YEAGER AIRPORT

Runway Safety Area Study

DRAFT – March 2019

PREPARED FOR
The Central West Virginia
Regional Airport Authority

PREPARED BY
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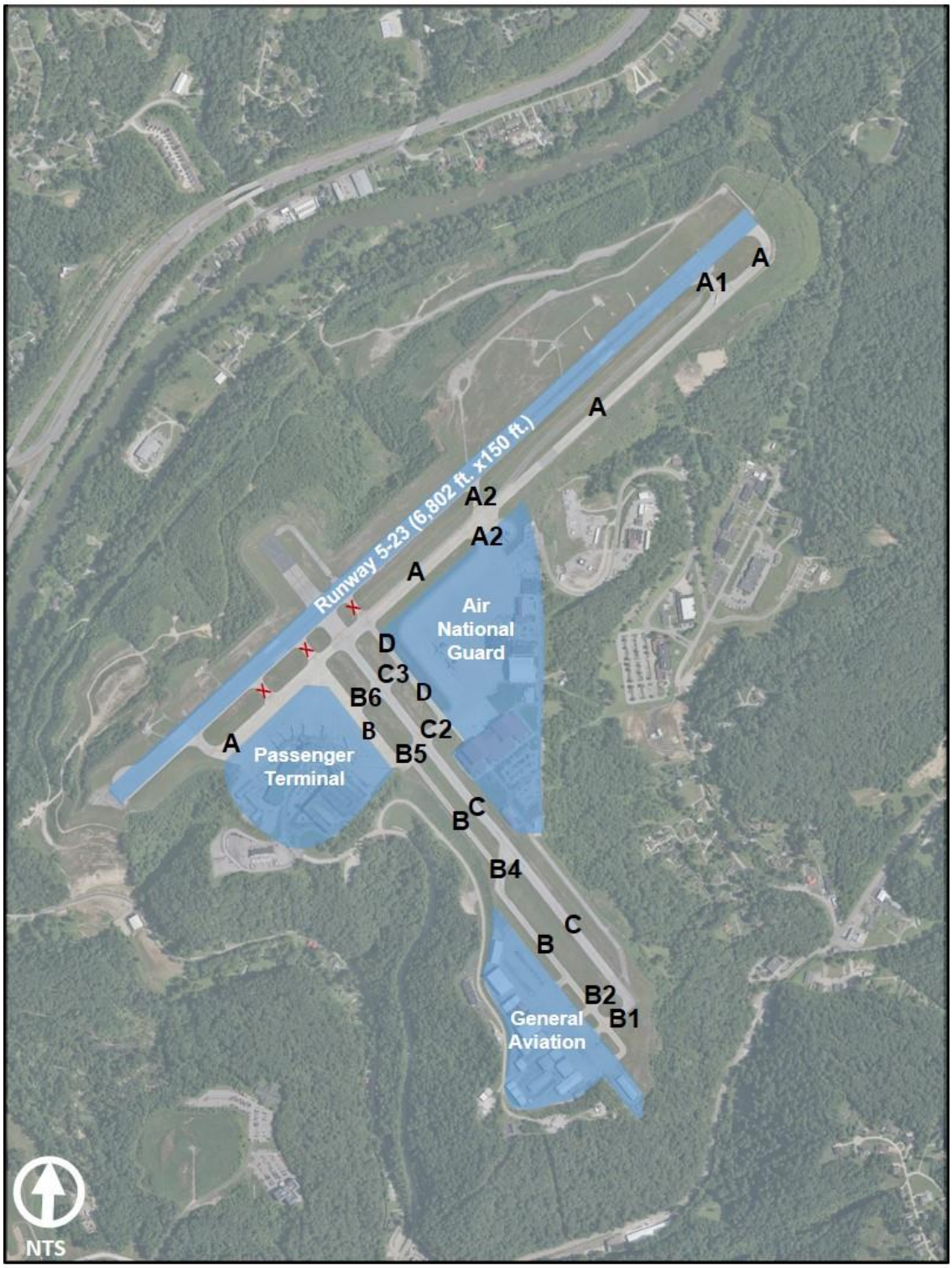
1 Introduction

Yeager Airport (CRW) is a joint-use civil aviation/Air National Guard airport located three miles east of Charleston, West Virginia, the state's capital. Owned and operated by the Central West Virginia Regional Airport Authority (CWVRAA), CRW is the largest airport in the state and generates over 174 million dollars per year in economic impact to the state.[1] The Airport offers approximately 17 daily scheduled flights from four airlines serving eight major airports, and more than 432,000 passengers annually.[2] The Airport is also home to the West Virginia Air National Guard's 130th Airlift Wing, an Air Mobility Command (AMC) unit, and a thriving general aviation community. The Airport serves as a vital component to the state's transportation system and serves as a key asset to the existing and future development of the area. The Airport has a single runway along with a passenger terminal, general aviation facilities, and Air National Guard facilities (see **Exhibit 1, *Existing Airport Facilities***).

1 *The Economic Impact of Yeager Airport*, Final Report, October 14, 2016.
2 July 2018 Official Airline Guide (OAG).

EXHIBIT 1 EXISTING AIRPORT FACILITIES



Note: Reflects current conditions as of December 2018. Does not reflect the Runway 05 RSA project that is currently being constructed.

Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

2 Runway Safety Area (RSA) Study Objectives

CRW currently does not have a standard Runway Safety Area (RSA) or Runway Object Free Area (ROFA). It also does not have the runway length necessary to meet the takeoff runway length needs of its existing users. Thus, the objective of this RSA Study is to identify a runway layout that:

1. Provides standard RSA and ROFA for Runway 05-23
2. Provides the necessary runway length to serve the existing demand and aircraft fleet mix at CRW

3 Runway and RSA Background

CRW opened in 1947 as Kanawha Airport, following the closure of Wertz Field during World War II. Kanawha Airport was later renamed Yeager Airport after famed aviator, Chuck Yeager, and his contributions to the aviation industry. The Airport originally opened with two active runways, Runway 05-23 and 14-32 (later renamed 15-33). Per the recommendations of the 2007 Airport Master Plan, Runway 15-33 was closed in 2008 because it had a shorter length as compared to Runway 05-23, the cost of making the runway comply with more recent RSA standards, and to make room for additional general aviation hangar development and expansion of the Air National Guard apron. Runway 05-23 is currently the sole runway on the airfield.

The CWVRAA conducted a *Runway Safety Area Determination Study* in 2003 (2003 RSA Study) in conjunction with the Federal Aviation Administration (FAA) because its RSAs did not meet modern design standards. The 2003 study recommended construction of a 520-foot long fill off the end of Runway 05 to support a 430-foot long Engineered Materials Arresting System (EMAS)[3] bed. Meanwhile, declared distances[4] were recommended for the Runway 23 end to provide an RSA with a length of 500 feet beyond the Runway 23 threshold. At the time of the 2003 RSA Study, a determination was made that high construction costs and potential impacts to Coonskin Park's access road precluded construction of an EMAS bed or a full-dimension RSA on the Runway 23 end. In 2007, a 440-foot by 175-foot EMAS was installed on the Runway 05 end and declared distances were applied to Runway 23. These projects improved the Runway 05-23 RSA at CRW but did not completely meet FAA standards.

Three years after the installation of the EMAS on Runway 05, a US Airways CRJ 200 aborted takeoff and skidded 1,921 feet before entering the EMAS bed. As a result of being able to stop approximately 130 feet into the EMAS bed, there were no injuries among the 30 passengers and 3 crew members.

[3] An EMAS uses crushable material which is placed at the end of a runway to stop an aircraft overrun. The aircraft tires sink into the EMAS material, which forces the aircraft to decelerate. EMAS is provided for runways where it is not possible to have a 1,000-foot overrun area. According to FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, a standard EMAS provides an equivalent level of safety as a full-dimension RSA.

[4] Per FAA AC 150/5300-13A, *Airport Design*, declares distances are "the distances the airport operator declares available for a turbine powered aircraft's takeoff run, takeoff distance, accelerate-stop distance, and landing distance requirements."

January 19, 2010 RSA Incident

Nearly five years after the CRJ 200 aborted takeoff, a slope failure destroyed the Runway 05 RSA and EMAS on March 12, 2015. The EMAS was eight years old and sat atop an engineered fill of 1.5 million cubic yards. The slope failure caused a significant amount of damage to the EMAS, as well as to the surrounding area. In addition to the damage on the Airport, the slope failure took out power lines, trees, and a nearby church. It also blocked a stream and Keystone Road. As a result of the stream blockage, one house was destroyed and there was minor flooding in the neighborhood, affecting additional properties.

Before Slope Failure

After Slope Failure

The loss of the EMAS resulted in the shortening of the usable lengths of Runway 05-23 by as much as 500 feet in the Runway 23 direction and by as much as 577 feet in the Runway 05 direction. The Runway 05 threshold was moved, which rendered its glide slope unusable. The slope failure also resulted in the implementation of a 500-foot long RSA on the Runway 05 end (the standard is 1,000 feet or EMAS).

In February of 2017, a landing regional jet overran the declared landing distance and used the entire runway to come to a complete stop. In addition, a fatal accident occurred on May 5, 2017. A twin-engine turboprop Short 330 cargo plane crashed while landing on Runway 05, tragically killing two people. The left wing of the aircraft struck the runway and the aircraft skidded off the runway and went down a steep embankment. These incidents demonstrate the need to improve runway safety at the Airport.

CWVRAA published an Interim RSA Study in January of 2018 to address the reduced runway length and RSA length that resulted from the slope failure. This study concluded that safety could be improved, and the declared distances could be increased with the installation of a new EMAS on the Runway 05 end. This solution is an interim solution because it does not restore all of the necessary runway length, nor does it provide standard RSA dimensions or a standard EMAS. It was selected as the preferred solution because it provides the best balance of improved safety and operational needs. It is the first step towards the long-term goal of achieving a standard RSA and meeting the runway length needs of CRW's users. Construction is currently underway and is expected to be complete in 2019.

4 RSA/ROFA Standards

The RSA and ROFA dimensions that will be in place after the Runway 05 EMAS project is completed are considered non-standard in accordance with FAA design standards found in FAA Advisory Circular 150/5300-13A Change 1, *Airport Design*. FAA requires that an RSA be 600 feet long prior to the runway threshold and 1,000 feet long beyond the runway end. The RSA width requirement is 500 feet. The ROFA has the same length requirements as the RSA but its width requirement is 800 feet.

