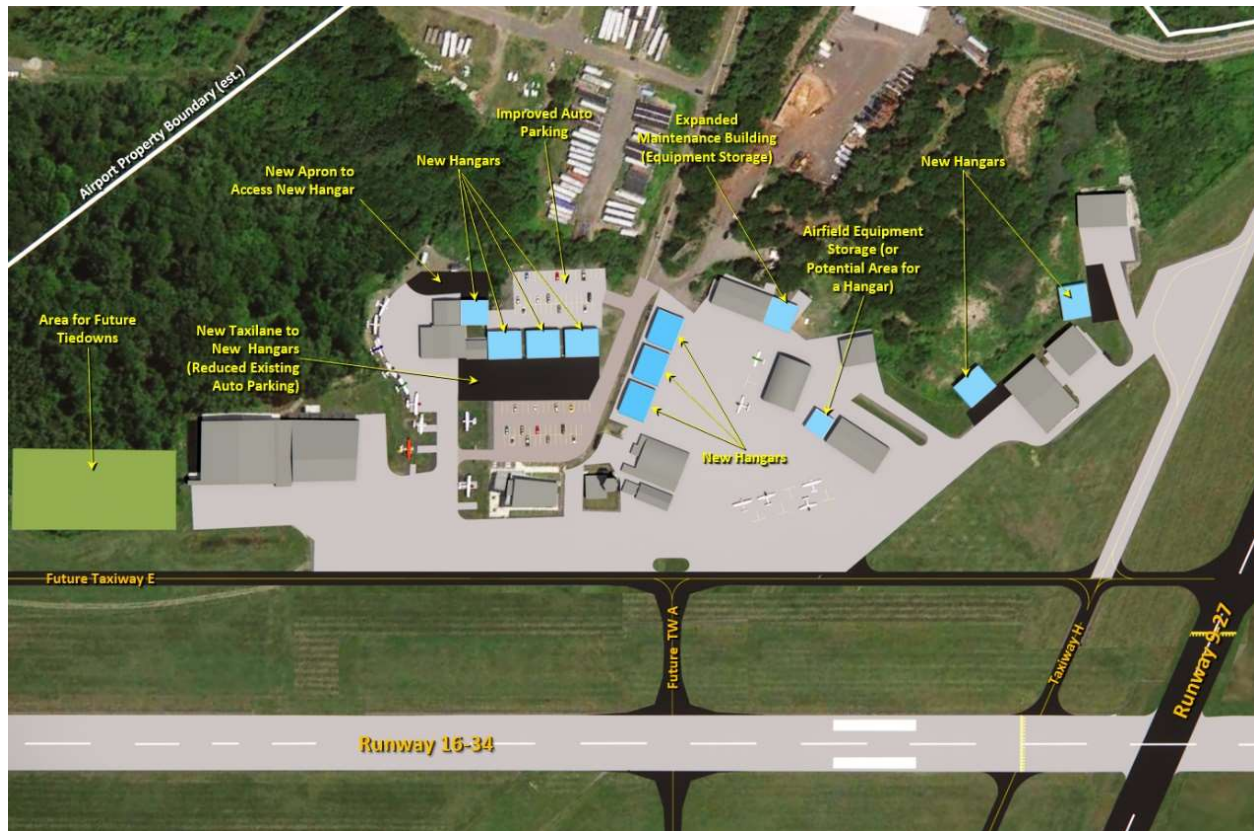


parking spots in the Administration Building parking lot, although the existing parking lot located north of Building 45 could be preserved and reconfigured to recoup many of those spots.

- Construction of a future hangar or expansion of existing Hangar 45. This could require additional paving for aircraft to access the site.
- An expansion of the existing airfield maintenance building as well as the relocation of underground fuel storage (Mogas) and fueling capabilities near this building.
- Construction of a structure between existing Hangars 3 and 5. Note that this structure could be designed for the storage of airport equipment (as described below). If that is ultimately not needed, the site could accommodate a hangar.

Additionally, it must be noted that development noted here in addition to the future relocation of Taxiway E will result in the total loss of up to 20 existing marked aircraft tiedowns. If there is a need to replace these tiedowns, a new turf tiedown area located in an uplands area north of Hangar 49 could be established.

