T.F. Green Airport Improvement Program

U.S. Army Corps of Engineers
Clean Water Act
Section 404 Permit Application

Prepared for **Rhode Island Airport Corporation**

Prepared by VHB *Vanasse Hangen Brustlin, Inc.*

July 2011

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT *(33 CFR 325)*	OMB APPROVAL NO. 0710-0003 EXPIRES: 31 August 2012

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PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This Information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME:	8. AUTHORIZED AGENT'S NAME AND TITLE (an agent is not required)
First - Kevin Middle - Last – Dillon	First - Carol Middle - Last – Lurie
Company – Rhode Island Airport Corporation	Company – Vanasse Hangen Brustlin, Inc.
E-mail Address – kdillon@pvdairport.com	E-mail Address – clurie@vhb.com
6. APPLICANT'S ADDRESS.	**9. AGENT'S ADDRESS**
Address - 2000 Post Rd	Address - 101 Walnut St
City – Warwick State – RI Zip – 02886-1502 Country – USA	City – Watertown State – MA Zip – 02472 Country – USA
7. APPLICANT'S PHONE NOs. W/AREA CODE	**10. AGENT'S PHONE NOs. W/AREA CODE**
a. Residence b. Business c. Fax	a. Residence b. Business c. Fax
401-727-4000	617-924-1770

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Carol Lurie to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

Clurie — APPLICANT'S SIGNATURE

6/27/11 — DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

T.F. Green Airport Improvement Program

13. NAME OF WATERBODY, IF KNOWN (if applicable)

Buckeye Brook, tributaries and wetlands

14. PROJECT STREET ADDRESS (if applicable)

Address 2000 Post Rd

City - Warwick State – RI Zip - 02886

15. LOCATION OF PROJECT

Latitude: °N 41.72
Longitude: °W 71.43

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

State Tax Parcel ID Municipality
Section – Township – Range –

17. DIRECTIONS TO THE SITE

From Providence, take I-95 to Exit 13 and follow signs to airport. See Figure 1 of 3 attached.

18. Nature of Activity (Description of project, include all features)

Construction of airfield safety and efficiency enhancements, including a runway extension, taxiway relocation, runway safety area improvements, and road relocations and/or realignments.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

The Basic Project Purpose is to enhance airport safety and enhance the efficiency of the Airport and the New England Regional Airport System to more fully meet the current and anticipated demand for aviation service. Refer to Chapter 2 of the attached narrative.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Construction activities will require direct placement of fill in jurisdictional wetlands and waterways. See Figure 2 of 3 and Figure 3 of 3 attached.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards
Typical airport and road construction borrow; volume of fill unknown at this time.		

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres Wetland impact would be 5.0 acres.

Or

Liner Feet Waterway impact would be 843 linear feet.

23. Description of Avoidance, Minimization, and Compensation (see instructions)

Conceptual avoidance, minimization, and compensation measures were designed for the Preferred Alternative. Refer to Chapter 6 of the attached narrative.

24. Is Any Portion of the Work Already Complete? Yes ☐ No ☑ IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

Address – See attachment

City – State – Zip –

26. List of Other Certifications or Approvals/Denials Received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
See attachment.					

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

Ken A Dullea	6/27/2011		10/27/11
SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

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JAN 17 2012

ENG FORM 4345, SEPT 2009

Supplemental Attachments

Block 25. Addresses of Adjoining Property Owners, Lessees, etc. Whose Property Adjoins the Waterbody.

Note: The entire Four Seasons apartment complex is an abutter to the project.

Abutter Name	Abutter Address
SPRING GREEN CORP	459 NAMQUID DR WARWICK, RI 02888
MALCOLM EKSTRAND	1466 WARWICK AVE WARWICK, RI 02888
SNH V DAO	226 PARTITION ST WARWICK, RI 02888
INTEGRITY INVESTMENTS INC	140 RESERVOIR AVE PROVIDENCE, RI 02907
TIMOTHY J HAWES	93 RIVERSIDE AVE WARWICK, RI 02889
ARNOLD CLARKE	178 BELLEVUE AVE WARWICK, RI 02888
BAR RI LLC	1400 POST RD WARWICK, RI 02888
CITY OF WARWICK	3275 POST RD WARWICK, RI 02886
SPRING GREEN REALTY LLC	558 SMITHFIELD AVE PAWTUCKET , RI 02860
BENCHMARK GPT WARWICK LLC	40 WILLIAMS ST, SUITE 350 WELLESLEY, MA 02481
SPRING GREEN REALTY LLC	560 SMITHFIELD AVE PAWTUCKET , RI 02860
SPRING GREEN REALTY LLC	559 SMITHFIELD AVE PAWTUCKET , RI 02860
SPRING GREEN REALTY LLC	561 SMITHFIELD AVE PAWTUCKET , RI 02860
ANN MARIE BOUCHARD	37 LAW ST WARWICK, RI 02889
CHRISTOPHER L BEAUREGARD	4 ETTA ST WARWICK, RI 02889
ANTONIO DIFRAIA	35 ELBERTA ST WARWICK, RI 02889
ROBERT A ANDERSON	266 WASHINGTON ST WARWICK, RI 02888
CATHY R THOMPSON	95 LYDICK AVE WARWICK, RI 02888
CHARLES GERMAN	56 CASWELL ST NARRAGANSETT, RI 02882
HELEN JODOIN	91 ELBERTA ST WARWICK, RI 02889
BURKE TARR FURNITURE CO	2011 GULF SHORE BLVD, NORTH 13 NAPLES, FL 34102
LEA and GENNARO SLAUGHTER	7 ETTA ST WARWICK, RI 02889
DENISE LHEUREUX-MCKENNA	57 ELBERTA ST WARWICK, RI 02889
EILEEN GOUVEIA	114 POTOMAC RD WARWICK, RI 02888
THAI XIONg	1 WAYCROSS DR WARWICK, RI 02888
ERIC A RUSCITO	83 ELBERTA ST WARWICK, RI 02889
GERALDINE S TRUDEAU	36 LOVEDAY ST WARWICK, RI 02888
RICHARD M GRENIER	51 ELBERTA ST WARWICK, RI 02889
CARL W SWANSON	21 ELBERTA ST WARWICK, RI 02889
TONIA ANN TARABORELLI-MINNICK	6 HARGRAVES ST WARWICK, RI 02889
MARY KANE	94 LYDICK AVE WARWICK, RI 02888
ETHEL SQUILLANTE and ESTA MILANO	104 POTOMAC RD WARWICK, RI 02888
PHOENIX-WORLDWIDE RIGP	1445 WAMPANOAG TR, STE 203 EAST PROVIDENCE , RI 02915
D & C ASSOCIATES LLC	190 COMMERCE DR WARWICK, RI 02889
RUNWAY HOLDING LLC	100 COMMERCE DR WARWICK, RI 02886
JOEL H HARRISON	230 AIRPORT RD WARWICK, RI 02889
FRANK E RUSILOSKI	33 HARMONY CT WARWICK, RI 02889
NORMAND S PROVENCAL	241 HOXSIE AVE WARWICK, RI 02889
JAY PRINTING AND LITHOGRAPHING	100 WARWICK INDUSTRIAL DR WARWICK, RI 02886
CHANDELLE ASSOCIATES	25 CLORANE ST WARWICK, RI 02889
SUMMIT ASSOCIATES	86 WARWICK INDUSTRIAL DR WARWICK RI 02886
BRENT E WYROSTEK	546 LAKE SHORE DR WARWICK, RI 02889
JOSE J LOZADA	158 HILTON RD WARWICK, RI 02889
SCHROFF INC	170 COMMERCE DR WARWICK, RI 02886
EIGHTY COMMERCE ASSOCIATES LLC	335 CENTERVILLE RD, BLD 5-E WARWICK, RI 02886

Abutter Name	Abutter Address
WILLIAM R JR FAY	2045 BROAD ST CRANSTON , RI 02905
JOSEPH J R SMITH	120 HILTON RD WARWICK, RI 02889
JOHN TAGLIONE	247 HOXSIE AVE WARWICK, RI 02889
SUMMIT ASSOCIATES	C/O EDWARD CERIO 25 CLORANE ST WARWICK, RI 02886
JOSEPH F KILDAY	910 CEDAR SWAMP RD WARWICK RI 02889
ROBERTA BARLOW	231 HOXSIE AVE WARWICK RI 02889
SPRING GREEN REALTY LLC	558 SMITHFIELD AVE PAWTUCKET , RI 02860
SPRING GREEN CORP	459 NAMQUID DR WARWICK, RI 02888
RAYMOND P SEVIGNY	41 HARMONY CT WARWICK, RI 02889
BARLOW, ROBERTA	231 HOXSIE AVE WARWICK, RI 02889
CARMINE JR TAVAROZZI	255 HOXSIE AVE WARWICK, RI 02889
CAROLINA PROPERTIES LLC	46 WARWICK INDUSTRIAL DR WARWICK, RI 02886
SHALVEY REALTY LLC	1301 CENTERVILLE RD WARWICK, RI 02886
NANCY A SMITH	524 LAKE SHORE DRIVE WARWICK, RI 02889
THEODORE CURTIS	564 LAKE SHORE DR WARWICK, RI 02889
WILLIAM R JR FAY	223 HOXSIE AVE WARWICK RI 02889
DAVID MEDEIROS	142 HILTON RD WARWICK, RI 02889
EDWARD B ANDREWS	183 WILBUR AVE WARWICK, RI 02889
MARY C GLODIS	84 HILTON RD WARWICK, RI 02889
MICHAEL A RAPOSA	87 WALKER RD WARWICK, RI 02889
CHARLES J VUCCI	70 RODNEY RD WARWICK, RI 02889
PETER A MUSSO	129 RODNEY RD WARWICK, RI 02886
FRANK NERI	1191 POST RD WARWICK, RI 02888
INTEGRITY INVESTMENTS INC	211 BLANCHARD AVE WARWICK, RI 02888
ROBERT A ANDERSON	15 ELBERTA STWARWICK, RI 02888
SPRING GREEN REALTY LLC	1463 WARWICK AVE WARWICK, RI 02888
ELBERT L JONES	132 HILTON RD WARWICK, RI 02889
EIGHTY COMMERCE ASSOCIATES LLC	80 COMMERCE DR WARWICK RI 02888
JACK L VICINO	74 HILTON RD WARWICK, RI 02889
ELIZABETH M THEISLER	80 WALKER RD WARWICK, RI 02889
MCKINNEY SHIRLEY J LIFE ESTATE	80 RODNEY RD WARWICK, RI 02889
VERTEAL D PATTERSON	119 RODNEY RD WARWICK, RI 02889
JOSEPH F KILDAY	20 STEP CIRCLE WARWICK, RI 02889
BENCHMARK GPT WARWICK LLC	75 Minnesota Ave Warwick RI 02888
SPRING GREEN REALTY LLC	1471 WARWICK AVEWARWICK, RI 02888
SPRING GREEN REALTY LLC	1449 WARWICK AVE WARWICK, RI 02888
JOSEPH JR DIORIO	150 HILTON RD WARWICK, RI 02889
SCHROFF INC	150 COMMERCE DR WARWICK RI 02888
DONALD P REDDY	64 HILTON RD WARWICK, RI 02889
TRACEY E DANIELS	73 RODNEY RD WARWICK, RI 02889
MARTIN MARKARIAN	133 RODNEY RD WARWICK, RI 02886
STUART LEE PERLMAN	99 RODNEY RD WARWICK, RI 02889
CHARLES GERMAN	71 WAYCROSS DR WARWICK RI 02888
TIMOTHY J HAWES	202 Blanchard Ave Warwick, RI 02888
SPRING GREEN REALTY LLC	1469 WARWICK AVE WARWICK, RI 02888
BURKE TARR FURNITURE CO	1441 WARWICK AVE WARWICK, RI 02888
Four Seasons Apartment Complex	
Current Residents	1471 WARWICK AVE WARWICK, RI 02888
Current Residents	1469 WARWICK AVE WARWICK, RI 02888
Current Residents	1467 WARWICK AVE WARWICK, RI 02888
Current Residents	1465 WARWICK AVE WARWICK, RI 02888
Current Residents	1459 WARWICK AVE WARWICK, RI 02888

Abutter Name	Abutter Address
Current Residents	1461 WARWICK AVE WARWICK, RI 02888
Current Residents	1463 WARWICK AVE WARWICK, RI 02888
Current Residents	1445 WARWICK AVE WARWICK, RI 02888
Current Residents	1453 WARWICK AVE WARWICK, RI 02888
Current Residents	1455 WARWICK AVE WARWICK, RI 02888
Current Residents	1457 WARWICK AVE WARWICK, RI 02888

Block 26. List of Other Certifications or Approvals/Denials Received from Other Federal, State, or Local Agencies for Work Described in This Application.

Note: All certifications or approvals listed will be applied for when the Preferred Alternative has been selected.

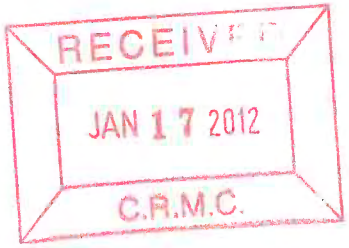
Agency	Permit or Approval
Federal	
Army Corps of Engineers	CWA Section 404 Individual Permit
Environmental Protection Agency	Safe Drinking Water Act Compliance
National Park Service	Section 6(f) Conversion Approval[2]
Tribe	
Narragansett Tribe	NHPA Section 106 Coordination
State	
RI Coastal Resources Management Council	Federal Consistency Review
RI Department of Environmental Management	Freshwater Wetlands Alteration Permit
	Rhode Island Pollution Discharge Elimination System (RIPDES) - Stormwater Design and Construction
	CWA Water Quality Section 401 Certification
	Preliminary Determination Application
	Air Pollution Control Permits – Minor Source Permits[3]
	Above Ground Storage Tank Application (Fuel Farm)
	Underground Injection Control Permit
	Section 6(f) Conversion Approval[2]
RI Department of Transportation	Physical Alteration Permits
	Category A/B Assent
RI Historic Preservation and Heritage Commission	NHPA Section 106 Concurrence
Municipal	
City of Warwick	Warwick Historical Cemetery Commission Approval

Source: VHB, Inc.

1 Consistency or concurrence from agencies not listed above may be required during the permit application process.

2 The City of Warwick is responsible for Section 6(f) conversion approval and coordination with RI Department of Environmental Management and National Park Service.

3 A modified permit is required for steam boilers and emergency generators and a new permit is required for new fuel storage tanks.



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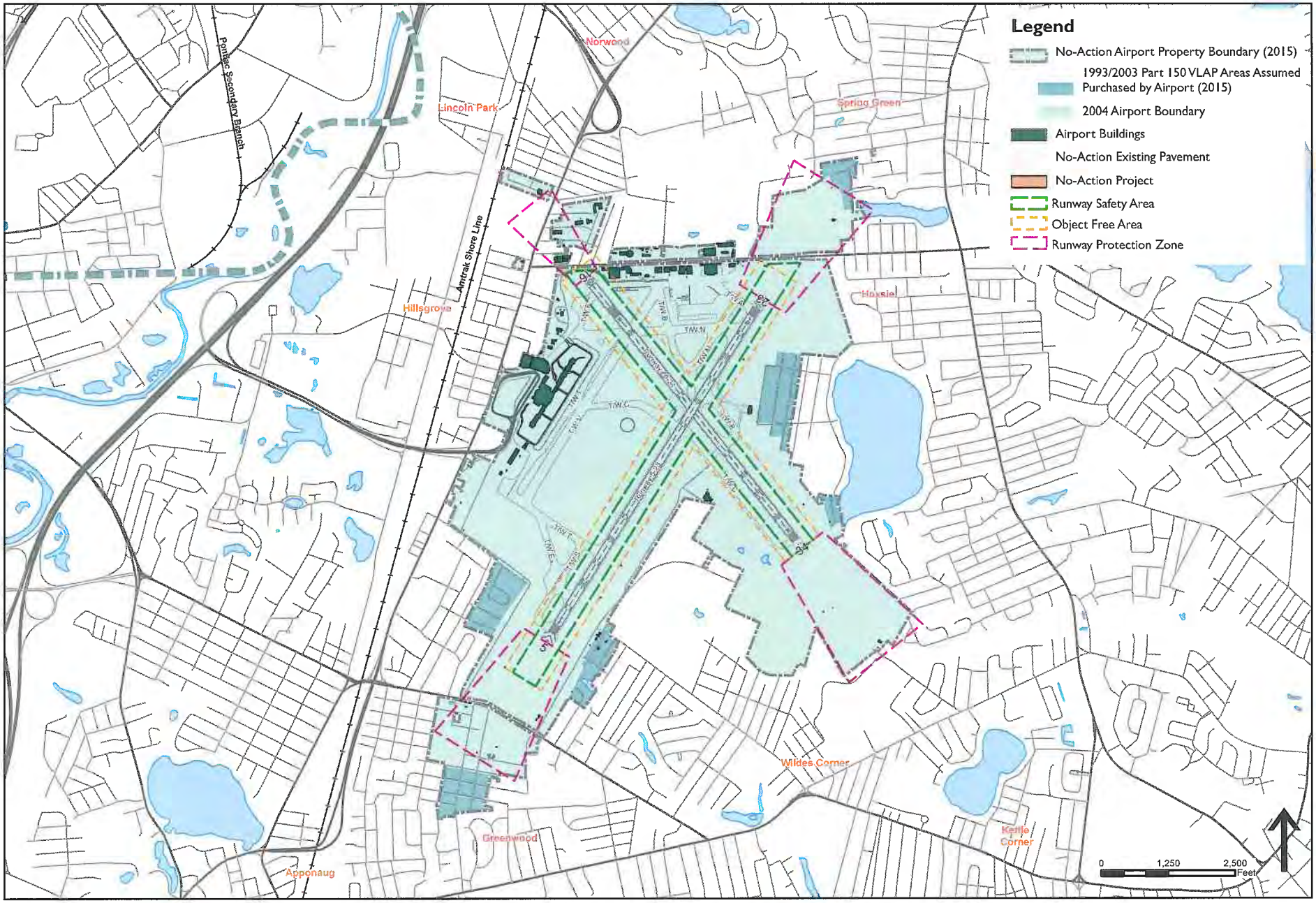

Rhode Island Airport Corporation
200 Post Road, Warwick, RI 02886

T.F. GREEN AIRPORT IMPROVEMENT PROGRAM
Vicinity Map

AT: Warwick
IN: Kent County, Rhode Island

APPLICATION BY:
Rhode Island Airport Corporation

DATE
July 2011

SHEET
1 of 3

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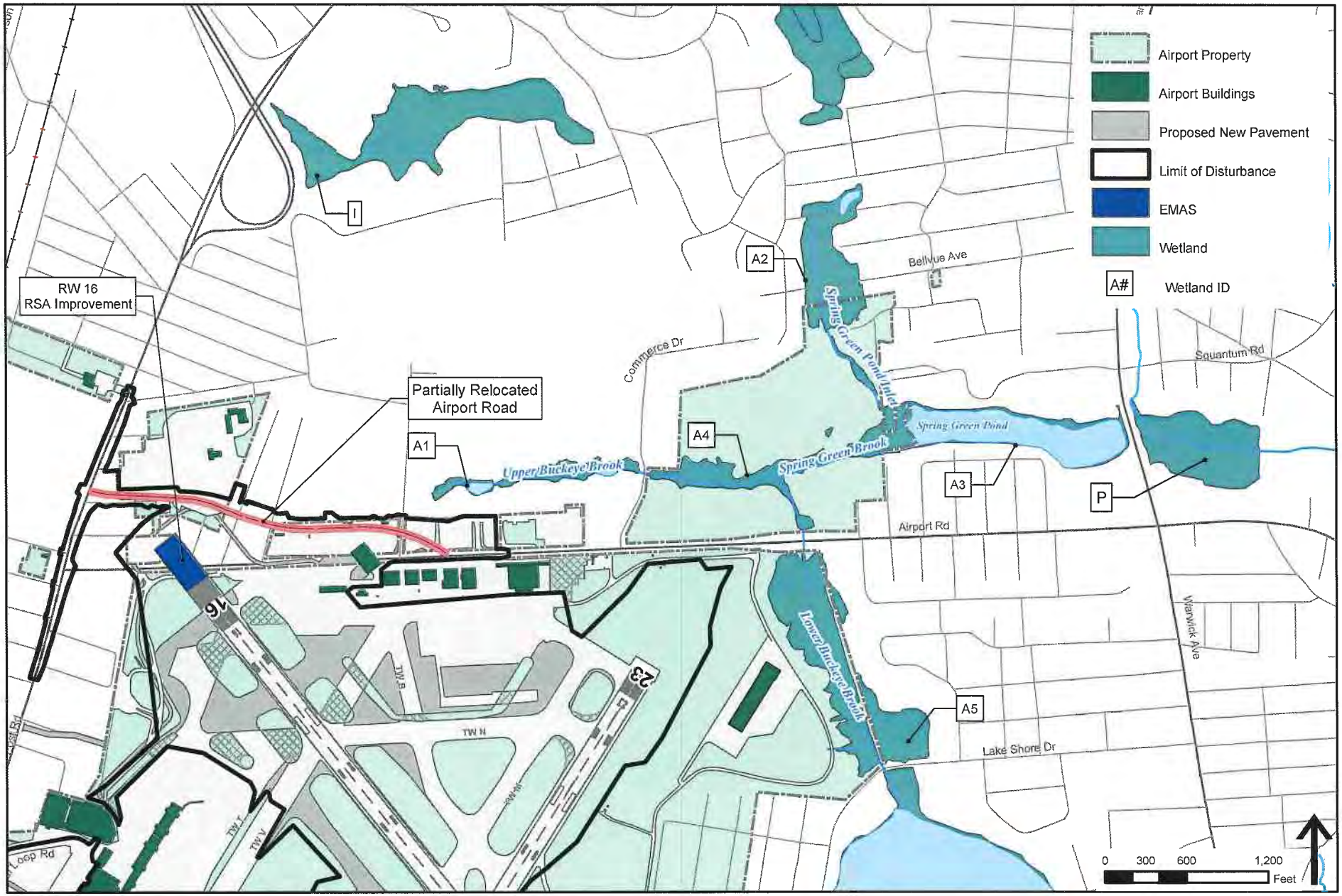

Rhode Island Airport Corporation
200 Post Road, Warwick, RI 02886

T.F. GREEN AIRPORT IMPROVEMENT PROGRAM
Alternative B4 (North)

DATE: July 2011

AT: Warwick
IN: Kent County, Rhode Island

APPLICATION BY: Rhode Island Airport Corporation

SHEET: 2 of 3

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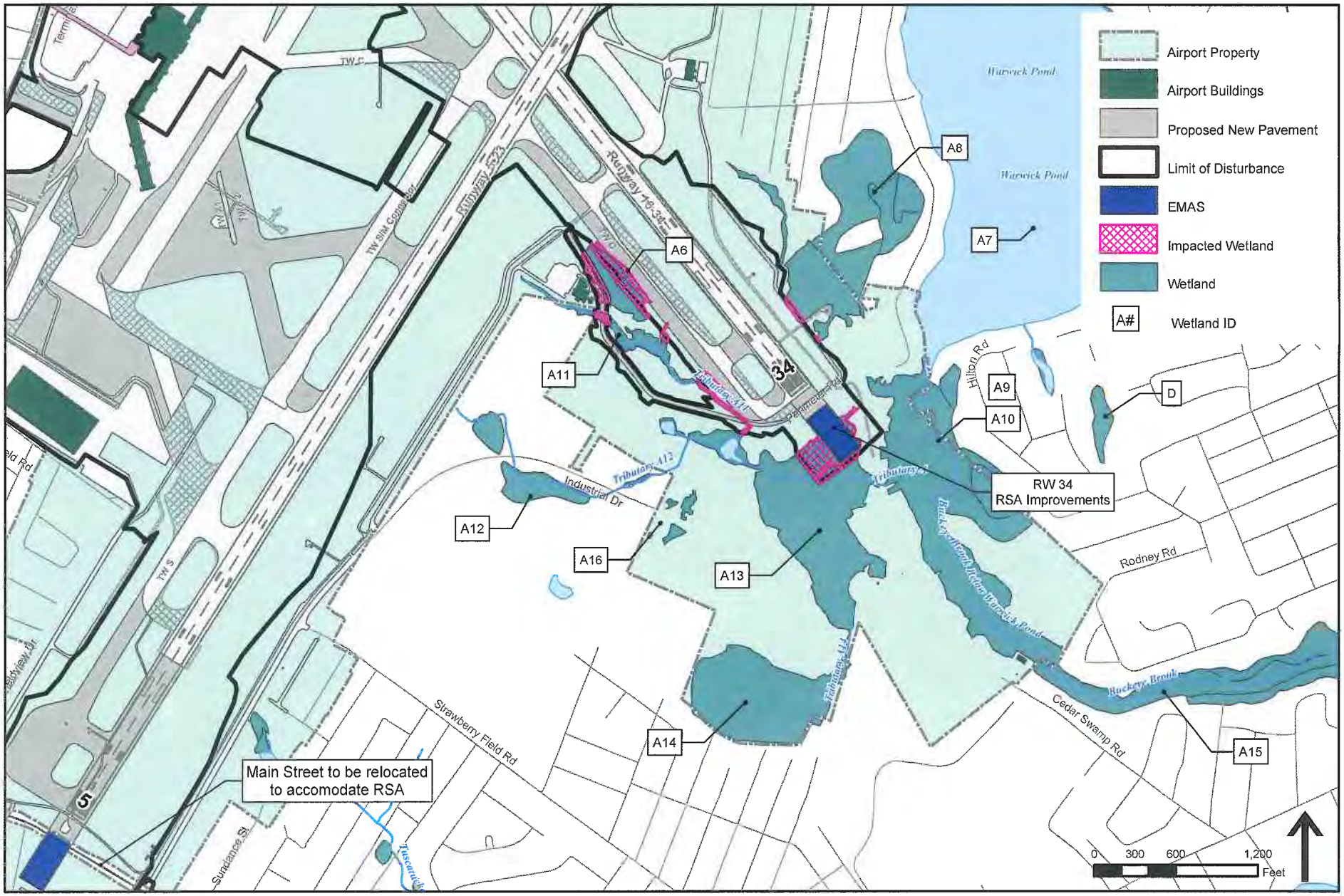

Rhode Island Airport Corporation 200 Post Road, Warwick, RI 02886	**T.F. GREEN AIRPORT IMPROVEMENT PROGRAM** **Alternative B4 (South)**		DATE July 2011
	AT: Warwick IN: Kent County, Rhode Island	APPLICATION BY: Rhode Island Airport Corporation	SHEET 3 of 3

T.F. Green Airport Improvement Program

U.S. Army Corps of Engineers Clean Water Act Section 404 Permit Application

Prepared for **Rhode Island Airport Corporation**

Prepared by *Vanasse Hangen Brustlin, Inc.*

July 2011

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1 Introduction and Overview

1.1 Introduction

Certain components of the T.F. Green Airport Improvement Program (the Improvement Program) will require authorization from the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (CWA). Specifically, program activities that will place dredged or fill material into waters of the United States must be permitted by the USACE.

This chapter summarizes the Improvement Program and the USACE's Highway Methodology[1] process that was used during CWA Section 404 permit pre-application coordination beginning in 2004. Subsequent chapters define the Basic Project Purpose, summarize the screening analysis for the alternatives considered, and describe the final two alternatives (Alternative B2 and Alternative B4) and the No-Action Alternative, as presented in the July 2011 Final Environmental Impact Statement (FEIS). Detailed analyses of the alternatives' potential impacts to aquatic resources and to other key environmental resources that distinguish between Alternatives B2 and B4 are summarized. Conceptual mitigation measures for Alternative B4 (the Preferred Alternative) are also described. The application concludes with a summary and comparison of Alternatives B2 and B4. Supporting information is provided in the T.F. Green Airport Improvement Program Draft Environmental Impact Statement (DEIS) and FEIS.

1.2 Regulatory Context

The Highway Methodology is a process that the USACE New England Division uses to coordinate the CWA Section 404 permit application review with the Federal Aviation Administration's (FAA's) National Environmental Policy Act (NEPA) process. The Rhode Island Airport Corporation (RIAC) has prepared this Phase II Permit Application in accordance with the Highway Methodology Phase II requirements concurrently with the FEIS in the NEPA process. (The Phase I requirements were fulfilled in a June 2007 memorandum, as described below.) This application presents detailed information on project alternatives to allow for meaningful

1 USACE New England Division. 1993. *The Highway Methodology Workbook. Integrating Corps Section 404 Permit Requirements with Highway Planning and Engineering and the NEPA EIS Process.*

agency and public comment in advance of the USACE's selection of the Least Environmentally Damaging Practicable Alternative (LEDPA).

Alternative B4, as the Preferred Alternative, will require a permit from the USACE under CWA Section 404 for the following elements:

- Runway 16-34 RSAs, taxiways, navigational aids and lighting, the Runway 16-34 Perimeter Road, drainage and utilities, land acquisition required for construction, Delivery Drive relocation, and Partially Relocated Airport Road (to accommodate the Runway 16 End Enhancements), including drainage and utilities and land acquisition required for construction;
- Taxiway C Relocation;
- Hangar No. 1 demolition; and
- Runway 5-23 extension and safety areas, taxiways and aprons, navigational aids and lighting, the Runway 5-23 Perimeter Road, drainage and utilities, land acquisition required for construction, and Realigned Main Avenue (to accommodate lengthening at the Runway 5 End), including drainage and utilities and land acquisition required for construction.

Construction activities for these program elements will require direct placement of fill in wetlands or waterways within the USACE's jurisdiction.

The first step in the Highway Methodology process, determining the Basic Project Purpose, was completed in March 2006 as described in Chapter 2 of this application. The second step is completing a USACE Highway Methodology Phase I Avoidance Technical Memorandum. The *T.F. Green Airport Improvement Program Phase I Technical Memorandum* [2] (the Phase I Technical Memorandum) was completed in June 2007 and describes a four-level screening process used to evaluate a broad range of alternatives; the Phase I evaluation is summarized in Chapter 3. This approach involved a focused analysis of the alternatives that best meet the NEPA project Purpose and Need as well as the USACE Basic Project Purpose.

The third step in the Highway Methodology process is completing a Phase II Permit Application. This document is the Phase II Permit Application and presents to the USACE detailed information on the alternatives advanced to and further screened in Phase II, as described in Chapters 4 through 7. It is anticipated that the USACE will publish a Public Notice of the Application, review the Project, select the LEDPA, complete an environmental review of the project, and issue the CWA Section 404 permit once the required state and local permits are secured.

USACE input and coordination with RIAC began early in the NEPA process. Early input included USACE approval of the Basic Project Purpose, which was used to comparatively assess alternatives. Additional input was received at Inter-Agency/Tribal Coordination Group meetings convened for the Improvement Program NEPA process. This input included consensus forms when determining the NEPA project Purpose and Need

2 FAA and RIAC. 2007. *T.F. Green Airport Improvement Program Phase I Technical Memorandum.* Prepared by Vanasse Hangen Brustlin, Inc., Watertown, MA.

and evaluating the range of alternatives. In April 2009, the USACE reviewed potential wetland impacts and discussed mitigation options at a June 3, 2009 meeting. Input from this meeting was incorporated into the preliminary application issued with the DEIS in July 2010.

Comments on the DEIS and the preliminary USACE application were obtained in writing and during the public hearing held at the Community College of Rhode Island auditorium on August 17, 2010. Several comments concerned inadequate focus on opportunities for mitigation in the Buckeye Brook watershed. To better explain the wetland mitigation program and receive input from local organizations, the FAA and RIAC hosted a meeting with non-governmental organizations (NGOs) including the Buckeye Brook Coalition, Save the Bay, the Rhode Island Rivers Council, and some members of the Warwick City Council. This meeting, which was held on November 4, 2010, led to further coordination with Save the Bay and the Mill Cove Conservancy, for the inclusion of a new wetland preservation site (Site 12) in the estuary of the Buckeye Brook watershed.

Subsequent meetings were held with the Wetland Working Group, including the USACE on February 15, 2011 at the RIDEM office in Providence and again on February 23, 2011 at the USACE New England Division (NED) Office in Concord, Massachusetts. The February 15, 2011 meeting presentation began with the description of redesign efforts directed by the FAA that had led to the reduction of wetlands impacts from 7.3 acres to 5.0 acres for the Preferred Alternative. This in turn led to a reduction in the mitigation requirement and elimination of half of the 12 mitigation sites considered. The USACE expressed concern that no agreements were in place for wetland and buffer preservation at Sites 8 and 12. It was explained that funding to acquire the rights to preserve these properties would only become available after the Record of Decision (ROD) was issued for the project. The USACE also recommended that Site 6 be dropped from the mitigation package and if additional areas for mitigation area were required sites outside of Warwick should be considered. Site 6 continues to be offered as mitigation in this application with the intention that this site can be dropped if adequate preservation can be achieved at Site 8 and 12 or an alternate site is identified.

1.3 T.F. Green Airport Improvement Program Overview

The Theodore Francis Green Airport (T.F. Green Airport, or the Airport) occupies 1,100 acres of land and is located in the dense, urban City of Warwick, Rhode Island, six miles south of the City of Providence (Figures 1-1 and 1-2). T.F. Green Airport is generally bounded by Airport Road to the north, Industrial Drive to the east/southeast, Main Avenue (State Route 113) to the south, and Post Road (U.S. Route 1) to the west. T.F. Green Airport is accessible via several major regional and national roadways, including Interstate Highways I-95 and I-295, U.S. Route 1, and State Routes 10 and 37. The Airport is also accessible via RIPTA and the Massachusetts Bay Transportation Authority (MBTA) bus lines. Adjacent land uses include residential development to the southwest, west, southeast, and east; commercial and industrial development along Post Road and Airport Road; and industrial development along Industrial Drive. The InterLink, recently constructed west of the Airport, includes a direct pedestrian link to the Airport for rail passengers, a consolidated car rental facility, and commuter parking. Warwick Pond and Buckeye Brook and associated wetland systems are located north and east of the Airport property.

T.F. Green Airport is owned by the State of Rhode Island and operated by RIAC. The Airport is a medium-hub commercial service provider that in 2010 served approximately 3.9 million passengers with approximately 220 daily aircraft operations (an aircraft landing or departure).[3] The Airport plays a vital role in fulfilling the local, regional, and national demands of business and leisure travel, as well as providing air cargo capacity for the eastern New England region. T.F. Green Airport is a critical catalyst for economic growth in the State of Rhode Island, directly and indirectly generating approximately $1.96 billion in economic activity and $603.9 million in earnings.[4] The Airport provides over 2,000 jobs directly, and indirectly supports employment at hotels, rental car agencies, parking facilities, gas stations, and other travel-related businesses in Warwick.

RIAC has primary responsibility for defining, developing, maintaining, and operating the physical infrastructure of the Airport to ensure that it functions effectively and efficiently as Rhode Island's primary commercial passenger airport. RIAC conducts planning efforts to assist in identifying the facility needs and, where appropriate, enhancements that will allow T.F. Green Airport to function efficiently and responsibly. Key components of these efforts have been the development of a 2002 Master Plan Update[5] and the 2004 Master Plan Supplement,[6] which form the basis for the preliminary list of projects that RIAC is proposing to undertake into the next decade. The T.F. Green Airport Improvement Program consists of the following key elements from these Master Plan documents, with specific safety improvement and efficiency enhancement needs:

- Safety Enhancement Elements
  - Enhance airfield safety by upgrading the crosswind Runway 16-34 RSAs to meet current FAA requirements[7]
  - Demolish Hangar No. 1 to remove an airspace penetration
  - Relocate Taxiway C to increase the current lateral separation between Runway 16-34 and Taxiway C to meet current FAA standard criteria
- Efficiency Enhancement Elements
  - Extend primary Runway 5-23 to fulfill New England Regional Airport System needs and more fully accommodate existing and anticipated demand for commercial non-stop service to the West Coast
  - Add up to seven additional commercial service gates to enhance passenger processing efficiency[8]
  - Relocate and replace existing belly cargo facility to accommodate space needs
  - Reconfigure the on-airport roadway system to improve traffic flow
  - Provide additional passenger and employee parking facilities to meet seasonal needs
  - Expand the airport fuel storage facility to maintain an on-airport fuel supply of five to seven days

3 *T.F. Green Airport – Monthly Airport Passenger Activity Summary*, Rhode Island Airport Corporation, December 2010.
4 RIAC. 2006. *Rhode Island Airport Economic Impact Study Update 2006.*
5 RIAC. 2002. *T.F. Green Airport Master Plan Update.* Prepared by Landrum and Brown, Inc.
6 RIAC. 2004. *T.F. Green Airport Master Plan Supplement.* Prepared by Landrum and Brown, Inc.
7 Improving the Runway 16-34 RSA would require shifting or relocating navigational aids that support that runway.
8 Since the DEIS, the need for commercial service gates has been changed from "8" to "up to 7" gates taking anticipated passenger demand into account.