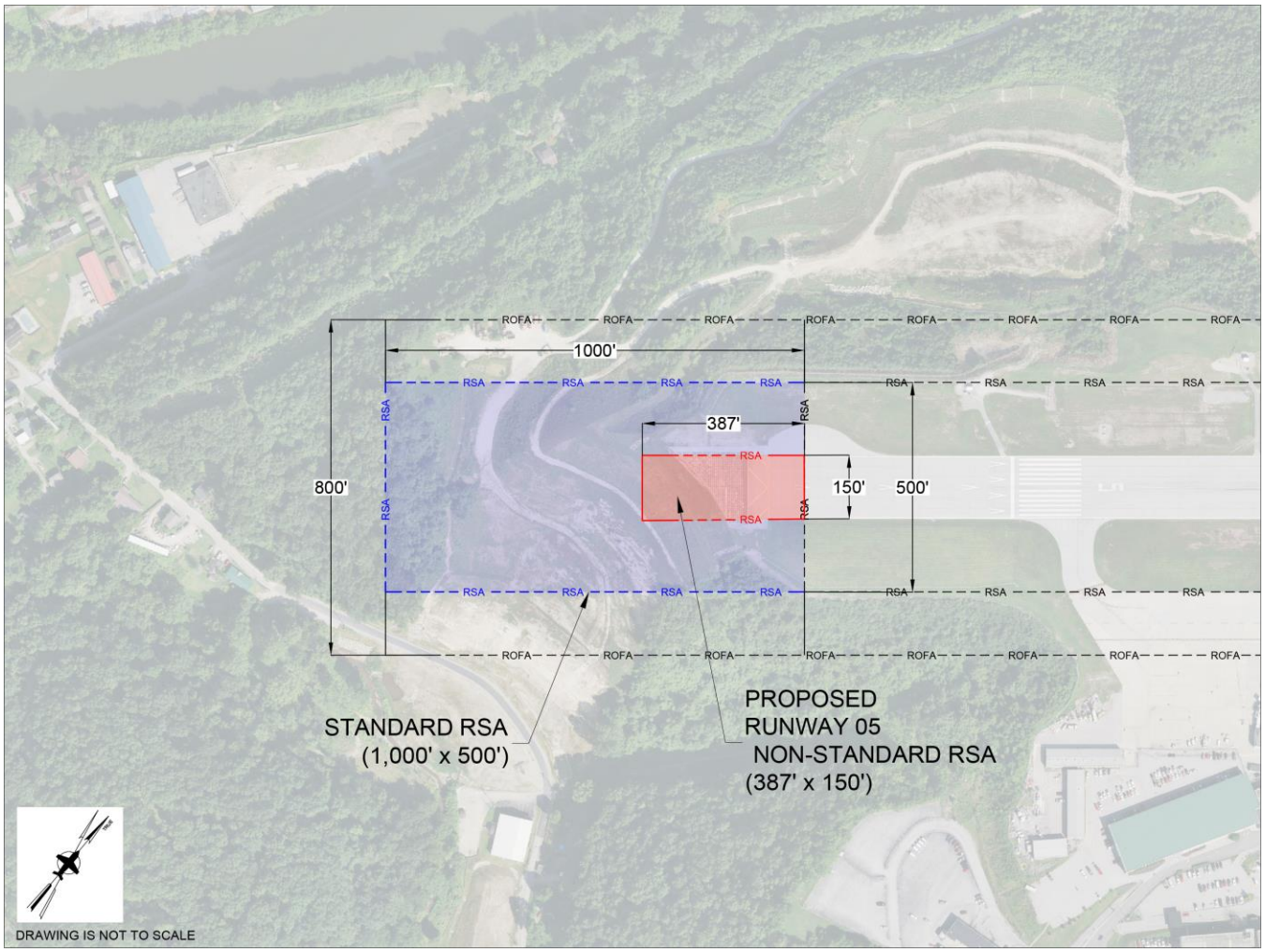
The EMAS that will be constructed on the Runway 05 end will increase safety but is not considered a standard EMAS (its length is shorter than a standard EMAS). It will also not meet the RSA/ROFA length requirement prior to the threshold (600 feet) or width requirement (500 feet for RSA and 800 feet for ROFA). The Runway 23 end RSA/ROFA is sufficiently wide. However, it is 500 feet long so it does not meet the 600-foot required length prior to the threshold or the 1,000-foot length requirement beyond the runway end. In addition, the ongoing Airfield Master Plan identified other RSA/ROFA deficiencies for Runway 05/23:

- Existing drainage structures within the RSA/ROFA to south of Runway 05/23 that span nearly three quarters of the runway from Taxiway D to Taxiway A1; the transverse grades within this area are greater than 3.0%.
- Lighting and navigational aids (NAVAIDS) that are not fixed by function in the Runway 05 end RSA/ROFA including the Distance Measuring Equipment (DME), Runway 23 localizer, Runway 05 glide slope, wind cone (ROFA only), and VASI system.
- Lighting and NAVAIDS that are not fixed by function in the Runway 23 end RSA/ROFA including the Runway 05 localizer, Visual Approach Slope Indicator (VASI) system, and Runway 23 end-fire glide slope.[5]

The RSA/ROFA deficiencies are shown on **Exhibit 2, *Runway 05 RSA/ROFA*,** and **Exhibit 3, *Runway 23 RSA/ROFA***.

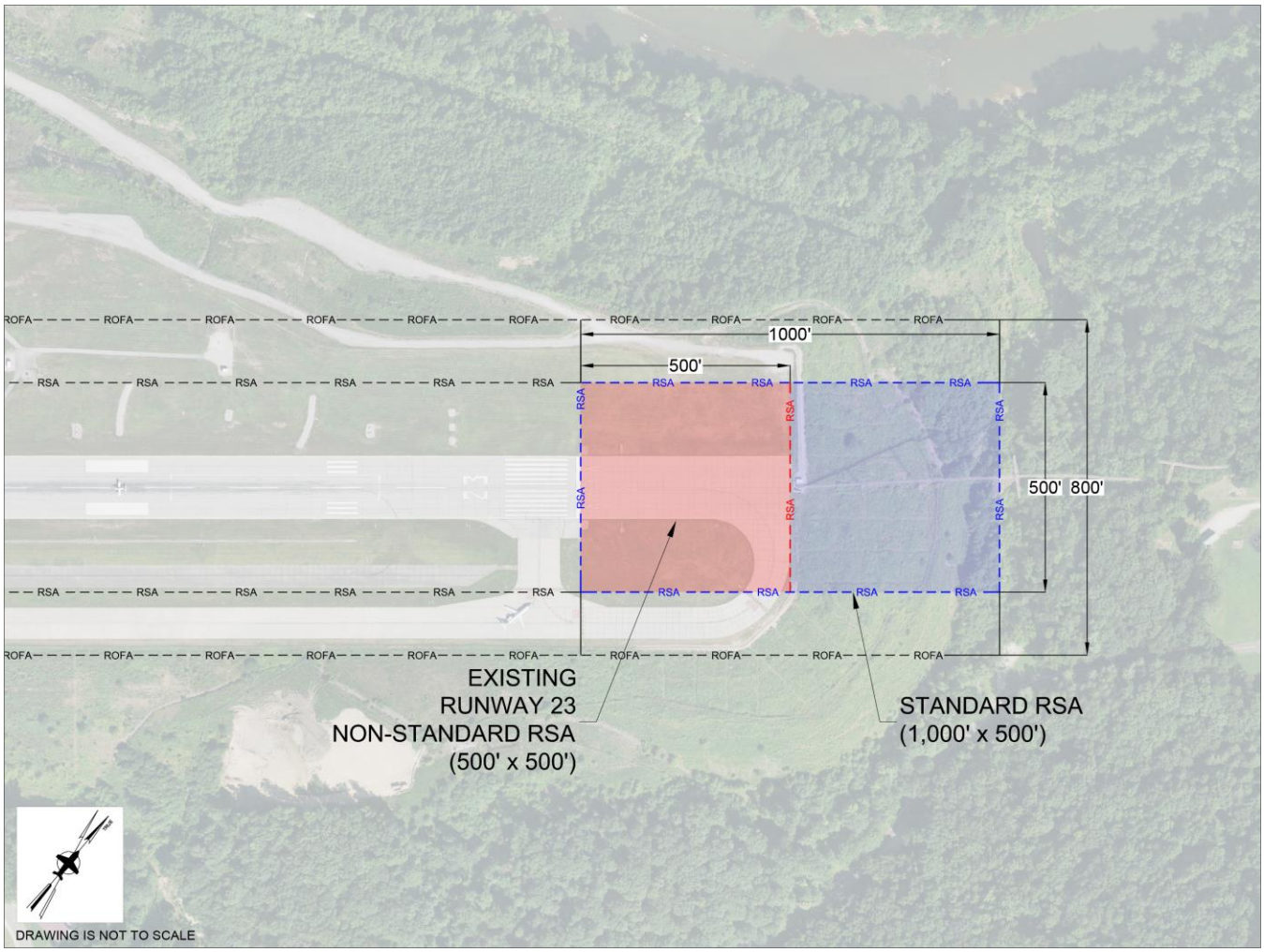
[5] This type of glide slope is technically allowed to be in the RSA. However, if a capture effect glide slope is desired, it could no longer be located in the RSA or ROFA.

EXHIBIT 2 RUNWAY 05 RSA/ROFA



Note: Reflects planned conditions after construction of the Runway 05 RSA project is complete.
Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

EXHIBIT 3 RUNWAY 23 RSA/ROFA



Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

5 Runway Length Requirements

The declared distances that are expected to be available upon completion of the Runway 05 EMAS project are compared to pre-slope failure and post-slope failure distances in **Table 1*, CRW Declared Distances Comparison (in feet)***. The project shortens the Takeoff Run Available (TORA) and Takeoff Distance Available (TODA) by 87 feet (from 6,802 feet to 6,715 feet) but increases the Landing Distance Available (LDA) and Accelerate Stop Distance Available (ASDA), as compared to post-slope failure conditions. The declared distances that were available before the slope failure will not be fully restored by the project.

TABLE 1 CRW DECLARED DISTANCES COMPARISON (IN FEET)

DECLARED DISTANCES	PRE-SLOPE FAILURE		POST-SLOPE FAILURE		RWY 05 PROJECT	
	RWY 05	RWY 23	RWY 05	RWY 23	RWY 05	RWY 23
TORA/TODA	6,802	6,802	6,802	6,802	6,715	6,715
LDA	6,302	6,302	5,725	5,802	6,015	6,215
ASDA	6,302	6,802	6,302	6,302	6,215	6,715

Notes: TORA = Takeoff Run Available; TODA = Takeoff Distance Available; LDA = Landing Distance Available; ASDA = Accelerate-Stop Distance Available.
Sources: 2018 Interim Runway Safety Area Study; Landrum & Brown analysis.

The 2018 Interim RSA Study identified a minimum LDA of 6,000 feet in both the Runway 05 and 23 directions based on the existing fleet mix and airline minimum requirements for commercial service. The LDA provided by the 2018 Interim RSA Study solution meets this minimum requirement. Thus, additional LDA length is not needed.

The 2018 Interim RSA Study identified a takeoff runway length requirement of 6,820 feet based on the EMB145 takeoff length requirement in the Runway 23 direction. This is shown in **Table 2*, CRW Existing Takeoff Length Requirements.***

TABLE 2 CRW EXISTING TAKEOFF LENGTH REQUIREMENTS

AIRCRAFT TYPE	RUNWAY 5 TAKEOFF REQUIREMENT (in feet)	RUNWAY 23 TAKEOFF REQUIREMENT (in feet)	2017 ANNUAL OPERATIONS
DC-9	7,500	8,020	64
B717	6,800	7,320	306
B737-800	6,400	6,920	0
EMB 145	***6,300***	***6,820***	***1,792***
Learjet (all series)	7,800	8,320	313
Falcon (all series)	6,800	7,320	146
Gulfstream (all series)	6,800	7,320	98
Total			**2,719**

Notes: 1. Cargo and general aviation flights were not scheduled in OAG so 2017 cargo operations were assumed to be equivalent to 2016 operations.
2. Runway 23 takeoff requirement includes 500 additional feet to reflect the uphill gradient in the Runway 23 direction.

Sources: FAA TFMSC database through aspm.faa.gov; 2017; OAG Aviation Worldwide Ltd, OAG Schedules Analyzer, accessed on February 28, 2017; Landrum & Brown analysis.

The takeoff requirement identified in the 2018 Interim RSA Study was increased to 7,000 for this RSA Study due to the runway gradient. The Runway 05 threshold is currently 52 feet higher than Runway 23 threshold. FAA Advisory Circular 150/5325-4B states that 10 feet of takeoff runway length requirement should be added for every foot of elevation increase on the runway, using the maximum difference in runway centerline elevation. The 6,820-foot takeoff length requirement reflects the addition of 520 feet to the calculated takeoff requirement. When the runway is shifted, an additional adjustment will have to be made. Continuation of the slope on the last quarter of the runway as required by FAA would result in the new Runway 23 end being an additional 10 feet lower, adding 100 feet to the takeoff runway length requirement. This results in a runway length requirement of 7,000 feet (6,920 feet rounded up to the nearest 100). Thus, an LDA of 6,000 and an ASDA of 7,000 are the minimum declared distances for CRW in this RSA Study.