**Figure 5-7: Potential East Side Development Options**



Source: Jviation

## 5.4.2 West Side Development Area

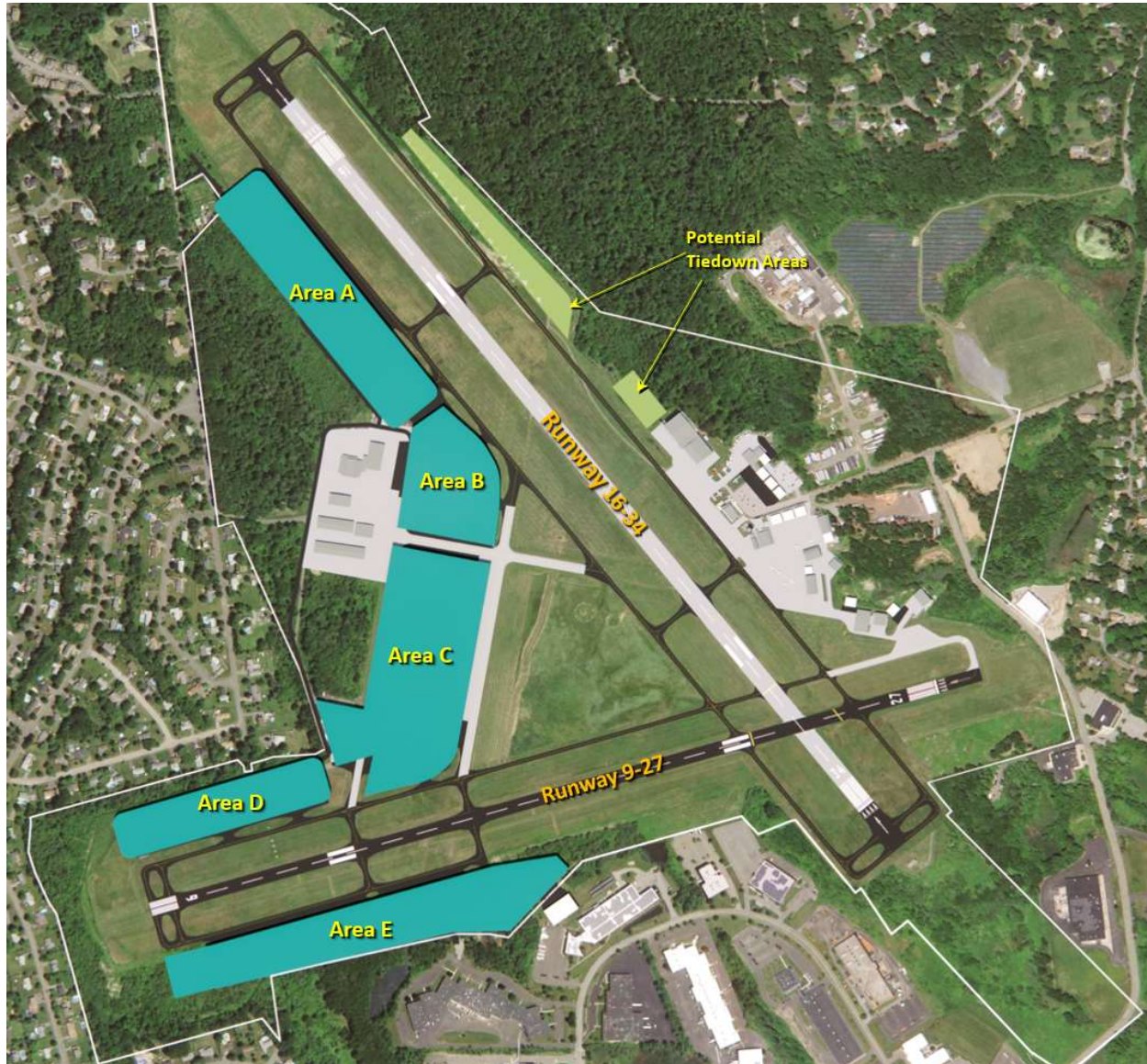
The Airport's West Side Development Area has historically been the center of larger general aviation including corporate jet operations; it will continue to serve in this role into the future. The West Side has the potential to establish new hangars and aprons through both redevelopment of existing areas as well as areas made available through the relocation and realignment of taxiways. Specific examples of such opportunities are reflected below in **Figure 5-8** and described below.