- Provide additional ground support equipment (GSE) facilities for maintenance and storage to meet current space needs
- Expand Integrated Cargo Facilities to meet anticipated demand

These airfield safety and efficiency enhancements include activities that require placement of fill or dredged material into waters of the United States. Alternative configurations of the airfield enhancements were evaluated with respect to potential impacts to waters of the United States, as described in this CWA Section 404 permit application and the FEIS Chapter 3, *Alternatives Analysis*.

1.4 Highway Methodology Evaluation Summary

The FEIS Chapter 3, *Alternatives Analysis* and the Phase I Technical Memorandum examined each of the alternatives with respect to the criteria established by the CWA Section 404 regulations. As stated in the regulations,[9] "[n]o discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." "Practicable" is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."[10]

Combined with FEIS Chapter 3, *Alternative Analysis*, the Phase I analysis evaluated, for each alternative:

- Whether it satisfies the Basic Project Purpose;
- Whether it is practicable;
- The magnitude of impacts to the aquatic ecosystem; and
- Other significant adverse environmental consequences.

A thorough six-level screening process was conducted as part of the DEIS, which narrowed the field of alternatives to two Build Alternatives (Alternatives B2 and B4) and the no build or No-Action Alternative. Alternatives B2 and B4 were reevaluated in the FEIS under revised forecast conditions based on the Draft 2010 Terminal Area Forecast (TAF), which was the latest forecast information available at the time the FEIS analysis was performed and was considered to reflect recent aviation trends. This alternatives screening process, described further below, was used for this Highway Methodology evaluation. The screening took into account considerations such as safety, operational efficiency, environmental impacts, and costs based on design concepts. This process provided the necessary context to identify a Preferred Alternative. The screening levels were:

- **Level 1 Screening - Candidate Alternatives** (Section 3.1.1) – Level 1 screening evaluated nine airports other than T.F. Green Airport, three non-aviation and non-construction alternatives, and 28 Candidate Alternatives for elements for the T.F. Green Airport Improvement Program. Level 1 identified a reasonable

9 EPA. 2009. 40 CFR 230.10(a).
10 EPA. 2009. 40 CFR 230.10(a)(2).

range of alternatives and evaluated the ability of each alternative to reasonably or practicably meet the Purpose and Need of the T.F. Green Airport Improvement Program. The analysis included on- and off-Airport alternatives, including non-construction alternatives identified through the NEPA scoping process and by the FAA and RIAC. Alternatives that did not meet the Purpose and Need of the Improvement Program totally or in substantial part were eliminated from further consideration. Only individual program elements that would meet the Purpose and Need were carried forward.

- **Level 2 Screening – Preliminary Alternatives** (Section 3.1.2) – Level 2 screening considered those individual program elements that would meet the Purpose and Need. Level 2 refined the alternatives retained from Level 1, and eliminated any alternatives that, on more detailed evaluation, were found to not be feasible, nor reasonable, nor meet the Purpose and Need. Upon completion of a draft Alternatives Analysis chapter for the DEIS, state and federal agencies, the City of Warwick, and members of the public raised issues that resulted in an additional round of Level 2 screening that included a preliminary wetland and stream bed impact analysis.

- **Level 3 Screening –Airport Improvement Program Alternatives Analysis** (Section 3.1.3) – Level 3 screening evaluated different combinations of the program elements. Level 3 developed and evaluated combinations of on-Airport program elements (particularly the Runway 16-34 and Runway 5-23 enhancements) that collectively form the T.F. Green Airport Improvement Program alternatives. These alternatives were evaluated to determine whether they would be reasonable and feasible, and should be retained for detailed environmental analysis. Four alternatives were carried forward to Level 4.

- **Level 4 Screening – Refined Combined Alternatives** (Section 3.1.4) –Level 4 refined the four Level 3 alternatives and added one alternative. Five on-Airport alternatives (Improvement Program [IP] Options A through E) were evaluated to determine if they were reasonable and feasible based on safety, environmental impacts, and cost, and if they should be retained for detailed environmental analysis. These IP Options were a combination of the eleven projects identified in the Purpose and Need facilities analysis.

- **Level 5 Screening – Further Refined Build Alternatives** (Section 4.1) –Level 5 modified the alternatives advanced from Level 4 and identified an additional alternative (Alternative B4). Alternatives B1 and B3 North and South were eliminated from further evaluation.

- **Level 6 Screening – Final Alternatives** (Section 4.2) - The Level 6 Screening compared the remaining alternatives (Alternatives B2 and B4) with the No-Action Alternative. It also utilized an updated forecast scenario (2009 DEIS Forecast).

- **FEIS Analysis – Final Alternatives, the Preferred Alternative, and the Environmentally Preferable Alternative** (Section 4.3) - The FAA performed updated environmental analyses in the FEIS with a forecast scenario consistent with the Draft 2010 TAF.[11] The FAA compared Alternatives B2 and B4 with the No-

11 The FAA also conducted an analysis while preparing the FEIS and confirmed that the actual aircraft activity counts from the Air Traffic Control Tower (ATCT) in 2010 agree with the Draft 2010 TAF for the same period. See *Final 2010 TAF Analysis Memorandum* in Section E.1, *Updated Forecast of Aviation Activity* of FEIS Appendix E, *Purpose and Need and Alternatives Analysis.*

Action Alternative to evaluate the Preferred Alternative identified in the DEIS (Alternative B4). The FAA also modified the design of Alternatives B2 and B4 to further minimize impacts to natural resources. The FAA identified Alternative B4 as the Preferred Alternative.

- **The Preferred Alternative** (Section 4.4) – RIAC confirmed that Alternative B4 is its Proposed Action.

A summary of the Phase I Highway Methodology evaluation (Screening Levels 1 through 4) is provided in Chapter 3. This Phase II Highway Methodology comprises the fifth and sixth screening levels, as well as the FEIS screening, which are described in Chapter 4. Alternatives B2 and B4 are the final alternatives considered. The USACE will use this analysis to identify the LEDPA.

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NEPA Purpose and Need and USACE Basic Project Purpose

This chapter presents the T.F. Green Airport Improvement Program NEPA Purpose and Need and the USACE Basic Project Purpose. The Council on Environmental Quality (CEQ) NEPA regulations require that an EIS briefly specify the underlying purpose and need to which the federal agency (in this case, the FAA) is responding in proposing the project alternatives, including the proposed action. The USACE determines the Basic Project Purpose, as required by the US Environmental Protection Agency (EPA) CWA Section 404(b)(1) Guidelines.[12] The Basic Project Purpose is used to determine if a project is water dependent, for the USACE's evaluation of the application for the CWA Section 404 permit. The USACE defines the Basic Project Purpose broadly to ensure that a reasonable range of alternatives will be examined.

2.1 Project Purpose and Need

The overall project purpose of the T.F. Green Airport Improvement Program is to enhance airport safety and airport efficiency.

The Airport Master Plan Update/Supplement identified the following actions to correct airfield facilities that do not meet current FAA airport design guidelines:

- Enhance Runway 16-34 RSA – The RSAs associated with Runway 16-34 do not meet current FAA airport design standards. In November 2005, the U.S. Congress, in consultation with FAA, required that all commercial passenger airports[13] (including T.F. Green Airport) enhance passenger safety by improving their RSAs by 2015. Additionally, Runway 16-34 pavement needs to be rehabilitated. This project also includes relocating navigational aids as appropriate.

12 EPA, 2009. Code of Federal Regulations, Title 40, Part 230, Section 404(b)(1) *Guidelines for Specification of Disposal Sites for Dredged or Fill Material, Subpart B, Compliance with the Guidelines*. EPA website: http://www.epa.gov/owow/wetlands/pdf/40cfrPart230.pdf. Accessed on 2 August 2009.
13 Commercial passenger airports subject to 14 CFR Part 139 conduct commercial passenger flight operations and must comply with the regulation's standards.

- Taxiway C - The centerline of Taxiway C is 300 feet from the centerline of Runway 16-34. FAA design standards for ARC C-IV[14] facilities require 400 feet of lateral separation between the centerlines of runways and their associated parallel taxiways.[15] The existing separation does not meet current FAA airport design standards. Therefore, a separation of an additional 100 feet needs to be provided between Taxiway C and Runway 16-34 to enhance the safety of airfield operations.
- Hangar No. 1 – Hangar No.1 is located within the Runway 16-34 Object Free Area (OFA) and penetrates a protected airspace surface.[16] The hangar needs to be removed from its current location to meet current FAA airport design standards and remove an obstruction to air navigation.

RIAC's planning efforts have also identified facilities in the T.F. Green Airport landside, passenger terminal, and airfield areas that need to be enhanced for the efficiency of passenger movements getting to the terminal and within the terminal; of airfield operations; and, of passenger air service within the New England Regional Airport System. The FAA has confirmed the need for each of the proposed efficiency-related enhancements by considering the 2010 FEIS No-Action and Incremental Build Alternative Forecasts in all relevant demand analyses. Airport facility enhancements needed for the efficiency of passenger movements include:

- Passenger terminal complex – Based on the forecast increase in passenger volumes through 2025, future modifications to the facilities associated with the terminal complex will be required to enhance efficiency and passenger convenience. Terminal complex facilities that would require modifications include the addition of up to seven aircraft gates, the concourse area, the terminal apron and taxi lanes, and the central heating and cooling plant.
- Roadways – The existing Terminal Loop Roadway experiences excessive peak hour delays as a result of deficiencies associated with the internal signalized intersection. Improvements to the roadways that provide access to the terminal area are needed to enhance the existing level of service of the roadway system and avoid further deterioration in the roadway system level of service.
- Parking facilities – The current capacity of the Airport's long-term passenger and airport employee parking facilities is sufficient for current demand. However, additional parking capacity must be provided to accommodate anticipated passenger and airport employee demand by 2020.

Airfield facilities needed to enhance the efficiency of airfield operations include:

- Primary Runway Length – The primary runway at the Airport (Runway 5-23) needs to be extended to an appropriate length to enhance the efficiency of the Airport and the New England Regional Airport System to more fully meet the current and anticipated demand for aviation services. The extended runway would more fully accommodate non-stop airline service to West Coast markets and provide alternatives to flights out of Boston-Logan International Airport. Reducing passengers using Logan Airport for air service would enhance the efficiency of the New England Regional Airport System by "reducing the region's over-reliance

14 According to FAA Advisory Circular 150/5300-13, *Airport Design*, Change 15, the Airport Reference Code (ARC) is a coding system used to relate airport design criteria to the operational and physical characteristics of the airplanes intended to operate at the airport.
15 FAA Advisory Circular 150/5300-13, Change 15.
16 The Runway OFA is an area on the ground centered on the runway centerline provided to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located within the Runway OFA for air navigation (navigational aids) or aircraft ground maneuvering purposes (airfield signage) . FAA Advisory Circular 150/5300-13, Change 15, section 307 states that "the runway OFA clearing standard requires clearing the OFA of above ground objects protruding above the runway safety area edge elevation."

on Logan."[17] This goal is a key component of FAA's planning for a more balanced, integrated use of public airports within the New England Region, as reflected in the New England Airport Regional System Plan.[18] The main challenge to T.F. Green Airport's competitive position in the region is inadequate primary runway length. The range of runway lengths required for non-stop service to West Coast markets by aircraft capable of providing the service from T.F. Green Airport exceed the existing primary runway length at the Airport. A longer primary runway not only benefits service to long-haul markets, but also medium- and short-haul markets.

- Air cargo facilities – Two facilities currently accommodate cargo operations at the Airport. In addition to being undersized, the existing belly cargo and ground service equipment maintenance building would need to be demolished to accommodate the proposed terminal expansion, requiring that the belly cargo facilities be replaced. Integrated cargo operators currently have 19,400 square feet of available building space.[19] Based on current industry standards, a facility sized between approximately 18,000 and 35,000 square feet is needed to accommodate existing demand in 2004, and between approximately 25,000 and 51,000 square feet to accommodate demand by 2020. A replacement facility for handling belly cargo will be needed and the integrated cargo facility is currently undersized. The efficiency of air cargo facilities will decrease in the future if additional capacity is not provided at the Airport.
- Support facilities - The existing belly cargo and GSE maintenance functions are operating in a shared facility. The existing belly cargo and GSE maintenance building would need to be demolished to accommodate the proposed terminal expansion, requiring that the GSE maintenance facilities be replaced. In addition, new GSE maintenance facilities will be needed to accommodate potential new entrant air carriers, the addition of terminal gates, shifts in the fleet mix, and increased daily departure activity. Demand for Jet-A fuel exceeds the existing fuel farm's capacity to receive, process, store, and deliver fuel. The existing fuel farm would not meet industry standards for processing procedures and fuel settling times. Additional Jet-A fuel storage capacity is needed to increase throughput and ensure efficient fueling operations at the Airport.

Airline business models are changing frequently and the existing runway does not allow RIAC to meet its responsibility to provide airport facilities that offer flexibility to airline carriers to meet current and anticipated industry demands. Lengthening the runway would provide the airlines with the flexibility to change fleet mixes and accommodate changes in schedules. A longer runway would also reduce or eliminate weight penalties currently incurred by the airlines operating at T.F. Green Airport. An extended runway also reduces the inherent business risk to airlines that initiate service to new markets.

Based on the deficiencies and constraints associated with the existing facilities and infrastructure identified in the Airport Master Plan Update/Supplement and to accommodate unmet demand for service, RIAC proposes to implement the T.F. Green Airport Improvement Program made up of the individual project elements described above.

17 *Logan International Airport Airside Improvements Planning Project EIS, Boston, Massachusetts*; FAA, New England Region; 2002.
18 *New England Regional Airport System Plan (NERASP)*, New England Airport Coalition, Fall 2006.
19 Integrated cargo operators at T.F. Green Airport include Federal Express and United Parcel Service.

2.2 USACE Basic Project Purpose

The USACE determined that the Basic Project Purpose of the T.F. Green Airport Improvement Program is to:

- Enhance Airport safety.
- Enhance the efficiency of the Airport and the New England Regional Airport System to more fully meet the current and anticipated demand for aviation services.[20]

The Basic Project Purpose establishes that the T.F. Green Airport Improvement Project is not water-dependent.

Hereafter, the NEPA Purpose and Need and USACE Basic Project Purpose will be referred to as the "Project Purpose."

20 USACE. 2009. T.F.Green Regional Airport Improvements. Letter to Mr. John Silva, FAA, from Ms. Christine Godfrey, USACE New England District: Concord, MA. January 4, 2006.

3 Phase I Screening Evaluation Summary

This chapter summarizes the Highway Methodology Phase I evaluation, as detailed in the Phase I Technical Memorandum. This evaluation consisted of developing, selecting, and screening a range of alternatives considered to meet the Project Purpose of the T.F. Green Airport Improvement Program. This chapter also outlines the screening process used to identify which of those alternatives are reasonable and feasible, and were considered for further analysis in the Phase II evaluation provided in subsequent chapters. For a detailed description of the screening process, refer to the Phase I Technical Memorandum and the FEIS Chapter 3, *Alternatives Analysis*.

3.1 Summary of the Phase I Analysis

The alternatives that were considered and dismissed or retained through the Highway Methodology Phase I Analysis for the T.F. Green Airport Improvement Program are described below. Using the first four levels of screening described in Section 1.4, this analysis examined a broad range of alternatives to determine the ability of each to reasonably or practicably meet the Project Purpose. Alternatives that were determined not to meet or determined to be ineffective in meeting the Project Purpose were eliminated from further consideration. Four alternatives that met the Project Purpose were retained for the Level 5 Screening, and two were carried forward for evaluation in the Level 6 Screening and FEIS Analysis. These last three steps comprise the Highway Methodology Phase II Analysis described in Chapters 4 through 7.

3.1.1 Level 1 Screening

The Level 1 Screening analyzed a series of potential on-Airport construction program element alternatives, off-Airport construction, and non-construction alternatives. The screening criteria consisted of the performance factors, design standards, service levels, and administrative issues that were used to qualitatively assess whether an alternative may meet the Project Purpose. The screening criteria were derived from the CEQ regulations[21] and are in two groups. The first set of criteria, related directly to the Project Purpose, includes the safety, efficiency, operational, and technical aspects as well as meeting anticipated demands of the T.F. Green Airport service area. The second set of criteria addressed whether an alternative is reasonable and

21 40 CFR §1502.14.

feasible. The geographic area analyzed in the Level 1 Screening is the T.F. Green Airport service area. The service area is based on the demographic and economic characteristics of the area and associated demand for air travel. Six alternatives were evaluated in the Level 1 Screening:

- Greater use of one or more existing airports in eastern New England (Logan Airport [Boston, MA], Bradley International Airport [Hartford, CT], Worcester Regional Airport, Hanscom Field [Bedford, MA], New Bedford Regional Airport, [New Bedford, MA], Quonset Airport [North Kingstown, RI], North Central Airport [Smithfield/Lincoln, RI], Groton-New London Airport [Groton, CT], and Otis Air National Guard Base [Falmouth, MA]);
- Development of a new airport in southeastern New England (two candidate sites, in Massachusetts and Rhode Island);
- Other (non-aviation) modes of transportation (train and automobile);
- Regional demand management (market based, administrative, and voluntary approaches);
- Use of new aviation technology (such as winglets to improve fuel efficiency and extend aircraft range); and
- On-Airport enhancements (runway extensions and RSAs).

The Level 1 Screening assessments were conducted on a qualitative basis, with evaluations of the potential effectiveness of each alternative based upon generally accepted planning standards and currently available data. The conclusions from the Level 1 Screening were:

- None of the options examined under Greater Use of Existing Airports alternative would meet the Project Purpose. In addition, none of these options were reasonable and feasible to implement.
- The development of a new airport in southeastern New England would not meet the Project Purpose, and is not reasonable or feasible to implement.
- Other non-aviation modes of transportation would not meet the Project Purpose.
- Demand management would not meet the Project Purpose.
- New aviation technology would not meet the Project Purpose.
- On-Airport enhancements would meet the Project Purpose and would be reasonable and feasible to implement.

3.1.2 Level 2 Screening

Selected Candidate Alternatives advanced from the Level 1 Screening were refined and all program elements were evaluated in the Level 2 Screening based on whether the alternative enhanced airfield safety and efficiency of the airfield and airport. Program elements that were not feasible or reasonable, and did not meet the Project Purpose, were eliminated. Project elements that address existing safety enhancements at T.F. Green Airport carried forward for Level 2 screening were:

- Enhance Runway 16-34 RSAs (including relocating navigational aids)
- Relocate Taxiway C
- Demolish Hangar No. 1

Project elements that addressed existing or anticipated facility deficiencies at the T.F. Green Airport carried forward for Level 2 screening were:

- Expand passenger terminal
- Construct new ground support equipment facility
- Construct new belly cargo facility
- Construct new fuel farm
- Construct new Integrated Cargo Facility
- Expand automobile parking facilities
- Reconfigure terminal access roadways
- Extend Runway 5-23 to 9,350 feet (including relocation of navigational aids)

The alternatives that could meet FAA's standard design criteria ("Candidate Alternatives") were refined using other ways of achieving FAA's safety requirements to reduce environmental impacts. The Candidate Alternatives were then developed into a range of Preliminary Alternatives for each program element, including airfield safety and efficiency enhancements as well as airport efficiency enhancements. These Preliminary Alternatives were subsequently combined to create a range of Airport Improvement Program Alternatives.

The Level 2 Screening evaluated options for:

- Improving Runway 16-34 RSAs (nine options), and
- Extending Runway 5-23 (five options).

The options to enhance Runway 16-34 RSAs included various combinations of runway shifts (to the north or south), construction of full RSAs, and use of an engineered materials arresting system (EMAS) to meet FAA safety requirements. All but one of the nine options considered for the Runway 16-34 enhancements were determined to meet the Project Purpose, were reasonable and feasible to implement, and were carried forward to the Level 3 Screening. The options to extend Runway 5-23 similarly included various combinations of runway extensions to the north or south, construction of full RSAs, and use of EMAS. All five options for the Runway 5-23 extension were carried forward to the Level 3 Screening.

3.1.3 Level 3 Screening

The Level 3 Screening developed and evaluated comprehensive Airport Improvement Program Options (referred to as the IP Options) made up of a combination of individual elements from the Level 2 Screening. The IP Options were developed by integrating each of the individual program elements (airfield and airport enhancements) in a manner in which they would function together. This was an iterative process of combining Runway 16-34 IP Options with Runway 5-23 IP Options, assessing the impacts to wetlands, local roads, residential neighborhoods, and commercial development, and identifying the appropriate Airport Road relocation or realignment requirements. This analysis identified five options that provided a full range of alternatives that met the Project Purpose and bracket the potential environmental impacts of the Improvement Program in order to allow comparative analysis and assessment of the program elements. Some Level 2 Preliminary Alternatives were not included as IP Options because they were not found to be reasonable and feasible or had similar impacts and/or benefits to those IP Options that were found to be reasonable and feasible. These Preliminary Alternatives were retained for further evaluation and/or modification.

The Level 3 Screening included evaluation of the No-Action Alternative. The No-Action Alternative does not meet the Project Purpose, but was evaluated for NEPA purposes to serve as a future baseline to which other alternatives can be compared.[22] The No-Action Alternative includes all actions that RIAC intends to complete independent of the Airport Improvement Program (actions that would be undertaken whether or not the Improvement Program is implemented). The No-Action Alternative includes periodic maintenance and minor modifications needed to maintain safe operations at the Airport. Other planned actions within, on, or near T.F. Green Airport, by RIAC and by other parties, were assumed to have occurred prior to constructing the first phase of the Improvement Program in 2015. These actions include the following projects:

- Airfield Maintenance Facility (AMF) and access roadway (construction completed in 2007)
- Full-length parallel Taxiway M supporting Runway 5-23 (completed 2008)
- New Deicer Management System at an on-Airport location to be determined
- Removal of the Winslow Park facilities within the Runway 5 End Runway Protection Zone (RPZ)
- Land acquisition under the Completed and Current Part 150 Voluntary Land Acquisition Program (VLAP)

Table 3-1 provides a summary of the Level 3 Screening of the IP Options, including the No-Action Alternative.

22 According to FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, NEPA requires a comparison of the No-Action and Build Alternatives to determine the impacts that would be attributed specifically to the proposed project.

Table 3-1 Summary of Level 3 Screening: IP Options

IP Option	Runway 16-34	Runway 5-23	Impacts to Main Avenue	Impacts to Airport Road	Impacts to Land Uses	Impacts to Buckeye Brook	Impacts to Wetlands	Carried Forward
A	**Option 3** Shift runway to south, full RSAs at both ends	**Option 1** Shift and extend runway to the south, full RSAs at both ends	Tunnels Main Ave.	Avoids Airport Road	Substantial impacts to Greenwood neighborhood; and to commercial uses at Post/ Airport Road Intersection	Impacts south, Avoids north	Substantial impacts on Runway 34 End	Yes
B	**Option 2A** Shifts runway to north, EMAS at Runway 34 End; full RSA at Runway 16 End	**Option 2A** Hold runway 5 End threshold and extend runway to the north, full RSAs at both ends	Avoids Main Ave.	Relocates Airport Road	Substantial impacts to Spring Green neighborhood	Impacts north, Avoids south	Substantial impacts on Runway 23 End, Moderate impacts on Runway 34 End	Yes
C	**Option 5C** Shift runway slightly north, EMAS at Runway 16 End; full RSA at Runway 34 End	**Option 4** Shift runway north and south, full RSAs at both ends	Tunnels Main Ave.	Relocates west end of Airport Road	Substantial impacts to Greenwood neighborhood, and commercial uses between railroad and Post Road in Lincoln Park area	Avoids	Moderate impacts on Runway 34 End	Yes
D	**Option 5** Shift runway slightly north, full RSAs at both ends	**Option 1** Shift and extend runway to the south, full RSAs at both ends	Tunnels Main Ave.	Relocates east end of Airport Road	Substantial impacts to Greenwood neighborhood; and limited area of commercial uses between railroad and Post Road	Avoids	Moderate impacts on Runway 23 End	Yes
E	**Option 3B** Shift runway to south, EMAS at both ends	**Option 4A** Shift runway north and south, EMAS at both ends	Tunnels Main Ave.	Relocates east end of Airport Road	Substantial impacts to Greenwood neighborhood; and residences to Bellevue Ave to north	Avoids	Moderate impacts on Runway 23 End, Moderate impacts on Runway 34 End	Yes
No-Action	**Existing**	**Existing**	No	No	Includes Completed and Current Part 150 VLAP	No	No	Yes

3.1.4 Level 4 Screening

In the Level 4 Screening, each of the five IP Options was advanced to a 30 percent engineering design level in order to evaluate the range of potential environmental impacts, potential for disruption to the community, and practicability, based on cost and construction logistics. Each IP Option includes all of the Airport Improvement Program elements and meets the Project Purpose to the same degree.

Based on the Level 4 Screening, FAA dismissed four of the five IP Options from further consideration because the impacts were too substantial or they would not be practicable to construct, based on cost and logistics. Table 3-2 summarizes the results of the Level 4 Screening.

Table 3-2 Summary of Level 4 Screening: IP Options Analysis

	Results of Analysis	Rationale
IP Option A	Eliminated	Not practicable due to the cost and public safety risks associated with placing Main Avenue in a tunnel. Maximum impact to Buckeye Brook (south) wetlands.
IP Option B	Retained	Practicable, minimizes impacts to Buckeye Brook (south) wetlands. Lowest cost to construct.
IP Option C	Eliminated	Not practicable due to the cost and public safety risks associated with placing Main Avenue in a tunnel.
IP Option D	Eliminated	Not practicable due to the cost and public safety risks associated with placing Main Avenue in a tunnel.
IP Option E	Eliminated	Not practicable due to the cost and public safety risks associated with placing Main Avenue in a tunnel.
Integrated Cargo Facility Site 1	Eliminated	Not practicable because of airside operational safety concerns and impacts to wetlands.
Integrated Cargo Facility Site 2	Eliminated	Not practicable because of airside operational safety concerns.
Integrated Cargo Facility Site 3	Retained	Practicable; no impacts to wetlands or to operational safety.

1 Under IP Options A through E, Runway 5-23 is extended to 9,350 feet.

Chapter 4 summarizes the Level 5, Level 6, and FEIS screening of the retained alternatives.

4 Phase II Alternatives Analysis

This chapter presents the results of the Level 5, Level 6, and FEIS alternatives screening and constitutes the Highway Methodology Phase II alternatives analysis.

4.1 Level 5 Screening

In the Level 5 screening, IP Option B was further refined to evaluate several different lengths for Runway 5-23 (shorter Runway 5-23 lengths were considered to reduce community and natural resource impacts) and to consider project phasing. The alternatives with shorter Runway 5-23 lengths (8,700 feet and 8,300 feet) were developed based on physical constraints (stream channel of Buckeye Brook and Main Avenue; existing residences and businesses) and to reduce environmental impacts to the greatest extent practicable while meeting the Purpose and Need. The Level 5 Alternatives were developed and refined through an iterative process, taking environmental impacts and program element utility into account. All Level 5 Alternatives were developed to avoid a Main Avenue tunnel.

The Level 5 Alternatives include:

- No-Action Alternative
- Alternative B1 with a 9,350-foot Runway 5-23 extended to the north, Partially Relocated Airport Road at Tennessee Avenue, Fully Relocated Airport Road, and Integrated Cargo Site 3
- Alternative B2 with an 8,700-foot Runway 5-23 extended to the north and south, Partially Relocated Airport Road at Tennessee Avenue, Fully Relocated Airport Road, and Integrated Cargo Site 3
- Alternative B3 North with an 8,300-foot Runway 5-23 extension to the north and south, Fully Relocated Airport Road, and Integrated Cargo Site 3
- Alternative B4 with an 8,700-foot Runway 5-23 extended to the south, Partially Relocated Airport Road at Hasbrouck Avenue, Realigned Main Avenue, and a split Integrated Cargo Facility on the north apron

- Alternative B3 South with an 8,300-foot Runway 5-23 extended to the south, Partially Relocated Airport Road at Hasbrouck Avenue, Realigned Main Avenue, and a split Integrated Cargo Facility on the north apron

4.1.1 Level 5 Alternatives

The No-Action Alternative and the alternatives retained for Level 5 screening are briefly described below.

4.1.1.1 No-Action Alternative

The No-Action Alternative serves as a baseline against which other alternatives can be compared.[23] As described in Section 3.1.3, the No-Action Alternative is comprised of actions that RIAC intends to complete that are independent of the T.F. Green Airport Improvement Program and some that have been undertaken whether or not the Improvement Program is implemented. The No-Action Alternative does not satisfy the Project Purpose, as it would not enhance airfield safety or efficiency.

4.1.1.2 Alternative B1

Alternative B1 (Figure 4-1) was developed to minimize impacts to residential communities and natural resources south of the Airport. Runway 5-23 would be extended north approximately 2,200 feet and would require a full relocation of Airport Road. Alternative B1 shifts Runway 16-34 north along its centerline approximately 400 feet to accommodate the enhanced RSAs on the Runway 16 and 34 Ends and to minimize impacts to natural resources on the Runway 34 End. Airport Road would be fully relocated from Warwick Avenue to Post Road with a direct connection to Route 37 to accommodate the Runway 5-23 extension and the Runway 16-34 safety enhancements.

In response to the substantial community and wetland impacts identified in the Level 4 Screening Step, the FAA evaluated shorter Runway 5-23 lengths. An additional runway length and utility analysis was conducted to evaluate options with a shorter extension to Runway 5-23 to the north and south (Alternatives B2 and B4 to 8,700 feet and Alternative B3 North and South to 8,300 feet). Alternative B1 meets the Project Purpose; it is described in detail in FEIS Chapter 3, *Alternatives Analysis*.

4.1.1.3 Alternative B2

Alternative B2 (Figure 4-2) was developed to minimize impacts to natural resources and residential communities south and north of the Airport. Alternative B2 extended the Runway 23 end as far north as possible without impacting Buckeye Brook, and identified design modifications at the Runway 5 End that could allow the runway to be extended to the south. Through an engineering analysis, it was determined that it would be possible to raise the grade of the Runway 5 End by six feet. This would avoid impacts to Main Avenue, allowing it to remain outside of the Runway OFA while still providing sufficient clearance for departing and arriving aircraft. The maximum runway length that could be achieved by this modification is 8,700 feet. Runway 5-23 would be extended approximately 600 feet north and 930 feet south for a total of 8,700 feet. Fully Relocated Airport Road was designed to remain outside of the Runway 23 End Runway Protection Zone (RPZ), following FAA direction. The Runway 16-34 safety enhancements and Fully Relocated Airport Road would be

23 According to FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, NEPA requires a comparison of the future No-Action and future Build Alternatives to determine those impacts that would be attributed to the proposed project.

the same as Alternative B1. Engineered Materials Arresting System (EMAS)[24] would be used on the Runway 23, 5, and 34 Ends. Alternative B2 meets the Project Purpose; it is described in detail in FEIS Chapter 3, *Alternatives Analysis.*

4.1.1.4 Alternative B3 North

Alternative B3 North (Figure 4-3) was developed to minimize impacts to natural resources and residential communities south and north of the Airport. Alternative B3 North includes a runway extension that would extend Runway 5-23 as far north as possible without impacting the stream channel of Buckeye Brook. The maximum runway length possible given these constraints is 8,300 feet. The runway extension would be located on airport property, but would still require the full relocation of Airport Road. Fully Relocated Airport Road was designed to remain outside of the Runway 23 End RPZ in compliance with FAA guidance at that time. Runway 5-23 would be extended approximately 600 feet north and 530 feet south to a total length of 8,300 feet by shifting the runway thresholds both north and south. The Runway 16-34 safety enhancements, Fully Relocated Airport Road, and the Integrated Cargo Facility would be the same as Alternatives B1 and B2. EMAS would be used at the Runway 23 and 34 Ends. Alternative B3 North does not meet the Purpose and Need, as described in FEIS Chapter 3, *Alternatives Analysis.*

4.1.1.5 Alternative B4

In 2008, after a review of impacts to natural resources and community disruption for Alternatives B1 and B2, and in response to stakeholder concerns, RIAC initiated a study to determine if another option could be developed that would limit community disruption and environmental impacts. This study led to the development of Alternative B4 (Figure 4-2). Alternative B4 was developed to:

- Minimize impacts to the residential communities and businesses
- Reduce mandatory land acquisition for construction by limiting construction as much as possible to land located south of the Runway 5 End already owned by RIAC
- Avoid the need to tunnel Main Avenue by adding fill to the Runway 5 End and constructing an effective and efficient realignment of Main Avenue
- Minimize impacts to natural resources north of the Airport including avoiding impacts to Buckeye Brook south and north of the Airport

In addition to environmental and community impacts, the FAA also considered construction and land acquisition program costs.[25] The FAA prepared preliminary cost data for Alternatives B1 and B2 based on the 30 percent level design drawings and a preliminary estimate of mitigation costs. The FAA estimated that the program's total cost would be over $500 million. A major cost associated with both alternatives was Fully Relocated Airport Road, which would cost an estimated $50 million. The FAA worked with the U.S. Army Corps of Engineers (USACE) and other federal and state agencies to look at other options to reduce

24 Engineered Materials Arresting System (EMAS) is a soft concrete material that can safely decelerate an aircraft to a complete stop with minimal damage if the aircraft overshoots the runway. It is typically placed within a 500-foot wide safety area that extends 600 feet beyond the end of the runway, and allows for a standard RSA that is less than 1,000-feet long.

25 If RIAC applies for a Letter of Intent under the AIP, the FAA will require a benefit-cost-analysis according to FAA Order 5100.38C page 186 b.

environmental impacts and lessen community disruption. Alternative B4 would extend Runway 5-23 south approximately 1,530 feet for a total of 8,700 feet and remain within RIAC-owned land. Alternative B4 shifts Runway 16-34 north approximately 100 feet to accommodate the enhanced RSAs and minimize impacts to businesses on the Runway 16 End and limit mandatory acquisition for construction on the Runway 34 End.

The Runway 16-34 safety enhancements would require a partial relocation of Airport Road at the intersection of Post Road and Airport Road. Airport Road would be partially relocated to the north. Alternative B4 would require Main Avenue to be realigned to the south at the Runway 5 End. EMAS would be used on the Runway 5, 16, and 34 Ends. The Integrated Cargo Facility would consist of a split operation in the vicinity of Site 3 including the reuse of existing Hangar No. 2, where cargo operations currently are housed, and a new cargo building east of the Runway 16 End. Wetland impacts were minimized at the AMF access road.

Key elements of Alternative B4 (all the safety projects as well as the extension of Runway 5-23, and related preparatory/associated work) could be completed by the end of 2015. This expedited schedule, proposed by RIAC, would only be possible for Alternative B4 because it would require substantially fewer parcels for mandatory land acquisition for construction than would be required to construct Alternatives B1 and B2. Some of the benefits associated with an accelerated schedule would be the earlier realization of important safety and operational benefits, earlier resolution of homeowner uncertainty regarding the necessary associated property acquisitions, shortening the overall timeframe for community disruption and temporary construction impacts, acceleration of enhancements that will accommodate West Coast flights, and attendant revenue and local economic benefits. Alternative B4 meets the Project Purpose; it is described in detail in FEIS Chapter 3, *Alternatives Analysis.*

Alternative B3 South

The FAA developed a second conceptual layout of an alternative with a Runway 5-23 extension to 8,300 feet to explore an alternate layout with different impacts and costs than Alternative B3 North. This layout is referred to as Alternative B3 South (Figure 4-3). After the development of Alternative B4, the FAA revisited an alternative with a runway length of 8,300 feet to evaluate if this alternative, with reduced impacts and construction costs, would be retained.