6 Airfield Master Plan Alternatives

An Airfield Master Plan to determine the 20-year development plan for CRW is ongoing. That study evaluated several alternatives that provided an 8,000-foot long runway, a standard Runway 05-23 RSA, a Category I approach for Runway 05, and a Category II approach for Runway 23. The Master Plan alternatives were used to develop the alternatives for this RSA Study. A summary of the development of the Master Plan alternatives is provided in this section. The alternatives chapter in its entirety can be reviewed in Appendix A, *Airfield Master Plan Alternatives Chapter – Level 1*.

Eight series of alternatives were developed, each with a set of four alternatives, for a total of 32 alternatives. The “A” alternatives have no EMAS, the “B” alternatives have EMAS on the Runway 05 end, the “C” alternatives have EMAS on the Runway 23 end, and the “D” alternatives have EMAS on both ends. These alternatives range from shifting Runway 05-23 westward by 2,174 feet to a 2,578-foot eastern shift.

The 32 alternatives were first pre-screened for constructability by analyzing each alternative based on its location, geometry, topography, and other constraints. This pre-screening process eliminated Alternatives 1A through 1D and 2A through 2D for a total of eight alternatives.

The remaining 24 alternatives were evaluated through a Level 1 screening process and evaluated based on their impacts involving the following criteria:

- Obstructions
- Air Traffic Control Tower (ATCT) siting
- RPZ impacts
- Terminal impacts
- Construction phasing
- NAVAID siting
- Grading Requirements
- Environmental and local impacts

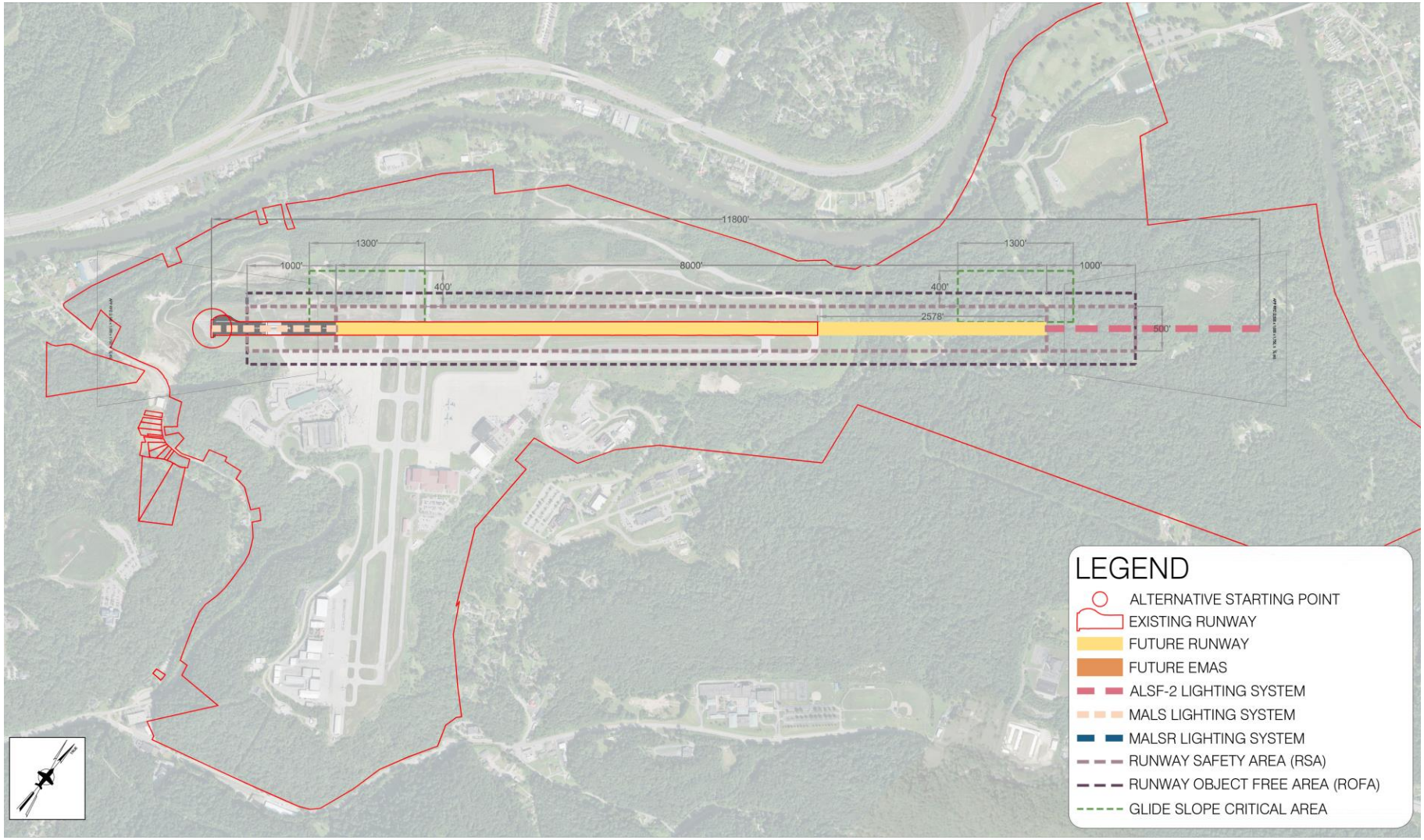
The Level 1 screening process resulted in 20 of the alternatives being eliminated from further consideration, with four carried forward for additional analysis. The 20 alternatives were eliminated for a variety of reasons including Runway 05 grading and wall height requirements, Runway 23 grading and wall height requirements, and Runway 23 glide slope siting requirements. The four alternatives that were carried forward in the Master Plan provide the best balance of Runway 05 end impacts versus Runway 23 end impacts. These alternatives are:[6]

- Alternative 4A: Shifts Runway 05-23 to the east by 1,400 feet to allow for the provision of a Medium Intensity Approach Light System (MALS) on the Runway 05 end. The runway is extended to the east by 2,578 feet and has full-dimension RSAs on both runway ends (no EMAS).
- Alternative 4C: Shifts Runway 05-23 to the east by 1,400 feet and extends the runway to the east by 2,578 feet (same as Alternative 4A). This alternative has a full-dimension RSA on the Runway 05 end and an EMAS on the Runway 23 end.
- Alternative 7A: Shifts Runway 05-23 to the east by 1,125 feet. This shift starts the Runway 05 end RSA at the point at which the standard 500-foot RSA width can be provided without any changes to the grading on the Runway 05 end. The runway is extended to the east by 2,300 feet. This alternative has a full-dimension RSA on both ends (no EMAS).
- Alternative 7C: Shifts Runway 05-23 to the east by 1,125 feet and extends the runway to the east by 2,300 feet (same as Alternative 7A). This alternative has a full-dimension RSA on the Runway 05 end and an EMAS on the Runway 23 end.

The alternatives are shown on **Exhibit 4 through Exhibit 7**. After these four long-term alternatives were shortlisted as part of the Airfield Master Plan, a detour was made to this RSA Study, which is focused on providing standard RSA/ROFAs and meeting existing runway length needs.

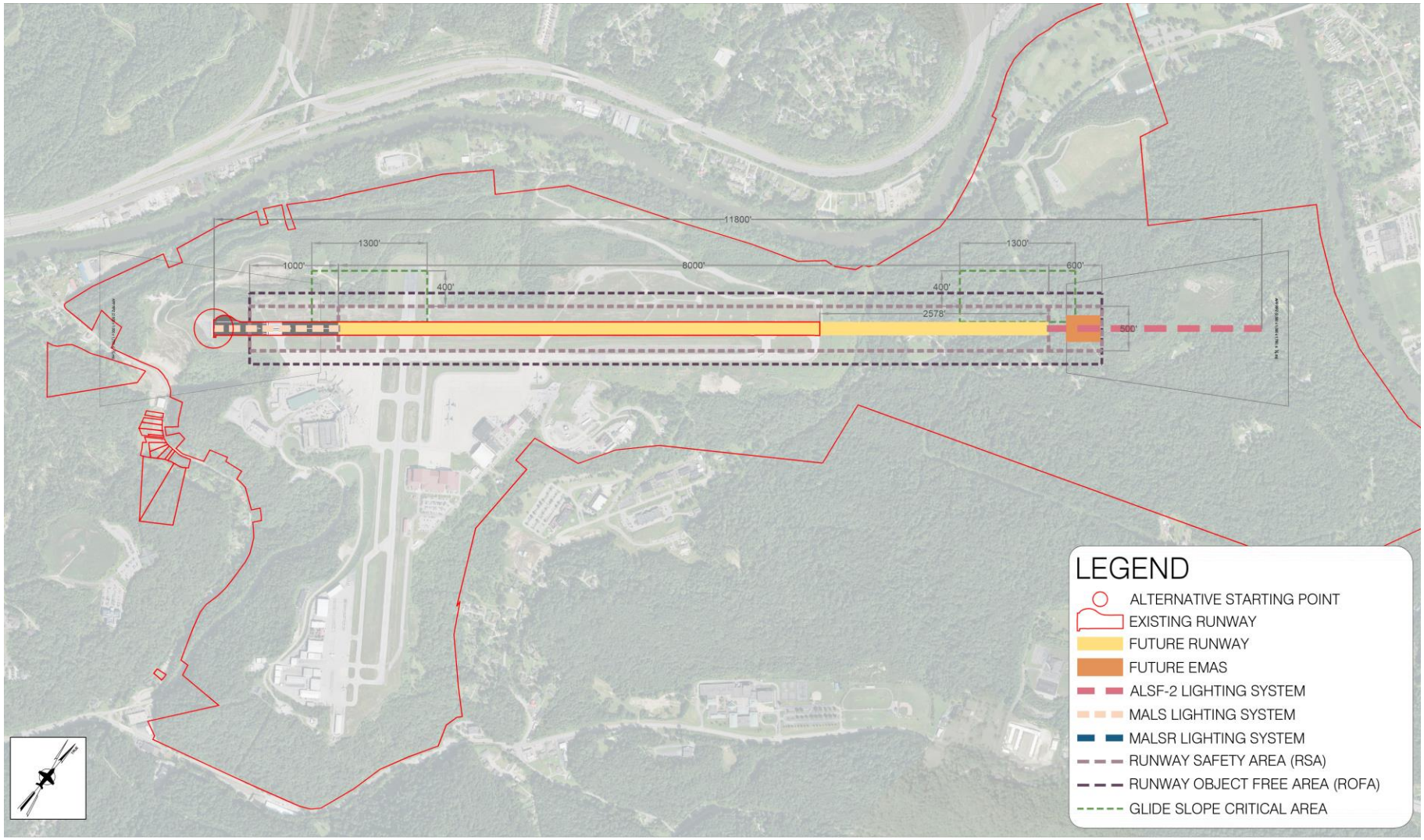
[6] All presented dimensions refer to the existing Runway 05 end, prior to implementation of the Runway 05 project.