- **Area A** is approximately 5.1 acres in size and is currently occupied by the existing Taxiway B. Based on taxiway reconfiguration plans described above, when this taxiway is relocated closer to Runway 16-34 to have a runway centerline to taxiway centerline separation of 300 feet, airport land will become available for landside redevelopment that could include hangars and apron.
- **Area B** is approximately 5.4 acres in size and is currently already partially developed with an aircraft parking ramp. However, with the future extension of the relocated Taxiway B to existing Taxiway F, Area B has the potential to become secured separate from the airside environment to have public access. Doing so would make this area available for possible future hangars, an FBO terminal, and associated aprons.
- **Area C** is approximately 12.7 acres in size, although approximately 3.6 acres of which has been identified as being wetlands. This area is currently surrounded by Taxiways A, B, D, and F and therefore essentially undevelopable for any purpose that would require public access. However, based on taxiway reconfiguration plans described previously, a section of existing Taxiway B has been identified for decommissioning. Doing so would allow for public access to Area C, which itself could be secured separate from the airside environment. This would make this area available for potential future hangars, associated aprons, an access road, and auto parking.
- **Area D** is approximately 6.4 acres in size and is currently occupied by the existing Taxiway D. Based on taxiway reconfiguration plans described above, when this taxiway is relocated closer to Runway 9-27 to have a runway centerline to taxiway centerline separation of 240 feet, airport land will become available for landside redevelopment that could include hangars and apron. (It should be emphasized that if such development were to occur in the future, care must be taken to design any structures to minimize any potential noise impacts on residential neighbors that abut the area to the north. Hangars and other structures can serve effectively as sound barriers if positioned and constructed appropriately.)
- **Area E** is approximately 11.0 acres in size and is currently undeveloped. Based on taxiway plans described above, if a new partial parallel taxiway were to be constructed south of the approach end of Runway 9, this area could be developed with hangars and aprons. Landside access to this site would likely be via Cherry Hill Drive to the south of the Airport.



Again, the potential for redeveloping existing areas is largely contingent on the implementation of elements of the taxiway development plan.

**Figure 5-8: Potential West Side Development Options**



Source: Jviation

### 5.4.3 Airport Perimeter Road

BVY has a need to improve vehicle circulation around the Airport and specifically to eliminate vehicles from crossing Runway 16-34. With levels of activity increasing on both the east side and the west side of the Airport, the frequency of vehicles having to travel from one side to the other will only increase. In particular, the BVY ATCT has repeatedly expressed concern about fuel trucks having to cross the runway to service fuel farms and aircraft on both sides of the Airport. To alleviate this concern, an airport perimeter road (or vehicle service road) is proposed that would link the east



and west sides by way of a path around the approach end to Runway 16 (see **Figure 5-6**). The positioning of this road is such that it would be located outside of relevant FAA Airport Design standard requirements as well as clear of critical airspace surfaces. Vehicles traveling on this road would not have to cross Runway 16-34 and should not have to communicate with the ATCT in most circumstance to travel on it. This road would primarily be a single lane paved road with some sections utilizing existing apron pavements for efficiency and cost-effectiveness.

#### 5.4.4 Miscellaneous Recommendations

Based on the requirements stipulated in Chapter 4, additional general recommendations include the following:

- BVY should continue to actively pursue airport security enhancements as available to help ensure the safety and security of operations on the Airport. This includes maintaining appropriate segregation of the public from all aircraft operations and airfield areas, as well as appropriate maintenance of all existing security elements including the security fence.
- The Airport must appropriately maintain its existing fuel tanks and prepare for a potential expansion of its Jet-A capacity over the long term. Specific actions could include the relocation of the functionality of the Mogas dispensing and fuel tank to an area near the airfield maintenance building.
- BVY and its tenants should continue to conduct deicing operations in compliance with US EPA regulations. It should also regularly monitor those regulations for any changes.
- BVY should continue to maintain and replace (as required) its SRE and airfield maintenance equipment. As noted previously, the Airport should also construct additional covered areas to store its equipment to preserve its lifespan. (Equipment replacement requirements have been reflected in the Capital Improvement Plan.)
- The Airport should continue to maintain its existing utility infrastructure as well as to expand that infrastructure to meet development demand within the 20-year planning period. BVY should establish and maintain a utility infrastructure plan to ensure that it has access to and knowledge of current conditions.