With the same general configuration and engineering solution as Alternative B4, Alternative B3 South would extend Runway 5-23 to a total of 8,300 feet and would remain on-Airport property, but would still require a realignment of Main Avenue within the OFA to allow for sufficient aircraft clearances. For this alternative, Runway 5-23 would be extended approximately 1,100 feet south to a total length of 8,300 feet by shifting the Runway 5 threshold to the south. Alternative B3 South shifts Runway 16-34 north approximately 100 feet to accommodate the enhanced RSAs and minimize impacts to businesses on the Runway 16 End. The Runway 16-34 safety enhancements would require a partial relocation of Airport Road at the intersection of Post Road and Airport Road. Airport Road would be partially relocated to the north. The existing Airport Road would remain in the Runway 23 End RPZ. EMAS would be used on the Runway 5, 16, and 34 Ends. The Integrated Cargo Facility would consist of a split operation in the vicinity of Site 3 including the reuse of existing Hangar No. 2, where cargo operations currently are housed, and a new cargo building east of the

Runway 16 End. Alternative B3 South does not meet the Purpose and Need, as described in FEIS Chapter 3, *Alternatives Analysis.*

4.1.1.6 Comparison of the Level 5 Alternatives

The following section compares the utility and impacts of the Level 5 Alternatives

Comparison of Alternatives B2 and B3 North

The purpose of the Runway 5-23 extension is to "enhance the efficiency of the Airport and the New England Regional Airport System, to more fully meet the current and anticipated demand for aviation services." The goal of the runway extension is to maximize the operational flexibility of the airport to the greatest practical extent to allow non-stop West Coast passenger airline service with a variety of aircraft types. Airlines prefer to have the ability to operate at maximum gross takeoff weight, or as close as practicable, as much as possible because it represents a full passenger and cargo load, thereby maximizing the profitability of each flight.

The flexibility of the airfield to accommodate various aircraft types that are capable of operating non-stop to West Coast destinations at maximum gross takeoff weight decreases as the length of the proposed runway extension decreases. Therefore, the flexibility of Alternative B3 North is less than Alternative B2 because it would be able to accommodate one less West Coast capable aircraft than Alternative B2 at maximum gross takeoff weight, and two fewer aircraft with reductions in belly cargo payload. Alternative B3 North would also cost $15 million, or approximately 12 percent, less than Alternative B2 and result in substantially similar environmental impacts.

RIAC considered that an 8,700 foot runway would accommodate a greater percentage of West Coast capable aircraft and passengers than an 8,300 foot runway, with only slightly higher costs and residential parcel acquisitions. The RIAC Board decided not to support Alternative B3 North because "an 8300 foot Runway 5-23 conceptual option will not produce the level of service benefits sought to be achieved through the Airport Improvement Program as generally stated in the EIS Purpose and Need Statement and will provide only limited potential environmental and costs savings benefits over those provided by an 8700 foot Runway 5-23 alternative."[26] FAA determined that Alternative B3 North (extending Runway 5-23 to 8,300 feet) would not meet the Purpose and Need as fully as Alternative B2 because it would not enhance the efficiency of the New England Regional Airport System as greatly as an alternative with a 8,700-foot runway extension and RIAC determined it was not practicable to justify the financial investment. Therefore, FAA did not advance Alternative B3 North further in the alternatives screening process.

An 8,700-foot runway maximizes the flexibility of the airfield within the constraints surrounding the Airport, and meets the Purpose and Need of the proposed T.F. Green Airport Improvement Program by enhancing the efficiency of the Airport and the New England Regional Airport System, to more fully meet the current and anticipated demand for aviation services. Therefore, Alternative B2 was advanced to the Level 5 environmental consequences screening step.

26 RIAC Board resolution dated May 30, 2007.

Comparison of Alternatives B4 and B3 South

Alternative B3 South Runway 5 23 extension to 8,300 feet would result in substantially similar noise impacts, Section 4(f) impacts, historical resources impacts, construction impacts and costs, and identical impacts to wetlands and floodplains as Alternative B4 (see Section 3.7.3, *Level 5 Screening Step 3 - Development of Alternatives B4 and B3 South*, of Chapter 3, *Alternatives Analysis* of the FEIS). RIAC evaluated this additional analysis and reaffirmed its position in 2010 that "a runway length of 8,300 feet for Runway 5-23 would not meet the service benefits sought to be achieved as generally stated in the EIS Purpose and Need statement, and provide only limited potential environmental and cost savings benefits over an 8,700 foot runway."[27] FAA did not advance Alternative B3 South further in the alternative screening process because it would result in a decreased likelihood that an airline would choose to commence non-stop West Coast service due to the runway utility findings presented in this section, and its potential environmental impacts would be substantially similar to Alternative B4.

Practicability Analysis of Alternative B1

Although Alternative B1, with a Runway 5-23 extension to 9,350 feet, most fully meets the Purpose and Need, it also has the greatest impacts to natural resources and the community, and has the highest costs. Mitigation for Alternative B1 adverse environmental impacts would be substantial and likely not possible to mitigate (i.e., impacts to wetlands).

Based on the Level 5 impact analysis of wetlands, Alternative B1 would result in wetland impact more than two and a half times greater than either Alternative B2 or B4. The selection of Alternative B1 is inconsistent with federal and state regulations and policies governing federal activities which alter wetlands because it does not avoid or minimize impacts to existing wetland resources to the greatest extent practicable.

Conceptual mitigation opportunities for Alternative B2 and B4 appear practicable. Developing and implementing a compensatory wetland mitigation program for Alternative B1, even if possible, would be substantially more costly and difficult to achieve especially given the impact to higher values of wetlands and streams. Based on these considerations, Alternative B1 is impracticable and was eliminated from further consideration. Therefore, only Alternatives B2 and B4, and the No-Action Alternative were carried forward in the Level 6 analysis.

4.1.2 Level 5 Construction Phasing

The Level 5 environmental consequences analysis assumed the following construction phasing schedule:

- 2015: Interim Build year (implementation of all Safety Enhancement Elements, including partial relocation of Airport Road). For Alternatives B4 and B3 South only, Runway 5-23 extension would also come on line in 2015.
- 2020: Build year (all runway enhancements and other program elements, including Efficiency Enhancements and roadway improvements completed and in operation).

27 See April 22, 2010 Letter from RIAC to FAA in DEIS Supporting Attachment E.A.6, *RIAC Decision Documents*, in DEIS Appendix E, *Alternatives Analysis*.

- 2025: Design year (represents the future growth with all program elements in place for more than five years).

For Alternatives B4 and B3 South only, an expedited construction schedule is possible because the number of parcels required for mandatory land acquisition for construction would be substantially fewer than the number of parcels that would be required to construct Alternatives B1, B2, and B3 North. The construction phasing schedule for Alternatives B4 and B3 South proposes that the efficiency enhancement elements (the Runway 5-23 extension and associated required realignment of Main Avenue) would be complete by 2015 along with the safety enhancements (Runway 16-34 and the partial relocation of Airport Road).

4.2 Level 6 Screening

The Level 6 screening step was required because of changes in aviation forecasts. In 2009, the 2004 forecasts that formed the basis for the EIS environmental analysis were reviewed to determine if they were current with the state of the aviation industry and consistent with the FAA's latest approved TAF (2008). The forecast review found that the forecast differed from the TAF by over 30 percent, well above the 10 to 15 percent deviation identified in FAA's NEPA Orders.[28] The EIS Forecast for the No-Action Alternative was updated (2009 Forecast), which in turn prompted a revised analysis of the environmental categories that are dependent on the number of aircraft operations for their impact assessment. The analysis conducted in Level 6 used the 2009 Forecast. The Level 6 Alternatives analyzed with the revised No-Action Alternative 2009 Forecast include:

- No-Action Alternative (see Figure 4-1)
- Alternative B2 (8,700-foot Runway 5-23 extended to the north and south)
- Alternative B4 (8,700-foot Runway 5-23 extended to the south)

The environmental analysis performed in the Level 6 screening compared the No-Action Alternative to Alternatives B2 and B4 and was discussed in detail in DEIS Chapter 5, *Environmental Consequences*. The Level 6 Screening includes a full comparison of the environmental impacts of the Level 6 Alternatives B2 and B4, and informs the FAA in its identification of the Preferred Alternative.

The environmental assessment of Alternatives B2 and B4 was reevaluated in the FEIS using 2010 forecast conditions and is discussed below in Section 4.3. A discussion of the FAA's identification of the Preferred Alternative is in Section 4.4.

4.3 FEIS Analysis - Final Alternatives

This section is a summary of the FEIS analysis, which includes additional environmental assessment of Alternatives B2 and B4. This analysis concludes that Alternative B4 would have greater aviation benefits than Alternative B2 due to an expedited construction schedule and fewer community impacts related to land

28 *FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions, U.S. Department of Transportation, April 28, 2006,* paragraph 504b.

acquisition and increases in vehicle traffic noise, and lower construction costs. This analysis provides the basis for FAA's identification of Alternative B4 as the Preferred Alternative.

4.3.1 Final Alternatives

This section describes the final alternatives analyzed in the FEIS. These include Alternative B2, Alternative B4, and the No-Action Alternative. The conceptual design of the FEIS Alternatives was the same as the 30 percent conceptual design underlying the alternatives analysis in the DEIS, except for modifications on the Runway 34 End to minimize wetland impacts. Since the DEIS, the FAA has identified further wetland impact avoidance and minimization opportunities for Alternatives B2 and B4, and modified the design at the Runway 34 End. Impacts to wetlands were avoided by re-examining the location of the Perimeter Road on the east side of Runway 34 along with the design requirements for the end-fire glide slope antenna;[29] a critical part of the system that allows aircraft to make instrument landings on the runway. Runway 34 is equipped with an end-fire antenna. The minimization measures incorporated in the Runway 34 design presented in the FEIS involved steepening the side slopes adjacent to wetlands from the previous 4:1 gradient to the present 3:1 slopes. This resulted in a further reduction of wetland impact.

The subsequent chapters of this application describe the impacts to aquatic resources, mitigation of those impacts, and impacts to other resource categories for Alternatives B2 and B4, completing the Highway Methodology Phase I analysis. Alternatives B2 and B4 satisfy the Project Purpose, are practicable to construct based on cost, and would minimize impacts to wetlands at the Runway 34 End compared to Alternative B1. These alternatives include all safety and efficiency enhancements of the T.F. Green Airport Improvement Program. The No-Action Alternative is included as a requirement of the NEPA process; it does not meet the Project Purpose. Alternatives B2 and B4 include the program elements summarized in Table 4-1 and shown in Figure 4-2.

4.3.1.1 Alternative B2

Alternative B2 (Figure 4-2) was developed to avoid impacts to Main Avenue and minimize impacts to natural resources and residential communities south and north of the Airport. Runway 5-23 would be extended approximately 600 feet north and 930 feet south for a total resulting length of 8,700 feet. The Runway 16-34 safety enhancements, Partially Relocated Airport Road, Fully Relocated Airport Road, and the Integrated Cargo Facility would be the same as Alternative B1. EMAS would be used on the Runway 23, 5, and 34 Ends.

The construction of Alternative B2 would be phased so that the safety enhancements associated with Runway 16-34 would be completed by the end of 2015, while the efficiency enhancements, including the extension of Runway 5-23, would be completed by 2020. As described above, the elements expected to be completed by the end of 2015 include:

- Runway 16-34 RSAs, taxiways and aprons, navigational aids and lighting, the Runway 16-34 Perimeter Road, drainage and utilities, necessary land acquisition, Delivery Drive relocation, and Partially Relocated Airport Road (to accommodate the Runway 16 End enhancements), including drainage and utilities and necessary land acquisition;

29 The end-fire system is a non-image system, and is designed for use in areas where conformance to the imaging type glide slope criteria is impractical. End-fire antenna systems are intended for runways having a limited amount of flat terrain.

- Taxiway C Relocation; and
- Hangar No. 1 Demolition.

The elements expected to be completed by 2020 include:

- Runway 5-23 extension and safety areas, taxiways and aprons, navigational aids and lighting, the Runway 5-23 Perimeter Road, drainage and utilities, necessary land acquisition, and Fully Relocated Airport Road (to accommodate the Runway 5-23 extension), including drainage and utilities and necessary land acquisition;
- Runway 5-23 and 16-34 reconstruction and repaving; and
- Expanded passenger terminal and gates; new GSE facility; new belly cargo facility; new fuel farm; new Integrated Cargo Facility; expanded auto parking facilities; and reconfigured terminal access roadways.

4.3.1.2 Alternative B4

Alternative B4 (Figure 4-2) would have fewer mandatory land acquisitions and lower construction costs when compared to Alternative B2. Therefore, the phasing of Alternative B4 differs from that for Alternative B2. Because of the reduced costs, the safety projects and the extension of Runway 5-23 would be phased so that work could be completed by the end of 2015. FEIS Chapter 3, *Alternatives Analysis*, Section 3.7.3, *Level 5 Screening Step 3 - Development of Alternative B4 and B3 South*, provides more detail on the rationale for developing Alternative B4.

Alternative B4 would extend Runway 5-23 south approximately 1,530 feet for a total of 8,700 feet by the end of 2015. Alternative B4 shifts Runway 16-34 north approximately 100 feet to accommodate the improved RSAs and minimizes impacts to businesses on the Runway 16 End and impacts to natural resources on the Runway 34 End. The Runway 16-34 safety enhancements would require a partial relocation of Airport Road at the intersection of Post Road and Airport Road. Airport Road would be partially relocated to the north by the end of 2015. Main Avenue would be shifted to the south at the Runway 5 End by the end of 2015. EMAS would be used on the Runway 5, 16, and 34 Ends. The Integrated Cargo Facility would consist of a split operation in the vicinity of Site 3 including the existing Hangar No. 2, where cargo operations currently are housed, and a new cargo building east of the Runway 16 End.

In order to meet the FAA's deadline that all RSAs be brought up to standard by 2015, as well as to address community concerns about which houses would be acquired, RIAC is considering ways to move certain program elements forward. An expedited schedule is only possible for Alternative B4 because the number of parcels required for mandatory land acquisition for construction is substantially less than the number of parcels that would be required to construct Alternative B2. For Alternative B4 only, it is assumed that construction would be phased so that the safety enhancements associated with Runway 16-34 and the Runway 5-23 extension would be completed by the end of 2015. Specifically, those elements expected to be completed by the end of 2015 include:

- Runway 16-34 RSAs, taxiways, navigational aids and lighting, the Runway 16-34 Perimeter Road, drainage and utilities, land acquisition required for construction, Delivery Drive relocation, and Partially Relocated Airport Road (to accommodate the Runway 16 End Enhancements), including drainage and utilities and land acquisition required for construction;
- Taxiway C Relocation;
- Hangar No. 1 demolition; and
- Runway 5-23 extension and safety areas, taxiways and aprons, navigational aids and lighting, the Runway 5-23 Perimeter Road, drainage and utilities, land acquisition required for construction, and Realigned Main Avenue (to accommodate lengthening at the Runway 5 End), including drainage and utilities and land acquisition required for construction.

The Runway 5-23 and Runway 16-34 reconstruction and repaving and the remaining efficiency enhancement elements should be completed by 2020, including the expanded passenger terminal and gates; new GSE facility; new belly cargo facility; new fuel farm; new Integrated Cargo Facility; expanded auto parking facilities; and reconfigured terminal access roadways.

4.3.1.3 No-Action Alternative

The future No-Action Alternative (Figure 4-1) provides a base scenario for assessing the impacts of Alternatives B2 and B4. The No-Action Alternative comprises any and all actions that RIAC intends to complete, independent of the T.F. Green Airport Improvement Program (i.e., projects would be undertaken whether or not the Improvement Program moves forward). The No-Action Alternative assumes that periodic maintenance and minor modifications needed to maintain safe operations at T.F. Green Airport would be undertaken. Other planned actions within, on, or near T.F. Green Airport, by RIAC (i.e., land acquisition under the Part 150 NCP) or by other parties (i.e., private development), are assumed in the No-Action Alternative to have occurred prior to constructing the first phase of the proposed Improvement Program (2015). Figure 4-1 identifies the No-Action Airport projects that would change the physical footprint of the Airport.

Table 4-1 Program Elements of Alternatives B2 and B4[1,2]

Program Element	Alternative B2	Alternative B4
Safety Enhancement Elements	***All completed by the end of 2015***	***All completed by the end of 2015***
Upgrade Runway 16-34 Runway Safety Areas, including:	X	X
Realign Off-Airport Roadways	Partially Relocate Airport Road at Tennessee Avenue	Partially Relocate Airport Road at Hasbrouck Avenue
Relocate Delivery Drive	X	X
Relocate Taxiway C	X	X
Demolish Hangar No. 1	X	X
Efficiency Enhancement Elements	***All completed by the end of 2020***	***Runway 5-23 completed by the end of 2015, remainder by the end of 2020***
Extend Runway 5-23, including:	Extend north and south to total of 8,700 feet	Extend south to total of 8,700 feet (Completed by the end of 2015)
Realign Off-Airport Roadways[1]	Fully Relocate Airport Road	Realign Main Avenue (Completed by the end of 2015)
Construct New Integrated Cargo Facility (Site 3)	Site 3	Split Facility at Site 3
Expand Passenger Terminal	X	X
Construct New Ground Support Equipment Facility	X	X
Construct New Belly Cargo Facility	X	X
Construct Fuel Farm	X	X
Expand Automobile Parking Facilities	X	X
Reconfigure Terminal Access Roadways	X	X

Note: See Figure 4-2 for Alternatives B2 and B4.
X Common program element.
1 The construction phasing for Alternative B2 include airfield safety enhancements in place by 2015 and airfield efficiency enhancements in place by 2020. For Alternative B4, an expedited construction schedule is proposed with the efficiency enhancements moved up to the 2015 timeframe along with the airfield safety enhancements. This schedule is possible for Alternative B4 because the number of parcels required for mandatory land acquisition for construction would be substantially less than the number of parcels that would be required to construct Alternative B2.
2 Runway 16-34 and Runway 5-23 would impact Airport Road differently: Runway 16-34 enhancements would result in a partial relocation of the western portion of Airport Road north of the Runway 16 End by the end of 2015, whereas Runway 5-23 extension for Alternative B2 would result in a full relocation of Airport Road to the north of both Runway 23 and 16 ends, connecting from Squantum Drive to Route 37 in 2020. Alternative B4 would not require a full relocation of Airport Road.

4.4 Preferred Alternative

The FAA, as the lead agency responsible for preparing the EIS and assuring its adequacy, identified Alternative B4 as the Preferred Alternative. The FAA selects the alternative that fulfills the agency's mission and responsibilities, and that would meet the Airport Improvement Program's Purpose and Need, giving consideration to economic, environmental, technical, and other factors. As required by the CEQ (40 CFR section 1502.14(e)), a lead agency must identify its Preferred Alternative in the FEIS, and must identify the Environmentally Preferable Alternative (40 CFR section 1505(2)(b)) at the time of its decision. RIAC has confirmed that Alternative B4 is its Proposed Action.

This section includes a summary comparison of impacts of the FEIS evaluation of Alternatives B2 and B4 and

the identification of the Preferred Alternative. FAA has completed the appropriate environmental review and the necessary steps in the NEPA process, including:

- Careful consideration of the alternatives and the ability of the alternatives to satisfy the identified Purpose and Need for the T.F. Green Airport Improvement Program (40 CFR section 1502.14(e)); and
- Evaluation of the potential impacts of the alternatives carried forward.

Alternatives B2 and B4 would meet the Purpose and Need and provide the same aviation and community benefits. Alternative B2 aviation (safety) benefits would begin in 2015, and socioeconomic benefits would begin in 2020. However, Alternative B2 would have substantially greater impacts to community resources (i.e., disruption to community, mandatory land acquisition of businesses, and mandatory land acquisition of residences), and higher construction costs than Alternative B4. Alternative B4 would have greater noise impacts, but would have substantially less mandatory land acquisition for construction.[30] Alternative B4 would also have greater floodplain impacts, but fewer wetland impacts.

Alternative B4 would meet the Purpose and Need for the T.F. Green Airport Improvement Program, providing the same aviation and community benefits as Alternative B2; however socioeconomic benefits would begin in 2015 with the extended Runway 5-23 coming on line. From a constructability perspective, Alternative B4 would also be more feasible to construct than Alternative B2 because it would have lower construction costs by $77 million. The reduced construction cost is partially due to fewer wetland impacts and a lower wetland mitigation cost when compared to Alternative B2. All significant impacts that would occur under Alternative B4 could be mitigated (see Chapter 6, *Mitigation*). When compared to Alternative B2, Alternative B4 is preferable for the following reasons:

- Alternative B4 would result 80 percent greater economic gains between 2015 and the end of 2020 than Alternative B2 because of the expedited construction schedule. Potential economic gains for Alternative B4 between 2015 and the end of 2020 would total $680 million more for the State of Rhode Island than under Alternative B2.
- Alternative B4 would require the acquisition of 97 fewer residential units, all of which are considered "affordable."
- Alternative B4 would impact 26 fewer businesses.
- Alternative B4 would impact 250 fewer jobs, including 50 fewer "most threatened" jobs.[31]
- Alternative B4 would introduce 782 total jobs in the City of Warwick in 2015. (Alternative B2 would not result in job growth until 2020.)
- Alternative B4 would remove 99 fewer housing units and 26 fewer businesses from the tax role preserving $606,476 more in annual City of Warwick property taxes in 2020.
- Alternative B4 would preserve the Spring Green Neighborhood because it would not include Fully Relocated Airport Road.

30 Many of the units impacted by noise in Alternative B4 would have otherwise been purchased under Alternative B2 for mandatory acquisition for construction.
31 Businesses and jobs unlikely to relocate within the City of Warwick due to limited vacant/developable industrial lands.

- Alternative B4 would expose 102 fewer residential units to roadway traffic noise impacts (when compared to No-Action noise levels).
- Alternative B4 would not have an adverse effect on Hangar No. 2.
- Alternative B4 would impact 0.8 fewer acres of wetlands and would not impact Buckeye Brook.
- Alternative B4 would cost $77 million less to construct and mitigate for impacts.

The FAA, therefore, has identified Alternative B4 as the Preferred Alternative. Alternative B4 would have the least environmental impacts and all significant impacts could be mitigated. No final FAA decision on the Preferred Alternative and associated mitigation has been or will be made until the issuance of the agency's ROD following the FEIS.

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5 Impacts to Aquatic Resources

This chapter provides an examination and comparison of the airfield safety and efficiency enhancements of Alternative B2's and Alternative B4's potential effect on aquatic resources, as this is the most critical factor in determining the LEDPA. The following sections describe the methodology used in evaluating potential impacts to aquatic resources, and then assess the direct, indirect, temporary, and cumulative impacts potentially resulting from these alternatives.

5.1 Resource Definition and Methodology

This section defines the wetland types present at the T.F. Green Airport and describes the methodology used to assess wetland functions and values, and to identify the direct, indirect, temporary (construction), and cumulative impacts to wetlands.

5.1.1 Wetland Types

The National Wetland Inventory (NWI) maps use the Cowardin Classification System[32] to classify wetlands into "systems" according to plants, soils, and frequency of flooding. The systems are then divided into subsystems, classes, and subclasses based on substrate material, flooding regime, and vegetative life form.

The three principal wetland types identified in the Study Area are forested wetlands, shrub wetlands, and emergent wetlands. All of the identified wetlands are Special Aquatic Sites per 40 CFR Part 230 Section 404(b)(1).

Forested Wetlands

Wetlands identified as palustrine (marsh) forested wetlands (PFO) on the NWI maps are grouped into the forested wetland category. Forested wetlands include forested bogs, fens, deciduous swamps, and coniferous swamps.

32 Cowardin, L. M., Carter, V., Golet, F. C. & LaRoe, E. T. 1979. *Classification of wetlands and deepwater habitats of the United States*. US Fish and Wildlife Service FWS/OBS 79/31. 103 pp.

Shrub Wetlands

Wetlands identified as palustrine scrub shrub wetlands (PSS) on the NWI maps are grouped into the shrub wetland category. Shrub wetlands include shrub bogs and shrub swamps.

Emergent Wetlands

Wetlands identified as palustrine emergent wetlands (PEM) on the NWI maps are grouped into the emergent wetland category. Emergent wetlands include freshwater marshes seasonally flooded wetlands that are frequently saturated at or near the surface when not flooded and are dominated by grasses or grass-like plants. Also included are freshwater wet meadows, which are seldom flooded wetlands that are saturated throughout the growing season and are dominated by herbaceous vegetation that is adapted to these saturated conditions. Where appropriate, emergent wetlands dominated by the invasive common reed (*Phragmites australis*) were separately identified in the evaluation of impacts.

5.1.2 Wetland Functions and Values

Wetlands were evaluated in terms of the functions and values that they provide, using the methodology outlined in the USACE Highway Methodology Workbook Supplement.[33] For example, information collected during aerial photo interpretation, such as type of wetland class present in the wetland, presence or absence of waterways or waterbodies, and adjacency to farm fields, was used to assess the ability of wetland systems to provide functions and values. The primary functions and values assessed for wetlands were:

- Groundwater recharge or discharge;
- Floodflow alteration (storage and desynchronization);
- Fish and shellfish habitat (aquatic diversity and abundance);
- Sediment, toxicant, and pollutant retention;
- Nutrient removal, retention, and transformation;
- Production export (nutrients);
- Sediment/Shoreline stabilization;
- Wildlife habitat;
- Recreation (consumptive and non-consumptive);
- Educational or scientific value;
- Uniqueness and heritage;
- Visual quality and aesthetics; and
- Endangered species habitat.

5.1.3 Direct Impacts

Direct permanent and temporary wetland impacts include filling, removing vegetation, dredging, and relocating or altering watercourses of federally regulated wetlands. Temporary impacts involve short-term disturbance to wetlands and waterways during construction that would cease once construction activities are complete. The loss of wetland functions and values are also direct impacts.

33 USACE. 1995. *Highway Methodology Workbook Supplement.* USACE New England District.

The areas of potential direct impact to wetlands and waterways were evaluated by overlaying the grading limits of Alternatives B2 and B4 on base maps depicting the regulated wetlands and waterways.

5.1.4 Indirect Impacts

Indirect impacts to wetlands may occur when wetland hydrology is altered by constructing new impervious surfaces in a watershed, creating new or modified drainage patterns, or filling wetlands. Modifications to wetland hydrology can alter the extent of wetlands and/or the performance of functions and values provided by wetlands. Other indirect effects could include fragmentation, edge effects, changes in species composition, and increased disturbance. Where new development crosses streams, adjacent wetlands, riparian corridors and associated wildlife movements can be disrupted. Stormwater runoff may also affect water quality in wetlands or may result in the deposition of sediments (such as sand) from roads. Indirect impacts also include reasonably foreseeable changes that could affect wetland functions and values associated with the implementation of the Airport Improvement Program, including secondary development that may occur within the Study Area. However, the area surrounding the Airport is intensely developed and future indirect impacts are not anticipated from secondary development. Wildlife present in habitats adjacent to the Airport has habituated to airport operations including noise generated by aircraft and are not expected to be permanently impacted.

5.1.5 Temporary Impacts

Wetlands may be temporarily disturbed to install conduits for navigation aids and lighting, resulting in increased soil erosion and sedimentation rates. Temporary impacts are also associated with construction activities that may disrupt wildlife utilization of adjacent wetland habitats. Wildlife currently utilizing these habitats has habituated to airport operations but may temporarily abandon these areas when disturbed by nearby heavy equipment operations. Predisturbance habitat utilization patterns would reestablish some time after construction has been completed.

5.1.6 Cumulative Impacts

Cumulative impacts include previous wetland impacts, additional impacts that would result from Alternatives B2 and B4, and any other anticipated future reasonably foreseeable changes in the Study Area, including those comprising the No-Action Alternative. Previous wetland impacts were determined for the time frame between 1939 and 2011, and future wetland impacts were evaluated for the 2025 planning horizon. Cumulative impacts were assessed using aerial photographs taken in 1939 as a baseline condition. The 1939 aerial photographs were chosen as the earliest set of available photographs with adequate quality for wetland evaluation.

5.2 Direct Impacts to Wetlands

This section addresses direct wetland impacts for Alternatives B2 and B4, and the No-Action Alternative. Figures 5-1 and 5-2 depict the north and south, respectively, portions of the Airport comparing the impacts to wetlands from each of the alternatives.

5.2.1 No-Action Alternative

Direct impacts associated with the No-Action Alternative include routine vegetation management and impacts from periodic maintenance and minor modifications needed to maintain safe operations at the Airport. The T.F. Green Airport Vegetation Management Program (VMP) includes work in wetlands within the Airport. All periodic maintenance and minor modifications would be located in upland areas and would not alter wetlands.

5.2.2 Alternative B2

Alternative B2 would impact 5.8 acres of wetlands and 773 linear feet of waterways. Impacts to federal jurisdictional wetlands have been reduced by 1.7 acres from the total 7.5 acres reported in the DEIS through avoidance and minimization measures. Table 5-1 provides information on impacts to wetland functions and values that may result from Alternative B2. Tables 5-2 and 5-3 provide information on wetland and waterway, respectively, impacts from Alternative B2 by program element. Table 5-4 provides detailed information on impacts to federal jurisdictional wetlands for Alternative B2. The referenced tables are provided at the end of this section.

Alternative B2 would impact five wetlands within the Buckeye Brook watershed (Wetlands A5, A6, A8, A10, A11, and A13), two wetlands within the Spring Green Pond subwatershed (Wetlands A2 and A3), and two wetlands outside of this watershed (Wetlands I and P). In addition, some waterways, including intermittent streams, would be placed in culverts or relocated. These impacts are described below for each element of Alternative B2.

Runway 34 End

Safety enhancements associated with Runway 16-34, including Taxiway C, would impact five wetlands at the Runway 34 End. Part of an intermittent stream would be placed in a culvert at two locations and one stream segment relocated (Figure 5-2). Direct impacts to Buckeye Brook below Warwick Pond would be avoided. Approximately 2.5 acres of wetlands would be filled by the Runway 34 End enhancements.

Wetland A6 would be impacted as a result of safety enhancements, including relocating Taxiway C and constructing the new Perimeter Road. Approximately 1.6 acres of wetland (consisting of 0.3 acres of wetland dominated by common reed [*Phragmites australis*], 0.9 acre of emergent wetland, and 0.4 acre of scrub-shrub wetland cover types) would be filled. This impact represents approximately 51.6 percent of the total area (3.1 acres) of Wetland A6. Additional avoidance and minimization measures incorporated into the Taxiway C and Perimeter Road layout during the FEIS alternatives screening reduced impacts to Wetland A6 by 0.3 acres from that reported in the DEIS.

The northern portion of this wetland area appears to have been created by excavation and supports low quality scrub-shrub habitat consisting of Bebb willow (*Salix bebbiana*), alder (*Alnus* sp.) and the invasive glossy buckthorn (*Rhamnus frangula*) established in low fertility sands. The southern part is a remnant of a former wetland system that once was continuous with Wetland A8 before Runway 34 was constructed.

The fragmented and disturbed character of Wetland A6 limits its wildlife habitat function. This wetland is highly altered and does not provide substantial ecological functions. The effectiveness of the water quality

function provided by this wetland is limited as there is no direct discharge of Airport stormwater into the wetland. The intermittent channel that drains Wetland A6 is a steep-sided ditch directed into Tributary A11, which flows seasonally into Wetlands A11 and A13. This intermittent stream does not support fish populations and the stream bed provides only marginal habitat for macrobenthic organisms. Channel flows in Tributary A11 are driven by precipitation events and result in channel erosion that contributes sediment to Wetlands A11 and A13. The groundwater discharge function provided by the portion of Wetland A6 that would not be altered under Alternative B2 and would continue to provide hydrologic support to Wetlands A11 and A13, both of which support base flow in Buckeye Brook below Warwick Pond.

Wetland A8 would be impacted by constructing the Perimeter Road, glide slope critical area, and RSA at the Runway 34 End. Impacts to Wetland A8 would be limited to approximately 0.1 acres of fill in the southwest corner of the wetland for the Perimeter Road and RSA. This area is approximately 0.6 percent of the total area (16.3 acres) of the wetland. Additional avoidance and minimization measures incorporated into glide slope area design and Perimeter Road layout during the FEIS alternatives screening reduced impacts to Wetland A8 by 1.4 acres from that reported in the DEIS.

The area of Wetland A8 that would be impacted consists primarily of scrub-shrub wetland and mown emergent wetland. This area is included in the Airport VMP. Fill placed in scrub-shrub and emergent wetland in Wetland A8 could affect floodflow alteration and water quality functions. Portions of Wetland A8 that contain the mature trees and snags that provide important wetland wildlife habitat would be avoided. The wetland's capacity to provide wildlife habitat functions would only be slightly diminished. Any lost wildlife habitat functions would be mitigated offsite.

Most of Wetland A8 would remain undisturbed and functions such as nutrient removal/retention/transformation and sediment/toxicant/pathogen reduction would not be significantly degraded. The loss of flood storage provided by this wetland is considered in detail in the *Floodplains Technical Report*.[34]

Wetland A10 would be impacted as a result of the RSA enhancements to Runway 34 and installation of navigation aids. Direct impacts to Wetland A10 include filling approximately 0.1 acres for the RSA in the northwestern portion. Impacts to common reed-dominated emergent wetlands would also result from installing new navigation aids within the wetland. This area is approximately 0.4 percent of the total area (25.6 acres) of the wetland. The wetland area that would be impacted is emergent common reed and scrub-shrub cover types within a portion of the Airport where vegetation is managed to maintain a clear Runway Object Free Area (ROFA) in conformance with FAA standards. Filling 0.1 acres of Wetland A10 and installing navigation aids would not impact the baseline aesthetic value of wetlands viewed from Warwick Pond as the Project Area would not be visible from the pond.

Wetland A10 provides floodflow alteration and water quality functions that would be only slightly affected by the safety enhancements, given that the impacts would comprise only 0.4 percent of the wetland area. Impacts to wetland wildlife habitat would be at the edge of the wetland immediately adjacent to Airport activities at the

34 FAA and RIAC. 2009. Draft *Floodplains Technical Report*. Prepared by Vanasse Hangen Brustlin, Inc. (DEIS Appendix Q).

Runway 34 End. Offsite mitigation would be proposed to compensate for losses of wetland wildlife habitat. The unique heritage value (herring run and presence of an Atlantic white cedar stand), fish habitat, water quality, floodflow alteration functions, and shoreline stability function associated with Wetland A10 would not be affected by the safety enhancements that would replace existing navigation aids within this wetland. Buckeye Brook emerges from the southern outlet of Warwick Pond and meanders through Wetland A10 and would not be directly impacted. Limited recreational opportunities afforded to paddlers accessing Buckeye Brook from Warwick Pond would be unaffected.

Wetland A11 would be impacted by constructing the Perimeter Road and relocated Taxiway C, resulting in approximately 0.6 acres of wetland loss. This area is approximately 22.2 percent of the total area (2.7 acres) of the wetland. Impacts would affect emergent and forested wetland cover types. This wetland does not provide water quality or sediment/shoreline stabilization functions as Tributary A11 shows signs of active erosion and sediment export to downstream wetlands. The stream bed habitat that would be altered does not support a productive or diverse macrobenthic community.

Approximately 510 linear feet of Tributary A11 would be relocated or placed in one of two box culverts with a total length of 350 linear feet. The larger box culvert would be 250 feet long and used to construct relocated Taxiway C at the Runway 34 End. This box culvert would discharge into a downstream segment of Tributary A11 south of Taxiway C. A second box culvert approximately 100 feet in length would be installed in an upstream segment of Tributary A11 to carry the Perimeter Road towards the Air Traffic Control (ATC) tower.

Wetland A13 would be impacted by the RSA enhancements to Runway 34, resulting in approximately 0.1 acres of wetland loss. This area is approximately 0.5 percent of the total area (19.4 acres) of wetland. Impacts would affect the common reed fringe at the base of the existing runway fill slope. Minor impacts to common reed-dominated emergent wetlands would also result from installing new navigation aids within the wetland.