EXHIBIT 4 AIRFIELD MASTER PLAN ALTERNATIVE 4A



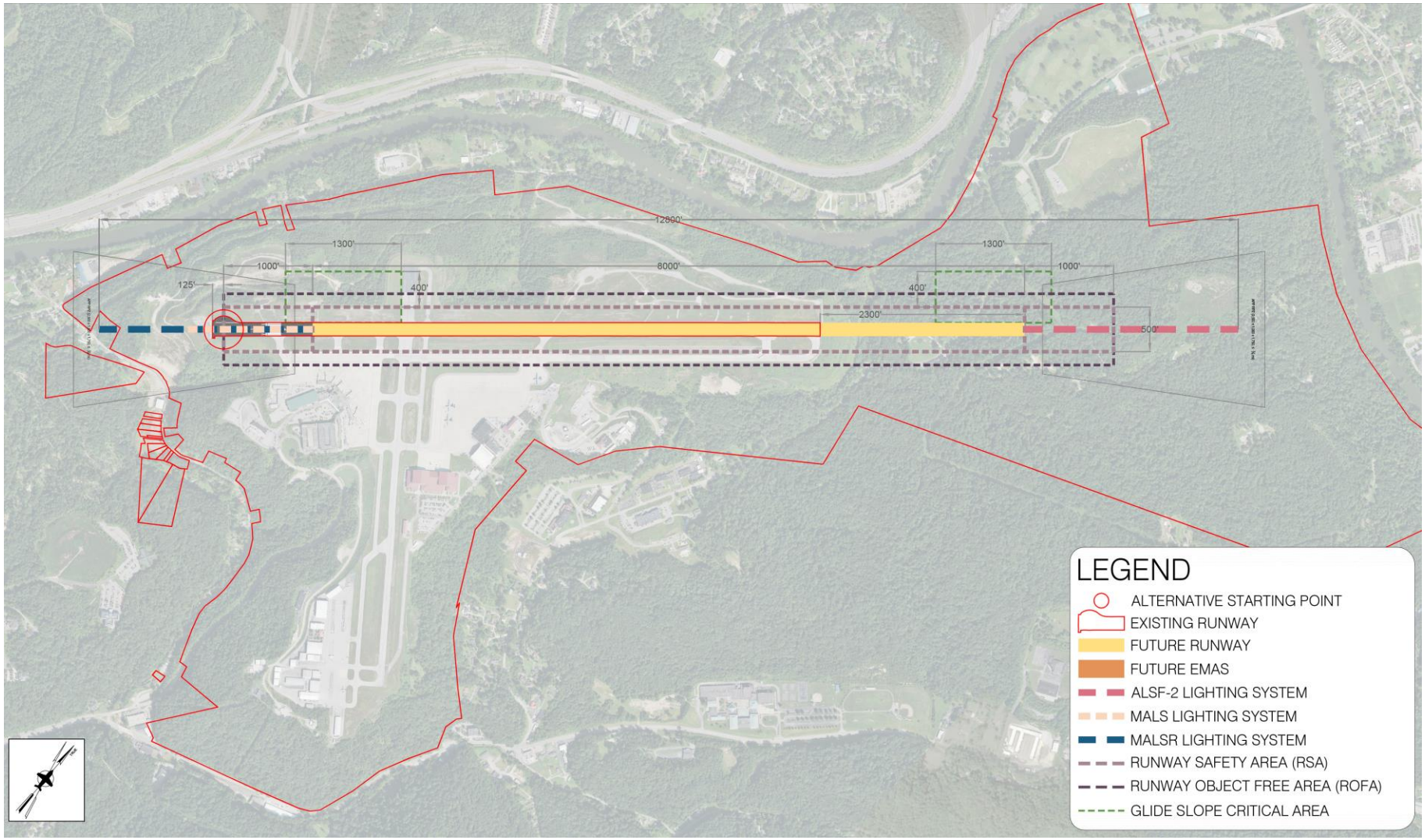
Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

EXHIBIT 5 AIRFIELD MASTER PLAN ALTERNATIVE 4C



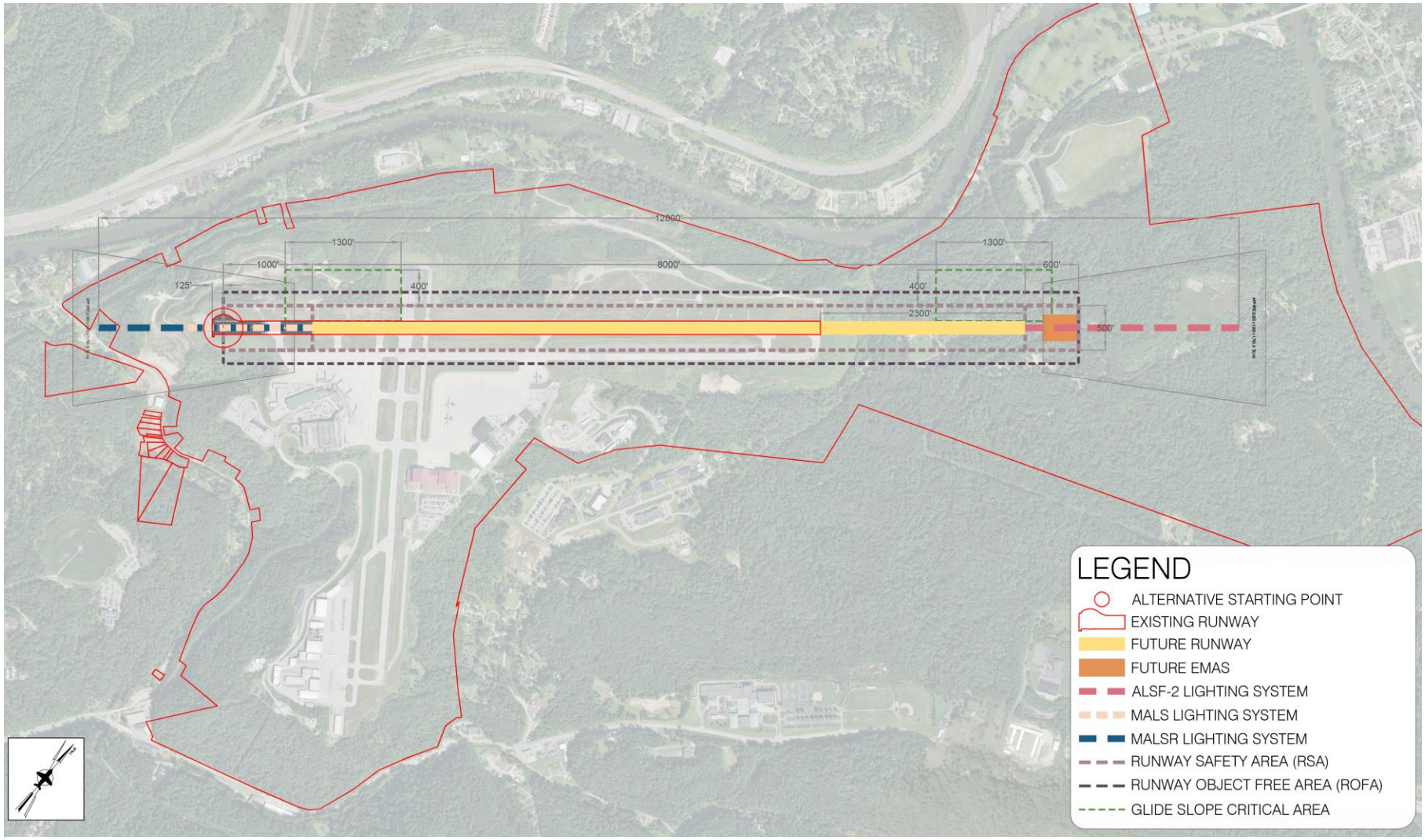
Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

EXHIBIT 6 AIRFIELD MASTER PLAN ALTERNATIVE 7A



Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

EXHIBIT 7 AIRFIELD MASTER PLAN ALTERNATIVE 7C



Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

7 RSA Study Alternatives

This section presents the development of the RSA Study alternatives, the evaluation of those alternatives, and the selection of the preferred solution.

7.1 Development of RSA Study Alternatives

The four shortlisted Airfield Master Plan alternatives, depicted in Section 6, *Airfield Master Plan Alternatives*, were reviewed for inclusion in the RSA Study alternatives evaluation. Alternatives 4A and 4C have a more extensive eastward shift to accommodate a MALS on the Runway 05 end, as compared to Alternatives 7A and 7C. The MALS is a long-term need and is not necessary in the short-term. Thus, the further eastward shift for Alternatives 4A and 4C was deemed unnecessary in the short-term, and these alternatives were eliminated from further consideration in the RSA Study. (Both remain valid long-term alternatives in the Airfield Master Plan.)

Alternatives 7A and 7C reflect a lesser shift to the east with the goal of providing a standard RSA on the Runway 05 end without requiring fill on that end. As a result, both were carried forward into the RSA Study. Alternative 7A has a full-dimension RSA (no EMAS) whereas Alternative 7C has an EMAS on the Runway 23 end. Series 7 alternatives with EMAS on the Runway 05 end (Alternative 7B) and EMAS on both ends (Alternative 7D) were eliminated from consideration in the Airfield Master Plan mainly due to the need to place the Runway 23 end capture effect glide slope on the south side of the runway. As with the MALS, switching to a capture effect glide slope is considered a long-term need. For this RSA Study, continued use of an end-fire glide slope is sufficient, so it is appropriate to evaluate Alternatives 7B and 7D in the RSA Study. Alternatives 7A, 7B, 7C, and 7D from the Airfield Master Plan were therefore modified to reflect a 7,000-foot long runway. The four alternatives were assumed to include the following lighting and NAVAID changes:

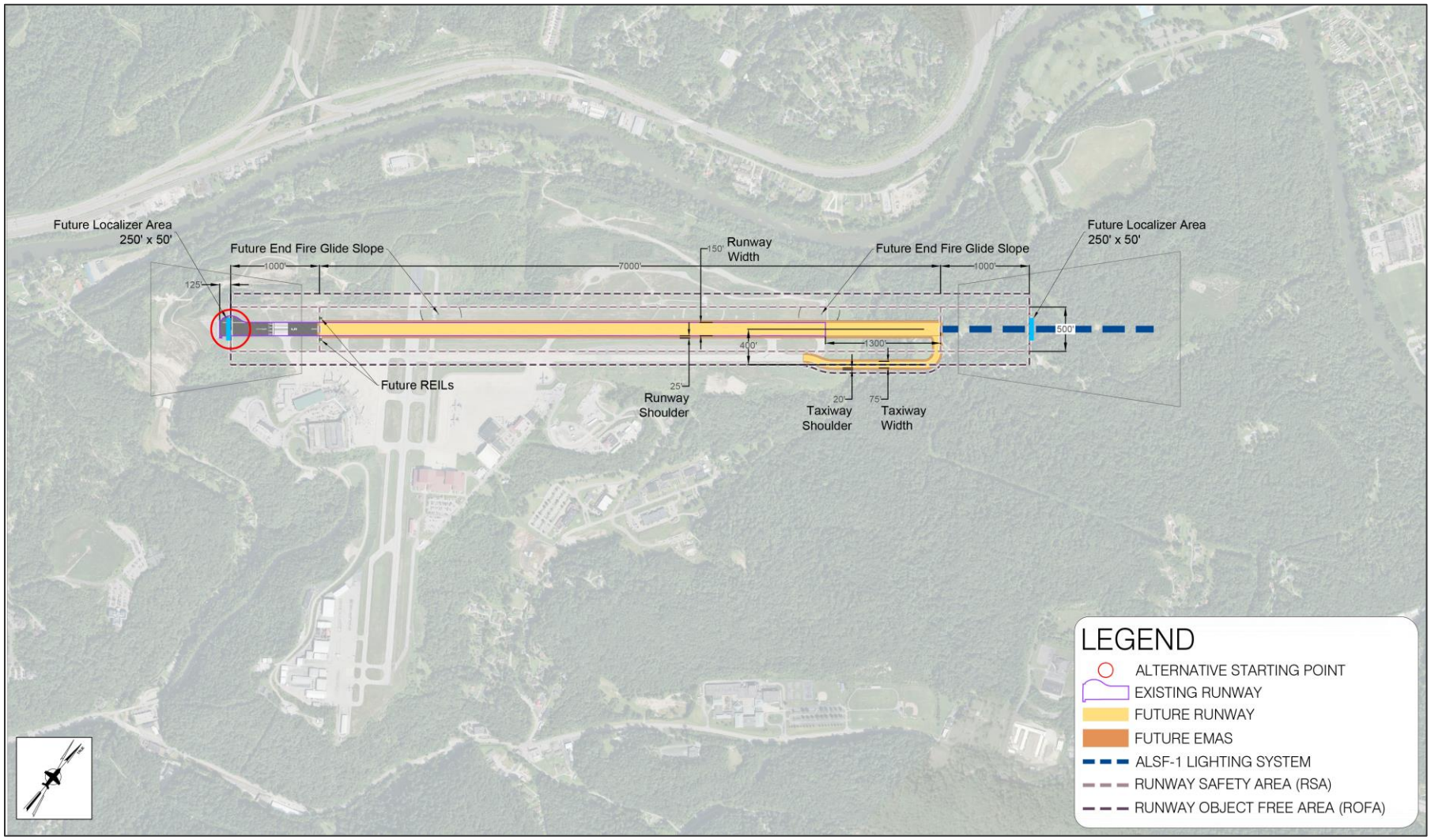
- Relocation of the Runway 05 and 23 localizers to the ends of the runway (both localizers are currently offset)
- Replacement of Runway 05 capture effect glide slope with an end-fire glide slope[7]
- Relocation of end-fire glide slope on Runway 23 end
- Relocation of the High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-1) on Runway 23 end
- No approach light system (ALS) on Runway 05 end

All four alternatives assume Taxiway A is extended to the relocated Runway 23 end at 400 feet of lateral separation between the runway and the taxiway. The existing portion of Taxiway A will not be relocated to the standard 400-foot separation as part of the RSA Study; it was assumed that CRW will continue to have a Modification of Standards (MOS) for the existing portion of Taxiway A.