### 5.5 Non-Aeronautical Development

In addition to the development alternatives presented above, there are other potential development options requiring consideration prior to their inclusion in the plan. In the sponsor grant assurances, the FAA has stated that airports should be as financially self-sufficient as possible. One way of meeting that goal is for airports to develop property that has been designated as surplus for aeronautical purposes. Such a designation is typically made if an airport has more land than it requires for development within the planning period and beyond, or if there are lands that are practicably inaccessible to the airfield and therefore not able to provide direct aeronautical support. Property designated as surplus for aeronautical purposes must be shown on the ALP as such and approved by the FAA. Any non-aeronautical



development must be fully compatible with airport operations and could be subject to an official FAA release of airport property process as detailed in FAA Order 5190.6B, *Airport Compliance Manual*. Additionally, the FAA requires that any airport property used for non-aeronautical purposes must be leased at fair market value, and as a result could potentially generate significant amounts of revenue for BVY. Such development could include commercial, light industrial, storage, etc.

BVY has previously identified several existing airport parcels as having the potential for nonaeronautical-related use. As reflected in the existing ALP, these parcels are located to the east of the East Side Development Area as well as on the extended centerline to the approach end of Runway 34. It should be noted that none of these parcels has direct and/or reasonable access to the airfield due to a variety of issues including environmental limitations and construction impracticability due to terrain. It should also be recognized that any development that could occur in these areas must comply with FAA Airport Design standards, including RPZ-based land use compatibility.

Because of the need to preserve airport property for future potential aeronautical-related development, no additional airport parcels have been identified for nonaeronautical-related use. Nevertheless, the Airport should pursue compatible development of those parcels already identified as being for nonaeronautical-related use at fair market value. This would be alignment with FAA goals of promoting airport financial self-sufficiency.

### 5.6 Recommended Development Plan

Recommended airside and landside alternatives are aligned with forecasted operations and based aircraft and to allow the Airport space to accommodate additional hangars and other landside development. Utilizing the evaluation of alternatives described in the previous sections, feedback from Airport staff, and the PAC (made up of key tenants and stakeholders), future improvements have been summarized in **Table 5-6**.

**Table 5-6** also includes key inputs for the ALP that will directly result from this Master Plan. Note that these include “ultimate” projects that area considered to be beyond the future or 20-year planning window. The purpose of including these ultimate projects is to protect for future potential development beyond the 20-year planning period. It should also be noted that ultimate projects should not be interpreted as being endorsed or funded by the FAA.

**Table 5-6 - Recommended Development Summary**

Development	Master Plan Recommendations
<b>Airside Development</b>	
Runway 9-27	No change in runway length; narrow runway to 75'
Runway 16-34	Alternative 2 – Extend each runway end 300' each runway end 300 feet into the area currently occupied by the existing RSA for departures; maintain width
Taxiway System	Progressively reconfigure system to reflect optimum configuration
Aprons	Construct aprons as required

Airfield Pavement Strength	Strengthen Runway 16-34 and selected taxiways as required to accommodate larger jets
Visual Aids	Develop as required by projects; Upgrade to LED
NAVAIDs	No Change
Airspace Obstructions	Remove / mitigate obstructions as required
<b>Landside / Other Development</b>	
Hangar Development	Construct hangars as required
Airport Perimeter Road	Construct road around the north end of Runway 16
Airport Security	Maintain existing (including fencing) and improve as available
Airport Support Facilities	Construct cold-storage structures for equipment preservation
Airfield Equipment	Replace as required
Utilities	Maintain existing and improve as required

Source: Aviation

These projects will be carried through the rest of the Master Plan study for further evaluation and depiction on the Airport Layout Plan, presented in the next chapter. The final chapter will estimate costs and financial resources available to fund recommended projects.

### 5.7 Environmental Review

The potential impacts to the environment from the alternatives presented above were important considerations in selection of the Recommended Plan for all project elements (Runway 19-27, Runway 16-34, taxiway improvements, west side development, and east side development). The potential environmental impacts of the Recommended Plan are summarized in the following sections as well as a discussion of permits that will likely be required for its implementation.