Wetland A13 provides floodflow alteration and water quality functions that would be only slightly affected by the proposed safety enhancements. Impacts to wetland wildlife habitat from the proposed alterations of Wetland A13 would be limited and occur at the edge of the wetland immediately adjacent to the Airport.

Runway 23 End

The direct impacts for the Runway 23 End element of Alternative B2 (Figure 5-1) are described below.

Wetland A5 would be filled to create the glide slope critical area and ROFA associated with Runway 23 End, south of existing Airport Road. The new Perimeter Road would also be carried around the ROFA on the top of the new fill. The existing access route to the AMF would have to be abandoned under Alternative B2 as it would be located within the new ROFA. The existing 70-foot long Buckeye Brook culvert shared by Lake Shore Drive and an Airport security road would be extended by 30 feet to allow a new AMF Access Road to be constructed. The AMF Access Road would then follow the route of the perimeter security road through Airport property to reach a segment of Airport Road that would remain after Runway 5-23 has been extended. While generally following the alignment of the existing unimproved road, constructing the AMF Access Road would fill wetlands and relocate approximately 112 linear feet of Buckeye Brook. In total, approximately 1.5 acres of

Wetland A5 would be filled for efficiency enhancements at the Runway 23 End and 142 linear feet of Buckeye Brook would be altered by relocation or placement in a culvert extension.

Wildlife habitat functions provided by Wetland A5 may be reduced as a result of the loss of Buckeye Brook riparian wetland habitat. Wetland A5 would be further fragmented by the conversion of an unimproved security road into a more heavily traveled AMF Access Road. The flood storage capacity of this wetland would also be reduced by fill placement. Minor relocation of Buckeye Brook to accommodate the proposed AMF Access Road would not significantly affect fish and shellfish habitat.

Partially Relocated Airport Road

As part of the safety enhancements to Runway 16-34, Airport Road would be partially relocated at Post Road (Figure 5-1) by 2015. This action would not impact wetland resources.

Fully Relocated Airport Road

Extending Runway 5-23 would require Airport Road to be fully relocated north of its present location, by 2020 (Figure 5-1). Implementing this program element would impact approximately 1.8 acres of wetlands.

Wetland A2 impacts would include filling approximately 1.1 acres of forested wetland. This area is approximately 14.5 percent of the total area (7.6 acres) of the wetland. An existing ditch that forms the headwaters of Spring Green Pond Inlet Stream would be placed in an approximately 121-foot long culvert beneath Fully Relocated Airport Road.

Forested Wetland A2 would be bisected by Fully Relocated Airport Road. This fragmentation would reduce the value of the remaining wetland wildlife habitat on either side of the road. Most of Wetland A2 south of the proposed Fully Relocated Airport Road would be filled. Constructing the road would represent further incremental loss, rather than fragmentation, to the affected functions and values described for the Runway 23 End.

Wetland A3 may be directly impacted by the construction of a Fully Relocated Airport Road stormwater outfall. Approximately 0.1 acres of scrub-shrub wetlands adjacent to Spring Green Pond may be temporarily or permanently altered. Impacts to Wetland A3 would be minor and at the edge of the wetland. These actions would not substantially diminish the existing functions and values provided by this wetland.

Wetland I would be impacted by the Fully Relocated Airport Road interchange with Route 37. Approximately 0.5 acres of forested wetland would be filled to build a ramp. This is approximately 3.3 percent of the entire wetland (15.3 acres) which is predominately forested wetland cover type. The portion of the wetland to be impacted provides an important sediment trapping function due to its location adjacent to Route 37 and Post Road.

Constructing Fully Relocated Airport Road would impact the western fringe of Wetland I near the intersection of Post Road (Route 1) and Route 37. This part of the wetland has suffered encroachment from development and sediment transported by stormwater runoff and provides poor wildlife habitat. This same wetland provides important water quality functions by trapping sediments, pollutants, and sequestering nutrients associated with untreated highway runoff. This lost water quality function may be mitigated in part by the incorporation of stormwater best management practices at the proposed new intersection and along Fully Relocated Airport Road.

Wetland P is located east of Warwick Avenue in the Occupessatuxet Cove watershed. Approximately 0.1 acres of wetland may be filled on the east side of Warwick Avenue at the fringe of this forested wetland. This action would not substantially diminish the functions and values provided by Wetland P.

Table 5-1 Alternative B2: Summary of Impacted Wetland Functions and Values

Program Element	Wetland ID	Wetland Impact (ac)	Wetland Area (ac)	Wetland Functions and Values											
				GWR/D	FFA	S/T/P R	NR/R/T	PE	S&S S	F&SH	WLH	T&E SH	REC	ED/SV	U/H	VQ/A
Runway 23	A2	0.0	7.6	P	X	X	X				P					
	A3	0.0	12.9			P	P	X		P	X		X		X	
	A4	0.0	4.4	P				X		X	X				X	
	A5	1.5	14.5	X	X			X		X	P				X	
Runway 34	A6	1.6	3.1	X												
	A8	0.1	16.3	X	P	P	X				X					
	A10	0.1	25.6	X	P		P	X	X	P	P		X		X	
	A11	0.6	2.7	X												
	A13	0.1	19.4		P	P	P				X					
Fully	A2	1.1	7.6	P	X	X	X				P					
Relocated	A3	0.1	12.9			P	P	X		P			X		X	
Airport Road	I	0.5	15.3	X		P	P				X					
	P	0.1	17.1	P		P	P				X					
Total Impact		5.8	159.4													

Functions and Values

P	Principal Wetland Function or Value
X	Additional Wetland Function or Value likely provided by wetland
GWR/D	Groundwater Recharge/Discharge
FFA	Floodflow Alteration
S/T/P R	Sediment/Toxicant/Pathogen Retention
NR/R/T	Nutrient Removal/Retention/Transformation
PE	Production Export
S&S S	Sediment and Shoreline Stabilization
F&S H	Fish and Shellfish Habitat
WLH	Wildlife Habitat
T&E SH	Threatened and Endangered Species Habitat
REC	Recreation
ED/SV	Educational/Scientific Value
U/H	Uniqueness/Heritage
VQ/A	Visual Quality/Aesthetics

Table 5-2 Alternative B2: Wetland Impacts by Program Element

Wetland ID	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	I	P	Total
Wetland Size (acres)	3.1	7.6	12.9	4.4	14.5	3.1	85.6	16.3	0.5	25.6	2.7	3.5	19.4	15.3	17.1	231.6
Program Element	Wetland Impact (acres)															
Runway 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Runway 34	0	0	0	0	0	1.6	0	0.1	0	0.1	0.6	0	0.1	0	0	2.5
Runway 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Runway 23	0	0	0.0	0[1]	1.5	0	0	0	0	0	0	0	0	0	0	1.5
Partially Relocated Airport Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fully Relocated Airport Road	0	1.1	0.1	0	0	0	0	0	0	0	0	0	0	0.5	0.1	1.8
Total Impact	0	1.1	0.1	0	1.5	1.6	0	0.1	0	0.1	0.6	0	0.1	0.5	0.1	5.8

1 Temporary impact of 0.1 acres to be restored in place

Table 5-3 Alternative B2: Waterway Impact by Program Element

Program Element	Waterway Impact (linear feet)
Runway 16	0
Runway 34	510
Runway 5	0
Runway 23	142
Partially Relocated Airport Road	0
Fully Relocated Airport Road	121
Total Impact	773

Table 5-4 Alternative B2: Wetland Plant Communities and Waterways Impacted

Wetland ID	Emergent[1]	Emergent Phragmites	Scrub-shrub[1]	Forested[1]	Total[1]	Waterway[2]
A2	0	0	0	1.1	1.1	121
A3	0	0	0.1	0	0.1	0
A4	0	0	0[3]	0	0	0
A5	0	0	0	1.5	1.5	142
A6	0.9	0.3	0.4	0	1.6	0
A8	0.1	0	0	0	0.1	0
A10	0	0	0.1	0	0.1	0
A11	0.4	0	0	0.2	0.6	510
A13	0	0.1	0	0	0.1	0
I	0	0	0	0.5	0.5	0
P	0	0	0	0.1	0.1	0
Total Impact	1.4	0.4	0.6	3.4	5.8	773

1 Acres
2 Linear feet, includes intermittent streams
3 Temporary impact with restoration in place

5.2.3 Alternative B4

Alternative B4 would impact 5.0 acres of wetlands and approximately 843 linear feet of waterways. This represents a 2.3-acre decrease from the 7.3 acres of impact to federal jurisdictional wetlands reported in the DEIS. Two new culverts are proposed that would place a total of approximately 340 linear feet of Tributary A11 in structures. The remaining total of 503 linear feet of Tributary A11 and Tributary A that would be impacted would be diverted into new channel or open water wetland areas.

Unlike Alternative B2, Alternative B4 would impact wetlands for safety enhancements, but only at the Runway 34 End. There would be no wetland impacts associated with Runway Ends 5, 16, or 23. Runway 23 End would not be shifted, the same as the No-Action Alternative. The existing Perimeter Road and AMF Access Road near this runway end would also remain in place. The Runway 34 End would be shifted 100 feet north and a portion of the RSA would be constructed by placing fill south of the existing Runway 34 End. Alternative B4 includes a partial, rather than full, relocation of Airport Road north of the Runway 16 End that would preserve most of the existing car rental facility. Main Avenue would be realigned to accommodate the southward extension of Runway 5-23.

Table 5-5 provides information on impacts to wetland functions and values that may result from Alternative B4. Tables 5-6 and 5-7 provide information on wetland and waterway, respectively, impacts from Alternative B4 by program element. Table 5-8 provides detailed information on impacts to wetlands for Alternative B4. The tables are provided at the end of this section.

Alternative B4 would impact four wetlands in the Buckeye Brook watershed (Wetlands A6, A8, A11, and A13) and intermittent streams would be relocated or have segments placed in culverts. These impacts are described below for each element of Alternative B4.

Runway 34 End

Safety enhancements associated with Runway 16-34 would impact four wetlands at the Runway 34 End (Figure 5-2) and require two segments of an intermittent stream, Tributary A11, to be placed in culverts and one segment to be relocated. A portion of a diffuse intermittent stream channel in Wetland A13 (Tributary A) would also be filled. Direct impacts to Buckeye Brook below Warwick Pond would be completely avoided. Approximately 5.0 acres of wetlands would be altered by the Runway 34 End enhancements.

Wetland A6 would be impacted by constructing Taxiway C to the north and the Perimeter Road to the south where it crosses the wetland near the ATC tower. Approximately 1.5 acres of this 3.1-acre wetland (48.4 percent) would be filled. Impacts to Wetland A6 have been reduced from 1.8 acres reported in the DEIS. The northern portion of this wetland appears to have been created by excavation in uplands and supports shrub wetland dominated by Bebb willow, glossy buckthorn, and alder. The southeastern part of the wetland is included in the Airport VMP and consists of low emergent vegetation dominated by grasses and rushes. The area that would be impacted consists primarily of emergent wetland including stands of common reed and shrub wetland. The hydrology of this wetland is driven by groundwater discharge which in turn supports the hydrology of downstream wetlands including Wetland A11 and A13. The wetland is situated between the ATC tower and Taxiway C, further limiting its value as wetland wildlife habitat.

Wetland A6 is highly altered and does not provide substantial ecological or water quality functions. The existing groundwater discharge function of Wetland A6 would continue to provide hydrologic support to Wetland A11 and Wetland A13 through a channel that would not be impacted.

Wetland A8 would be impacted by constructing the Perimeter Road and RSA on the Runway 34 End. Impacts to Wetland A8 would be limited to approximately 0.1 acres of filling along the fringe of the existing Runway 34 fill section, as compared to the 1.8 acres reported in the DEIS. The 0.1-acre area is approximately 0.6 percent of the total area (16.3 acres) of the wetland. This area consists primarily of mown emergent wetland. The revised design largely avoids impact to this scrub-shrub and forested wetland that provides flood storage and water quality functions at the principal level in the former impact area. The larger forested wetland off-Airport property that provides wetland wildlife habitat would not be impacted.

Wetland A10, which provides wildlife and fish habitat, would be avoided by Alternative B4 as new navigation aids would not be required at the Runway 34 End.

Wetland A11 would be impacted as a result of constructing safety enhancements, including relocated Taxiway C and the Perimeter Road. Approximately 0.6 acres of this sloping, linear wetland system consisting of emergent and forest wetland cover types would be altered. This area represents approximately 22.2 percent of the total area (2.7 acres) of this wetland. Impacts to Wetland A11 have been reduced from 0.7 acres reported in the DEIS. Wetland A11 is a remnant of a former system that once was continuous with Wetland A8 before Runway 34 was

constructed in its current location. Portions of Tributary A11, which conveys flow through Wetland A11 around the Runway 34 End, were constructed by excavation through uplands. Approximately 602 linear feet of Tributary A11 would be relocated or placed in one of two culverts. A 250-foot long box culvert would be used to construct relocated Taxiway C at the Runway 34 End. This box culvert would discharge into a downstream segment of Tributary A11 south of Taxiway C. As the Perimeter Road approaches the ATC tower, a second box culvert approximately 100 feet long would be used to cross Tributary A11.

The fragmented and disturbed character of Wetland A11 limits its wildlife habitat function. The stream that drains this system (Tributary A11) does not provide habitat for fish or a productive stream bed macrobenthic community. Groundwater discharge from this wetland supports base flow in Buckeye Brook below Warwick Pond. This wetland also does not provide sediment/shoreline stabilization functions.

Wetland A13 would be impacted as a result of constructing the RSA for the Runway 34 End. Direct impacts to Wetland A13 would consist of approximately 2.8 acres of wetland loss, a reduction of 0.2 acres from that reported in the DEIS. This area is approximately 14.4 percent of the total area (19.4 acres) of the wetland. The impacted wetland consists of two cover types. Approximately 1.8 acres is emergent wetland dominated by common reed. The remainder is shrub-dominated beyond the runway end. In addition, approximately 241 linear feet of Tributary A, a poorly defined and diffuse intermittent stream located south of the Runway 34 End, would be filled. This wetland traps sediments that are washed in from upgradient landscapes and streams. Open water areas in this wetland that may attract waterfowl would not be impacted.

Wetland A13 provides floodflow alteration and water quality functions that would be affected by the safety enhancements. Impacts to ecological functions including wetland wildlife habitat would be minimal as open water areas in Wetland A13 would be avoided. Constructing the Runway 34 RSA would divert Tributary A into a longer flow path through the poorly drained and near level Wetland A13, potentially enhancing the water quality function of the remaining wetland.

Partially Relocated Airport Road

As part of the safety enhancements to Runway 16-34 End, Airport Road would be partially relocated at Post Road (Figure 5-1). This would not impact existing wetland resources, as there are no wetlands in this area.

Realigned Main Avenue

To accommodate the southward extension of Runway 5-23 End to 8,700 feet, a section of Main Avenue would be realigned through developed areas and would not impact existing wetland resources, as there are none.

Table 5-5 Alternative B4: Summary of Impacted Wetland Functions and Values

Program Element	Wetland ID	Wetland Impact (ac)	Wetland Area (ac)	GWR/D	FFA	S/T/P R	NR/R/T	PE	S&S S	F&SH	WLH	T&E SH	REC	U/H	VQ/A
Runway 34	A6	1.5	3.1	X											
	A8	0.1	16.3	X	P	P	X				X				
	A10	0	25.6	X	P		P	X	X	P	P		X	X	
	A11	0.6	2.7	X											
	A13	2.8	19.4		P	P	P				X				
Total		5.0	67.1												

P	Principal Wetland Function or Value	F&S H	Fish and Shellfish Habitat
X	Additional Wetland Function or Value likely provided by wetland	WLH	Wildlife Habitat
GWR/D	Groundwater Recharge/Discharge	T&E SH	Threatened and Endangered Species Habitat
FFA	Floodflow Alteration	REC	Recreation
S/T/P R	Sediment/Toxicant/Pathogen Retention	ED/SV	Educational/Scientific Value
NR/R/T	Nutrient Removal/Retention/Transformation	U/H	Uniqueness/Heritage
PE	Production Export	VQ/A	Visual Quality/Aesthetics
S&S S	Sediment and Shoreline Stabilization		

Table 5-6 Alternative B4: Wetland Impacts by Program Element

Wetland ID	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	I	P	Total
Wetland Size (acres)	3.1	7.6	12.9	4.4	14.5	3.1	85.6	16.3	0.5	25.6	2.7	3.5	19.4	15.3	17.1	231.6
Program Element	**Wetland Impacts (acres)**															
Runway 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Runway 34	0	0	0	0	0	1.8	0	1.8	0	0	0.7	0	3.0	0	0	7.3
Runway 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Runway 23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Partially Relocated Airport Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Impact	0	0	0	0	0	1.8	0	1.8	0	0	0.7	0	3.0	0	0	7.3

Table 5-7 Alternative B4: Waterway Impact by Program Element

Program Element	Waterway Impact (linear feet)
Runway 16	0
Runway 34	918
Runway 5	0
Runway 23	0
Partially Relocated Airport Road	0
Total Impact	918

Table 5-8 Alternative B4: Wetland Plant Communities and Waterways Impacted

Wetland ID	Emergent[1]	Emergent Phragmites	Scrub-shrub[1]	Forested[1]	Total[1]	Waterway[2]
A2	0	0	0	0	0	0
A3	0	0	0	0	0	0
A4	0	0	0	0	0	0
A5	0	0	0	0	0	0
A6	0.9	0.3	0.3	0	1.5	0
A8	0.1	0	0	0.2	0.1	0
A10	0	0	0	0	0	0
A11	0.4	0	0	0	0.6	602
A13	0	1.8	1.0	0	2.8	241
Total Impact	1.4	2.1	1.3	0.2	5.0	843

1 Acres
2 Linear feet

5.3 Indirect Impacts to Wetlands

Airport enhancements can induce development around the Airport; however, indirect impacts to future baseline wetlands from such secondary development are not anticipated. The potential for new commercial development is limited to areas such as the agricultural land and former industrial parcels north of Airport Road. The potential redevelopment of these properties is not anticipated to result in further significant impact to remaining wetlands. Indirect impacts can also include secondary effects that would occur at a later time or in a different place, or that would cause changes in wildlife habitat or populations as an indirect consequence of wetland loss. Edge effects could also degrade wetland wildlife habitat.

The introduction of invasive species at areas disturbed during construction would also be a potential indirect impact to adjacent wetlands for Alternatives B2 and B4. The presence of an invasive species seed bank and the extent of the wetland disturbance would affect the level of this risk. Monitoring may be required to assess this indirect impact and determine if measures to control or remove invasive species would be needed.

5.3.1 No-Action Alternative

Discharged stormwater runoff from the Airport could contribute to erosion in stream channels (Tributary A11 and Tributary A) and within Wetlands A11 and A13 south of Runway 34 (Figure 5-2). Erosion could move soil and debris, which could lead to sedimentation in downstream Wetlands A10 and A13.

5.3.2 Alternative B2

Indirect impacts to existing wetlands are not anticipated. The potential for new commercial development is limited to areas such as the agricultural land and former industrial parcels north of existing Airport Road. The potential redevelopment of these properties is not anticipated to result in further significant impacts to remaining wetlands. Indirect impacts can also include impacts that would occur at a later time or in a different place, or that would cause changes in wildlife habitat or populations as an indirect consequence of wetland loss.

Constructing Fully Relocated Airport Road through Wetland A2 would divide this wetland into half, fragmenting the remaining wetland wildlife habitat not directly impacted by road construction. This action could indirectly impact the wetland through the discharge of stormwater runoff, potentially affecting water quality. Filling Wetland A5 to accommodate the glide slope area and Perimeter Road would reduce flood storage function, potentially increasing flood heights and durations in the wetland above Lakeshore Drive. Introducing traffic along the AMF access road in Wetland A5 could further degrade the wetland wildlife habitat function of the remaining portion of Wetland A5. Clearing vegetation along portions of the AMF access road proximate to Buckeye Brook could lead to undesirable thermal impacts to the stream habitat.

Introducing invasive species at areas disturbed during construction would also be a potential indirect impact to adjacent wetlands for Alternatives B2 and B4. The presence of an invasive species seed bank and the extent of the wetland disturbance would affect the level of this risk. Monitoring would be required to assess this indirect impact and determine if mitigation measures would be required.

5.3.3 Alternative B4

Indirect impacts associated with Alternative B4 could include increased flood heights in Buckeye Brook associated with the loss of flood storage in Wetland A13 associated with the fill placement for the enhanced RSA. This indirect impact would be mitigated by the construction of wetland Mitigation Site 1, described in Chapter 6. The mitigation area would be constructed prior to fill placement for the RSA to minimize the opportunity for short-term impacts.

Fill placement in Wetland A13 could reduce the water quality function provided by the wetland by shortening the residence time of water passing through the wetland. Mitigation Site 1 would be designed to replace this wetland function.

5.4 Construction/Temporary Impacts to Wetlands

Construction activities associated with Alternatives B2 and B4 could temporarily affect wetlands that are not permanently impacted. Constructing new navigation aids under Alternative B2 may require equipment to enter wetlands and temporarily disturb existing vegetation. Utility conduits may be installed in wetlands to provide electrical and communication service to navigation aids. These impacts would be temporary and wetland substrates would be restored in place after work is completed. Alternative B4 would not require the installation of new navigation aids.

Construction best management practices for stormwater, such as hay bales and silt fences, would be implemented to avoid and minimize construction impacts.

Wetland A2 may be crossed to install navigation aids on the north side of the Spring Green Pond inlet stream under Alternative B2. No permanent impact are expected. Temporary disturbance is likely to be less than 0.1 acres. The vegetation in these temporarily disturbed areas would be allowed to recover naturally. Monitoring would be required to ensure that invasive species do not establish in the disturbed areas.

Wetland A4 may be temporarily impacted to install navigation aids north of Upper Buckeye Brook under Alternative B2. The navigation aid is proposed to be installed adjacent to the wetland edge and an estimated 0.1 acres would be temporarily altered to complete this work. Approximately 37 linear feet of Upper Buckeye Brook may be temporarily disturbed to install conduit with electrical service. Appropriate measures such as limiting in-stream work to a low flow period between July and October, use of a temporary diversion to maintain stream flow, or directional drilling to avoid the need to disturb the stream bed, could be taken to minimize impacts.

Wetlands A10 and A13 would be temporarily impacted to install new navigation aids at the Runway 34 End under Alternative B2. Alternative B4 would continue to use the existing navigation aids. These temporary impacts could include vegetation clearing around proposed structures and using construction mats (swamp mats) to facilitate construction equipment operating in wetlands. The vegetation in these temporarily disturbed areas would be allowed to recover naturally. Monitoring would be required to ensure invasive species do not establish in these areas.

5.5 Cumulative Impacts to Wetlands

This section assesses historical impacts to wetlands, cumulative impacts of Alternatives B2 and B4, and reasonably foreseeable future impacts. Wetland functions and values that were lost due to previous impacts were visually identified in historical aerial photographs but cannot be quantified as they occurred prior to this study and exact pre-disturbance conditions are not known.

5.5.1 Historical Impacts

Based on a comparison of the 1939 aerial photographs to current conditions, the greatest previous impacts to wetlands within the Project Area occurred south of Warwick Pond (Figure 5-3). The expansion of the Airport and development of a landfill in this area resulted in large areas of wetland loss, changes in hydrologic patterns, and habitat fragmentation. The wetlands to the north of the Airport have remained relatively the same since 1939, with the exception of impacts from the surrounding land use change (from primarily agricultural to residential and commercial). One notable impact to wetlands north of the Airport occurred prior to 1939 when the flow out of Spring Green Pond was reversed by the construction of Warwick Avenue. Water flow out of Spring Green Pond was originally to the east. After Warwick Avenue was constructed, flow was directed west in an excavated channel (Spring Green Brook) to a confluence with Buckeye Brook. Historical topographic maps dating back to 1892 show flow out of Spring Green Pond to the west, indicating this reversal occurred prior to that year. In the 1939 photographs, portions of Wetlands A6 and A11 appear to be part of a large wetland system that drained towards Wetland A8. This wetland drained northeasterly into Warwick Pond. The central portion of this wetland was filled for the construction of Runway 16-34, separating Wetlands A6 and A11 from Wetland A8. As a result, Tributary A11 drains to the south into Wetland A13. Wetland A6 appears to have been enlarged by excavation at the northern end of this wetland. Functions and values that were potentially lost include wildlife habitat, groundwater recharge/discharge associated with the stream that once flowed into Warwick Pond, and flood storage.

Prior to the development of the landfill in the southern portion of the Project Area, Wetlands A13, A14, and A16 were part of the same wetland system which originally extended west toward the current junction of Taxiways E, T, and S. The landfill filled the majority of the eastern part of this wetland and the construction of Runway 5-23 filled the western portion, leaving the remaining portions of Wetlands A13, A14, and A16 functionally isolated from each other. Functions and values that were potentially lost include flood storage, and water quality functions (such as sediment/toxicant/pathogen retention, nutrient/removal/retention/transformation), and wetland wildlife habitat.

Upper and Lower Buckeye Brook, Spring Green Brook, and Spring Green Pond north of existing Airport Road (Wetlands A1, A2, A3, and A4) have remained relatively unchanged since 1939, except for continuing incremental encroachment by surrounding residential development.

Historical wetland losses on a state-by-state basis for the United States during the 200-year period between the 1780s and 1980s have been quantified by Dahl.[35] It is estimated that approximately 38,000 acres, or 37 percent, of Rhode Island's wetlands were lost during this time. The 1939 aerial photographs (Figure 5-3) indicate that the area of wetland present in the Project Area in 1939 was approximately 397 acres. The same area was evaluated using wetlands delineated on the Airport and available Rhode Island geographic information system (RIGIS) data to determine that approximately 118 acres of wetlands remain in the Project Area. This change represents a loss of approximately 70 percent of the wetlands in the vicinity of the Airport since 1939.

35 Dahl, Thomas E. 1990, *Wetland losses in the United States 1780s to 1980s.* U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

5.5.2 Cumulative Effects of Alternatives B2 and B4

The cumulative effects of Alternatives B2 and B4 are described below. Aside from the Project Area activities, there are few or no reasonably foreseeable future activities that would impact wetlands in the Study Area.

Alternative B2

Alternative B2 would reduce the impacts to wetlands in the Buckeye Brook watershed north of Warwick Pond to approximately 1.5 acres and relocate or culvert approximately 112 linear feet of the Buckeye Brook stream channel adjacent to the culvert at Lakeshore Drive. Fully Relocated Airport Road would require filling approximately 1.1 acres of Wetland A2, but over 84 percent of forested Wetland A2 would remain.

Alternative B2 would result in the loss of an additional 2.5 acres of wetland on the Runway 34 End within the Buckeye Brook watershed. The largest impacts are associated with the relocation of Taxiway C, which impacts Wetlands A6 and A11, and enhancements to Runway 34, which extend into Wetland A8. Wetlands A6 and A11 were once contiguous with the higher value Wetland A8 and now only provide limited wetland functions and values due to previous encroachments. Wetland A8 would continue to provide wildlife habitat, flood storage, and other wetland functions after this safety improvement is completed. Impacts to Wetland A13 and A10 at the Runway 34 End are minimal (0.1 acres in each wetland).

It is estimated that there were 397 acres of wetlands in the Project Area in 1939 compared with 118 acres currently. Alternative B2 would impact 5.8 acres of wetlands resulting in a cumulative loss since 1939 of approximately 284.8 acres of wetlands. This represents a 72 percent loss of total wetlands area without mitigation since 1939.

Alternative B4

Alternative B4 would result in the loss of 5.0 acres of wetlands on the Runway 34 End within the Buckeye Brook watershed. The largest impacts are associated with the construction of the RSA that would fill approximately 2.8 acres of Wetland A13. Constructing the RSA would cause Tributary A to follow a longer flow path through Wetland A13, potentially enhancing the water quality function of the remaining wetlands. Wetland A8 would continue to provide wildlife habitat, flood storage, and other wetland functions after the runway safety improvement is completed. Alternative B4 completely avoids impacts to Buckeye Brook. Under Alternative B4, there would be no wetland impacts associated with extending Runway 5-23 to the south or relocating Airport Road, avoiding further cumulative impacts north of the Airport.

If Alternative B4 were to be constructed, the total of past and proposed losses in the Project Area would be 284.0 acres, 72 percent of the historic wetlands area without mitigation.

Summary of Cumulative Effects

Based on a review of historic aerial photographs, there has been a 70 percent loss of wetlands area since 1939 within the Project Area. The cumulative loss of wetlands area since 1939 associated with either Alternative B2 or B4 would be approximately 72 percent. The cumulative loss of wetland functions and values provided by the Buckeye Brook/Spring Green Pond wetland system north of existing Airport Road from Alternative B2 would

be limited to minor edge impacts. Alternative B4 would have no cumulative impacts to wetlands north of the existing Airport Road. Alternative B4 would not further impact Buckeye Brook or its adjacent riparian wetlands.

Impacts to wetlands at the Runway 34 End common to Alternatives B2 and B4 would occur along edges of the existing Airport development and would not result in any cumulative wetland habitat fragmentation. Alternative B2 avoids impacts to wetlands south of the Runway 34 End. Under Alternative B4, approximately 2.8 acres of Wetland A13 would be filled to construct the Runway 34 RSA. Cumulative impacts to functions such as flood storage and water quality would be minimized through the creation of a wetlands compensation area within the Airport. Implementing Alternative B4 would not result in significant cumulative degradation of the wetland wildlife habitat function at the Runway 34 End as Wetland A13 has historic degradation of the wildlife habitat function and wetlands providing this function at a higher level (Wetland A10 and A14) would not be impacted.

5.6 Summary of Impacts to Wetlands

Alternative B2 would result in filling 5.8 acres of wetlands and filling or altering 773 linear feet of waterways. Alternative B4 would result in filling 5.0 acres of wetlands and filling or altering 918 linear feet of waterways. Table 5-9 summarizes wetlands impacts by alternative. Mitigation will offset proposed losses.

Table 5-9 Alternatives B2 and B4: Areas of Wetland and Waterway Impacts[1]

Program Element and Associated Action	Alternative B2		Alternative B4	
	Wetlands[1]	Waterways[2]	Wetlands[1]	Waterways[2]
Runway 5 End	0	0	0	0
Runway 23 End	1.5	142[3]	0	0
Runway 16 End	0	0	0	0
Runway 34 End	2.5	510	5.0	843
Partially Relocated Airport Road	0	0	0	0
Fully Relocated Airport Road	1.8	121	0	0
Total Impacts	5.8	773	5.0	843

1 Acres
2 Linear feet
3 Includes temporary impact where mitigation can be accomplished in place

The following sections summarize the wetlands and waterways impacts of the safety and efficiency enhancements of each alternative.

5.6.1 Safety Enhancements

The safety enhancements to Runway 16-34 (including Partially Relocated Airport Road) would result in wetland impacts only at the Runway 34 End. There would be no wetland impacts at the Runway 16 End because there are no wetland resources present. The impacts at the Runway 34 End listed in Table 5-9 are summarized below for each alternative.

Alternative B2

Implementing safety enhancements to Runway 16-34 under Alternative B2 would result in loss of 2.5 acres of wetlands and 510 linear feet of intermittent watercourse (Tributary A11) without mitigation. Wetland impacts associated with safety enhancements at the Runway 34 End would primarily impact Wetland A6 (1.6 acres) and Wetland A11 (0.6 acres). Wetland A11 and Wetland A6 are remnants of a larger wetland system and were found to provide limited wetland functions and values. Impacts to Wetland A8 (0.1 acres) would occur along the edge closest to the Airport and would have only minor effects on the existing level of wetland functions provided by this wetland. Impacts to Wetlands A10 and A13 would be minimal (0.1 acres each) and would occur along the wetland edge.

Alternative B4

Implementing safety enhancements to Runway 16-34 under Alternative B4 would result in loss of 5.0 acres of wetland and 843 linear feet of intermittent watercourse (Tributary A11 and Tributary A) without mitigation. Under Alternative B4, wetland impacts associated with safety enhancements at the Runway 34 End would primarily impact Wetland A13 (2.8 acres), Wetland A6 (1.5 acres), and Wetland A11 (0.6 acres). Impacts to Wetland A6 and A11 are similar to those described for Alternative B2. The portion of Wetland A13 that would be impacted is located immediately south of the runway end and consists of a stand of emergent wetland vegetation dominated by common reed and scrub-shrub wetland and does not provide high value wildlife habitat. Importantly, Alternative B4 would avoid higher value habitats associated with open water areas in Wetland A13 and the Buckeye Brook corridor at Wetland A10. Impacts to Wetland A8 (0.1 acres) would occur along the edge closest to the Airport and would have only minor effects on the existing level of wetland functions provided by this wetland.

5.6.2 Efficiency Enhancements

The proposed efficiency enhancements to Runway 5-23 would result in wetland impacts only at the Runway 23 End. There would be no wetland impacts at the Runway 5 End because there are no wetland resources present there. Fully Relocated Airport Road, which is necessary if Runway 5-23 is to be extended under Alternative B2, would result in additional wetland impacts. Impacts at the Runway 23 End and those associated with Fully Relocated Airport Road are summarized below for Alternatives B2 and B4.

Alternative B2

Alternative B2 would permanently impact wetlands in the Buckeye Brook watershed north of existing Airport Road for Fully Relocated Airport Road (1.1 acres of Wetland A2) and minor road widening impacts at Warwick Avenue. Approximately 1.5 acres of Wetland A5 would be altered at the Runway 23 End, including wetlands along Buckeye Brook, which provides wildlife habitat and supports an anadromous fish run. These impacts would diminish the wetland functions and values provided by these wetlands, but this action would not reach the level of a significant impact (as defined by FAA Order 1050.1E, Change 1).

Alternative B4

Under Alternative B4, wetland impacts associated with changes to Runway 5-23 would be entirely avoided. There would be no impacts at the Runway 23 End because Alternative B4 proposes no changes at that end, and there would be no impacts at the Runway 5 End because there are no wetland resources present.

6 Mitigation

This chapter describes the conceptual mitigation measures considered for Alternative B4, the Preferred Alternative. As applied in the FEIS and in the 1990 *Memorandum of Agreement Between the Department of the Army and the Environmental Protection Agency Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines*,[36] mitigation of wetland impacts consists of three sequential steps:

1. Avoidance through the examination of potential project alternatives;
2. Minimization through the incorporation of special design measures that reduce unavoidable impacts; and
3. Mitigation to offset unavoidable impacts that cannot be reduced through sound design measures.

Mitigation features incorporated into Alternative B4 are described below, including opportunities for compensatory mitigation for unavoidable impacts to wetlands and waterways. This analysis incorporates a reduction of Alternative B4's wetland impacts from the 7.3 acres described in the DEIS to 5.0 acres, as described in Chapter 5 of this application . Waterways impacts were reduced from approximately 918 linear feet to and approximately 843 linear feet. Minimizing the impacts was accomplished by advancing the design of Alternative B4 as part of developing the FEIS.

6.1 Avoidance

Wetlands occur adjacent to the Airport Road, and Runway 23 and Runway 34 Ends, requiring consideration of wetland avoidance strategies for Alternative B4. Alternative B4 was specifically developed to avoid wetland impacts at Airport Road and Runway 23 End. Further avoidance strategies at these locations are not necessary. Avoidance strategies at the Runway 5 and Runway 16 Ends are also not necessary as wetlands are not present in these areas.

There are seven wetlands present at the Runway 34 End (Figure 5-2), including Buckeye Brook and a series of related tributaries. Impacts to wetlands south of Runway 34 could be avoided if the runway end is shifted north.

36 USACE and EPA. 1990. *Memorandum of Agreement Between the Department of the Army and the Environmental Protection Agency Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines.*

This scenario was evaluated in the Level 4 Alternatives Analysis and was found not practicable since this would require Post Road (US Route 1) to be relocated or closed.