The four alternatives were renumbered as Alternatives 1 through 4. The alternatives are shown on **Exhibit 8 through Exhibit 11**.

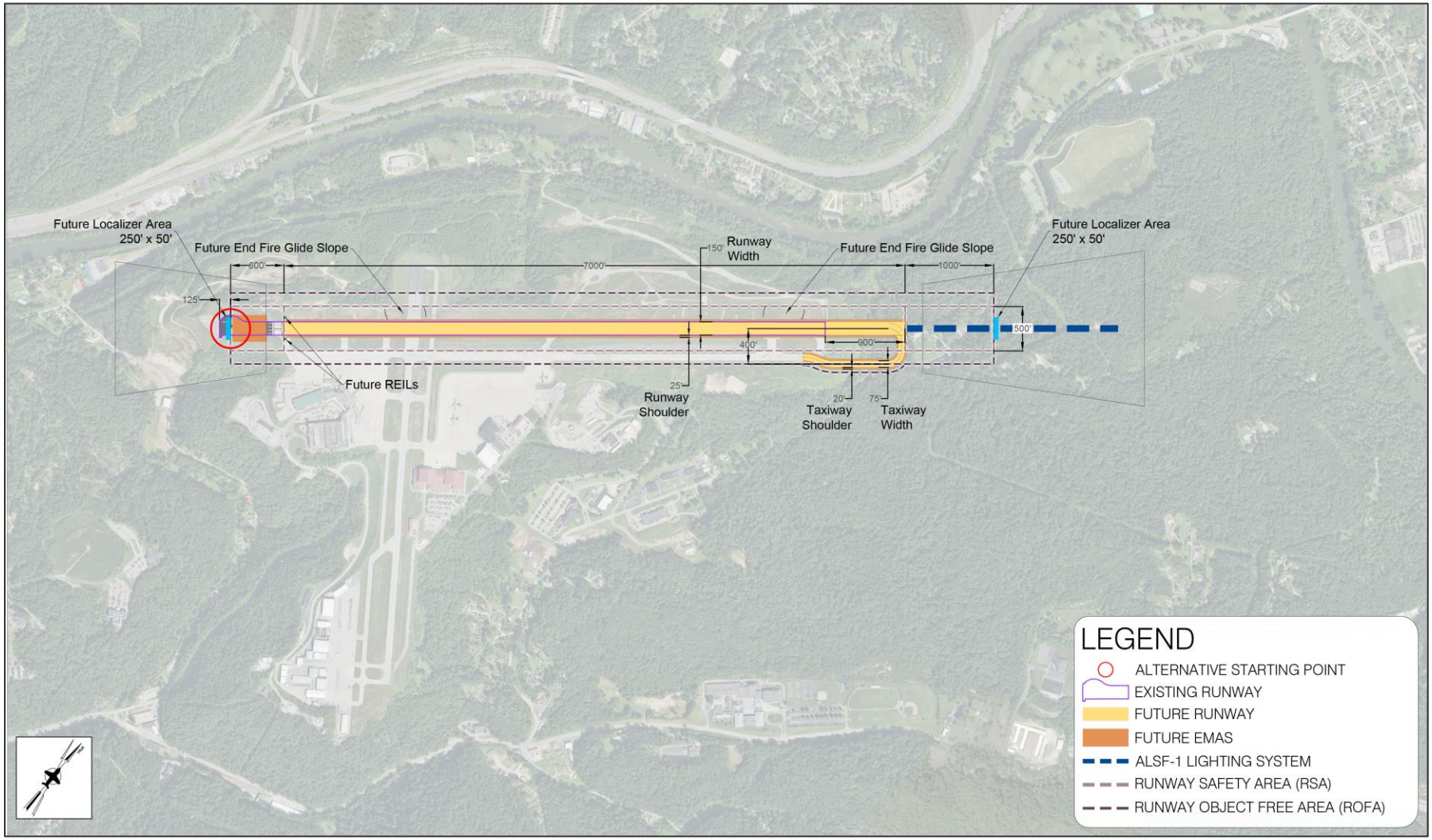
[7] The capture effect glide slope was assumed to be replaced with an end-fire glide slope because it is not known if the Runway 05 end can support the grading requirements associated with a capture effect glide slope.

EXHIBIT 8 RSA STUDY ALTERNATIVE 1 (7A)



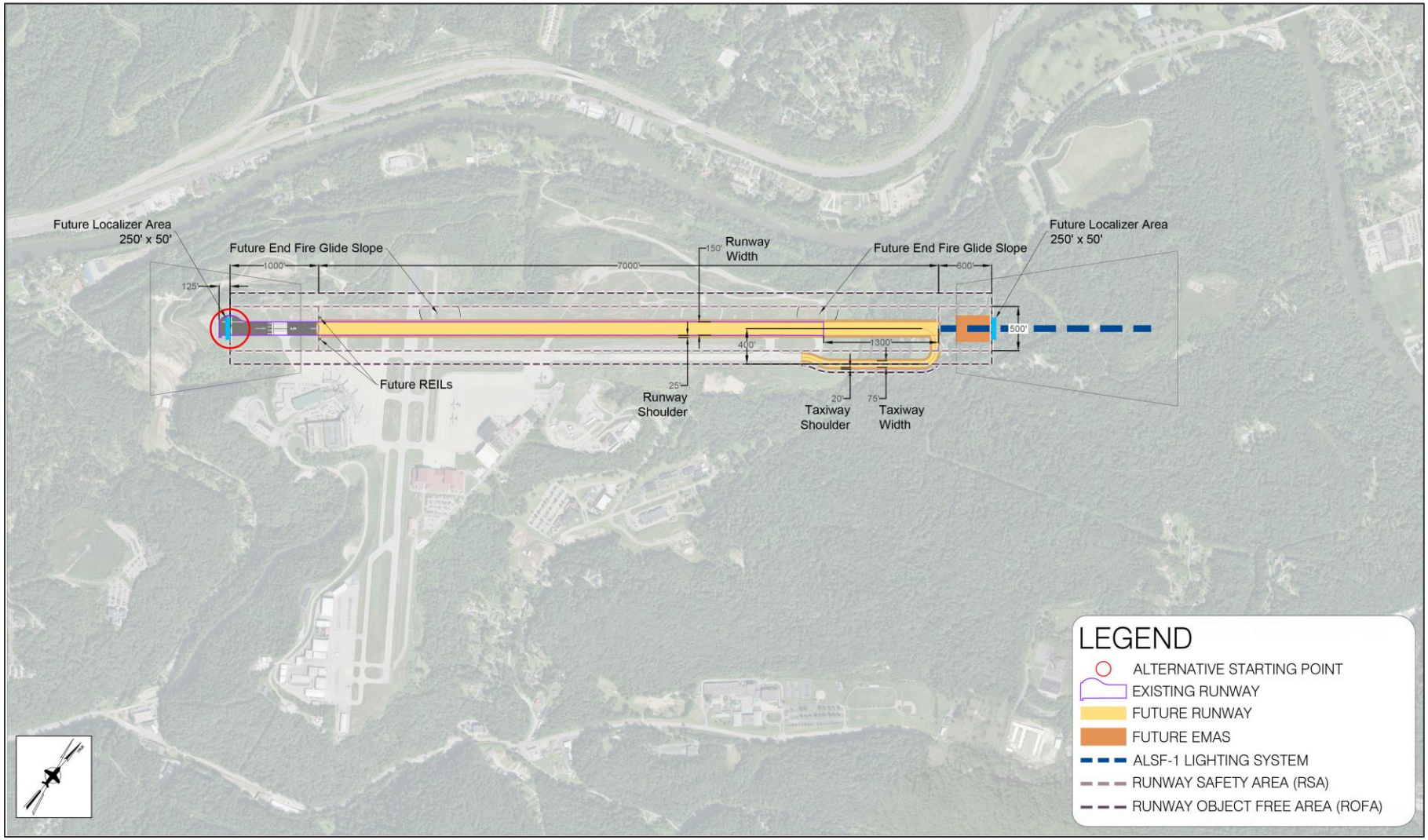
Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

EXHIBIT 9 RSA STUDY ALTERNATIVE 2 (7B)



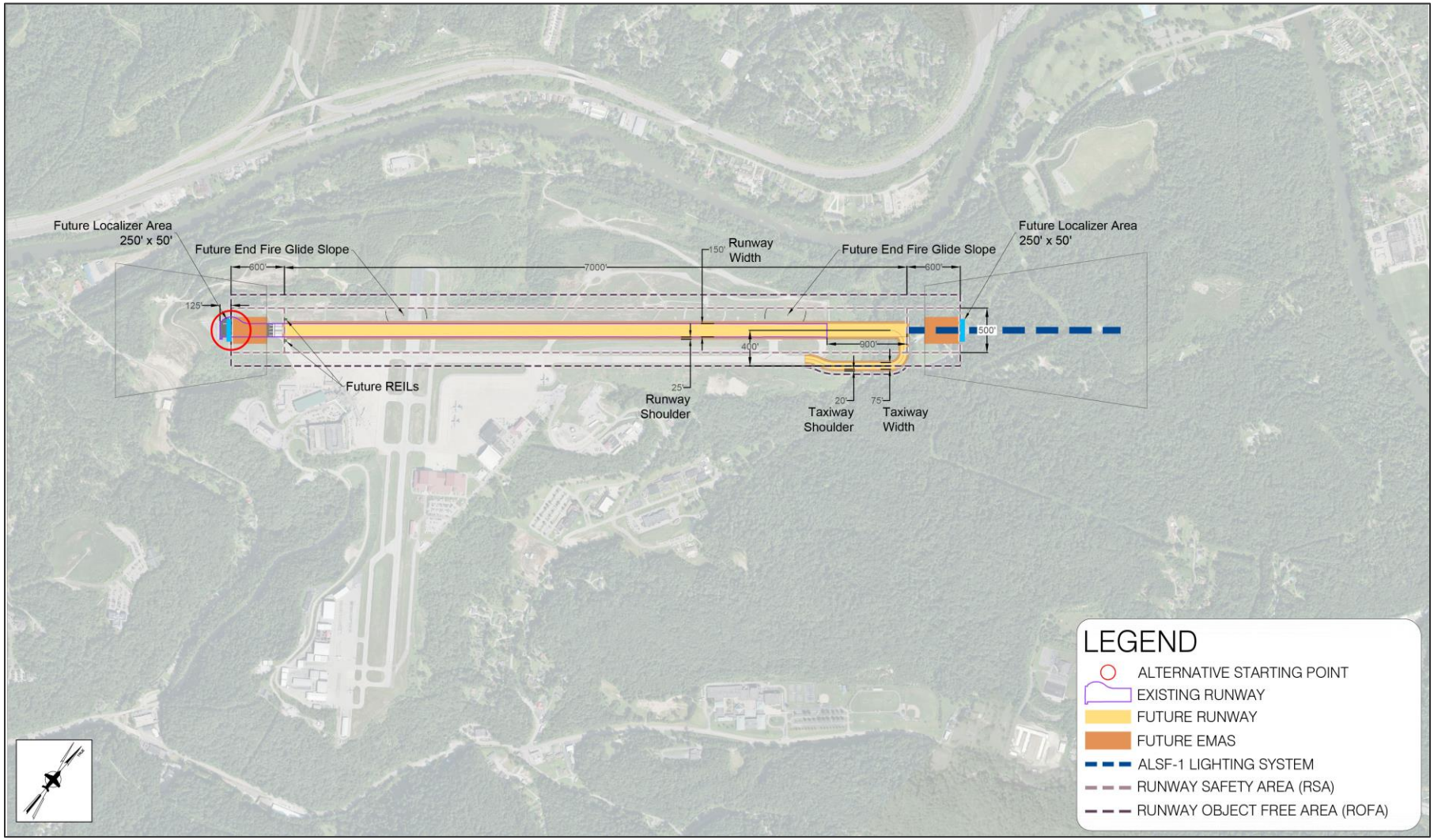
Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