The overarching environmental review of federally funded airport projects is the National Environmental Policy Act (NEPA); therefore, a summary of NEPA is provided here. In accordance with FAA Orders 1050.1F Environmental Impacts: Policies and Procedures and 5050.4B National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions, airport development projects must be evaluated for environmental impacts per criteria from the FAA. FAA Order 1050.1F specifically defines what level of environmental review is required depending upon the level of impact a project may have. Typically, there are four levels of NEPA review depending on the scope and potential environmental impacts of the proposed action. These include FAA internal memos, documented categorical exclusions (CATEX), environmental assessments (EA), and environmental impact statements (EIS):

- FAA Internal Memo.** Projects that can be categorically excluded per FAA Order 1050.1F and per FAA knowledge of the airport and project do not require documented analysis of each environmental category. The FAA issues a list of projects internally reviewed each year; these projects will likely be included on that list.



- **Documented CATEX.** Projects that can be categorically excluded per FAA Order 1050.1F; however, the FAA requires documented analysis of potential impacts to environmental resources.
- **EA.** Projects that can normally be categorically excluded but involve extraordinary circumstances; cannot be categorical excluded; do not require an EIS; that do not create significant environmental impacts; or may create significant impacts, but the impacts can be mitigated.
- **EIS.** Projects that were evaluated in an EA and it was found that the project would result in impacts greater than the allowable significance threshold and that mitigation would not reduce the impacts below the threshold. It is not anticipated that any projects at EGE will require an EIS.

Based on a review of project elements in the Recommended Plan and the environmental resources inventoried in **Chapter 2**, some level of NEPA documentation will be required. It should be noted that this Master Plan contains a general assessment of environmental impacts and a forecast of the environmental permits that may be required for the recommended plan in its entirety or for specific project elements of the Recommended Plan. Further design is needed to definitively determine/quantify the amount and/or degree of impacts, and the type and level of permitting required.

### 5.7.1 Environmental Impact Categories

Important local, state, and federally regulated natural resources exist on and around the Airport and those are listed below and described in detail in **Chapter 2**. The following sections summarize the expected environmental impacts to each of these resources resulting from the Recommended Plan.

- Air Quality
- Biological Resources (Rare and Endangered Species / Vernal Pools)
- Coastal Resources
- Section 4f Properties
- Farmlands
- Hazardous Materials, Pollution Prevention, and Solid Waste (RCRA & CERCLA & MassDEP)
- Historical / Archeological Resources
- Energy and Natural Resources
- Noise and Noise-Compatible Land Use
- Socioeconomic Impacts, Environmental Justice and Children's Environmental Health and Safety Risks
- Light Emissions, Visual Resources, and Visual Character
- Water Resources and Wetlands
- Floodplains
- Surface and Groundwater Supplies
- Wild and Scenic Rivers
- Construction Impacts

### **Air Quality**

The Recommended Plan would have a potential temporary negative impact on air quality from the installation of new asphalt, although this would be quick and dissipated by winds immediately after installation. Construction vehicles would produce exhaust, but this also would be temporary in nature.

Mitigation measures identified in FAA AC 150/5370-10, *Standards for Specifying Construction at Airports*, will be followed during construction. FAA specifications included in FAA AC 150/5370-10, Item P-156 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control will be included in the specifications to minimize impacts to air quality.

The capacity of the runways will not increase for size and weight of the aircraft. Instead, the runways will be modified to increase safety for the existing size and weight of aircrafts currently using the runways; therefore, there will be no increase in aircraft emissions because of the Recommended Plan.

Stationary sources such as boilers, emergency generators and other fuel combustion equipment used during construction or operations associated with potential developments may be required to meet applicable emissions and permitting requirements. However, given the size of the Airport, it is unlikely that any concentration increases would contribute to a violation of the National Ambient Air Quality Standards (NAAQS). Any Federal actions, or actions obtaining Federal funding, must comply with *Conformity* under Section 176 (c) of the Clean Air Act requires that any federal agency which “engage[s] in, support[s] in any way or provide[s] financial assistance for, license or permit, or approve[s], any activity which does not conform to an implementation plan” for achieving and maintain air quality standings must evaluate and mitigate for such impacts.