Alternative B4 would impact wetlands at the Runway 34 End to construct the glide slope critical area, relocated Taxiway C, and Perimeter Road. Alternative B4 would shift Runway 16-34 approximately 100 feet north of its present location. This was determined to be the maximum distance that Runway 16-34 could be shifted that would still comply with FAA standards and avoid environmental impacts. Under Alternative B4, impacts to wetlands would be avoided by eliminating the hold apron west of the Runway 34 End and by constructing the Perimeter Road through the RSA and ROFA between the Runway 34 End and the EMAS bed. Impacts to other wetlands would be further avoided by routing the Perimeter Road away from the side of relocated Taxiway C to the south side of these wetlands. Wetlands impacts associated with Taxiway C and Perimeter Road cannot be avoided and still meet minimum FAA safety distances.

6.2 Minimization

Impacts to wetlands have been minimized through modifications to the design of Alternative B4, as described below. Additional minimization measures may be feasible and would be evaluated in the final design process.

Runway 34 safety enhancements (including relocating Taxiway C) would have unavoidable impacts to Wetlands A6, A8, A11, and A13. Impacts to these wetlands have been minimized through the alternatives analysis process, from a maximum of 32 acres of wetland loss under Level 4 Screening IP Option A.

Alternative B4 would impact 5.0 acres of federal jurisdictional vegetated wetlands and approximately 843 linear feet of waterways. This represents a 2.3-acre decrease from the 7.3 acres of impact to federal jurisdictional wetlands reported in the DEIS. The additional avoidance and minimization measures incorporated into the Runway 34 design are described in FEIS Section 5.10.8, *Avoidance and Minimization*. The Runway 34 End would be shifted nearly 100 feet north and a portion of the RSA would be constructed by placing fill south of the existing substandard Runway 34 End. Alternative B4 includes a partial relocation of Airport Road in a developed area. This would not impact wetland resources, as there are no wetlands in this area. Alternative B4 does not require Airport Road to be fully relocated. Importantly, Alternative B4 would not directly impact Buckeye Brook and would avoid any impact to Wetland A5 and Wetland A10 through which the brook flows.

Two new culverts are proposed that would place a total of approximately 340 linear feet of Tributary A11 in structures. The remaining total of 503 linear feet of Tributary A11 and Tributary A that would be impacted would be diverted into new channel or open water wetland areas.

6.3 Mitigation

This section describes the mitigation goals and potential mitigation sites for the 5.0 acres of wetlands and 843 linear feet of waterways that would be impacted by Alternative B4. Mitigation site selection and designs will be further developed later in permitting process for the Preferred Alternative and as additional information is

obtained during coordination with stakeholders including the USACE, RIAC, EPA, Rhode Island Department of Environmental Management (RIDEM), the City of Warwick, and the public.

6.3.1 Mitigation Goals

The USACE and EPA have a national goal of no net loss of wetland functions.[37] Accordingly, compensatory wetland mitigation will be required to offset wetland losses of the functions and values that cannot be avoided or reduced through minimization. Mitigation for wetland areas and functions and values (services) must be consistent with USACE New England District mitigation plan guidelines,[38] a recent USACE/EPA regulation *Compensatory Mitigation for Losses of Aquatic Resources; Final Rule*,[39] and the FAA *Hazardous Wildlife Attractions on or Near Airports* Advisory Circular.[40]

Compensatory mitigation is defined as the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and (in certain circumstances) preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practical avoidance and minimization has been achieved. USACE guidance states that, in general, compensatory mitigation should be located within the same watershed as the impacted wetland site, but compensatory projects should not be located where they would increase the risks to aviation by attracting wildlife near airports.

According to the final rule for *Compensatory Mitigation for Losses of Aquatic Resources* Section 230.93(f) "If the district engineer determines that compensatory mitigations is necessary to offset unavoidable impacts to aquatic resources, the amount of required compensatory mitigation must be, to the extent practicable, sufficient to replace the lost aquatic resource functions."[41] The USACE New England District has established standard "ratios to serve as a starting point for developing adequate compensation."[42] Acceptable ratios are established for wetland compensation through restoration or creation that are multiples of the actual wetland areas impacted. In some instances, preservation and other creative forms of mitigation may be acceptable for certain project impacts and may be used to reduce these ratios. The recommended minimum compensatory mitigation ratios are based on the wetland cover types impacted (e.g., emergent wetland 2:1, forested wetland 3:1, etc.).[43] However, "there continues to be flexibility of a project by project basis to achieve appropriate mitigation."[44] The Preferred Alternative would fill 5.0 acres of federally regulated wetland. Based on the wetland cover types filled and USACE New England District guidance, a minimum equivalent of 10.2 acres of wetland creation and/or restoration would be recommended.

Compensatory mitigation should replace the wetland functions and values losses attributed to the action. Table 6-1 provides the functions and values of the 5.0 acres of wetlands that would be impacted under Alternative B4 for Runway 34.

37 USACE and EPA, 1990. *Memorandum of Agreement Between the Department of the Army and the Environmental Protection Agency Regarding The Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines.*
38 USACE. 2007. *New England District Mitigation Plan Checklist* (March 13, 2007) and *Guidance for the New England District Mitigation Plan Checklist* (January 12, 2007; addendum issued December 18, 2007). USACE New England District, Regulatory Division: Concord MA.
39 USACE and EPA. 2008. *Compensatory Mitigation for Losses of Aquatic Resources; Final Rule.* 33 CFR Parts 325 and 332, and 40 CFR Part 230.
40 FAA. 2007. *Hazardous Wildlife Attractions On or Near Airports.* Advisory Circular 150/5200-33B.
41 USACE and EPA. 2008. *Compensatory Mitigation for Losses of Aquatic Resources; Final Rule.* 33 CFR Parts 325 and 332, and 40 CFR Part 230.
42 USACE New England District Regulatory Division, *New England District Compensatory Mitigation Guidance*, July 20, 2010, pg. 11.
43 USACE New England District Regulatory Division, *New England District Compensatory Mitigation Guidance*, July 20, 2010, Table 1, pg. 15.
44 USACE New England District Regulatory Division, *New England District Compensatory Mitigation Guidance*, July 20, 2010, pg. 12.

Table 6-1 Alternative B4: Wetland Functions and Values Impacted (acres)

Program Element	GWR/D-SWGW	FFA	S/T/P R-WQ	NR/R/T-WQ	PE	S&S S	F&SH	WLH-WWH	T&E SH	REC	U/H-AES	VQ/A-AES
Runway 34	2.2	2.9	2.9	2.9				2.9				

X.X	Principal Wetland Function or Value.	S&S S	Sediment and Shoreline Stabilization.
X.X	Additional Wetland Function or Value likely provided by wetland.	F&SH	Fish and Shellfish Habitat.
GWR/D	Groundwater Recharge/Discharge.	WLH	Wildlife Habitat.
SWGW	Surface Water and Groundwater.	WWH	Wildlife and Wildlife Habitat.
FFA	Floodflow Alteration.	T&E SH	Threatened and Endangered Species Habitat.
S/T/P R	Sediment/Toxicant/Pathogen Retention.	REC	Recreation.
NR/R/T	Nutrient Removal/Retention/Transformation.	ED/SV	Educational/Scientific Value.
WQ	Water Quality.	U/H	Uniqueness/Heritage.
PE	Production Export.	AES	Aesthetic.
		VQ/A	Visual Quality/Aesthetics.

Some activities such as the replacement of a culvert under Lakeshore Drive to improve anadromous fish passage and correct flooding problems and the removal of the security fence Airport property along Buckeye Brook and Wetland A5 are difficult to evaluate in terms of a mitigation acre equivalent. According to the Final Rule: *"The district engineer must determine the compensatory mitigation to be required in a Department of the Army permit, based on what is practicable and capable of compensating for the aquatic resource functions that will be lost as a result of the permitted activity."*[45] The compensatory mitigation provided in this program achieves the goal of compensating for aquatic functions lost due to the project.

The USACE recommends the use of the "watershed approach"[46] to develop a compensatory wetland mitigation program that sustains and even improves the aquatic resources in the project's watershed. Where possible, this approach considers the landscape setting of potential mitigation sites to identify the types and locations of compensatory mitigation projects that will benefit the watershed and offset losses of aquatic resource functions and services associated with the proposed activity that requires a CWA Section 404 permit from the USACE. Because this application involves enhancements at a commercial airport, mitigation would also have to be consistent with the FAA *Hazardous Wildlife Attractions on or Near Airports* Advisory Circular.[47]

The wetlands for the T.F. Green Airport Study Area are located in four Rhode Island Watersheds that are assigned Hydrologic Unit Code (HUC) 12 designations, as listed in Table 6-2.

Table 6-2 Study Area Watersheds

Watershed Name	HUC 12 Designation
Upper Narragansett Bay	010900040902
Greenwich Bay	010900040903
Seekonk & Providence River	010900040901
Pawtuxet River Main Stem	010900040609

45 Federal Register, 40CFR Part 230. Compensatory Mitigation for Losses of Aquatic Resources; Final Rule. April 2008.
46 USACE and EPA. 2008. *Compensatory Mitigation for Losses of Aquatic Resources; Final Rule.* 33 CFR Parts 325 and 332, and 40 CFR Part 230.
47 FAA. 2007. *Hazardous Wildlife Attractions On or Near Airports.* Advisory Circular 150/5200-33B.

In identifying potential sites for compensatory mitigation the focus was on areas within this watershed in the City of Warwick that could benefit from the mitigation program. The approximate limits for the first level of search were bounded by Upper Narragansett Bay and the Providence River to the east, Greenwich Bay to the south, and the Pawtuxet River to the west and north (Figure 6-1).

The mitigation program would consists of creating, restoring, preserving, and enhancing wetland areas that provide 4.3 acres flood storage as a principal function and 3.0 acres of wetland with water quality as a principal function. Some of the potential mitigation sites would be incorporated into a program to mitigate for aquatic resources functions that will be lost. Approximately 1.5 acres of wetland wildlife habitat would be restored or enhanced. In addition, the culvert at Lakeshore Drive may be replaced to enhance fish passage along an anadromous fish run and correct a localized flooding problem that leads to frequent road closures. Wetland wildlife habitat would be preserved in two off-site locations that are threatened by encroaching development. Table 6-3 provides a summary of potential wetland mitigation sites in the program and the conceptual wetland mitigation estimated acreages for Alternative B4.

Table 6-3 Alternative B4: Wetland Mitigation Sites - Functions and Values

Mitigation Site No./ Location/ Wetland ID	Mitigation Type	Wetland Class	Acres (est.)	Ownership	Functions and Values Provided by Mitigation						
					GWR/D	FFA	WQ	PEx	F&SH	WLH-WWH	REC
Site 1 /Onsite/ WL A13	Create (includes some restoration)	PSS	3.0	RIAC		P	P	-	-	-	-
Site 2 /Onsite/ Lakeshore Drive	Replace culvert	-	-	RIAC/City		X			P	X	-
Site 3 /Onsite/ WL A5	Restore: remove old fills Enhance: micro-relief and planting of wet roads	PSS/PFOPSS/PFO	1.3 0.2	RIAC	-	P	X	X	-	P	-
Site 6 /Onsite	Creation	PSS	0.4	RIAC	X	X	X				
Site 8 /Offsite/ Three Ponds Brook Marsh	Preserve: Wetland and Upland Buffer	PEM/PSS Buffer	32.0	Public/Pvt	P		X	P	X	P	-
Site 12/Offsite Conimicut Point Marsh	Preserve: Coastal wetland and upland buffer	Estuarine Intertidal Emergent	8-12	Pvt				X	P	P	X

P	Principal Wetland Function or Value.	PFO	Palustrine Forested Wetland.
X	Additional Wetland Function or Value likely provided by wetland.	PSS	Palustrine Scrub-Shrub Wetland.
GWR/D	Groundwater Recharge/Discharge.	WLH	Wildlife Habitat.
FFA	Floodflow Alteration.	WQ	Water Quality.
F&S H	Fish and Shellfish Habitat.	WWH	Wildlife and Wildlife Habitat.
PEM	Palustrine Emergent Wetland.	REC	Recreation.
PEx	Production Export.		

6.3.2 Proposed Mitigation Sites

FAA and RIAC hosted a meeting on November 4, 2010 with representatives of the City of Warwick, non-government agencies, and other stakeholders with interests in natural resource conservation including the Buckeye Brook Coalition, Save the Bay, and the Rhode Island Rivers Council. After touring the proposed wetland impact areas associated with Runway 34 safety enhancements, the group met to discuss opportunities for adding new mitigation sites into the program. This meeting resulted in the addition of another potential site, Site 12, which seeks to preserve properties within the Mill River[48] estuary known as the Conimicut Point Marsh.

Further evaluation of wetland mitigation opportunities led to a program consisting of six potential sites (Figure 6-1). Mitigation Sites 1, 3, and 6 are on the Airport and two preservation sites, Mitigation Sites 8 and 12 are off the Airport. A sixth site, Mitigation Site 2, involves replacing the existing Buckeye Brook culvert under Lakeshore Drive north of Warwick Pond. Incorporating Mitigation Sites 8 and 12 may allow the program to achieve mitigation goals without Mitigation Site 6. This will be evaluated once agreements for the preservation site are negotiated.

Preliminary conceptual designs for three on-Airport sites and potentially a new culvert under Lakeshore Drive (partially on the Airport) have been completed. Two off-site mitigation sites selected for preservation still require negotiations to secure permanent protection through the use of conservation easements or other legal vehicles. Final mitigation site design and legal protection of preservation sites will be completed after the ROD has been issued for the project. The ROD will commit FAA to fund the mitigation program to offset impacts associated with mandated safety enhancements. These funds will be used to complete designs, construct mitigation areas, purchase easements, and implement monitoring and evaluation programs. It is anticipated that one or two of the potential mitigation sites may be eliminated if adequate compensation can be achieved at fewer sites. Final design plans for the mitigation sites will be submitted to the RIDEM Office of Water Resources as part of an Application to Alter Freshwater Wetlands. Once the designs have been approved by the RIDEM, these plans will be submitted to the USACE New England District Office as a final addendum to this application.

6.3.2.1 Mitigation Site Descriptions

The following paragraphs describe each potential mitigation site.

Mitigation Site 1

Mitigation Site 1 is located on the Airport within the Buckeye Brook watershed south of Runway 34 (Figure 6-2). The site design compensates for the flood storage lost from fill placement in Wetland A13 for the Runway 34 RSA. This wetland mitigation area is in uplands adjacent to Wetland A13 and in the same floodplain that would be filled south of Runway 34.

The soil in this area is a well sorted, sandy outwash deposit resting over slowly permeable glacial lakebed deposits composed of thinly interbedded very fine sand and silt. The lakebed deposit forms a restrictive layer that inhibits further infiltration. Groundwater elevation monitoring in the upland area that would be excavated

48 The Mill River begins below the confluences of Lockwood Brook and Warner Brook with Buckeye Brook.

to create a wetland revealed an apparent flow direction toward Wetland A13. The surface water elevation in Wetland A13 is outlet-controlled by the culvert that restricts the flow between Wetlands A13 and A10. The water level in Wetland A13 was never recorded below elevation 12.1 feet NAVD 88, approximately 0.1 feet below the culvert invert. Water levels in Wetland A13 rose to or above elevation 13.0 feet NAVD 88 a total of 14 times during the 189-day monitoring period in 2010. The longest duration it remained at or above this elevation was 7.5 hours, with an average duration of only 3.5 hours. This information is important as the mitigation area within the Airport cannot be designed to pond water for prolonged periods, which could create a wildlife hazard to aviation. The mitigation area will be designed to only hold water during the duration of larger storms and will be graded to drain positively back into Wetland A13. A low shrub cover consisting of species which do not produce fruits that attract wildlife (e.g., willow or sweet pepperbush) would be planted to obscure the brief periods of shallow flood which may occur immediately after heavy rains.

Crushed stone beds would be installed beneath the manufactured high organic content soil in portions of the created wetland to enhance subsurface flow in the direction of the outlet culvert. This would enhance the opportunity for plants growing in this substrate to sequester nutrients even when surface water is not present. The stone would be installed below the ordinary water table (anaerobic zone) to minimize the potential for sealing by iron ochre deposits.

In addition to work within Mitigation Site 1, other water quality benefits may be achieved through the installation of stone check dams to create pool and riffle morphology in Tributary A11. These features would be installed in eroding segments of this stream and in segments to be relocated for the project. The oxygenation promoted by this practice should lower levels of dissolved iron and manganese concentrations in surface waters reaching Wetland A13.

Mitigation Site 2

Mitigation Site 2 would replace the existing restrictive culvert under Lakeshore Drive (Figure 6-3). The culvert currently consists of three parallel, approximately 85 feet long, 30-inch diameter reinforced concrete pipes installed with reversed slopes. This culvert was analyzed with the HEC-RAS model developed for the project and it was determined that it may not have the capacity to handle flows generated by a one-year storm. Replacement of the culvert would alleviate a localized flooding problem along Lakeshore Drive and enhance fish and wildlife passage between Warwick Pond and Wetland A5.

The conceptual design for a new culvert consists of three box culverts, two 4-foot wide by 3-foot high units sandwiching a single 10-foot wide by 5-foot deep box that would be embedded two feet into the stream bed. With the elimination of the gravel road at the Airport perimeter, this new culvert can be shortened to approximately 60 feet (refer to Mitigation Site 3 below). The large central box would be filled to the stream bottom elevation with river stone to create a natural bottom. The river stone would be contoured to form a central channel that would maintain fish passage during low flow periods. Flow velocities would be analyzed to ensure that river herring can pass through the structure during spring flows.

The culvert would achieve an openness ratio of approximately 0.5 which exceeds the minimum 0.25 ratio recommended by the USACE for wildlife passage.[49] This action, along with Mitigation Site 3, should help reestablish habitat continuity between the seven acres of forested habitat at the north end of Warwick Pond and the 22 acres of forested habitat along Buckeye Brook between Lakeshore Drive and Airport Road.

The proposed culvert has been modeled to pass flows from a 10-year storm without overtopping the roadway. Since the existing Lakeshore Drive road profile would be maintained, no additional permanent wetland impacts would be required to complete this mitigation.

Temporary impacts associated with construction activity would be minimized by conducting operations when herring are not passing through Buckeye Brook. Since the existing and proposed culverts are multi-barreled, flow can be maintained during construction without the need for a pump around or separate diversion channel. Construction sequencing details would be determined prior to ground breaking.

Mitigation Site 3

Mitigation Site 3 involves several different activities proposed to enhance the level of wetland functions and values provided by Wetland A5 near Lakeshore Drive (Figure 6-4). The primary activity is the restoration of 1.3 acres of wetland buried beneath existing roads built in fill sections. Another 0.2 acres of wetlands previously impacted by roadways constructed in shallow areas would be enhanced by abandoning the roadways and planting native species. The roads were originally constructed for rescue operations when the first Airport runway was oriented in an east to west direction parallel to Airport Road. These roads no longer serve this purpose and are not essential to safe airport operations.

In addition, 49 linear feet of Buckeye Brook presently conveyed through culverts would be day-lighted and placed in constructed stream channels at two locations. Removing these culverts would eliminate obstructions to fish passage. Three other culverts that pass under the roads would be daylighted to restore approximately 87 linear feet of intermittent stream channel. These surface channels would restore aquatic habitat continuity and provide better exchange between Buckeye Brook and wetlands now separated from the brook by roads.

Additional mitigation at this site would be provided by the removing the perimeter security fence that separates approximately 13 acres of forested wetland and upland habitat within the Airport from 16 acres of similar habitat between the north end of Warwick Pond and Airport Road. Restoring habitat continuity would enhance the wildlife habitat value of the entire area.

Finally, removing existing fill from 1.3 acres of wetland would restore flood storage capacity and the water quality function of wetlands isolated from Buckeye Brook by existing road fill sections. With berms and culverts removed, stream flows associated with smaller storms may reach wetland areas that are currently isolated. Excavation quantities have not been calculated at this level of design but is presumed to be on the order of two acre feet.

49 New England District, U.S. Army Corps of Engineers, Regulatory Division Openness Ration Spreadsheet (1/4/2006).

The design for this site was developed by field delineating wetland limits and using instrument survey to prepare a topographic plan of the road network that was mostly obscured in the aerial survey. Larger trees established in the road fill section were also surveyed so they could be preserved on "hummocks" with excavation activities excluded from the drip lines. Removing these roads would not only restore the underlying wetland, but would also restore the wetland's floodplain function during smaller, more frequent storms that do not overtop the existing road fill sections. This increased frequency of exchange will enhance the production export function of Wetland A5.

In summary, Mitigation Site 3 would provide 1.3 acres of wetland restoration by excavating to the former wetland surface. In addition 0.2 acres of road which consists of partially filled wetland would be enhanced through minor re-grading to provide micro-relief, followed by seeding and planting with wetland tree species. Compensation for project related forested wetland impacts (0.2 acres) would be achieved without the lag time associated with other forested wetland restoration projects. The roadways are located within forested wetlands; once the roads are removed, the substrate would be shaded and receive inputs from leaf fall almost immediately. Removing three other existing culverts under the Airport Perimeter Road would provide an additional 87 linear feet of open channel.

Taken together, the actions proposed for Mitigation Sites 2 and 3 provide opportunities to restore fish passage in Buckeye Brook and forested wetland habitats along the brook. These benefits are not limited to the area of direct work, but extend into the last wild area between Warwick Pond and Lakeshore Drive where the continuity of both aquatic and terrestrial habitats would be restored.

Mitigation Site 6

Mitigation Site 6 would address the Spring Green Pond Inlet Stream, which originates in Wetland A2 as a ditch dug through the wetland (Figure 6-5). This ditch was apparently installed to lower the surface and groundwater elevation in the wetland. While restoration of the original hydrology of wetland system could be achieved by backfilling the ditch and raising the culvert invert elevation under Lydick Avenue, this action could result in unintended damage to properties abutting the wetland, including City-owned roads. This ditch is steeply incised south of Lydick Avenue where it passes through a former home site acquired by the Airport. A portion of the lawn area which abuts this channel would be excavated to create approximately 0.4 acres of shrub and forested wetland next to the stream. An upland buffer would be planted in the slopes grading to the wetland and existing mature trees would be preserved. This would provide a floodplain function to attenuate flood flows and provide a wetland buffer to enhance the water quality of runoff. The site would be graded to drain back into the stream so a wildlife hazard is not created. Plant species that do not produce fruit sought after by wildlife such as willow, alder, and sweet pepperbush would be used. This area would also provide a wildlife corridor for mammals traveling between habitats at Spring Green Pond and Wetland A2.

Mitigation Site 8

Mitigation Site 8 is at the Three Ponds Brook wetland system, south of the Airport Connector in the Pawtuxet River watershed (Figure 6-6). The Three Ponds wetland system is listed in City of Warwick Comprehensive Plan

as one of the "priority open space sites for protection."[50] This site offers an opportunity to preserve wildlife (primarily waterfowl and wading birds) and warm water fish habitats. Approximately 2.1 acres of wetland impact would be offset by acquiring the development rights to 32 acres of dry oak forest, upland grassland, and a portion of the marsh. The preserved area would include approximately 12 acres of marsh. These acquisitions would protect the upland areas to the south and west of the marsh along with a portion of the wetland. Attempts to acquire development rights for 20 acres of surrounding uplands along the northeastern part of the marsh were abandoned after it was learned that a commercial office development had already been planned and designed for the area.

Mitigation Site 12

Mitigation Site 12, the Conimicut Point Marsh, is named for its proximity to Conimicut Point in Warwick (Figure 6-7). It is the easternmost part of the Mill River estuary (part of the Buckeye Brook Watershed) and is separate from the larger, more prominent Mill Cove. The Mill River is formed below the confluences of Buckeye Brook with Warner Brook and Lockwood Brook. The City of Warwick Comprehensive Plan Open Space / Recreation Element states "The marshlands along Mill Cove support a large amount of aquatic life and are one of the City's best shelters for ducks."[51]

The Conimicut Point Marsh is divided by Point Avenue into northern and southern parts. The larger southern marsh (Site 12A) is contiguous with the coast and bounded on the north by Point Avenue. The smaller northern part (Site 12B) is landlocked between Point Avenue and Shawomet Avenue. Site 12A consists of approximately 12 acres, two-thirds of which is marsh or tidal river. Site 12B consists of approximately six acres, half of which is wet. Tidal restrictions have degraded the quality of the marsh in Site 12B. Mitigation opportunities would focus on preservation; restoration work could take years of study prior to implementation.

This area was platted into very small lots in the 1920s and supported dense development of summer cottages up until the 1938 hurricane. This area continues to face development pressure due to its high aesthetic value and concerns about challenging the right to build on an existing building lot. The Mill Cove Conservancy (MCC) was formed to protect and restore portions of the marsh that be degraded by filling and loss of tide exchange. Together with Save the Bay, MCC has prepared a program identifying nearly 19 acres of land along the marsh where they wish to purchase development rights. In addition to the aesthetic value, the marsh provides wildlife habitat for waterfowl and wading birds and important fish and shellfish habitat. Recreational values include kayaking and bird watching. Although RIAC could assist the MCC in acquiring between eight to 12 acres of land within the Conimicut Point Marsh, focusing on properties that include uplands at risk for development, it would be complicated by the number of parcels and RIAC's inability to ensure that the land is acquired within a particular time frame.

6.3.2.2 Estimated Acreage for Alternative B4 Wetland Mitigation

Alternative B4 would impact 5.0 acres of wetland within the Buckeye Brook Watershed. Except for preservation proposed at Site 8, all of the proposed mitigation sites are located within the Buckeye Brook watershed.

50 http://www.warwickri.gov/index.php?option=com_content&view=article&id=852:city-warwick-comprehensive-plan&catid=67:planning-department&Itemid=159 accessed January 24, 2011.
51 http://www.warwickri.gov/index.php?option=com_content&view=article&id=852&Itemid=159 accessed January 24, 2011.

Table 6-4 provides an assessment of the compensatory wetland mitigation acreage values for the on-Airport mitigation sites to demonstrate that the mitigation program for Alternative B4 complies with USACE-recommended minimum mitigation ratios.[52] Furthermore, the mitigation approach includes preservation sites that are consistent with the City of Warwick Comprehensive Plan. In addition to mitigating for impacts to vegetated wetlands, Site 2 involves the replacement of the Buckeye Brook culvert at Lakeshore Drive that could enhance fish and wildlife passage and correct flooding problems on Lakeshore Drive. If selected, the mitigation area equivalent of this activity would be the subject of discussion with USACE through an adjustment of ratios of impact to mitigation.

Table 6-4 Alternative B4: Wetland Functions and Values Mitigated by Creation, Restoration and Enhancement (acres)

Mitigation Site/Type	GWR/D-SWGW	FFA	S/T/P R-WQ	NR/R/T -WQ	PE	S&S S	F&SH	WLH-WWH	T&E SH	REC	U/H-AES	VQ/A-AES
Site 1/C		**3.0**	**3.0**	**3.0**								
Site 2[1]/R					X		P	X				
Site 3/R/E		1.3	1.3	1.3	1.5			**1.5**				
Site 6/C		0.4	**0.4**	**0.4**								
Total		4.7	4.7	4.7	1.5			1.5				

X.X	Principal Wetland Function or Value.	S&S S	Sediment and Shoreline Stabilization.
X.X	Additional Wetland Function or Value likely provided by wetland.	F&SH	Fish and Shellfish Habitat.
1	No area associated with the culvert replacement	WLH	Wildlife Habitat.
GWR/D	Groundwater Recharge/Discharge.	WWH	Wildlife and Wildlife Habitat.
SWGW	Surface Water and Groundwater.	T&E SH	Threatened and Endangered Species Habitat.
FFA	Floodflow Alteration.	REC	Recreation.
S/T/P	Sediment/Toxicant/Pathogen Retention.	ED/SV	Educational/Scientific Value.
NR/R/T	Nutrient Removal/Retention/Transformation.	U/H	Uniqueness/Heritage.
WQ	Water Quality.	AES	Aesthetic.
PE	Production Export.	VQ/A	Visual Quality/Aesthetics.

Table 6-5 Alternative B4: Wetland Mitigation Estimated Acreage

Wetland Mitigation Type	Wetland Mitigation Site Numbers	Compensation Site Area (acres)[1]	USACE New England District Recommended Ratio[2]	Impacted Wetland Area Equivalent
Creation/Restoration (In Kind)[3]	1, 3, & 6	4.7	2.04:1[4]	2.3
Restoration/Enhancement (In Kind)	3	0.2	3:1	0.1
Wetland/Buffer Preservation	8 & 12	40.0	15:1	2.7
Total		44.9	NA	5.1[5]

1 The mitigation program will replace the functions and values of the impacted wetlands as required by USACE.
2 Weighted average for all wetland classes impacted from New England District Compensatory Mitigation Guidance (7-20-2010) Table 1.
3 PEM dominated by Phragmites will not be replaced in kind.
4 The mitigation equivalent of a creation/restoration site is calculated by dividing the area of the site by 2.04
5 Alternative B4 would require mitigation for the loss of 5.0 acres of wetland.

52 USACE New England District, July 2010. New England District Compensatory Mitigation Guidance.

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Impacts to Other Environmental Resources

This chapter summarizes and compares the environmental consequences and benefits of the No-Action Alternative and Alternatives B2 and B4 for other environmental resource categories specified in FAA Order 1050.1E.[53] FEIS Chapter 5, *Environmental Consequences*, includes an overview of the environmental impacts of Alternatives B2 and B4. As required by NEPA regulations, the technical reports include analyses of any adverse environmental effects that cannot be avoided, the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources that would be involved in the T.F. Green Airport Improvement Program should it be implemented.

The following sections focus on the environmental impacts and program characteristics that differentiate between Alternatives B2 and B4. In addition to the aquatic resources that are the focus of prior chapters, key environmental and community resource impacts that may distinguish the alternatives from one another include:

- Noise;
- Community disruption and economic benefits;
- Surface transportation;
- Air quality;
- Cultural resources;
- Section 4(f) resources; and
- Flood storage.

The impacts to these resources summarized in this chapter are intended to focus on a comparison of the significant impacts of Alternatives B2 and B4, and form the basis for identifying the Preferred Alternative (Alternative B4) and the LEDPA. There are some minor changes in impacts to certain resources in comparison to the DEIS Level 6 Alternatives due to the revised operational and passenger demand forecasts and noise modeling described in Section 4.2. Thus, some of the Level 6 screening analysis results vary from the prior screening analyses conducted for Alternatives B2 and B4. Also, it should be noted that neither of these alternatives would impact biological resources, threatened or endangered species, or water quality.

53 FAA. 2006. *FAA Order 1050.1E, Environmental Impacts: Policies and Procedures*, FAA, United States Department of Transportation, March 20, 2006.

7.1 Analysis Years

Some environmental impact categories are affected by aircraft operations levels because the impacts are caused by aircraft operations, rather than by the construction of facilities or relocation of residents and businesses. These include noise, air quality and surface transportation (vehicular traffic) impacts,[54] and other impact categories that could be affected by noise.[55] Because both of the Build Alternatives are planned to be constructed in two major phases that would be completed in 2015 and 2020, the EIS evaluated impacts in these categories in each of these years The analysis in the FEIS assumed the following phasing schedule for construction of the elements of Alternatives B2 and B4:

- Elements to be completed by the end of the 2015 Interim Build year:
  - Implementation of all Safety Enhancement Elements, including partial relocation of Airport Road
  - For the Project only, the extension of Runway 5-23, including partial realignment of Main Avenue, would be completed by the end of 2015
- Elements to be completed by the end of the 2020 Build year:
  - All Alternative B2 runway enhancements and other program elements, including Efficiency Enhancements and roadway improvements completed by the end of 2020

7.2 Noise

Noise associated with Alternatives B2 and B4 includes noise from aircraft operations, cargo ground operations, and automobile traffic. FAA assessed changes in noise as a result of the Project using the Integrated Noise Model, as required by FAA Order 1050.1E. The FAA also applied its criteria of significance for noise impacts, an increase of at least DNL 1.5 dB[56] at or above DNL 65 dB, to determine whether the Project will result in a significant noise impact.[57] All residences and non-residential noise-sensitive sites that will experience a significant noise impact will be eligible for mitigation in the form of sound insulation.

FAA evaluated other noise impacts that will be eligible for mitigation (either through voluntary sound insulation or land acquisition). Both the Department of Housing and Urban Development (HUD) and FAA consider noise-sensitive properties exposed to noise levels of DNL 65 dB or above as incompatible and prescribe various ways to make the land compatible with the airport environment.[58,59] Therefore, in accordance with 14 CFR Part 150, *Airport Noise Compatibility Planning*, FAA identified the noise-sensitive land uses that will be located within the DNL 65 dB and above noise contour as a result of the Project. FAA evaluated changes in

54 Noise and air quality impacts and vehicular traffic can also be caused by construction; however other categories of impacts are not caused by aircraft operations.
55 Environmental categories that could be affected by changes in noise include: land use compatibility; social and socioeconomic impacts; environmental justice historic, architectural, archaeological, and cultural resource impacts; US Department of Transportation Act Section 4(f) resources; and Land and Water Conservation Fund Act: Section 6(f) resources.
56 DNL is the day-night average sound level. It is the required metric for analyzing aircraft noise for FAA projects.
57 FAA Order 1050.1E.
58 *Environmental Criteria and Standards of the Department of Housing and Urban Development*, 24 CFR Part 51; 44 Federal Register 40861, U.S. Department of Housing and Urban Development, Washington DC, July 12, 1979.
59 *14 CFR Part 150, Airport Noise Compatibility Planning.*

noise levels associated with vehicular traffic in accordance with Rhode Island Department of Transportation (RIDOT) requirements.

7.2.1 No-Action Alternative

RIAC's ongoing Part 150 Noise Compatibility Program (NCP) acquires residential land through a Voluntary Land Acquisition Program (VLAP) for homes that would be exposed to noise levels at or above DNL 70 dB (without the Improvement Program) according to an updated Noise Exposure Map (NEM).[60] Based on the 2008 Noise Exposure Map (NEM) update, 285 residential properties (280 housing units) were identified as eligible for acquisition and were acquired in 2009 (referred to herein as the Completed Part 150 VLAP). In early 2010, RIAC continued implementation of its Part 150 NCP based on the 2020 NEM, which was accepted by the FAA on July 27, 2010 (the 2010 NEM).[61] The 2010 NEM update identified 115 residential parcels (consisting of 135 housing units) as eligible for acquisition of which 70 properties have been acquired as of May 2011 (referred to herein as the Current Part 150 VLAP). The majority of these housing units would be located off of Runway 5-23 Ends. The Current Part 150 VLAP is scheduled to be complete by 2015.

Under the No-Action Alternative in 2020, no people and no housing units would be exposed to aircraft noise levels of DNL 70 and above under the No-Action Alternative in 2015, 2020, or 2025. The noise impact numbers exclude the number of people that would be relocated and the number of housing units assumed to be acquired under the Completed and Current Part 150 VLAPs.

7.2.2 Alternatives B2 and B4

Table 7-1 compares the noise impacts of Alternatives B2 and B4 in 2015 and 2020, showing the net change, as compared to the No-Action Alternative, in housing units, population, and non-residential noise-sensitive sites exposed to noise above regulatory thresholds. Residences exposed to significant noise impacts (an increase of at least DNL 1.5 dB at or above DNL 65 dB) are eligible for sound insulation. Residences exposed to noise levels of DNL 70 dB and above are eligible for acquisition. Residences and non-residential noise-sensitive sites (i.e., schools) exposed to noise levels between DNL 65 dB and DNL 69.9 dB are eligible for sound insulation. There is no predicted ground noise impact from cargo operations under Alternatives B2 and B4.

60 RIAC's Part 150 NCP was initiated by the 1986 NEM and NCP approval, and includes the1991 NEM update, 1995 NEM update, 2000 NCP revision, 2008 NEM update, and 2010 NEM update.

61 The 2020 NEM was derived from the Level 6 2020 No-Action Alternative DNL 70 dB noise contour with additional rounding, as documented in the DEIS.