EXHIBIT 10 RSA STUDY ALTERNATIVE 3 (7C)



Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

EXHIBIT 11 RSA STUDY ALTERNATIVE 4 (7D)



Sources: Aerial photography by Quantum Spatial, 2017; Landrum & Brown analysis.

7.2 Evaluation of RSA Study Alternatives

The four RSA Study alternatives were evaluated based on the following criteria:

- RPZ Impacts
- Runway Obstructions
- Environmental and Local Impacts
- Fill Volumes
- NAVAID Siting
- Cost
- Construction Phasing
- Implementation Time Frame
- EMAS Service Reliability

Each alternative was evaluated against the criteria and given a green, yellow, or red color in the final evaluation matrix based on that evaluation (see **Table 3, *Evaluation Criteria Color Definitions***). The definitions of these colors for each criterion are further defined in the subsections that follow. It is important to note that red does not necessarily mean an alternative is infeasible. Rather, the color coding is a tool to show minor (green), moderate (yellow), or more extensive (red) impacts.

TABLE 3 EVALUATION CRITERIA COLOR DEFINITIONS

Definition	Coloring
Minor	
Moderate	
More Extensive	

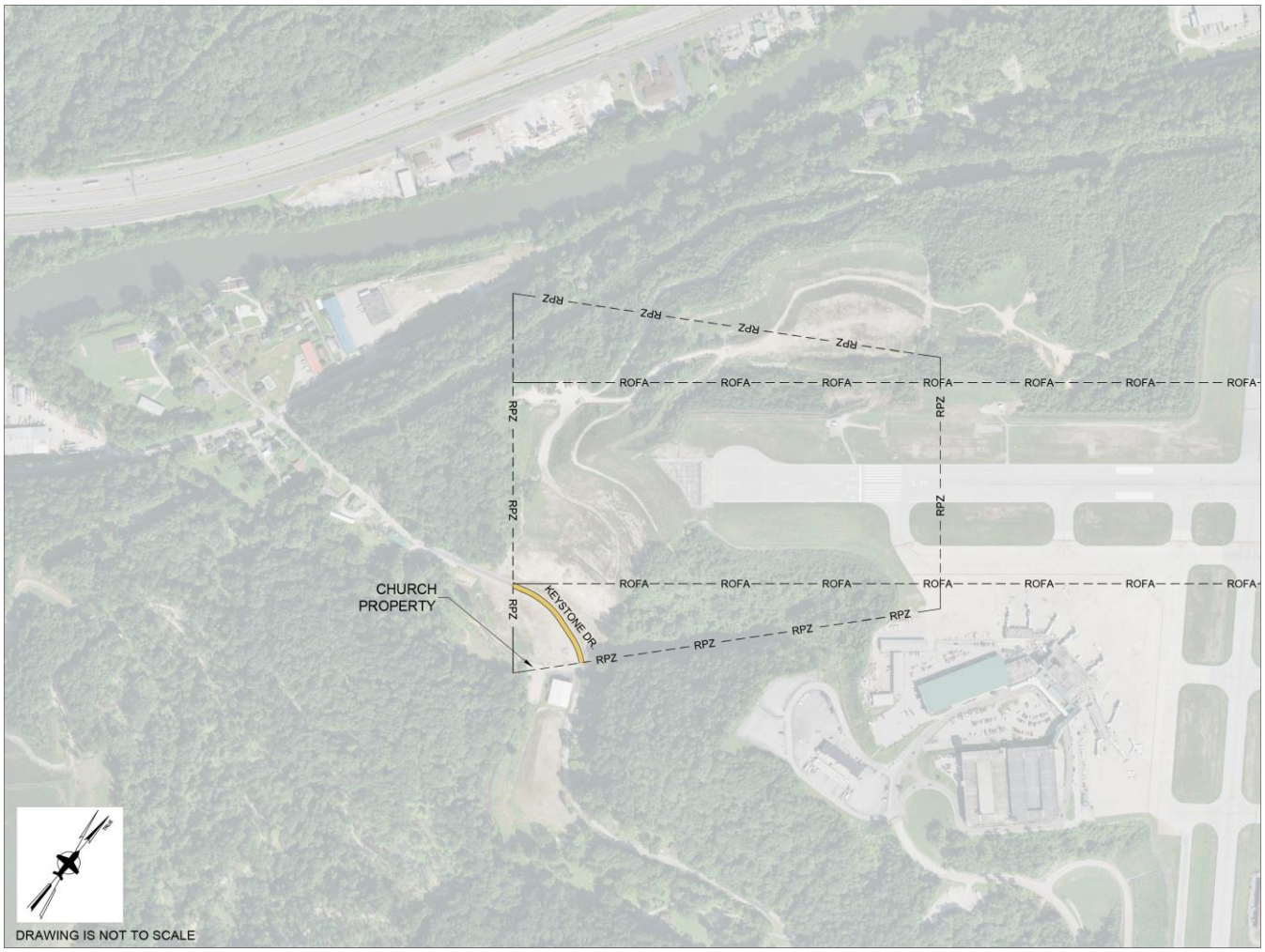
Source: Landrum & Brown Team analysis.

7.2.1 Runway Protection Zone (RPZ) Impacts

The first step in the evaluation process included the assessment of the RPZs in each of the alternatives. Structures and roads within the Runway 05 RPZ were identified as incompatible land uses for the four alternatives as shown on **Exhibit 12 through Exhibit 15**. The Runway 05 RPZ for Alternatives 1 and 3 was deemed minor in impact (green). It encompasses 440 linear feet of Keystone Drive and one church property. The Runway 05 RPZ impacts for Alternatives 2 and 4 are greater and were considered moderate in impact (yellow), encompassing 810 linear feet of Keystone Drive, 320 feet of Barlow Drive, and one business.

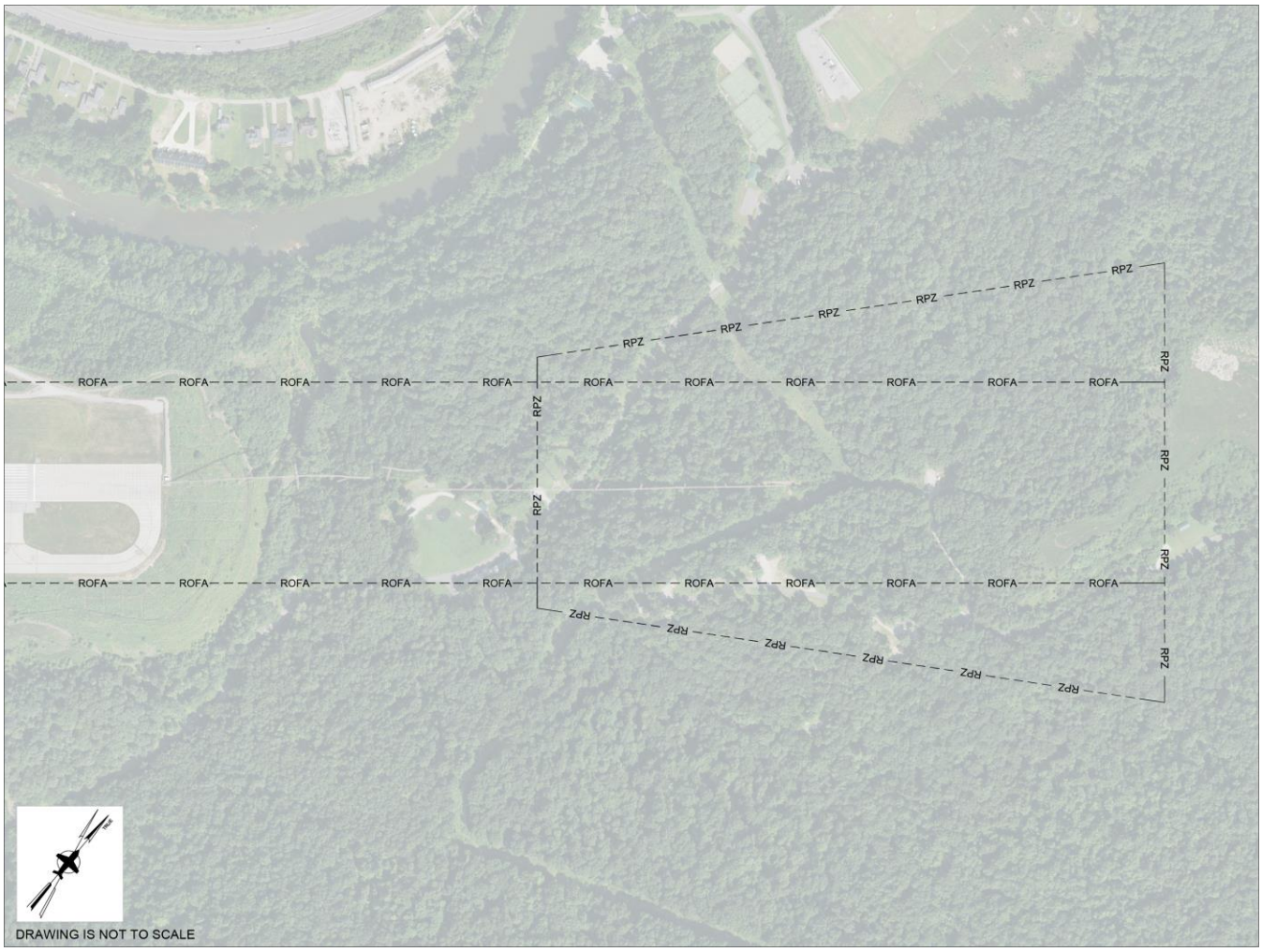
The Runway 23 RPZs impacts were also assessed. The Runway 23 RPZ is fully encompassed by Coonskin Park in all alternatives. The impact to the park was considered more severe (red) in all alternatives, as there are Section 4(f) and Section 6(f) lands, which would require significant environmental mitigation. Coonskin Park is owned by the CWVRAA but would still require mitigation that would need to be further analyzed.