The Recommended Plan and elements therein may be subject to the Massachusetts Environmental Policy Act Greenhouse Gas Policy, this policy requires applicants to avoid or minimize greenhouse gas emissions to the greatest extent possible.

### **Biological Resources - Rare and Endangered Species / Vernal Pools**

The Airport is not located within known Priority or Estimated Habitats regulated by the Natural Heritage & Endangered Species Program (NHESP) under the Massachusetts Endangered Species Act (MESA). The NHESP commented in 1990 stating that the Golden-winged Warbler (*Vermivora chrysoptera*), a State endangered species, was identified on the Airport property in the 1980s. NHESP did not indicate the presence of this species in a response obtained for the airport in 1996 nor was it on the public map in 2019.

For federally protected species, the U.S. Fish & Wildlife Service (USFWS) through use of its Information for Planning and Consultation (IPaC) indicated the possible presence of a federally protected species, the Northern Long-Eared Bat (*Myotis septentrionalis*), although no critical habitats are present at the Airport. This means that no further review is required beyond rerunning the IPaC report at each instance



that a new airport project is proposed unless that particular project requires submittal of NEPA documentation or a USACE Section 404 permit application.

The online reviewable databases and maps depicting state and federally protected species and their habitats are updated by NHESP; thus, as these Master Plan projects are implemented, these sources should be reviewed.

### ***Coastal Resources***

The City of Beverly contains some land subject to the jurisdiction of the Massachusetts Coastal Zone Management (CZM) program; however, the limits of the Airport are located beyond the coastal zone.

No coastal barriers exist on or adjacent to the Airport property; therefore, no impacts to these resources would occur.

### ***Section 4(f) Properties***

The Airport property is not 4(f) land, and the Recommended Plan will not result in any land or easement acquisition of 4(f) properties. The current zoning maps of all three municipalities were reviewed to identify any publicly owned open space and/or historic districts or places adjacent to the airport or within the runway approaches where obstructions may occur, and none were found.

In general, it is not anticipated that the Recommended Plan will impact any of the homes to the west of the approach end to Runway 9. Also note that it is understood that there are multiple historic places (residences) listed on the State Register of Historic Places along Locust Street in Danvers.

### ***Farmlands***

No active agricultural fields exist on the Airport property or within any areas that may be altered by the construction of any selected improvement projects; however, prime agricultural soils and farmland of statewide importance do exist on Airport property.

The Recommended Plan will not impact land that is currently in agricultural use; however, some of the potential west side development options may occur within soils designated as Farmland of Statewide Importance.

### ***Hazardous Materials, Pollution Prevention, and Solid Waste (RCRA & CERCLA & MassDEP)***

Waste disposal during project implementation will be managed separately from normal Airport solid waste management operations. The airside elements of the Recommended Plan are not likely to introduce new hazardous materials into the area. However, potential landside development may involve the use and storage of hazardous materials. Aside from products directly related to aircraft operations and maintenance, the Airport makes concerted efforts in the areas of pollution prevention, waste reduction, and solid waste recycling. The Airport holds a current Stormwater Pollution Prevention Plan (SWPPP) and Spill Prevention Control and

Countermeasures Plan (SPCC). These plans will be updated as necessary for each proposed development opportunity.

There are several recorded spills (a.k.a. releases) on the Airport that may have impacted soil or groundwater. Any work within or near these release areas should undergo the required due diligence for proper characterization and handling as required by the Department of Environmental Protection (DEP), the U.S. Environmental Protection Agency (USEPA), and by local authorities such as the fire department.

### *Historical / Archeological Resources*

The National Park Service's National Register of Historic Places online data viewer was reviewed, and no National Register sites were identified at the Airport; therefore, no federal historic review is required. The Massachusetts Historic Commission (MHC) should be reviewed prior to initiating any proposed airport project to ensure the Commission has no new concerns.

The Recommended Plan will have no impact on known archaeological or historic resources. The runway improvements will be done on previously disturbed soils and therefore no artifacts are expected to be present in these areas. Potential development areas that occur within undisturbed soil should undergo, at a minimum, a desktop cultural resources survey to determine the potential for archaeological or historic resources.