Table 7-1 Alternatives B2 and B4: Noise Impacts

	Alternative B2		Alternative B4	
	2015	2020	2015	2020
Impact Category	Net Change Compared to No-Action Alternative			
Residences significantly impacted by noise (increase of at least 1.5 dB at or above DNL 65 dB)	0	74	184	174
Population significantly impacted by noise (increase of at least 1.5 dB at or above DNL 65 dB)	0	174	432	409
Non-residential noise-sensitive sites exposed to noise levels > DNL 70 dB	0	0	2	2
Housing units exposed to noise levels > DNL 70dB	0	15	2	20
Population exposed to noise levels > DNL 70dB	0	35	5	47
Housing units exposed to noise levels between DNL 65 dB and DNL 69.9 dB	3	-40	109	68
Population exposed to noise levels between DNL 65 dB and DNL 69.9 dB	7	-17	261	160
Non-residential noise-sensitive sites exposed to noise levels > DNL 65 dB	0	1	1	1
Housing units exposed to traffic noise	8	102	0	0

7.3 Community Disruption and Economic Impacts

This section describes the community disruption and economic impacts of Alternatives B2 and B4. The evaluation includes land acquisition requirements for each alternative, and impacts to residences and businesses, including displacements and job losses. Personal income, business revenues, and property taxes would be impacted at the local and state levels.

7.3.1 Community Disruption

Table 7-2 summarizes the community disruption and land acquisition requirements of Alternatives B2 and B4.

Table 7-2 Alternatives B2 and B4: Community Disruption/Land Acquisition

Impact Category	No-Action Alternative	Alternative B2	Alternative B4
Residential Impacts			
Residential Units Acquired for Construction (Mandatory Acquisitions)	0	67	11
Residential Units Acquired for Noise Mitigation (Voluntary Participation)	135[1]	36[2]	69[2]
Residential Units Acquired for RPZ (Voluntary Participation)	0	134	60
Total Residential Units Acquired	135	237	140
Business Impacts			
Business Displaced for Construction (Mandatory Acquisition) and/or RPZ (Voluntary Participation)[3]	0	38	12
Displaced jobs (due to Mandatory Land Acquisitions for Construction or Voluntary Land Acquisitions for RPZ)[4]	0	309	59

1 Based on the 2020 NEM which was derived from the Level 6 2020 No-Action Alternative DNL 70 dB noise contour with neighborhood rounding (described in note 2 below), as documented in the DEIS.

2 Housing units that would be exposed to aircraft noise levels of DNL 70 dB and additional housing units identified as eligible for acquisition under a Future Build VLAP. For the purposes of the EIS analysis, the concept of "neighborhood equity," also referred to as "neighborhood rounding," has been applied where the FAA identified some residential parcels outside the DNL 70 dB noise contour as eligible for federal noise mitigation funding (voluntary participation in a land acquisition program) as part of the FEIS. This includes homes where any portion of the lot is within the DNL 70 dB noise contour, homes that would have been the few remaining residences on the block (or dead-end street) after the project, or homes that would be left isolated or surrounded by non-residential land use.

3 For the purposes of the EIS analysis, it is assumed that there would be 100 percent participation; however, for commercial businesses located within the RPZ, it is possible that owners would choose not to participate since close proximity to the Airport potentially provides economic benefits depending on the type of business.

4 Based on an assessment of available commercial space, the majority of these businesses would relocate within Warwick. The "most threatened" jobs (39 jobs under Alternative B2 and 14 jobs under Alternative B4) are industrial and warehousing jobs because these businesses unlikely to relocate within the City of Warwick due to limited vacant/developable industrial lands. It is likely that all but manufacturing jobs will be able to be relocated in Warwick.

The No-Action Alternative would require acquiring a total of 135 residential units under the Current Part 150 VLAP. Alternatives B2 and B4 would require acquiring 67 residential units and 11 units for construction, respectively each representing less than one percent of the City of Warwick's housing stock. Table 7-2 also presents the total number of residential units that would be eligible for land acquisition as noise mitigation for noise impacts in 2015 and 2020 (36 units under Alternative B2 compared to 69 units under Alternative B4). For RPZ clearing, Alternative B2 would result in the highest number of voluntary acquisitions for the RPZs (134 units) compared to Alternative B4 (60 units). In total, 237 units would be acquired for Alternative B2, and 140 units for Alternative B4.

Commercial land acquisitions required to implement the T.F. Green Airport Improvement Program would displace businesses, resulting in changes to employment in the City of Warwick and in the State of Rhode Island. Table 7-2 presents the total number of businesses that would be displaced due to commercial land acquisitions under Alternatives B2 and B4. Alternative B4 would displace 12 firms and 59 jobs, while Alternative B2 would displace 38 firms and 309 jobs. Firms and jobs most at risk of not relocating within the City of Warwick are agriculture, manufacturing and warehousing jobs. The loss in city annual property (residential and commercial) taxes due to the acquisition of these properties is discussed below in Section 7.2.2.

7.3.2 Economic Impacts

For Alternatives B2 and B4, economic benefits would be derived from on-Airport business activities, increased visitor spending, and development of spin-off Airport-related businesses. Table 7-3 summarizes the gains in jobs, business revenues, and personal income as well as state sales and income taxes under each alternative projected for the years 2015 and 2020.

Table 7-3 Alternatives B2 and B4: Summary of Economic Impacts

	No-Action Alternative		Alternative B2[1]		Alternative B4[1]	
Benefit	2015	2020	2015	2020	2015	2020
Total New Jobs in Warwick[2]	(538)	(322)	-	797	796	797
Total Impacts to Personal Income in Warwick	($21,515,000)	($14,752,000)	-	$24,908,000	$24,936,000	$24,908,000
Total Impacts to Business Revenue in Warwick[2]	($43,389,000)	($28,643,000)	-	$63,328,000	$64,240,000	$63,328,000
Total Annual Property Tax Impacts (Losses) in Warwick	-	-	($536,075)	($1,173,997)[4]	($371,616)	($567,521)[5]
Total New Jobs in Rhode Island[3]	(739)	(451)	-	1,813	1,810	1,813
Total Impacts to Personal Income in Rhode Island[2]	($27,759,000)	($19,088,000)	-	$53,104,000	$53,089,000	$53,104,000
Total Impacts to Business Revenue in Rhode Island[2]	($52,231,000)	($34,322,000)	-	$135,998,000	$135,964,000	$135,998,000

Source: ADE, IMPLAN, Rhode Island Airport Economic Study (Wilbur Smith Associates, June 2006), RIDLT.
Note: Represents the total economic gains created within that analysis year as a result of the Build Alternative. Numbers are not cumulative.
1 Note that the economic benefits of Alternatives B2 and B4 are expected to be the same in 2020. Because Alternatives B2 and B4 would realize the same projected increases in operations, passengers, and cargo activity due to extending Runway 5-23 to 8,700 feet, both would result in the same anticipated number of additional jobs within the City of Warwick and the state, the same increases to personal income and business revenue, and the same gains in state sales and income taxes.
2 Includes direct and indirect additional jobs from on-Airport business activities, visitor spending, and development of spin-off Airport-related business in the City.
3 Includes direct and indirect impacts from on-Airport business activities, visitor spending, and development of spin-off Airport-related business in the City of Warwick and rest of the State of Rhode Island.
4 Starting in 2020, an additional $637,922 in annual tax revenue would be lost to the City of Warwick due to the efficiency enhancements, including $198,303 lost due to residential and commercial land acquisitions required for construction of Fully Relocated Airport Road and $439,619 lost due to land acquisition associated with a Future Build VLAP and newly created RPZ for a total annual loss of $1,173,997 under Alternative B2.
5 Starting in 2020, an additional $195,905 of residential property tax revenue would be lost annually due to residential acquisitions for noise mitigation for noise impacts in 2020 for a total annual loss of $567,521 under Alternative B4.

On-Airport impacts are generated by a combination of passengers and operations. Overall, future total (annual) aircraft operations are projected to decline under the No-Action Alternative in 2015, 2020, and 2025 when compared to the Baseline Condition operations (2004), based on the FAA's Draft 2010 TAF for T.F. Green Airport (as directed by FAA Order 5050.4B section 504 b). This decline in projected future airport operations is due to continuing changes in the aviation industry associated with the national economic downturn (as discussed in FEIS Chapter 5, *Environmental Consequences*, Section 5.1.3, *Operations Forecast Update*). Therefore, there would be a decline in direct jobs, wages, and business revenue in most airport-related business sectors in 2015, 2020, and 2025. However, off-Airport visitor spending (indirect or secondary impacts) is based on passengers (not operations), which is projected to decrease in 2015, but increase in 2020 and 2025 under the No-Action Alternative compared to the Baseline Condition. This increase is because forecast passenger activity levels are anticipated to increase at a higher rate than operations due to more efficient utilization of aircraft by airlines (resulting in decreased "capacity", or operations) while still accommodating greater passenger demand resulting in higher aircraft load factors (greater percentage of seats filled by paying passengers on each flight).

Under either Alternative B2 or B4, the Airport would continue to serve and increase its role as a substantial economic driver for the State of Rhode Island and the region by providing additional economic benefits in the

form of new jobs, increased on- and off-Airport spending and business revenues, and increased state tax revenues. As presented in Table 7-3, almost 800 new jobs would be created in the City of Warwick, and over 1,800 state-wide, under either Alternative B2 or B4. Personal income and business revenues would also increase at both the local and state levels.

Since Alternative B4 includes a Runway 5-23 extension by the end of 2015 it would result in 80 percent greater economic gains between 2015 and the end of 2020 than Alternative B2 because of the expedited construction schedule. (It is assumed that the runway extension would come online in 2015 for Alternative B4 and in 2020 for Alternative B2; therefore, project-related impacts and benefits associated with runway operations were considered for these years.) Specific economic benefits associated with Alternatives B2 and B4 include:

- Alternative B4: Potential economic gains between 2015 and the end of 2020 would total $385 million in business revenues in the City of Warwick and $816 million for the State of Rhode Island, and $13 million in state tax revenue (sales and income taxes). Alternative B4 would begin to generate economic gains due to the runway extension in 2015 compared to Alternative B2 where the runway would come on line by the end of 2020. After 2020, these potential economic gains would continue to result from Alternative B4.
- Alternative B2: By the end of 2020, potential economic gains would total $63 million in business revenues in the City of Warwick and $136 million for the State of Rhode Island, and $2 million in state tax revenue (sales and income taxes).
- Cumulative gains in sales and income taxes would reach approximately $13.3 million under Alternative B2 (between 2020 and 2025) and more than $22.7 million under Alternative B4 (between 2015 and 2025).

Additionally, the following temporary construction-related economic benefits are expected for Alternative B2 and Alternative B4:

- Constructing Alternative B2 would directly generate a total of 803 jobs, $37.7 million in personal income, and nearly $92.1 million in business spending in the City of Warwick during the 2012 to 2020 construction period. When including indirect and induced impacts, the total benefit would be 1,173 jobs, $50.1 million in income, and $134.3 million in additional spending in the City of Warwick, and additional benefits statewide (1,227 jobs, $53.6 million in wages, and $161.5 million in business revenue).
- Constructing Alternative B4 would directly generate a total of 872 jobs, $40.9 million in personal income and $90.6 million in business spending in the City of Warwick during the 2012 to 2020 construction period. When including indirect and induced impacts, the total benefit would be 1,335 jobs, $58.3 million in income and $157.8 million in additional spending in the City of Warwick, and additional benefits statewide.

There would be no substantial loss in community tax base under either Alternatives B2 or B4 as the total potential annual property tax loss (for land acquisitions) represents less than one percent of the total annual tax revenue base for the City of Warwick[62] ($1,173,997 would be lost annually starting in 2020, or 0.57 percent of the base, under Alternative B2 and $567,521 would be lost annually starting in 2020, or 0.28 percent of the base, under Alternative B4). Over time, cumulative decreases in City of Warwick property tax revenue would total $5.9 million by 2025 for Alternative B2 and $3.2 million by 2025 for Alternative B4. (These losses in property tax revenue represent substantially less than one percent of the City or Warwick's tax base for 2010 and, therefore, is not considered significant.)

The construction and land acquisition costs range from $516 million for Alternative B2 to $439 million for Alternative B4.

7.4 Surface Transportation

Under Alternative B2, Airport Road would be fully relocated to the north to accommodate the proposed extension of Runway 5-23 and the new Integrated Cargo Facility. Fully Relocated Airport Road would connect directly to Route 37. The existing Airport Road alignment would be discontinued west of Harmony Court and the traffic signal at Hade Court/Etta Street would likely be removed. Under Alternative B4, Airport Road would not be fully relocated to the north; only the western portion of Airport Road would be relocated, as required by the Runway 16-34 RSA enhancements. The alignment of Partially Relocated Airport Road under Alternative B4 would be closer to existing Airport Road. Under Alternative B4, Main Avenue would be realigned to accommodate the southern extension of Runway 5-23.

Alternative B2 and Alternative B4 would not result in significant surface transportation impacts since neither would cause a substantial reduction in the LOS of roads serving the Airport and its surrounding communities. The results show that there would be no freeway segment, ramp merge and diverge area, or freeway weave segment capacity constraints on the Airport Connector or Route 37 and that there would be no locations that would degrade to LOS E or LOS F as a result of Alternative B2. Under Alternative B2, there would be no substantial reduction in the LOS of roads serving the Airport and its surrounding communities. Alternative B2 would improve traffic circulation surrounding the Airport, specifically with the Fully Relocated Airport Road and the Airport gateway improvements on Post Road.

For Alternative B4, the results show that there would be no freeway segment or ramp merge and diverge area capacity constraints on the Airport Connector or Route 37 and there would be no locations that would degrade to LOS E or LOS F as a result of Alternative B4. Under Alternative B4, there would be no substantial reduction in the LOS of roads serving the Airport and its surrounding communities. Alternative B4 also would improve traffic circulation surrounding the Airport, specifically with the proposed improvements to Airport Road and Main Avenue, and the Airport gateway improvements on Post Road (U.S. Route 1).

62 Based on the City of Warwick's 2010 estimated total local tax revenue base of $204,173,334, as provided by Rhode Island Municipal Affairs, Department of Administration.

Under Alternatives B2 and B4, a number of intersections are expected to see improved levels of service when compared to the No-Action Alternative. Traffic operations under Alternative B2 are expected to improve at six intersections in 2020 and six different intersections in 2025 due in part to shifts in regional traffic from roadways throughout the City of Warwick to Fully Relocated Airport Road. Improvements are also attributed to the optimization of signal timing at a number of intersections throughout the Study Area. Fully Relocated Airport Road would provide an improved east-west connection through the City, which is critical to traffic circulation both related and unrelated to the Airport. This key improvement would require land acquisition and roadway construction to occur over multiple years (between 2015 and 2020) causing community disruption to the Spring Green Neighborhood during the construction period only.

Under Alternative B4 in 2015, traffic operations would improve at one intersection (Post Road [U.S. Route 1] at Partially Relocated Airport Road and Ann & Hope driveway) when compared with the No-Action Alternative. The relocated intersection would be designed to accommodate all movements at the intersection, including vehicles entering and exiting the relocated Ann & Hope driveway. Under Alternative B4, traffic operations are expected to improve at eight intersections in 2020 and at six intersections in 2025. Improvements are attributed to the optimization of signal timings at a number of intersections throughout the Study Area. Under Alternative B4, four intersections in 2020 and six intersections in 2025, that are projected to operate at LOS E or LOS F conditions under the No-Action Alternative, would remain at capacity under Alternative B4. Alternative B4 does not degrade the level of service at these intersections (therefore, no mitigation is required), but it also does not result in the benefit of regional traffic shifts away from the local roadway system that Alternative B2 offers. Alternative B4 would require realigning Main Avenue to the south between Palace Avenue and Brentwood Avenue. There are no new signals proposed along Realigned Main Avenue and the current functional classification and traffic control would remain the same. While the design speed of Realigned Main Avenue would be reduced by five miles per hour to 40 miles per hour, the posted speed limit would remain at 35 miles per hour.

Both Alternatives B2 and B4 would cause two unsignalized driveways along Post Road (Relocated Delivery Drive and Donald Avenue) to degrade to LOS E or LOS F in 2020 and 2025. The amount of traffic at Post Road at Donald Avenue would be reduced due to the elimination of Aviation Avenue with the new Gateway Entrance and would no longer warrant a signal. To present a conservative assessment of impact, this analysis assumes that the traffic signal would no longer be warranted, however, RIDOT would make the final determination to remove the traffic signal. Relocated Delivery Drive is a new driveway that would service the Airport and would not generate enough traffic to warrant a signal. Both driveways would operate similarly to other existing driveways along Post Road.

7.5 Air Quality

This section provides a summary of the effects of each alternative to air quality in both the short- and long-term. The findings show that Alternatives B2 and B4 would not have any significant effect on air quality conditions locally, state-wide, or regionally when compared to regulatory thresholds. Neither Alternative B2 nor B4 would result in significant air quality impacts, since neither would exceed one or more of the NAAQS. Based on the NAAQS assessment there would be no new violation of the NAAQS following implementation of either Alternative B2 or B4, and the amount of ozone precursors emitted by Alternatives B2 and B4 are less than the General Conformity Rules *de minimis* thresholds. In addition, the proposed T.F. Green Airport Improvement Program would not be regionally significant.

7.5.1 Operational Emissions Inventory

Carbon monoxide (CO) emissions are predominant among the alternatives, followed by emissions of nitrogen oxides (NO_X), volatile organic compounds (VOCs), sulfur oxides (SO_X), particulate matter greater than 10 microns in diameter (PM_{10}), and particulate matter greater than 2.5 microns in diameter ($PM_{2.5}$). In all cases and for all pollutants, total emissions in 2015, 2020, and 2025 are expected to increase somewhat with or without implementing the T.F. Green Airport Improvement Program (Table 7-4) due to the forecasted increase in operations over this time period. The highest predicted concentrations of carbon monoxide (CO), nitrogen dioxide (NO_2), and particulate matter with 10 and 2.5 microns in aerodynamic diameter (PM_{10} and $PM_{2.5}$, respectively) are well within the NAAQS for these pollutants for Alternatives B2 and B4 in 2015, 2020, and 2025.

Table 7-4 FEIS Alternatives: Air Emissions Inventory Summary - Operational (tpy)

	2015			2020			2025		
	Alternatives								
Pollutant	No-Action	B2	B4	No-Action	B2	B4	No-Action	B2	B4
CO	1,493	1,497	1,586	1,430	1,510	1,492	1,582	1,662	1,644
VOC	107	107	116	105	113	113	113	122	121
NO_X	367	367	417	379	427	427	410	458	458
SO_X	32	32	37	35	39	39	38	43	43
PM_{10}	8	8	9	9	9	9	9	10	10
$PM_{2.5}$	7	7	8	7	8	8	8	8	8

Source: KB Environmental Sciences, Inc., 2011.

7.5.2 Atmospheric Dispersion Analysis

As shown in Table 7-5, the highest predicted concentrations of CO, NO_2 PM_{10} and $PM_{2.5}$ are below the National Ambient Air Quality Standards (NAAQS) for these pollutants for all alternatives in 2015, 2020, and 2025. There are only small (less than eight percent) differences in the predicted concentrations among Alternatives B2 and B4 and the No-Action Alternative. Concentrations are approximately two percent higher in 2015 under Alternative B4 compared to Alternative B2 and the No-Action Alternative due to the earlier implementation of the runway extension and additional aircraft operations. Concentrations of CO are approximately two percent higher in 2025 under Alternative B4 due to Partially Relocated Airport Road and its proximity to one of the modeled receptors. Generally, there would be only slight differences in pollutant concentrations between Alternatives B2 and B4.

Table 7-5 FEIS Alternatives: Atmospheric Dispersion Analysis Summary (µg/m³)

			2015			2020			2025		
			Alternatives								
Pollutant	NAAQS		No-Action	B2	B4	No-Action	B2	B4	No-Action	B2	B4
CO	1 hour	40,000	19,179	19,551	19,768	17,561	17,968	18,904	18,275	19,102	19,499
	8-hour	10,000	5,455	5,437	5,523	5,357	5,416	5,487	5,460	5,512	5,609
NO_2	Annual	100	42	42	43	40	41	41	40	40	40
PM_{10}	24-hour	150	40	40	40	40	39	39	40	39	39
$PM_{2.5}$	24-hour	35	34	34	34	34	34	34	34	34	34
	Annual	15	12	12	12	12	12	12	12	12	12

Source: KB Environmental Sciences, Inc., 2011.

7.5.3 CO "Hot-Spot" Analysis

The highest predicted CO levels at all of the intersections analyzed in the CO "Hot-Spot" analyses for each alternative are summarized in Table 7-6.The CO "Hot-Spot" analysis showed that CO values are all well within the NAAQS for this pollutant in 2015, 2020, and 2025 for Alternatives B2 and B4 as well as for the No-Action Alternative. Predicted CO levels would be approximately two percent higher for Alternative B4 than for Alternative B2 because Alternative B4 is forecasted to result in slightly higher levels of vehicle delay and idling at roadway intersections.

Table 7-6 FEIS Alternatives: CO "Hot-Spot" Analysis Summary (µg/m³)

Year	NAAQS		No-Action Alternative	Alternative B2	Alternative B4
2015	1 hour	40,000	10,400	10,400	10,500
	8-hour	10,000	4,700	4,700	4,800
2020	1 hour	40,000	9,600	9,600	9,500
	8-hour	10,000	4,400	4,400	4,300
2025	1 hour	40,000	10,700	10,700	10,800
	8-hour	10,000	4,800	4,800	4,900

Source: KB Environmental Sciences, Inc., 2011.

7.5.3 Construction Emissions Inventory

Table 7-7 shows total construction-related emissions arranged by construction phase, alternative, and pollutant type. The values shown represent the year of greatest emissions during each construction phase. Under Alternative B4, construction emissions during the initial phase (2015), shown in Table 7-7, are predicted to be less when compared to Alternative B2. However, during the second phase (2020), Alternative B4 is estimated to

result in greater construction emissions. For Alternative B2, both the North Apron construction and the Runway 16-34 reconstruction would be completed prior to 2016. Neither of these projects would begin prior to 2016 for Alternative B4.

Table 7-7 Alternatives B2 and B4: Air Emissions Inventory Summary - Maximum Construction Emissions (tpy)

	2015 Phase[1,2]		2020 Phase[1,3]	
Pollutant	Alternative B2	Alternative B4	Alternative B2	Alternative B4
CO	20.9	18.9	18.7	17.8
VOC	4.4	3.8	3.8	3.9*
NO_X	49.5	38.3	19.4	31.6
SO_X	0.2	0.1	0.1	0.1
PM_{10}	7.3	6.8	5.7	6.4
$PM_{2.5}$	2.7	2.3	1.3	1.9

Source: KB Environmental Sciences, Inc., 2011.
1 2015 Phase includes 2012 through 2015 (Alternative B2) and 2010 through 2015 (Alternative B4); 2020 Phase includes 2016 through 2020.
2 The results shown are for the year 2013 (Alternatives B2) and year 2014 (Alternative B4); the year of greatest emissions in the 2015 phase.
3 The results shown are for the years 2018 and 2020 (Alternative B2), and year 2016 (Alternative B4); the year of greatest emissions in the 2020 phase.

These values are will within the General Conformity Applicability Thresholds for VOC and NO_x of 50 and 100 tons/year, respectively.

7.6 Cultural Resources

Table 7-8 summarizes impacts to historic and archaeological resources as a result of Alternatives B2 and B4. Both Alternatives B2 and B4 would require the removal of Hangar No. 1 to enhance safety, resulting in an adverse effect to Hangar No. 1 and to the eligible airport historic district. This impact cannot be avoided. Under Alternatives B2 and B4, modifications and enhancements to runways and taxiways at the northern end of the airfield would further alter the historical configuration of the airfield, resulting in an adverse effect to the eligible airport historic district. Under Alternative B2, the proposed Fully Relocated Airport Road would have a visual impact on the Rhode Island State Airport Terminal (Operations Building), Hangar No. 2, and the eligible airport historic district. The relocation would limit the public's view of the historical setting, resulting in an adverse effect. Alternative B4 would have a direct impact on the landscaping of the Rhode Island State Airport Terminal resulting in an adverse effect. In addition, the split Integrated Cargo Facility would block the public view and access to the Terminal from Airport Road.

Alternative B2 would directly impact the Double L site due to the extension of the runway at the Runway 23 End. Based on the results of Phase II site examinations, the FAA determined that the Double L site did not meet the criteria for listing in the NRHP although the RISHPO disagreed with this determination. The FAA will undertake additional Phase II site examinations, with appropriate consultation with the NITHPO, should Alternative B2 be selected as the

Preferred Alternative. Under Alternative B2, Fully Relocated Airport Road would be constructed in an area of moderate to high archaeological sensitivity that was not surveyed due to denied access. Therefore, it is unknown at this time whether Fully Relocated Airport Road would impact archaeological sites. Under Alternatives B2 and B4, areas identified as potential wetland mitigation sites would require archaeological investigations. In response to a request from NITHPO, a Phase I(c) archaeological investigation was conducted along Realigned Main Avenue under Permit No. 2011-03 (issued by RIHPHC on January 7, 2011).

Historical cemeteries are important elements of the historical past of local communities in Rhode Island and are protected under Rhode Island General Law 23-18-11 *et seq.* Both Alternatives B2 and B4 would result in significant direct impacts to WHC 26 located at the Runway 5 End. The limits of WHC 26 were confirmed between April 7 and 12, 2011 under Permit No. 2011-02 issued by the RIHPHC on January 7, 2011. Three historical cemeteries (WHC 76, WHC 77, and WHC 78) located in the APE, in addition to WHC 26 (discussed previously), may be impacted by proposed enhancements related to Alternative B4, as presented in Table 7-8.

The *National Historic Preservation Act* (NHPA) Section 106 coordination is ongoing between the FAA and the Rhode Island Historical Preservation and Heritage Commission regarding potential impacts to historic and cultural resources expected to result from the proposed Improvement Program.

FAA and RIAC have consulted with the RISHPO and the Narragansett Indian Tribal Historic Preservation Office (NITHPO) regarding the adverse effect of the project on historical properties and locally important historical cemeteries. This consultation has resulted in a Memorandum of Agreement (MOA) that includes stipulations to address and mitigate the adverse effect of the project. The executed MOA has been submitted by FAA to the Advisory Council on Historic Preservation (for filing) along with supporting documentation as specified in 36 CFR Part 800.11(f).

The public outreach portion of the Airport Improvement Program included coordination with the tribe on cultural resources issues. Interested groups with jurisdiction by law or with special expertise on the resources that the project may affect were invited to participate in the NEPA process as part of an Inter-Agency/Tribal Coordination Group. Thirteen Agency/Tribe Coordination Group Meetings were held to discuss the NEPA process between 2005 and 2011. Additional meetings were also held with individual regulatory agencies and the Narragansett Tribe. In addition to regular meetings, agencies and organizations were involved in the review of technical reports to be included in the EIS. Technical reports drafted by consultants and reviewed by FAA were selectively sent to entities with regulatory jurisdiction for further review and input. Agencies were also given the opportunity to submit comments and questions relating to the technical reports and were able to discuss these comments during the Coordination Group meetings.

Table 7-8 Alternatives B2 and B4: Summary of Direct and Indirect Impacts to Historical and Archaeological Resources

Alternative	Property	Impact	Reason for Impact	Type of Impact
B2	Eligible Airport Historic District	Demolish Hangar No. 1, public view and access impact, alter historical runway/taxiway configuration	Remove airspace obstruction, airside modifications and enhancements; roadway relocation	Significant Direct and Indirect Impacts
	Hangar No. 1	Demolish Hangar No. 1	Remove airspace obstruction	Significant Direct Impact
	Hangar No. 2	Interior modifications, public view and access impact	Use interior space for Integrated Cargo; roadway relocation	Indirect Impacts
	Rhode Island State Terminal	Public view and access impact	Relocation of Airport Road	Significant Indirect Impacts
	Archaeological Resources	Potential presence of archaeological resources	Relocation of Airport Road and Runway 23 extension	Potential Direct Impacts
	WHC 26	Headstones impact	Clear Object Free Area	Significant Direct Impact
B4	Eligible Airport Historic District	Demolish Hangar No. 1, diminished public view, alter historical runway/taxiway configuration	Remove airspace obstruction and airside modifications and enhancements	Significant Direct and Indirect Impacts
	Hangar No. 1	Demolish Hangar No. 1	Remove airspace obstruction	Significant Direct Impact
	Hangar No. 2	Interior modifications	Use interior space for Integrated Cargo	No Impacts.
	Rhode Island State Terminal	Landside landscaping removal and diminished public view	Construction of split Integrated Cargo Facility	Significant Direct and Indirect Impact
	WHC 26	Headstones impact	Clear Object Free Area	Significant Direct Impact
	WHC 76	Ground disturbance within 25 feet of WHC 76	Voluntary Land Acquisition for Project-Related Noise Impacts	Potential Significant Direct Impact[1]
	WHC 77 & 78	Construction potentially occurring within 25 feet of WHC 77 & 78	Realigning Main Avenue	Potential Significant Direct Impact[2]

Sources: The Public Archaeology Laboratory, Inc.; VHB, Inc.; National Register Database; Rhode Island Cemetery Database; and RIGIS.

WHC Warwick Historical Cemetery.

1 Alternative B4 may result in a significant direct impact to WHC 76 because it lies within an area of Future Build VLAP for noise mitigation. If abutting landowners elect to have their property acquired and the building is demolished, potential impacts to WHC 76 will be evaluated by FAA and RIAC in consultation with the WHCC prior to any acquisition, per stipulations contained in the MOA.

2 Alternative B4 may result in a significant direct impact to WHC 77 and 78 due to Realigned Main Avenue; however, the boundaries of WHC 77 and 78 are based on the City's plat maps and have not been field verified. Once permission is granted to strip top soils around the perimeter of visible headstones at these cemeteries and the boundaries of WHC 77 and 78 are fully confirmed, the significant, or direct (physical), impact can be identified. For the purposes of this EIS it is assumed that the redesign of Realigned Main Avenue to avoid the cemeteries would be implemented in final design.

7.7 Section 4(f) and Section 6(f) Impacts

An evaluation of impacts to *US Department of Transportation Act,* Section 4(f) resources determined that physical or constructive use of identified resources would result from the T.F. Green Airport Improvement Project. Additionally, Section 6(f) resources, in accordance with the *Land and Water Conservation Fund Act of 1965.*[63] Under the Alternatives, including the No-Action Alternative, Winslow Park, a Section 4(f) recreational resource, would be directly impacted. A portion of Winslow Park improved using Land and Water Conservation Fund (L&WCF) grants, constituting it a Section 6(f) resource, would be converted from recreational to non-recreational uses under Alternatives B2 and B4.[64] Table 7-9 presents a summary of impacts and mitigation for the each alternative. Both Alternatives B2 and B4 would result in significant impacts to Section 4(f) resources, since the direct impact (physical use) of Section 4(f) resources would be more than minimal and its indirect impact (constructive use) substantially impairs the 4(f) property. The Section 4(f) and Section 6(f) resources impact analysis is described fully in FEIS Chapter 7, *Final Section 4(f)/Section 6(f) Evaluation.*

Alternatives B2 and B4 require the removal of Hangar No. 1 to enhance safety, resulting in a Section 4(f) use of Hangar No. 1. This impact cannot be avoided. Alternative B2 would result in a Section 4(f) constructive use of Hangar No. 2 because full relocation of Airport Road to the north would limit the public view and access to Hangar No. 2 resulting in substantial impairment of this resource. Under Alternative B4, there will be minor changes to the interior of Hangar No. 2 to accommodate cargo operations, which will likely result in *de minimis* physical impacts to Hangar No. 2. Alternative B2 would result in a Section 4(f) constructive use of Rhode Island State Airport Terminal as a result of the relocation of Airport Road to the north, which would affect the historical vantage point of the Rhode Island State Airport Terminal building. Alternative B4 would have a direct impact on the landscaping along Airport Road that is associated with the Rhode Island State Airport Terminal, resulting in a Section 4(f) physical use of this historical property. In addition, the split Integrated Cargo Facility would block the public view and access to the Terminal from Airport Road.

Under the No-Action Alternative, Winslow Park, a Section 4(f) recreational resource, would be directly impacted. Winslow Park, a 31.7 acre park comprised of softball and soccer playing fields, two playgrounds, a walking trail and passive recreation area, a concession building with a restroom, and parking, is located on RIAC- and City-owned property primarily within the existing RPZ of the Runway 5 End. The FAA recommends that the park's playing fields and playgrounds within the RPZ be removed to enhance safety. Alternative B2 and B4 would have similar impacts and would both result in the physical use of portions of the Winslow Park that lie within the newly created RPZ of Runway 5. Under the No-Action Alternative, one small softball field, one full-sized softball field, two playgrounds, and soccer fields would be removed because they are within the RPZ.

The walking trail and passive recreational area could remain within the RPZ under all Alternatives. There are no prudent or feasible alternatives to avoiding Winslow Park impacts. The Winslow Park facilities that would be impacted under Alternatives B2 and B4 (four full-sized softball ball fields, a clubhouse, two parking lots, a playground, and soccer fields) would be replaced. After coordination with the City of Warwick and a review of possible relocation sites, RIAC has chosen a site on Cedar Swamp Road as the location for the relocated

63 *Section 6(f) of the Land and Water Conservation Fund Act of 1965,* codified at as amended 16 U.S.C. 4601, et. seq.
64 The Department of Interior stated in its comment letter on the DEIS that "once the Section 4(f) process has been completed, the City must promptly undertake resolution of the Section 6(f)(3) conversion, working directly with the Rhode Island Department of Environmental Management and the National Park Service to complete this LWCF requirement." (Refer to Appendix A, *Responses to Comments,* for the entire letter).

facilities. The impacted recreation facilities at Winslow Park are anticipated to be relocated in 2012 in advance of the construction of Realigned Main Avenue and the construction and operation of extended Runway 5-23. It is anticipated that after the proposed mitigation, the impacts to Winslow Park would not be significant.

Table 7-9 FEIS Alternatives: Summary of Use and Mitigation of Section 4(f) Properties by Alternative

Alternative	Property	Impact	Reason for Impact	Use	Proposed Mitigation
No-Action Alternative	Winslow Park	Significant Impact: remove one small softball field, one full-sized softball field, two playgrounds, soccer fields, and two parking lots.	Clear Runway Protection Zone	Physical	None proposed
Alt. B2	Eligible Airport Historic District	Significant Impact: demolish Hangar No. 1, public view and access impact, alter historical runway/taxiway configuration	Remove airspace obstruction, airside modifications and improvements; roadway relocation	Physical	Archival documentation; historical display
	Hangar No. 1	Significant Impact: demolish Hangar No. 1	Remove airspace obstruction	Physical	Archival documentation; historical display
	Hangar No. 2	Significant Impact: interior modifications, public view and access impact	Use interior space for Integrated Cargo; roadway relocation	Constructive	Archival documentation; historical display
	Rhode Island State Terminal	Significant Impact: public view and access impact	Relocation of Airport Road	Constructive	Archival documentation; historical display
	Winslow Park	Significant Impact: remove four full-sized softball fields, clubhouse, two parking lots, soccer fields, and one playground.	Clear Runway Protection Zone	Physical	Replace impacted Winslow Park facilities
Alt. B4	Eligible Airport Historic District	Significant Impact: demolish Hangar No. 1, diminished public view, alter historical runway/taxiway configuration	Remove airspace obstruction and airside modifications and improvements	Physical	Archival documentation; historical display
	Hangar No. 1	Significant Impact: demolish Hangar No. 1	Remove airspace obstruction	Physical	Archival documentation; historical display
	Hangar No. 2	No Significant Impact: interior modifications	Use interior space for Integrated Cargo	*De minimis*	None
	Rhode Island State Terminal	Significant Impact: landside landscaping removal and diminished public view	Construction of split Integrated Cargo Facility. Visual impacts and landscaping impacts.	Physical	Archival documentation; historical display
	Winslow Park	Significant Impact: remove four full-sized softball fields, clubhouse, two parking lots, soccer fields, and one playground	Clear Runway Protection Zone	Physical	Replace impacted Winslow Park facilities

Source: VHB, Inc.
RIHRA Rhode Island Historic Resource Archive.

The Secretary of Transportation may not approve any program or project that requires the use of any publicly owned land from a park or recreation area of national, state, or local significance as determined by the officials having jurisdiction thereof or of any historic sites listed or eligible for listing in the National Register, unless there is no feasible and prudent alternative to the use of such land and such program and the project includes all possible planning to minimize harm resulting from the use. The MOA described above includes stipulations to address and mitigate the adverse effect of the project on Section 4(f) resources.