EXHIBIT 12 ALTERNATIVES 1 AND 3 RUNWAY 05 RPZ



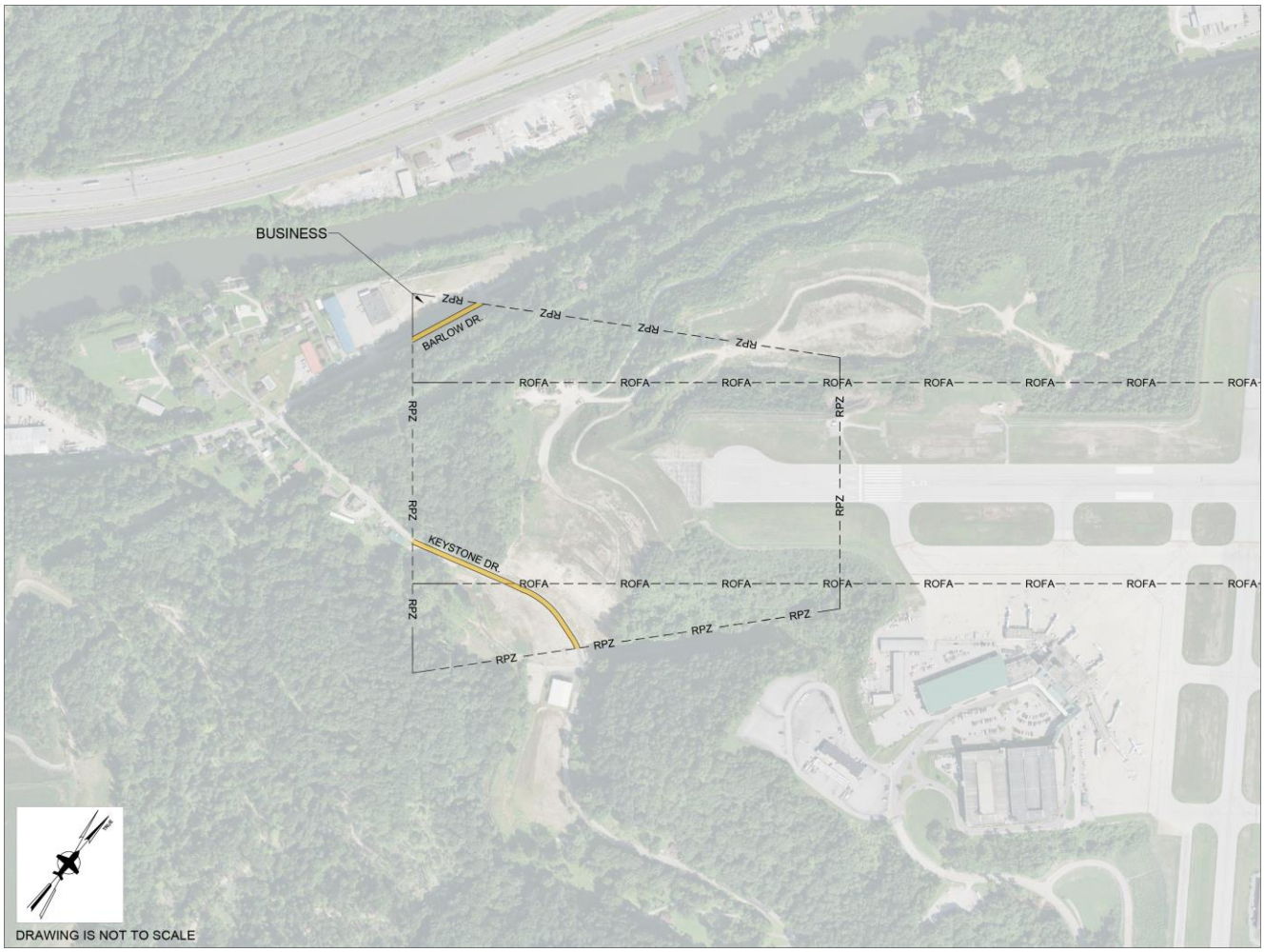
Source: Landrum & Brown analysis.

EXHIBIT 13 ALTERNATIVES 1 AND 3 RUNWAY 23 RPZ



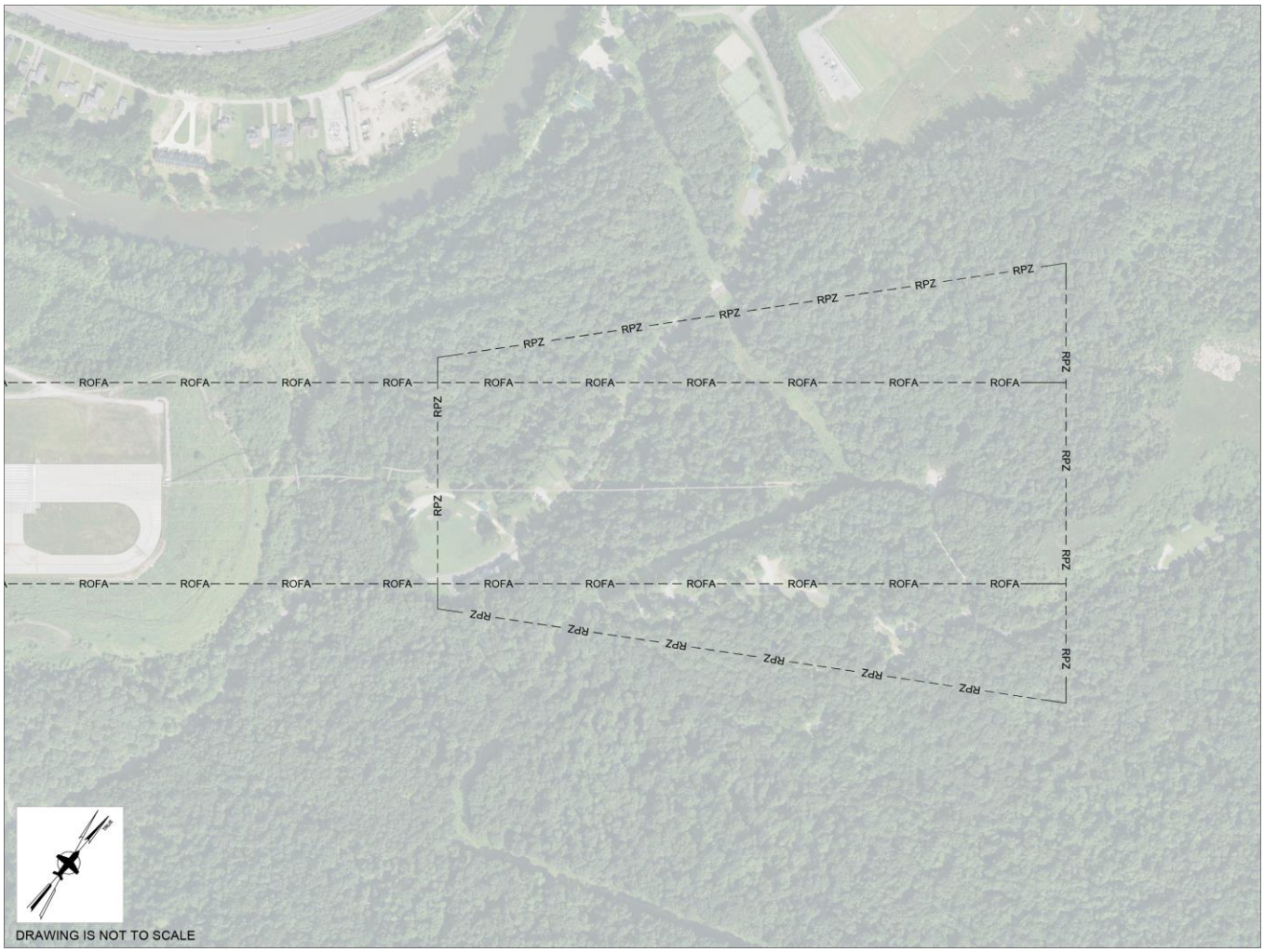
Source: Landrum & Brown analysis.

EXHIBIT 14 ALTERNATIVES 2 AND 4 RUNWAY 05 RPZ



Source: Landrum & Brown analysis.

EXHIBIT 15 ALTERNATIVES 2 AND 4 RUNWAY 23 RPZ



Source: Landrum & Brown analysis.

RPZ impacts for both runways are summarized in **Table 4, *RPZ Evaluation Summary***.

TABLE 4 RPZ EVALUATION SUMMARY

Alternative	Runway 5 RPZ Impacts	Runway 23 RPZ Impacts
1	Central Portion: 70 ft. of Keystone Drive Controlled Portion: 1 church property & 370 ft. of Keystone Drive	Fully encompassed within Coonskin Park/Airport property
2	Central Portion: 510 ft. of Keystone Drive Controlled Portion: 1 business, 300 ft. of Keystone Drive, & 320 ft. of Barlow Drive	Fully encompassed within Coonskin Park/Airport property
3	Central Portion: 70 ft. of Keystone Drive Controlled Portion: 1 church property & 370 ft. of Keystone Drive	Fully encompassed within Coonskin Park/Airport property
4	Central Portion: 510 ft. of Keystone Drive Controlled Portion: 1 business, 300 ft. of Keystone Drive, & 320 ft. of Barlow Drive	Fully encompassed within Coonskin Park/Airport property

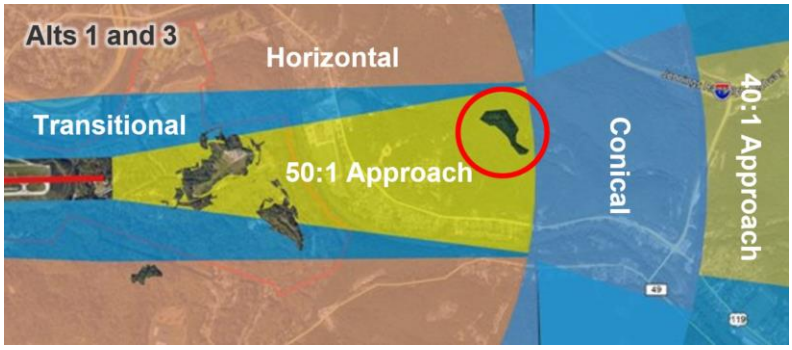
Source: Landrum & Brown analysis.

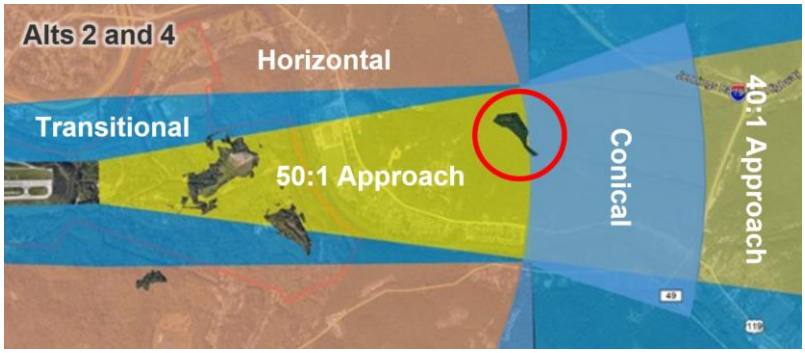
7.2.2 Obstructions

Obstructions to the Runway 23 Part 77 surfaces were evaluated for each of the alternatives to identify the extent of obstruction removal that may be required. The surfaces that were evaluated include the Part 77 50:1 approach, 40:1 approach, and inner transitional surfaces. The surfaces were brought into 3D Google Earth Terrain to show the penetrations of terrain and vegetation.

Exhibit 16*, Runway 23 Obstructions*, shows the areas that are considered obstructions to the Runway 23 approach. There are three areas with obstructions to the Runway 23 Part 77 50:1 approach surface, but two of these areas are encompassed within the borrow areas for the runway extension project and will not be obstructions once the runway is constructed. For this reason, these obstructions were not considered in this analysis. The areas circled in red are the only obstruction issues on the Runway 23 approach. This applies to all four alternatives.