### *Energy and Natural Resources*

The Recommended Plan will result in only minor additional demands for electricity. Fuel consumption will increase at the rate of operational increases, which had been project in the previous Airport Master Plan Update in 1999 to be 1.4 percent per annum. This slow growth rate combined with the minor increases in electrical demand will not jeopardize the availability of these resources in the future. Additionally, only common construction machinery and methods are needed to construct projects.

For these reasons, no impacts to the available energy supply are anticipated.

### *Noise and Compatible Land Use*

The Recommended Plan is proposed to be located entirely on Airport property and is therefore consistent with existing land use. With respect to potential noise impacts, an airport noise analysis was conducted as part of this Airport Master Plan (see Appendix B, Aircraft Noise Technical Report). Specifically, that report describes the noise exposure and methodology used to develop existing and future aircraft noise contours for the Airport based on the forecasts presented in **Chapter Three**. In general, the Airport's operations are expected to grow at an average annual rate of 1.1% over the next 20 years, and when combined with the fact that many of the aircraft currently using the Airport will be replaced by newer, quieter aircraft, critical noise impact levels (as defined by FAA day-night levels) will remain almost entirely on Airport property. (Note that those areas that lie within the FAA-critical 65 DNL and



are located off-Airport property are currently, and are projected to remain, unpopulated in all timeframes.)

Additionally, the Airport already has voluntary noise abatement procedures established and voluntary time restrictions to reduce potential noise impacts on the surrounding community. The Preferred Alternative proposes the paving of the runway safety areas while maintaining the current threshold locations. While this will result in departing aircraft starting their operation 300 feet closer to the Airport property line than today, the overall land use on the Airport within these safety areas will not change – it will remain part of the runway operational envelope.

Note that the Recommended Plan will not directly result in an increase in the volume of air traffic nor the size of the aircraft which may use the facility. It will make the aircraft that already operate on the runway do so with a greater degree of safety. Therefore, there is not expected to be a significant change to the amount of noise produced by aircraft at the Airport. Again, critical noise contours for existing and future conditions will remain almost entirely on Airport property.

#### ***Socioeconomic Impacts, Environmental Justice and Children's Environmental Health and Safety Risks***

In accordance with FAA Order 5050.4B, community disruptions include projects that relocate any residence or business; alter surface-transportation patterns; divide or disrupt established communities; disrupt orderly, planned development; or create an appreciable change in employment.

Community impacts as defined in FAA Order 5050.4B are not anticipated to result from the implementation of the Recommended Plan. Long-term development associated with the Airport and the projected increased use of airport services could positively impact employment opportunities and improve transportation in the municipalities and surrounding area.

Executive Order 12898, *Federal Actions to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations*, was issued on February 11, 1994. It established procedures for the U.S. Department of Transportation (USDOT) (of which the FAA is a part) to “achieve environmental justice as part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects, including interrelated social and economic effects, of its programs, policies, and activities on minority populations and low-income populations in the United States.” The nearest EJ population is more than one mile south of the Airport; thus, no negative impacts to EJ communities are anticipated.

Additionally, the Recommended Plan is also not expected to have a significant negative impact on local residences; thus, children within the adjacent community should not be negatively affected.



### Light Emissions

Potential adverse impacts from light emissions refer to the potential for creating an annoyance to residents in the vicinity of the lighting installation or modification. FAA Order 5050.4B states that “Only in unusual circumstances, as for example when high-intensity strobe lights would shine directly into people’s homes, will the impact of light emissions be considered sufficient to warrant special study and a more detailed examination of alternatives in an environmental impact statement.” The proposed Master Plan elements do not incorporate such devices; therefore, by definition, any light impacts will be minimal.

### Wetlands

There are wetlands on the Airport property that pose development constraints that limit the development alternatives available for the Airport. The Recommended Plan has been developed to avoid or at least minimize impacts to these wetlands to the extent practicable. Nevertheless, wetland impacts could occur, and these would be subject to local, state and/or federal permitting. Additional design is needed to quantify wetland impacts and to determine the level of permitting required for each Master Plan element.

The Recommended Plan could impact wetlands at the Runway 16 and Runway 34 approach ends, depending on the grading of slopes. Potential west side and east side development options are also within/proximal to mapped wetland areas. At a minimum, these projects are within wetland buffer zones that are regulated by the municipalities, but not the U.S. Army Corps of Engineers (USACE).