7.8 Flood Storage

Both Alternatives B2 and B4 would encroach on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map- (FIRM-) defined 100-year floodplains. FIRM flood zones are a projection of the coastal flood stillwater elevation up Buckeye Brook from the coast, and displacement of flood storage would not increase the height of the flood.

The impacts to floodplains that would result from Alternatives B2 and B4 are not avoidable, as the eastern limits of both runways are within or adjacent to floodplains associated with Buckeye Brook and Warwick Pond. Table 7-10 shows the FIRM-mapped floodplain loss and storage fill for Alternatives B2 and B4. The natural floodplain values lost by floodplain fill associated with each Build Alternative include the natural moderation of floods and water quality maintenance. The proposed Mitigation Sites 1, 2, and 3 (described in Chapter 6) would provide compensation for these impacts.

Table 7-10 Alternatives B2 and B4: Summary of Impacts to FEMA-mapped Floodplains

		Alternative B2		Alternative B4	
Program Element and Associated Action	Floodplain Area	Area (acres)	Storage Volume (cubic yards)	Area (acres)	Storage Volume (cubic yards)
Runway 23 End and AMF Access Road relocation	A	0.4	218	0.0	0
Runway 34 End and Taxiway C relocation	B	0.1[1]	0	2.3	726
	C	0.0	15	0.0	0
Total		**0.5**	**233**	**2.3**	**726**

1 Alternative B2 impacts associated with Floodplain Area B are related to navigational aids. Volume impacts are considered negligible.

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8

Summary and Comparison of Alternatives

This chapter evaluates whether Alternatives B2 and B4 meet the Basic Project Purpose and are practicable. A summary is also presented of wetland impacts from Alternatives B2 and B4 compared to the No-Action Alternative.

8.1 Evaluation of the Basic Project Purpose and Practicability

Alternative B2 meets the Basic Project Purpose as outlined in Section 2.2. Alternative B2 would shift Runway 16-34 north by 400 feet and would largely avoid impacts to wetlands south of the existing Runway 34 End. Impacts to wetlands have been avoided by eliminating the hold apron west of the Runway 34 End and by constructing the Perimeter Road through the RSA and ROFA between the Runway 34 End and the EMAS bed. Impacts to wetlands have been further avoided by routing the Perimeter Road away from the side of relocated Taxiway C to uplands south of these wetlands.

Further evaluation of shifting Runway 16-34 north by 400 feet, as required for Alternative B2, revealed several undesirable effects that make this action impracticable. Evaluation of the impacts to natural resources, community disruption, losses to the City tax base, and costs of acquiring and demolishing the Airport Plaza parcel and relocating the rental car facility led to the development of Alternative B4.

Alternative B4 meets the Basic Project Purpose as outlined in Section 2.2 and is practicable. This alternative has been identified as the Preferred Alternative.

8.2 Wetland Impacts

Table 8-1 lists the impacts to wetlands and waterways that differentiate the alternatives from each other and provides a basis for identifying the LEDPA.

Table 8-1 Alternatives B2 and B4: Summary of Wetlands Impacts

Impact Category	Alternative B2	Alternative B4
Wetland Impacts by Program Element (acres)		
Runway 16	0.0	0.0
Runway 34	2.5	5.0
Runway 5	0.0	0.0
Runway 23	1.5	0.0
Partially Relocated Airport Road	0.0	0.0
Fully Relocated Airport Road	1.8	0.0
Total Wetlands Impacts	**5.8**	**5.0**
Waterway Impacts by Program Element (feet)		
Runway 16	0	0
Runway 34	510	843
Runway 5	0	0
Runway 23	142	0
Partially Relocated Airport Road	0	0
Fully Relocated Airport Road	121	0
Total Waterways Impacts	**773**	**843**

The efforts to reduce impacts to natural resources are evident. When compared to the environmental analysis described in the DEIS, both alternatives have reduced impacts to wetlands. Alternative B2 would impact a total of 5.8 acres of wetlands with impacts on the Runway 23 End and Runway 34 End. Alternative B4 would impact 5.0 acres of wetlands and limits the wetland impacts to the Runway 34 End only. However, Alternative B4 would impact a greater length of waterways (843 feet) as compared to Alternative B2 (773 feet). All of the Alternative B4 waterway impacts would be at Runway 34 End, while the Alternative B2 waterway impacts would be at Runway 34 End and at Runway 23 End.

Impacts to non-aquatic resources vary considerably between Alternatives B2 and B4, with impacts to socioeconomic resources varying most substantively. Alternative B2 would require acquisition of 237 residential units, while Alternative B4 would require 140 residential units. Additionally, Alternative B2 would displace 38 firms and 309 jobs, while Alternative B4 would displace 12 firms and 59 jobs. For both alternatives, almost 800 new jobs would be created in the City of Warwick and over 1,800 state-wide. Personal income and business revenues would also increase at both the local and state levels. Decreases in City property tax revenue due to property acquisition from Alternatives B2 and B4 would impact the City of Warwick property tax base by annual losses of approximately $1,173,997 and $567,521, respectively, by 2020. The construction and land acquisition costs for Alternatives B2 and B4 range from $530 million for Alternative B2 to $445 million for Alternative B4.

Figures

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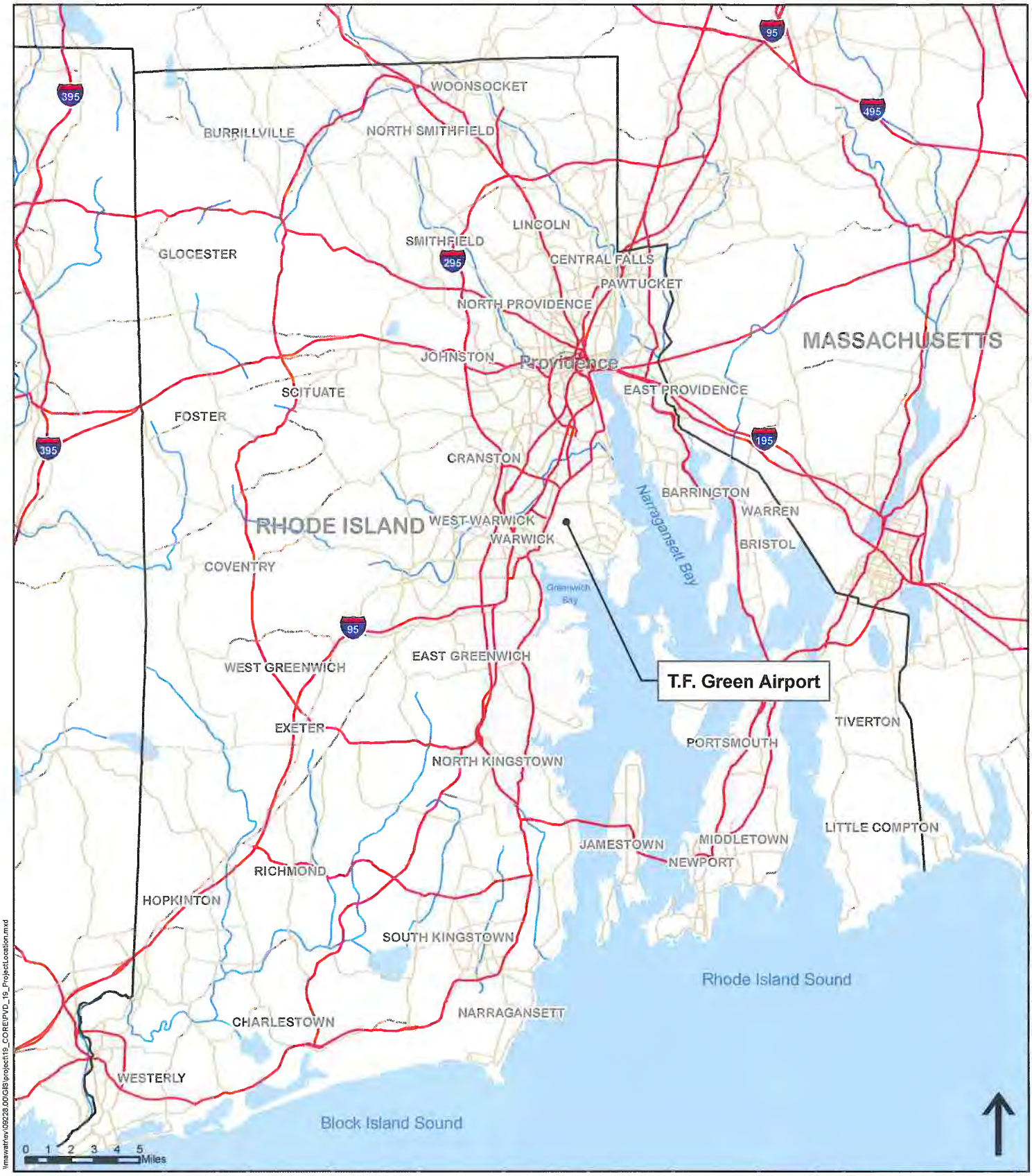

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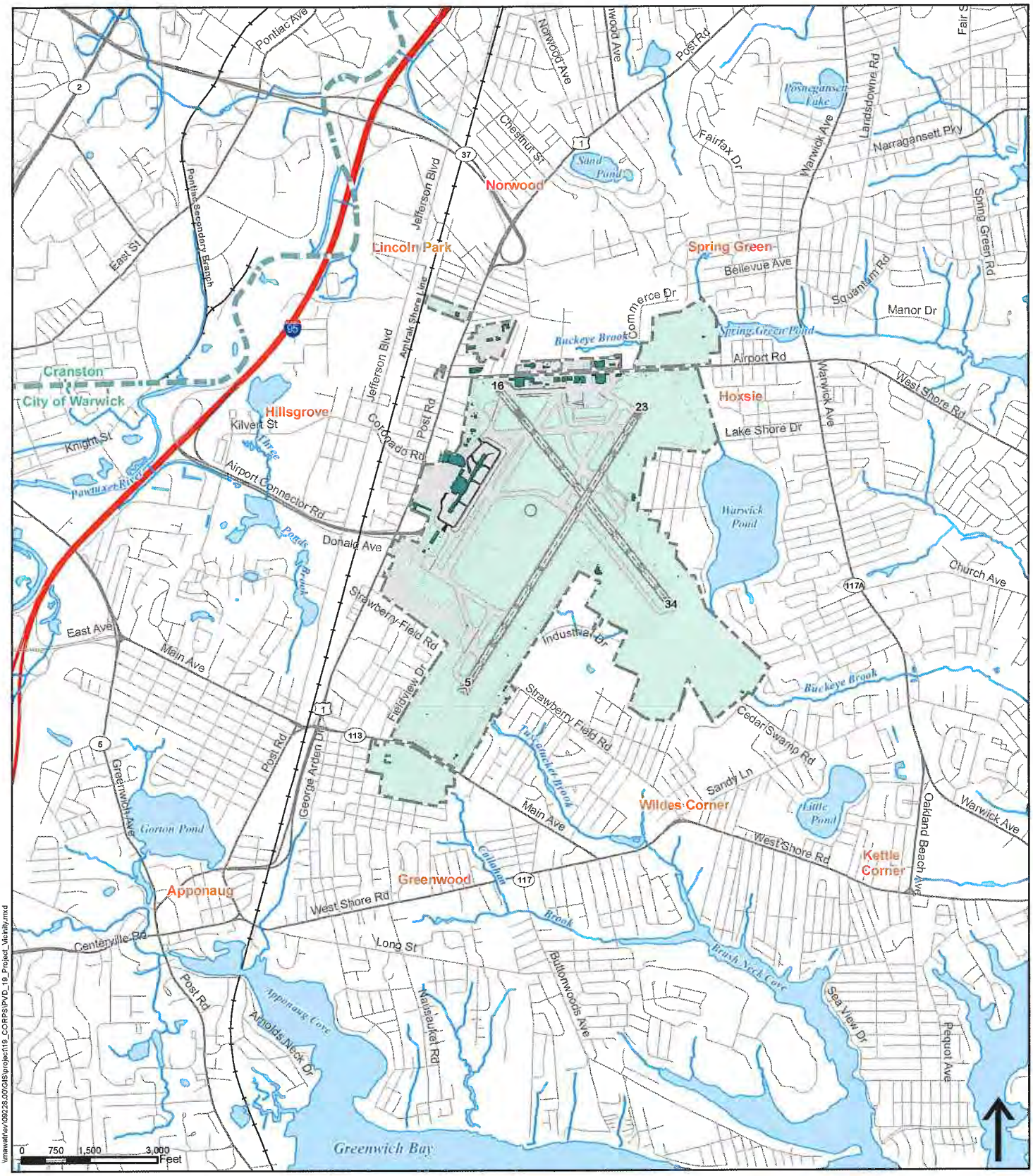
Legend

- State Boundary
- Highway
- Major Road
- Major Railroad Lines
- Urban Areas
- Park or Recreation Area

Figure 1-1
T.F. Green Airport Improvement Program Section 404 Permit Application
Project Location

Source: Base Map Data (Street Map 9.0)



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Legend

- No-Action Airport Property Boundary (2015)
- Municipal Boundary
- Airport Buildings
- Norwood Warwick Neighborhoods

Figure 1-2

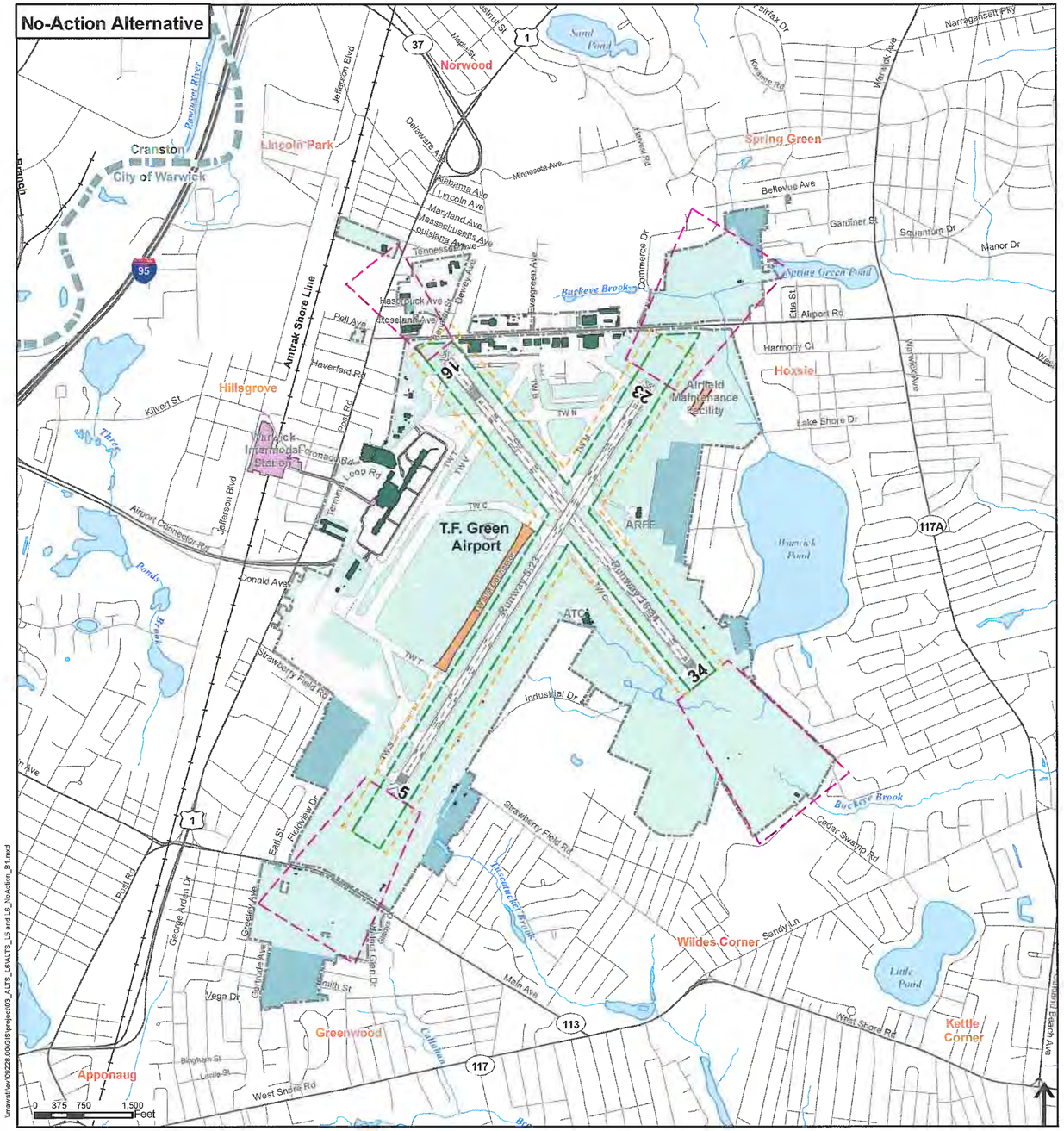
T.F. Green Airport Improvement Program Section 404 Permit Application

Project Vicinity

Source: Airport Base (Landrum & Brown)
Roads, Hydrology (RIGIS)

No-Action Alternative

Alternative B1



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Legend

- No-Action Airport Property Boundary (2015)
- 2004 Airport Boundary
- Completed Part 150 VLAP
- Airport Buildings
- Projects included in No-Action Alternative
- EIS Project
- Efficiency Enhancement Element
- Safety Improvement Element
- Fully Relocated Airport Road (2020)
- Partially Relocated Airport Road (2015)
- No-Action Existing Pavement
- Proposed Pavement to be Removed
- Proposed New Pavement
- Runway Object Free Area
- Runway Safety Area
- Runway Protection Zone
- EMAS

Note: New Deicer Management System to be constructed under the No-Action Alternative at an on-Airport location to be determined.

Airfield Facilities

1. Improve Runway 16-34 Runway Safety Areas
2. Relocate Taxiway C
11. Extend Runway 5-23 to 9,350 Feet

Roadways and Parking Facilities

9. Expand Automobile Parking Facilities
10. Reconfigure Terminal Access Roadways

Terminal and Support Facilities

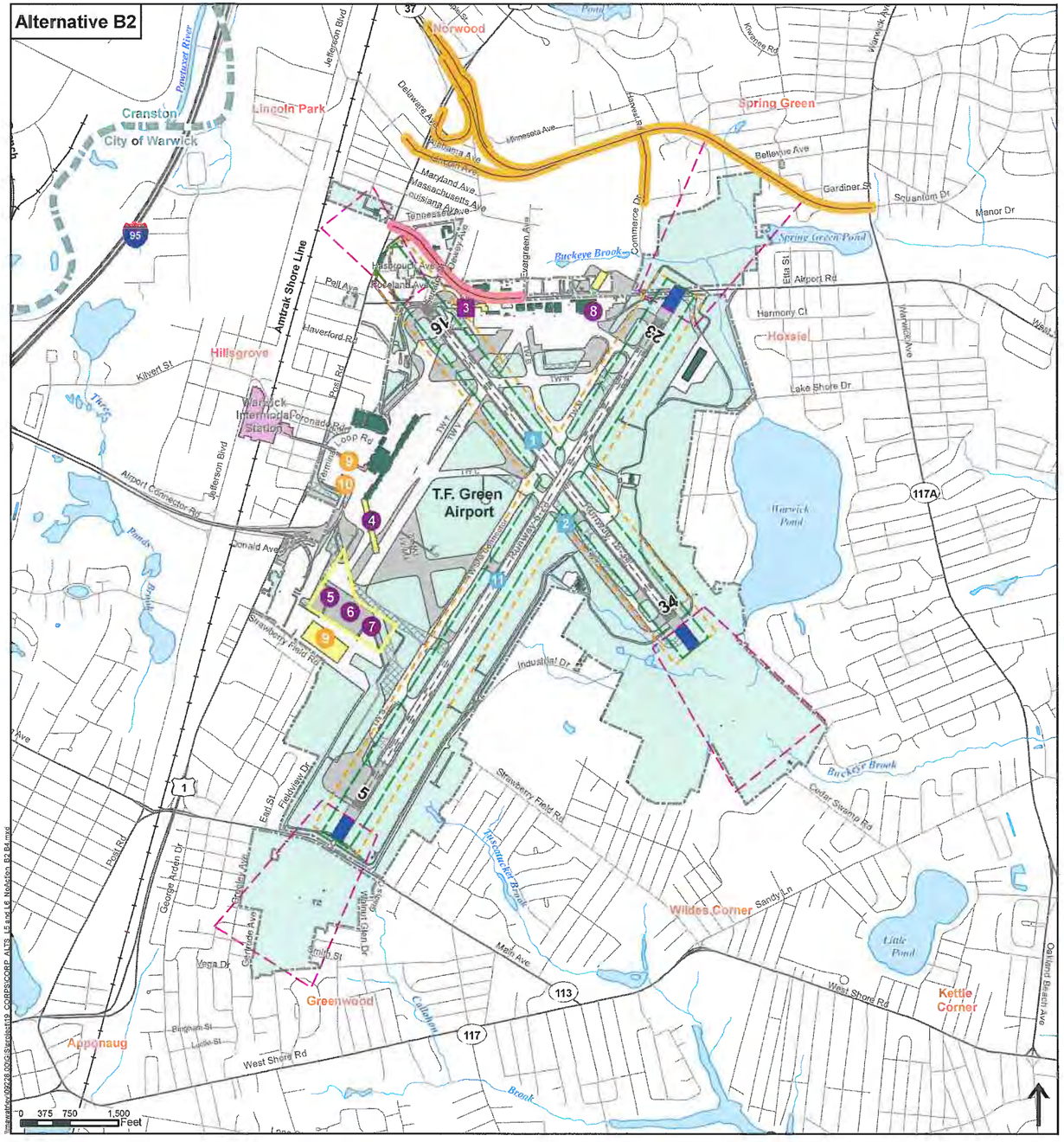
3. Demolish Hangar No. 1
4. Expand Passenger Terminal
5. Construct New Ground Support Equipment Facility
6. Construct New Belly Cargo and USPS Facilities
7. Construct New Fuel Farm
8. Construct New Integrated Cargo Facility

Figure 4-1
T.F. Green Airport Improvement Program Section 404 Permit Application

No-Action Alternative and Alternative B1

Alternative B2

Alternative B4



Legend

- No-Action Airport Property Boundary (2015)
- Airport Buildings
- EIS Project
- Efficiency Enhancement Element
- Safety Improvement Element
- Fully Relocated Airport Road (2020)
- Partially Relocated Airport Road (2015)
- Realigned Main Avenue (2015)
- No-Action Existing Pavement
- Proposed Pavement to be Removed
- Proposed New Pavement
- Runway Object Free Area
- Runway Safety Area
- Runway Protection Zone
- EMAS

Note: New Deicer Management System to be constructed under the No-Action Alternative at an on-Airport location to be determined.

Airfield Facilities

1. Improve Runway 16-34 Runway Safety Areas
2. Relocate Taxiway C
11. Extend Runway 5-23 to 8,700 Feet

Roadways and Parking Facilities

9. Expand Automobile Parking Facilities
10. Reconfigure Terminal Access Roadways

Terminal and Support Facilities

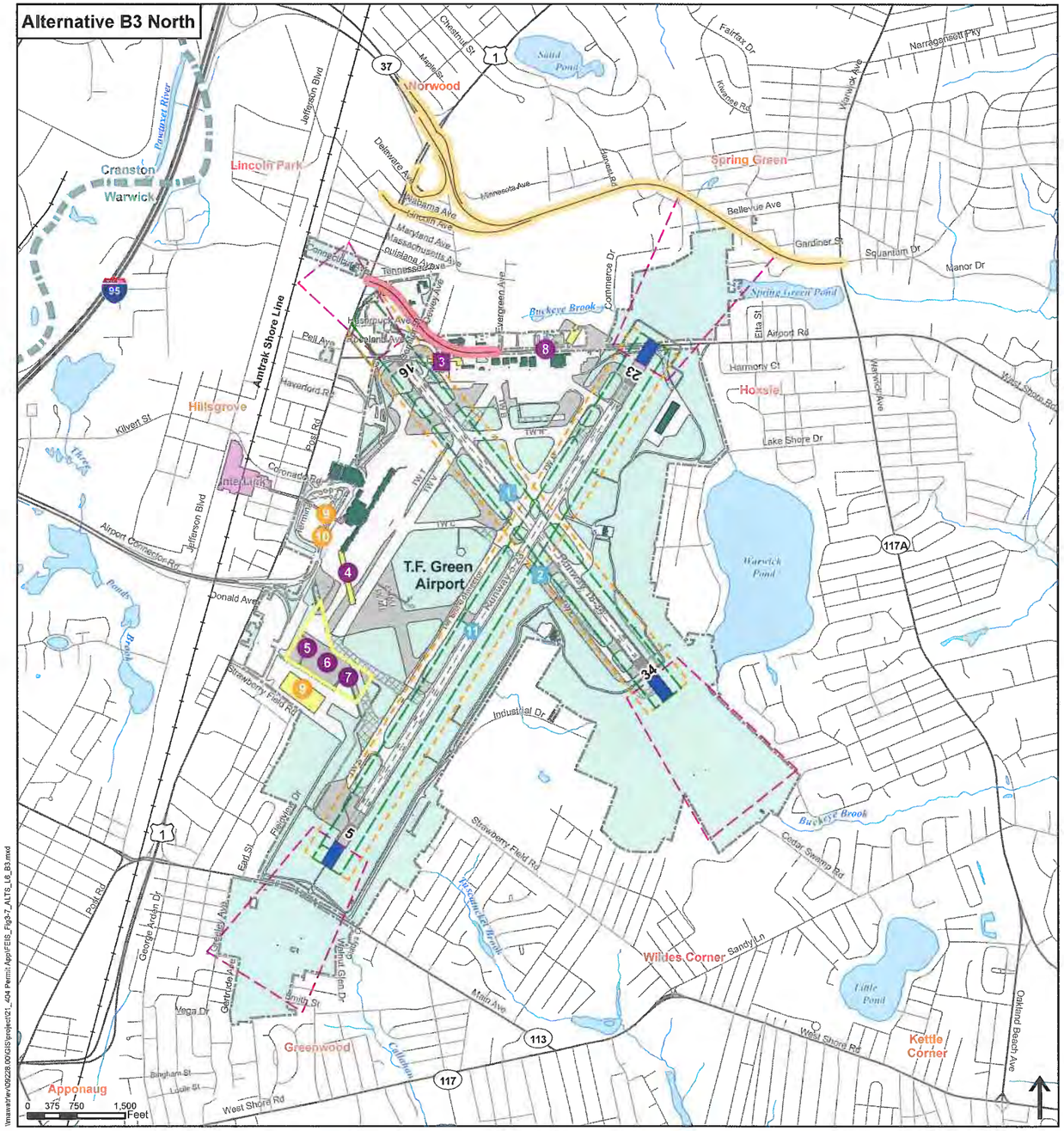
3. Demolish Hangar No. 1
4. Expand Passenger Terminal
5. Construct New Ground Support Equipment Facility
6. Construct New Belly Cargo and USPS Facilities
7. Construct New Fuel Farm
8. Construct New Integrated Cargo Facility

Figure 4-2

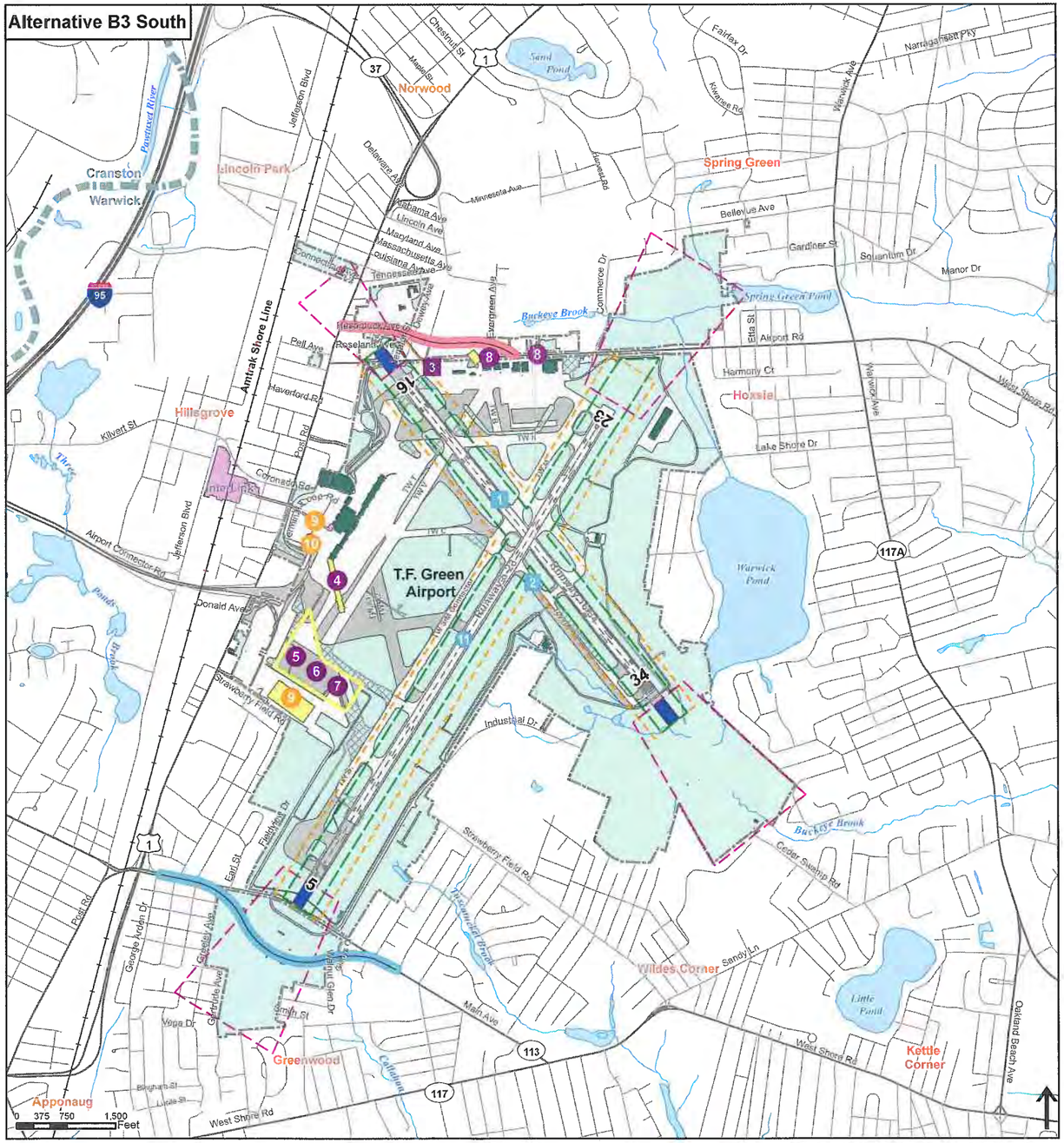
T.F. Green Airport Improvement Program Section 404 Permit Application

Alternatives B2 and B4

Alternative B3 North



Alternative B3 South



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Legend

- No-Action Airport Property Boundary (2015)
- Airport Buildings
- EIS Project
- Efficiency Enhancement Element
- Safety Enhancement Element
- Fully Relocated Airport Road (2020)
- Partially Relocated Airport Road (2015)
- Realigned Main Avenue (2015)
- No-Action Existing Pavement
- Proposed Pavement to be Removed
- Proposed New Pavement
- Runway Object Free Area
- Runway Safety Area
- Runway Protection Zone
- EMAS

Note: New Deicer Management System to be constructed under the No-Action Alternative at an on-Airport location to be determined.

Airfield Facilities

1. Enhance Runway 16-34 Runway Safety Areas
2. Relocate Taxiway C
11. Extend Runway 5-23 to 8,700 Feet

Roadways and Parking Facilities

9. Expand Automobile Parking Facilities
10. Reconfigure Terminal Access Roadways

Terminal and Support Facilities

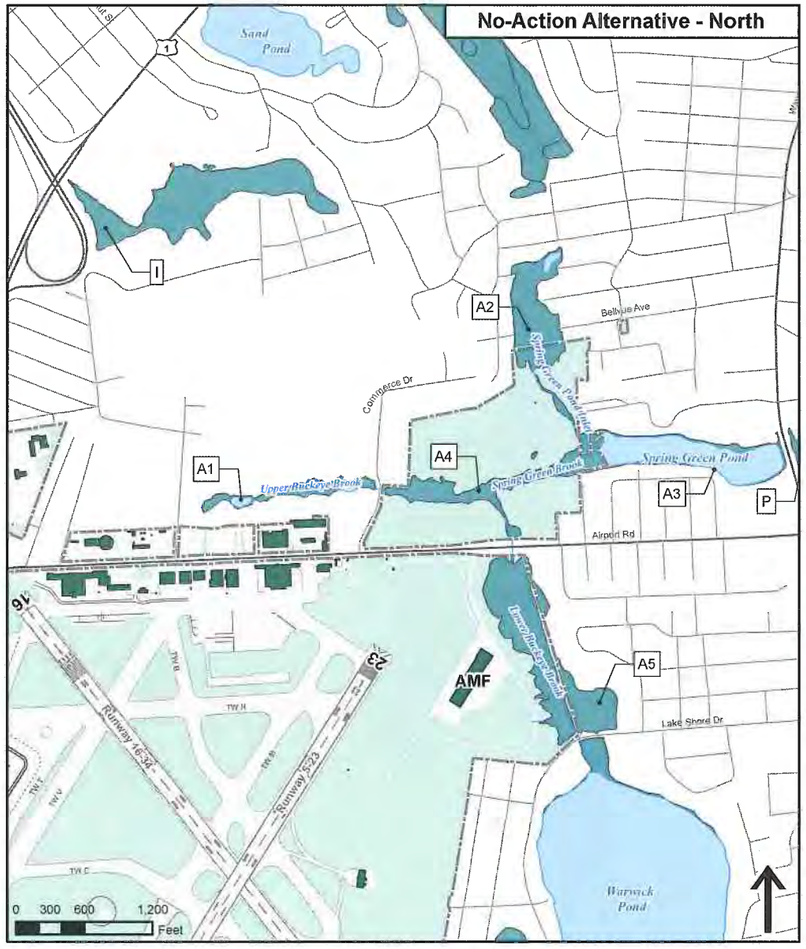
3. Demolish Hangar No. 1
4. Expand Passenger Terminal
5. Construct New Ground Support Equipment Facility
6. Construct New Belly Cargo and USPS Facilities
7. Construct New Fuel Farm
8. Construct New Integrated Cargo Facility

Figure 4-3

T.F. Green Airport Improvement Program Section 404 Permit Application

Alternatives B3 North and B3 South

No-Action Alternative - North



Wetland ID	A2	Total Acres	7.6
B2 Impacts	1.1	B4 Impacts	0.0

Wetland ID	A3	Total Acres	12.9
B2 Impacts	0.1	B4 Impacts	0.0

Wetland ID	A4	Total Acres	4.4
B2 Impacts	<0.1*	B4 Impacts	0.0

Wetland ID	A5	Total Acres	14.5
B2 Impacts	1.5	B4 Impacts	0.0

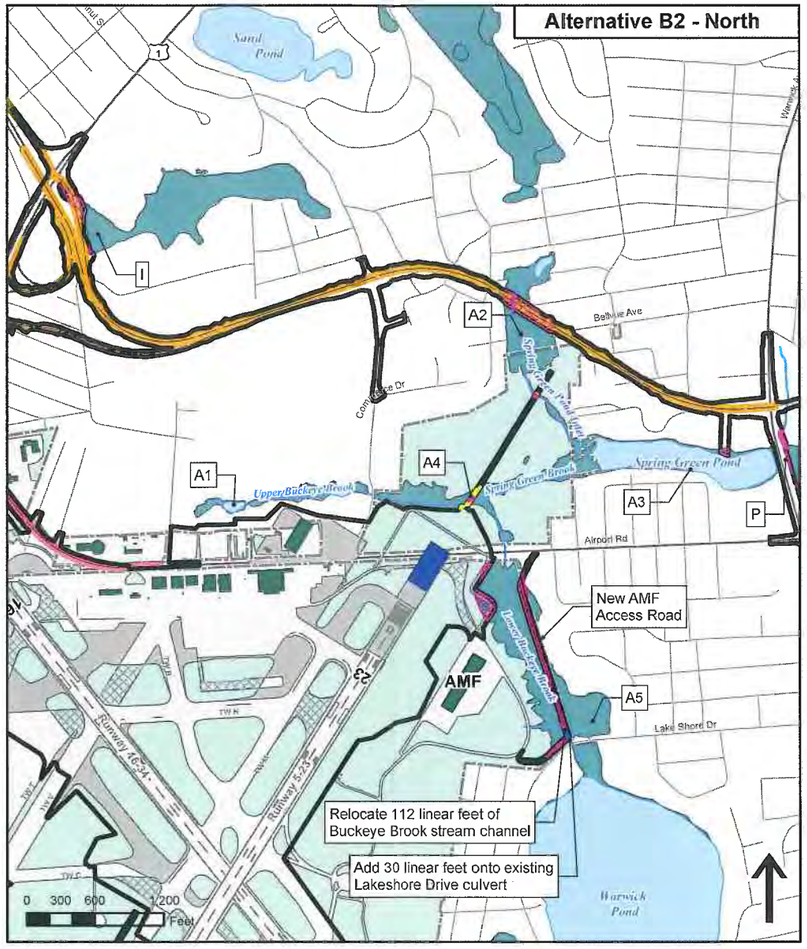
Wetland ID	I	Total Acres	15.3
B2 Impacts	0.5	B4 Impacts	0.0

Wetland ID	P	Total Acres	17.1
B2 Impacts	0.1	B4 Impacts	0.0

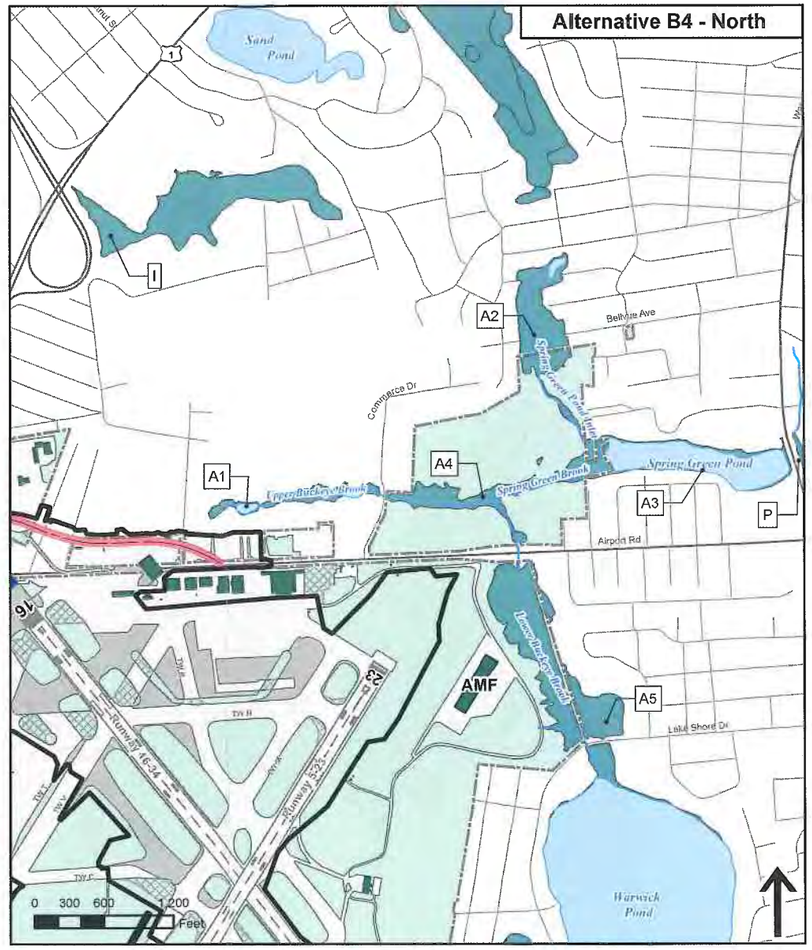
Note: There are no wetland impacts for Alternative B4 at the northern end of the Airport.

* Temporary Impacts

Alternative B2 - North



Alternative B4 - North



Functions and Values

- Groundwater Recharge/Discharge
- Floodflow Alteration (Storage & Desynchronization)
- Fish and Shellfish Habitat
- Sediment/Toxicant/Pollutant Retention
- Nutrient Removal/Retention/ Transformation
- Production Export (Nutrient)
- Principal Function/Value
- Sediment/Shoreline Stabilization
- Wildlife Habitat
- Recreation
- Educational/Scientific Value
- Uniqueness/Heritage
- Visual Quality/Aesthetics
- ES Endangered Species Habitat

Legend

- No-Action Airport Property Boundary (2015)
- Airport Buildings
- No-Action Existing Pavement
- Proposed Pavement to be Removed
- Proposed New Pavement
- EMAS Bed
- Partially Relocated Airport Road (2015)
- Fully Relocated Airport Road (2020)
- Limit of Disturbance
- Wetland
- Stream
- Wetland Impacts
- Temporary Wetland Impacts
- Impacted Stream
- New Culvert and Stream Relocation

Note: New Deicer Management System to be constructed under the No-Action Alternative at an on-Airport location to be determined.

Figure 5-1

T.F. Green Airport Improvement Program Section 404 Permit Application

FEIS Alternatives: Impacts to Wetlands and Waterways: North

Source: Field Delineated Wetlands (CDM, Inc. 2004); Wetlands (RIGIS- 1989), Hydrology (RIGIS -2001)

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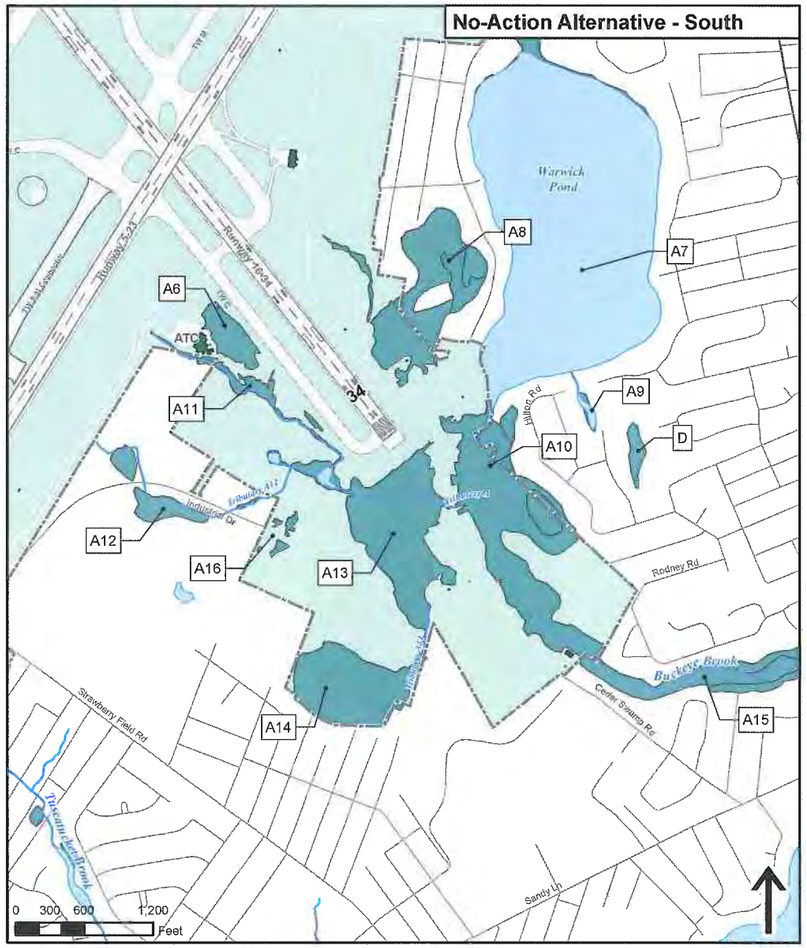

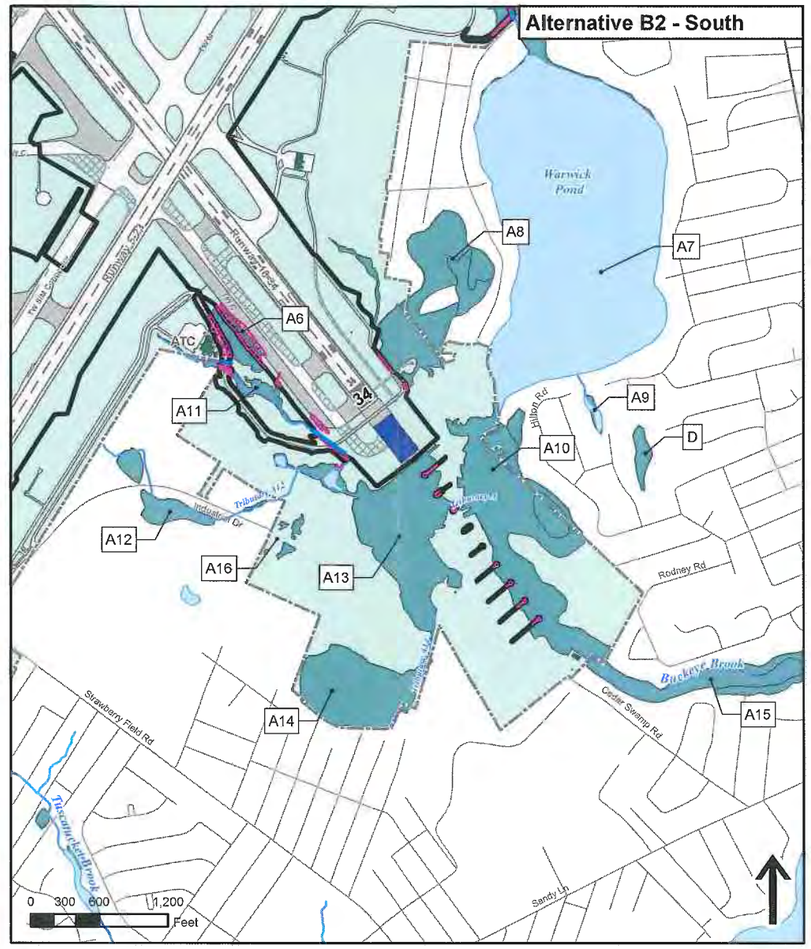

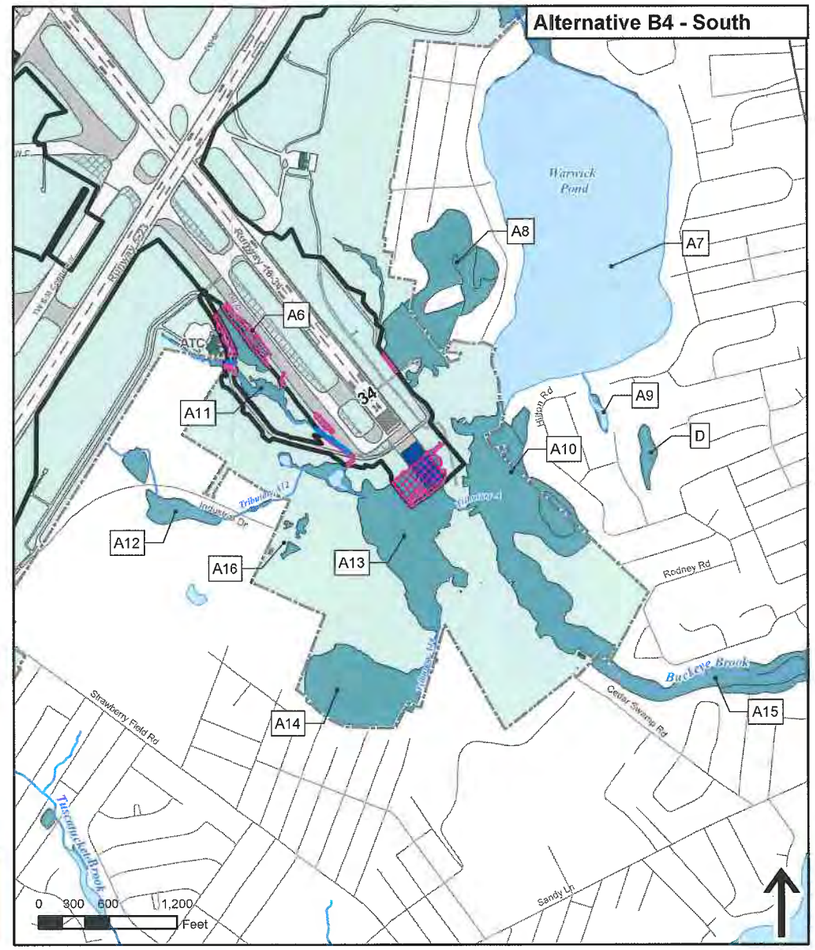

Wetland ID	A8	Total Acres	16.3
B2 Impacts	0.1	B4 Impacts	0.1

Wetland ID	A10	Total Acres	25.6
B2 Impacts	0.1	B4 Impacts	0.0

Wetland ID	A11	Total Acres	2.7
B2 Impacts	0.6	B4 Impacts	0.6

Wetland ID	A13	Total Acres	19.4
B2 Impacts	0.1	B4 Impacts	2.8

Wetland ID	A6	Total Acres	3.1
B2 Impacts	1.6	B4 Impacts	1.5

Note: There are no wetland impacts for Alternative B4 at the northern end of the Airport. Alternative B4 Runway 34 End approach lights would not require relocation.

Functions and Values

- Groundwater Recharge/Discharge
- Floodflow Alteration (Storage & Desynchronization)
- Fish and Shellfish Habitat
- Sediment/Toxicant/Pollutant Retention
- Nutrient Removal/Retention/ Transformation
- Production Export (Nutrient)
- Principal Function/Value
- Sediment/Shoreline Stabilization
- Wildlife Habitat
- Recreation
- Educational/Scientific Value
- Uniqueness/Heritage
- Visual Quality/Aesthetics
- ES Endangered Species Habitat

Legend

- No-Action Airport Property Boundary
- Airport Buildings
- No-Action Existing Pavement
- Proposed Pavement to be Removed
- Proposed New Pavement
- EMAS Bed
- Limit of Disturbance
- Wetland
- Stream
- Impacted Wetland
- Impacted Stream
- New Culvert and Stream Relocation

Note: New Deicer Management System to be constructed under the No-Action Alternative at an on-Airport location to be determined.

Figure 5-2

T.F. Green Airport Improvement Program Section 404 Permit Application

FEIS Alternatives: Impacts to Wetlands and Waterways: South

Source: Field Delineated Wetlands (CDM, Inc. 2004); Offsite Wetlands (RIGIS- 1989) and Hydrology (RIGIS -2001)

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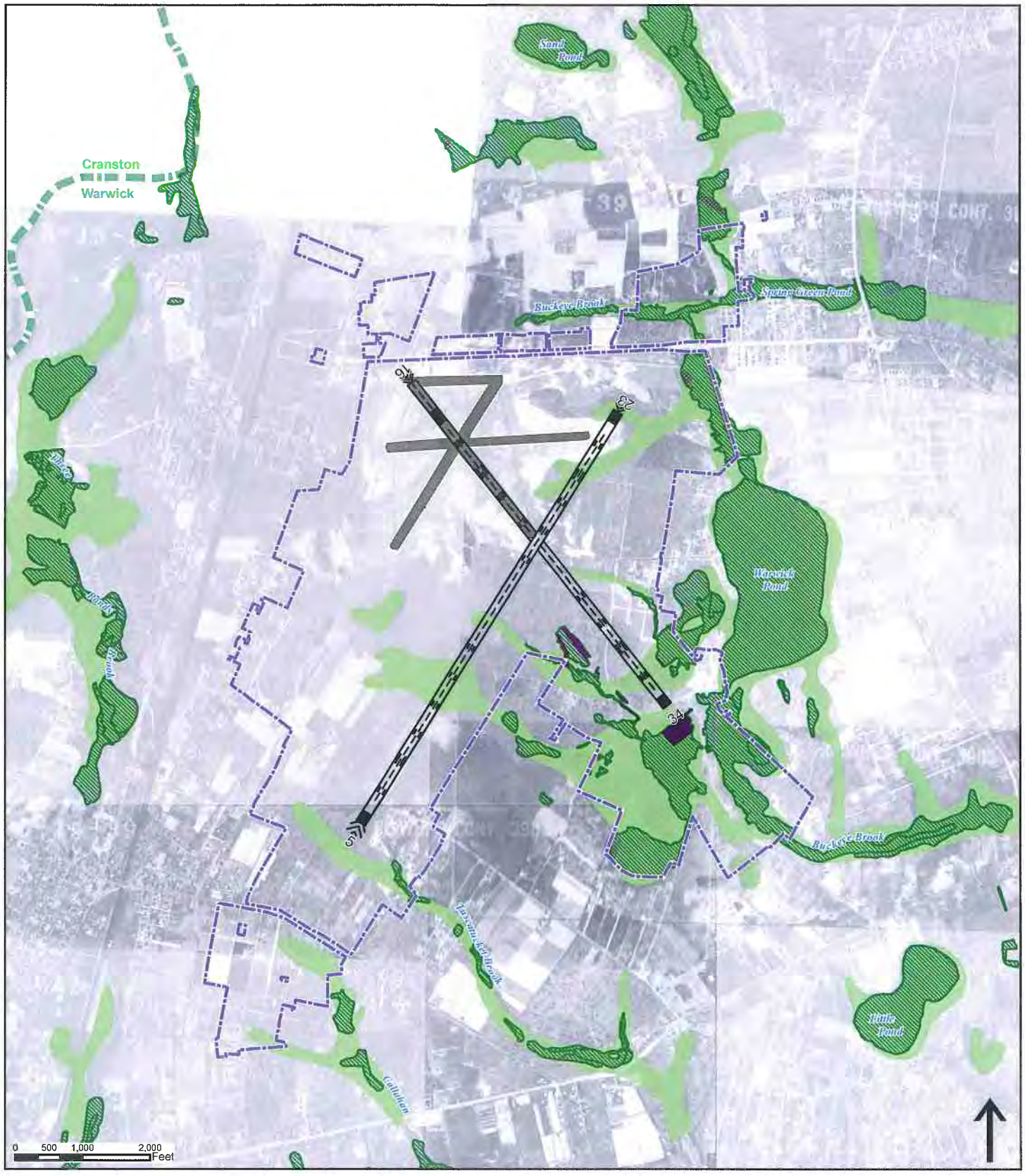

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Legend

- No-Action Airport Property Boundary (2015)
- Municipal Boundary
- 2004 Airport Runways
- 1939 Runways
- 1939 Wetland
- Existing Wetland
- Wetland Impact by Alternative B2
- Wetland Impact by Alternative B4

Figure 5-3

T.F. Green Airport Improvement Program Section 404 Permit Application

Cumulative Impacts to Wetlands

Source: 1939 Aerial Base (RIGIS)
Wetlands (Photo Interpreted VHB 2006)

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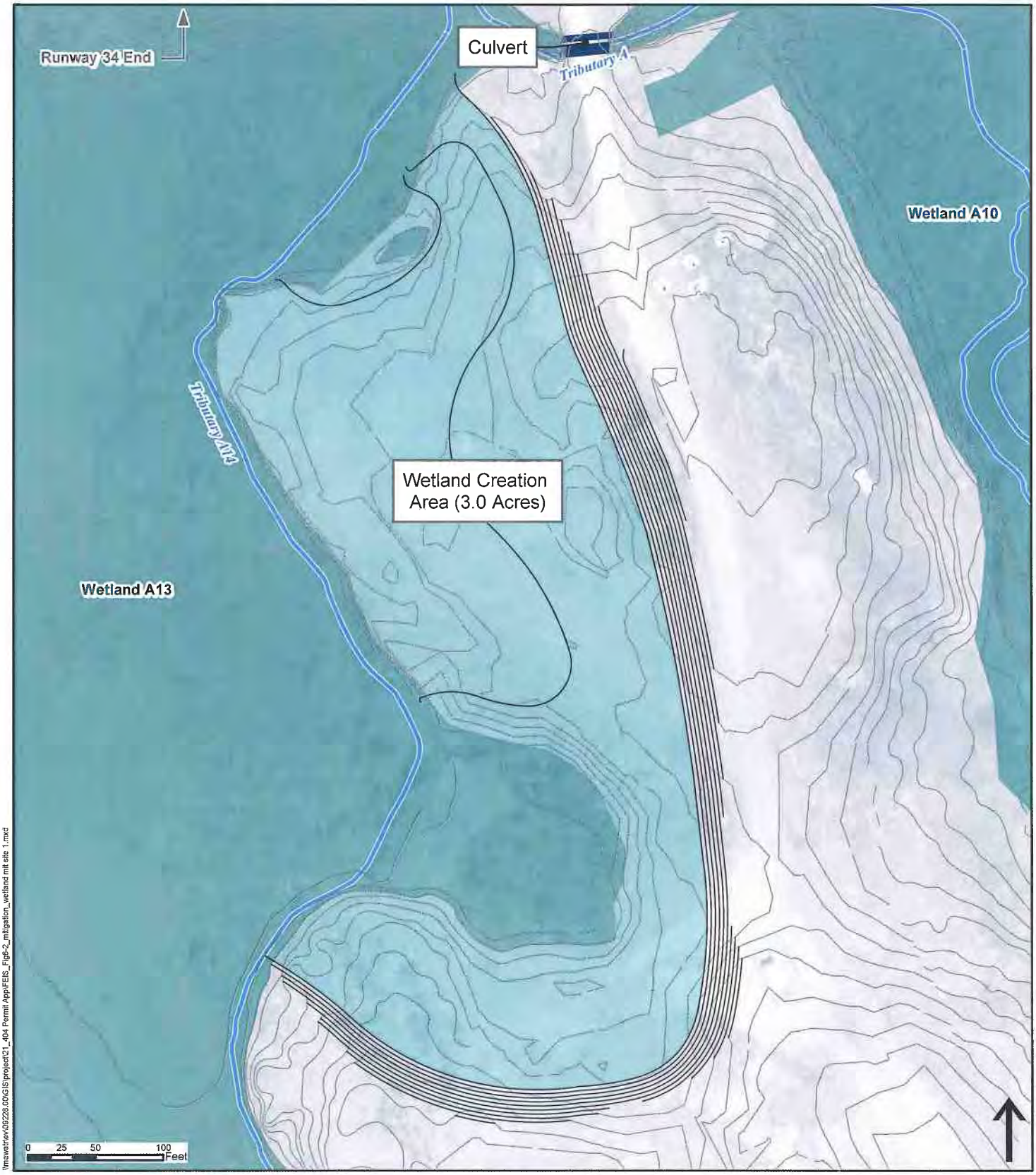
Legend

- No-Action Airport Property Boundary (2015)
- Proposed Watershed Limits for Wetland Mitigation
- Site # — Wetland Mitigation Site Included in the FEIS
- Site # — Wetland Mitigation Site Dropped from the FEIS

Figure 6-1

T.F. Green Airport Improvement Program Section 404 Permit Application

Potential Compensatory Wetland Mitigation Sites



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Legend

- Existing Wetland
- Wetland Creation Area
- Existing Stream
- Existing Contours
- Proposed Contours

Figure 6-2

T.F. Green Airport Improvement Program Section 404 Permit Application

Wetland Mitigation Site 1
South of Runway 34, Warwick

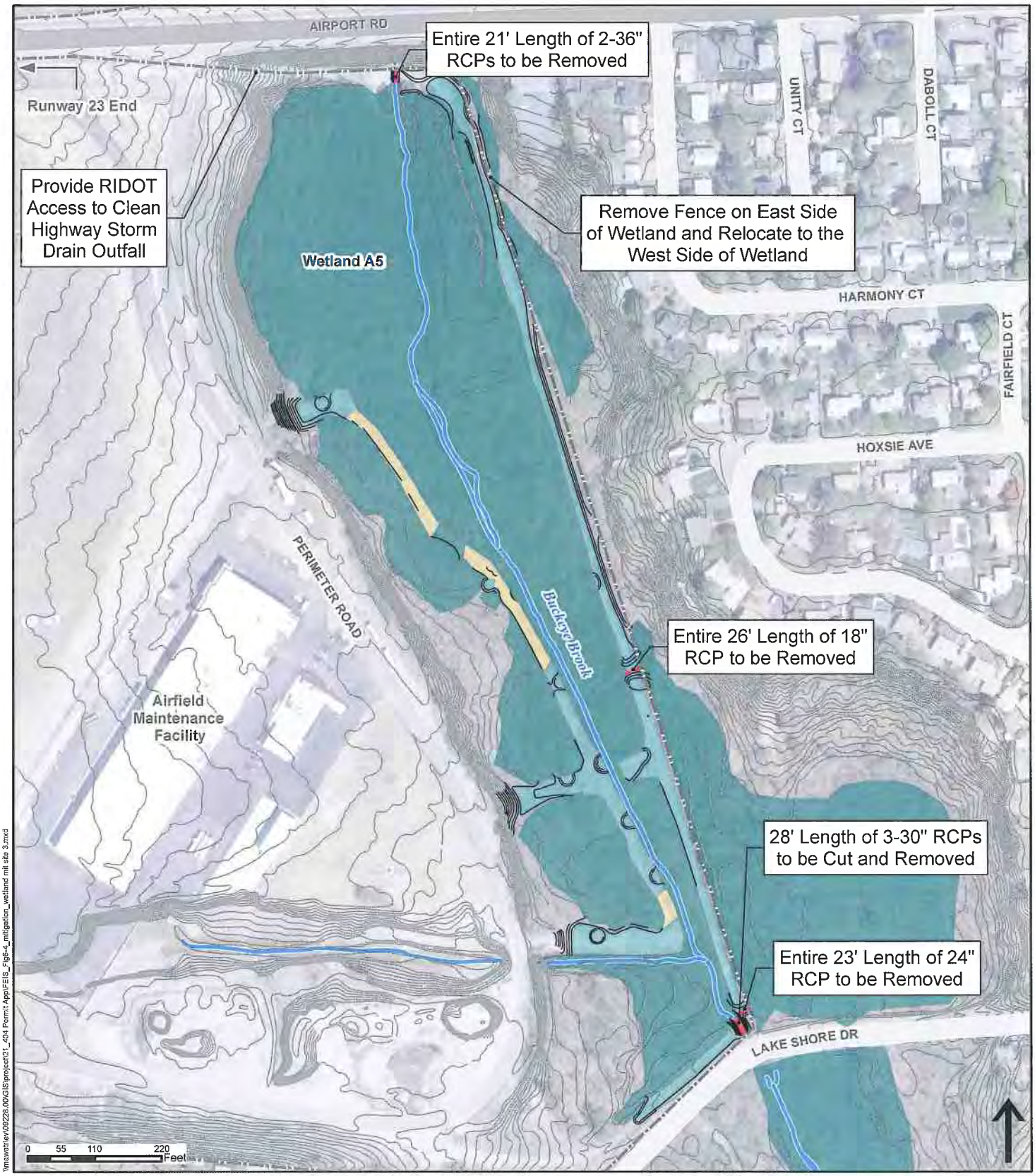
Legend

- No-Action Airport Property Boundary (2015)
- Existing Wetland
- Pipe Removal
- Box Culvert

Figure 6-3

T.F. Green Airport Improvement Program Section 404 Permit Application

Wetland Mitigation Site 2
Culvert Replacement
Lakeshore Drive, Warwick



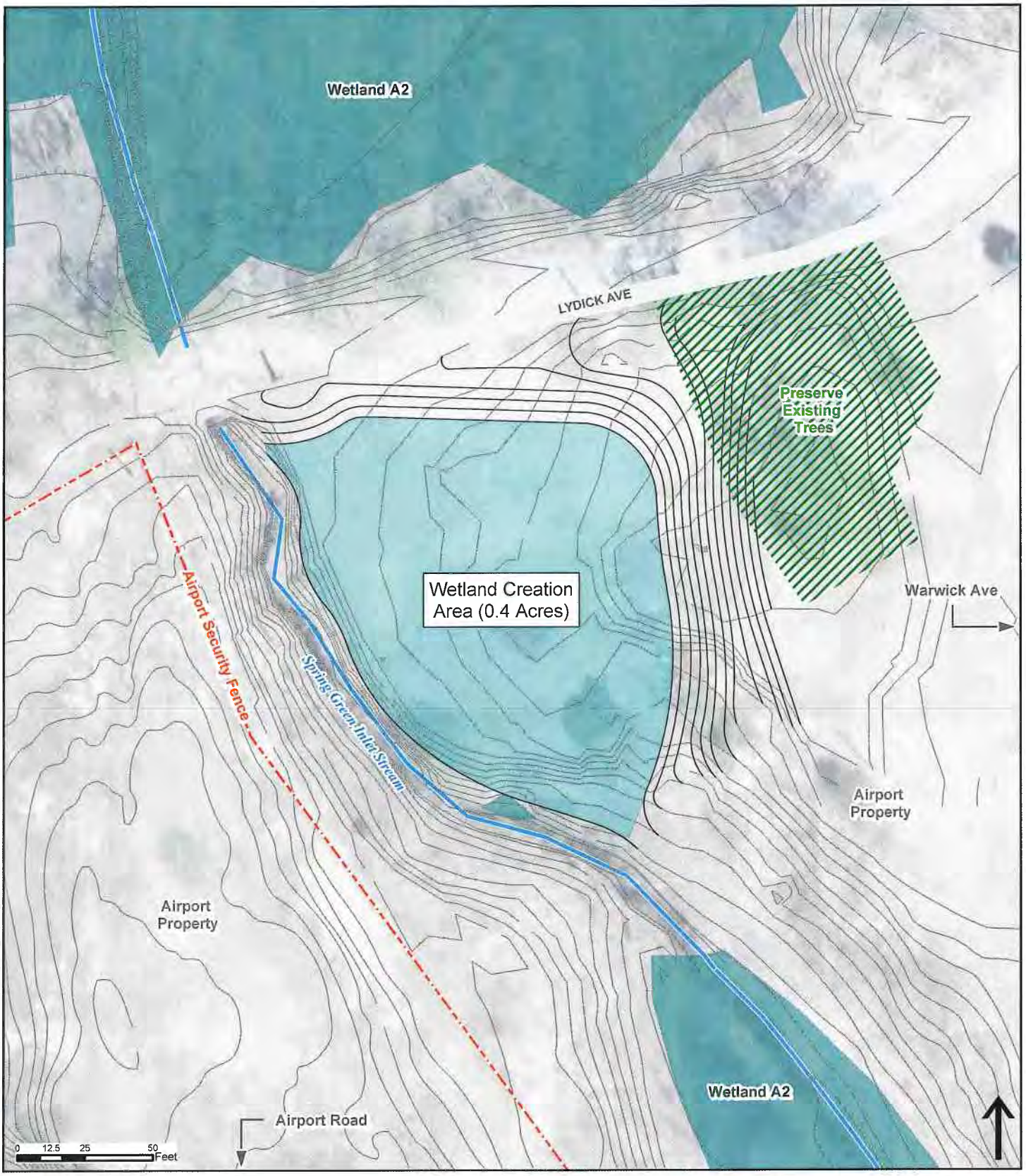
Legend

- No-Action Airport Property Boundary (2015)
- Existing Contours
- Proposed Contours
- Existing Stream
- Existing Wetland
- Wetland Restoration Area (1.3 Acres)
- Wetland Enhancement Area (0.2 Acres)
- Culvert Removal/Stream Daylighting Culvert

Figure 6-4

T.F. Green Airport Improvement Program Section 404 Permit Application

Wetland Mitigation Site 3
Lakeshore Drive, Warwick



Legend

- Existing Wetland
- Wetland Creation Area
- Existing Stream
- Existing Contours
- Proposed Contours

Figure 6-5

T.F. Green Airport Improvement Program Section 404 Permit Application

Wetland Mitigation Site 6
Wetland Creation, Lydick Ave
Warwick

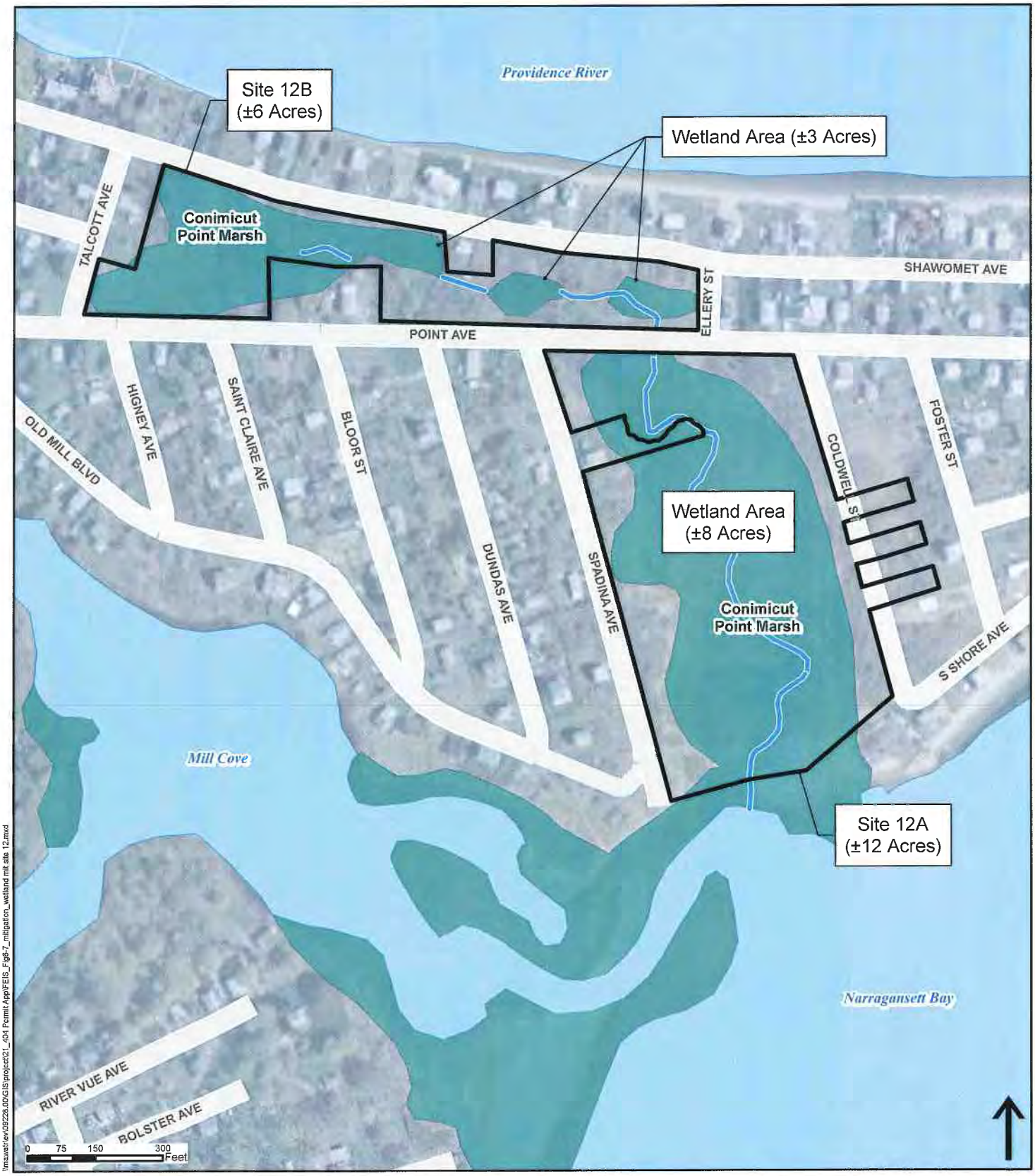
Legend

- Existing Wetland
- Water
- Existing Stream
- Limit of Preservation Area
- Property Line

Figure 6-6

T.F. Green Airport Improvement Program Section 404 Permit Application

Wetland Mitigation Site 8
Three Ponds Marsh
Preservation, Warwick



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Legend

- Existing Wetland
- Water
- Existing Stream
- Limit of Preservation Area

Figure 6-7

T.F. Green Airport Improvement Program Section 404 Permit Application

Wetland Mitigation Site 12
Conimicut Point Marsh
Preservation, Warwick