The addition of taxiways may result in infield wetland impacts as evident in **Figure 5-6**. During the environmental permit application process, alternatives to reduce, eliminate, and/or mitigate those impacts will be prepared and presented to the various commissions as appropriate.

### Floodplains

Both 1% annual chance and 0.2% annual chance FEMA flood zones exist at the Airport. Any work which may occur within the 1% annual chance area would be regulated as Bordering Land Subject To Flooding (BLSF) under the Massachusetts Wetlands Protection Act (MWPA). The 1% zone is located in the City of Beverly, north of JP Henderson Road as well as a small portion to the northwest of Hilltop Drive. Although not regulated by the MWPA, the 0.2% chance exists to the east of Old Burley Street in the Town of Danvers on the western side of the Airport and should be considered in the planning and design of future development. The Recommended Plan would impact the 0.2% flood zone with the modification to the taxiways; although this impact is expected to be minimal. Future design will consider elevating the taxiway above the 0.2% elevation.

### Surface and Groundwater Resources

Wenham Lake is a primary drinking-water supply source for the Airport, the Cities of Beverly and Salem, as well as a secondary source for the Town of Wenham. The



Salem-Beverly Water Supply Board has jurisdiction over activities in the watersheds of Wenham Lake, Putnamville Reservoir, and the Salem-Beverly Waterway Canal. This includes most of the Airport property located east of the approach end of Runway 16 and north of LP Henderson Road, approximately one mile from Wenham Lake. This portion of the Airport in Beverly is zoned as Restricted Industrial, Research and Office (IR) with a Watershed Protection Overlay. In Danvers, the Airport is zoned as Industrial II, and in Wenham, it is zoned as Residential, although no residences exist in this portion of the town on Airport property – not that there are some residences along the nearby streets of Nathaniel Circle, Burley Street, Orchard Lane, and Middlewood Drive.

With proper construction and operational controls in place, the Recommended Plan is not anticipated to have a negative impact on Wenham Lake. There are no groundwater protection zones within or adjacent to the Airport; therefore, no impacts to these resources are expected.

### ***Wild and Scenic Rivers***

The U.S. National Park Service maintains a database of all rivers and river segments that are currently listed as Wild and Scenic, or have been afforded the status of a “study river” and may be eligible in the future for inclusion on the list. This list, updated in April 2019, does not include the Danvers or Porter Rivers or any of the smaller tributaries that receive drainage from the Airport; therefore, the Recommended Plan will not impact any Wild and Scenic Rivers.

### ***Construction Impacts***

FAA Order 5050.4B suggests that, in general, impacts during construction are of lesser magnitude than long-term impacts of any proposed action. Many of the specific types of impacts that could occur are discussed in descriptions of other impact categories. Only in unusual circumstances (e.g., construction in an ecologically sensitive area or involving substantial urban impacts) would this category be considered to create significant consequences that may not be adequately mitigated. It is recommended that the proposed project specifications include provisions of FAA AC 150/5370, *Standards for Specifying Construction of Airports*, which specifies the use of responsible design practices, appropriate project scheduling (i.e., hours of operation), and erosion and sedimentation control plans.

By adhering to reasonable hours of operation and including adequate dust and sediment controls in the specifications, construction impacts on these adjacent residential parcels can be minimized to acceptable levels

There are various federal, state, and local statutes, ordinances, and regulations that address construction-related environmental impacts, including impacts on air quality, water quality and noise. A Construction Management Plan (CMP) will be prepared which will address construction impacts. The Preferred Alternative CMP will describe measures that will be implemented to avoid or minimize environmental impacts.

Typical temporary impacts which will result from the construction period that may result from grading, paving or hangar development include noise, emissions and dust

impacts from typical construction equipment and methodology. During the development of the CMP and permitting applications and required town, state, and federal permitting, potential environmental issues will be identified, and impacts will be minimized and mitigated to the extent possible.

The Preferred Alternative will need to comply with the National Pollutant Discharge Elimination System (NPDES) General Permit for Construction and the Stormwater Pollution Prevention Plan (SWPPP), and State Greenhouse Gas Compliance Best Management Practices (BMPs)



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