EXHIBIT 16 RUNWAY 23 OBSTRUCTIONS

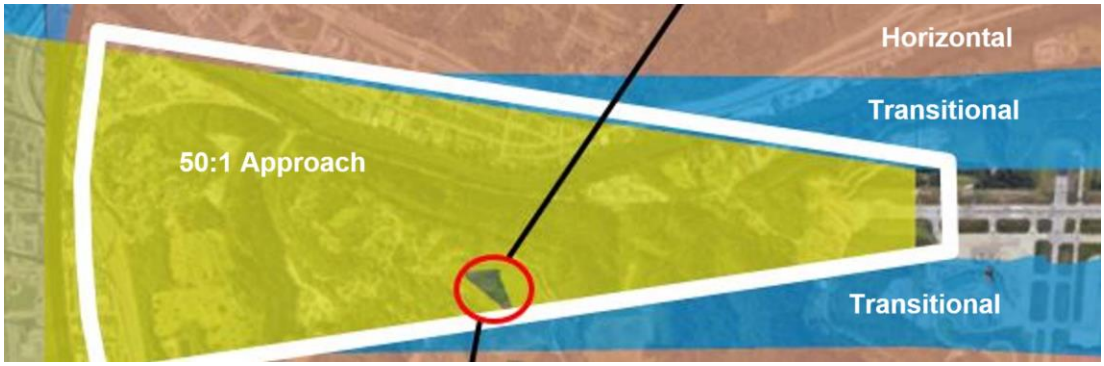




Note: Red area indicates obstructions that must be addressed. Other penetrations are in borrow areas.
Source: Landrum & Brown analysis.

On the Runway 05 end, Alternatives 2 and 4 have the same obstruction issues, while Alternatives 1 and 3 have none. The Alternatives 2 and 4 obstructions are shown on **Exhibit 17, *Runway 05 Obstructions for Alternatives 2 and 4.***

EXHIBIT 17 RUNWAY 05 OBSTRUCTIONS FOR ALTERNATIVES 2 AND 4



Note: Red area indicates obstructions that must be addressed.
Source: Landrum & Brown analysis.

The quantification of the terrain and vegetation impacts is shown in **Table 5, *Terrain and Vegetation Impacts***. The cost of clearing this amount of terrain and vegetation was estimated based on a unit cost of $3,000 per acre of vegetation and $4 per cubic yard of terrain. The estimated costs were developed for comparison purposes only; actual costs could differ. The actual costs could differ depending on many factors (such as the number of trees in an area, the type of terrain to be removed, etc.). Also, it is unknown at this time to which surface the FAA will require clearing. As a result, these costs were not included in the overall cost estimates for the alternatives. The terrain and vegetation volumes and mitigation costs were estimated to be higher with Alternatives 1 and 3 as compared to Alternatives 2 and 4.

TABLE 5 TERRAIN AND VEGETATION IMPACTS

RUNWAY	ALTERNATIVES 1 & 3	ALTERNATIVES 2 & 4
Rwy 05 Terrain (CY)	<1	63,432
Rwy 23 Terrain (CY)	426,554	299,297
Total Terrain (CY)	**426,554**	**362,729**
Rwy 05 Vegetation (acres)	0	1.7
Rwy 23 Vegetation (acres)	44.8	36.1
Total Vegetation (acres)	**44.8**	**37.8**
Estimated Cost	**$1.83M**	**$1.56M**

Sources: Schnabel Engineering and Landrum & Brown analysis.

Obstruction impacts for both runway ends are summarized in **Table 6, *Obstruction Evaluation Summary***. Obstruction impacts to Alternatives 1 and 3 are estimated to be nonexistent on the Runway 5 end (green) but major on the Runway 23 end (red). Meanwhile, both Runway 05 and 23 obstruction impacts to Alternatives 2 and 4 were considered to be moderate in impact (yellow).

TABLE 6 OBSTRUCTION EVALUATION SUMMARY

Alternative	Runway 5 Obstructions	Runway 23 Obstructions
1	<1 CY of terrain; 0 acres of vegetation clearing	426,600 CY of terrain; 45 acres of vegetation clearing
2	63,400 CY of terrain; 2 acres of vegetation clearing	299,300 CY of terrain; 36 acres of vegetation clearing
3	<1 CY of terrain; 0 acres of vegetation clearing	426,600 CY of terrain; 45 acres of vegetation clearing
4	63,400 CY of terrain; 2 acres of vegetation clearing	299,300 CY of terrain; 36 acres of vegetation clearing

Sources: Schnabel Engineering and Landrum & Brown analysis.

7.2.3 Environmental and Local Impacts

The objective of the analysis of environmental and local impacts was to estimate and evaluate the environmental and local impacts associated with the four alternatives (Alternatives 1 through 4). Alternatives 1 through 4 all had the following potential environmental impacts associated with their development:

- Loss of Wetlands
- 4(F) Impacts to Physical And Potential Constructive Use of Coonskin Park
- 6(F) Impacts to Replacement of Land and Resources purchased with Land and Water Conservation Funds
- Loss of Coonskin Branch Conservation Easement WV 401 / U.S. Army Corps of Engineers Section 404 Permit of the Clean Water Act (USACE 404)
- Impacts to Rare, Threatened and Endangered Species in Elk River
- Loss of Floodplain Storage due to placing fill over Coonskin Branch
- Cultural Resources Impacts
- and Noise-Compatible Land Use Issues
- Potential Air Quality Impacts including Construction Emissions
- Visual Effects of Project
- Compatible Land Use Impacts
- Socioeconomics, Environmental Justice, and Children's Environmental Health Impacts to Keystone Drive Residents and Coonskin Park Users
- Loss of return to service of inactive Norfolk Southern Corporation Railroad in Coonskin Park

The only differentiating environmental impacts were from the loss of portions of Coonskin Branch. Alternatives 2 and 4 had the least impact with a loss of 2,300 linear feet of Coonskin Branch, while Alternative 1 impacted 2,500 linear feet, and Alternative 3 had the greatest impact of 2,600 linear feet.

In additional to environmental impacts, local impacts were also evaluated for the four alternatives. All four of the alternatives had the following local impacts associated with their development:

- Closure or relocation of 8,500 linear feet of roadways for the borrow areas
- Loss of 20 picnic shelters and sites in Coonskin Park
- Loss of 10 hiking trails in Coonskin Park
- Interrupted access to the Kanawha Railroad Club
- Potential loss of return-to-service of inactive Norfolk Southern Corporation railroad that passes through Coonskin Park
- Closure of Coonskin Drive in Coonskin Park

7.2.4 Fill Volumes

Due to complexity of the terrain surrounding the Airport, some form of fill is needed for all four alternatives with some portions of fill and borrow areas extending beyond the Airport's property limit. Each alternative requires a 75-foot high retaining wall with a total retaining wall area of nearly 50,000 square feet on the Runway 23 end. The fill that would be required for each alternative varies from roughly 12.8 million cubic yards to nearly 17.0 million cubic yards.

The fill volumes for each alternative are summarized in **Table 7, *Fill Volume Evaluation Summary***. Alternative 1 (no EMAS) requires the most fill (red), while Alternative 4 (two EMASs) requires the least amount of fill (green). Alternatives 2 and 3 are similar and require moderate fill volumes (yellow). Alternative 3 is slightly higher due to the need for a longer Taxiway A extension, which requires more fill.

TABLE 7 FILL VOLUME EVALUATION SUMMARY

Alternative	Fill Volume	Retaining Wall Height
1	17.0M cubic yards	75 feet
2	15.0M cubic yards	75 feet
3	15.6M cubic yards	75 feet
4	12.9M cubic yards	75 feet

Source: Schnabel Engineering analysis.

7.2.5 NAVAID Siting

The ability to site NAVAIDS such as Airport Lighting Systems (ALSs), Runway End Identifier Lights (REILs), Precision Approach Path Indicators (PAPIs), localizers, and glide slopes was evaluated for each alternative. All ALSs, REILs, and PAPIs, can be in standard locations in all four alternatives, but will each have unique construction and grading impacts. It is important to note that for the localizers, the array is proposed to be located along the runway centerline and outside of the RSA, with full line-of-sight to the opposite runway end. End fire glide slope antennae are to be located inside of the RSA and ROFA. All associated equipment (shelters, equipment racks, disconnects, etc.) will be located outside of the RSA and ROFA.

All NAVAIDs will be designed and placed in locations that comply with the following FAA standards:

- FAA Order 6750.16E, Siting Criteria for Instrument Landing Systems
- FAA Advisory Circular 150/5300-13A, Airport Design
- FAA AC 150/5340-30E, Design and Installation Details for Airport Visual Aids

The performance of the NAVAIDs in the proposed locations for each alternative has not been modeled at this time. Modeling should be completed prior to the final relocation to identify any conflicts and required mitigation measures that may be needed.

The NAVAID siting impacts in each alternative were considered moderate (yellow) in impact and are summarized **Table 8, *NAVAID Siting Evaluation Summary***.

TABLE 8 NAVAID SITING EVALUATION SUMMARY

Alternative	NAVAID Siting Impacts
1	Moderate NAVAID siting challenges
2	Moderate NAVAID siting challenges
3	Moderate NAVAID siting challenges
4	Moderate NAVAID siting challenges

Source: ACDI analysis.

7.2.6 Cost

Cost plays a significant role in the evaluation of the alternatives. The cost of each alternative was calculated using an earthwork estimate of $4 per cubic yard based on industry and regional examples. However, the actual cost for earthwork could end up being higher, which would significantly affect the cost of each alternative. A set cost of $15.5 million was assumed for each alternative to mitigate environmental and local impacts to Coonskin Park (*see Section 7.2.3 Environmental and Local Impacts*). The cost of each alternative includes the following line items:

- Earthwork, Retaining Walls, and Tunnels
- Pavement and Markings
- EMAS (applicable on Alternatives 2, 3, and 4)
- NAVAID Installation
- Airfield Electrical Work
- Storm Drainage Systems
- Topsoil and Seeding
- Fencing and Perimeter Controls
- Coonskin Park Mitigation
- Design Contingency
- Construction Security Plan
- Additional Program Costs (Design and Cost Management and Inspection (CMI) Fees)

Obstruction mitigation costs were not considered at this time since it is unknown which surface the Airport will be required to clear. Those costs should be considered once the preferred alternative is selected.

Cost estimates for each alternative are summarized **Table 9, *Cost Estimates Evaluation Summary***. Alternatives 1 and 3 have the highest costs (red), while Alternative 4 has the lowest cost (green), and Alternative 2 has moderate cost (yellow).

TABLE 9 COST ESTIMATES EVALUATION SUMMARY

Alternative	Cost Estimates
1	$168 million
2	$163 million
3	$168 million
4	$159 million

Source: Schnabel Engineering and ADCI analysis.

7.2.7 Construction Phasing

Construction phasing plays an important role in developing the alternatives at CRW, especially because the Airport has only one operational runway. Even though each alternative would result in a different geometric layout for the Airport, there are some construction phasing impacts that would be consistent for all four alternatives. These include the following:

- A minimum runway length of 6,715’ can be available during peak aircraft activity periods throughout construction.
- One precision instrument approach (ILS) can be maintained/available throughout construction.
- Construction must remain clear of the RSA while the runway is open.
- Construction must remain clear of approach and departure surfaces while the runway is open.
- The Runway 23 ALS will be out of service for an extended period while the new system is installed.
- Each alternative will have approximately similar numbers of nightly closures, which will be increased for the options that include EMAS installation.
- Each ILS (Runway 05 and Runway 23) will be temporarily out of service while the new one is “burned in”.
- The runway will likely need to be closed for two extended periods (likely over weekends) during conversion activities, including switching to the new lighting, localizer, glide slopes, and markings, and switching to the final threshold configuration on both runway ends.

To minimize operational impacts to air service at CRW, it has been determined that construction for each alternative should commence on the Runway 23 end, due to the ability to conduct most initial construction activities outside of the RSA. The primary operational impacts to be considered include:

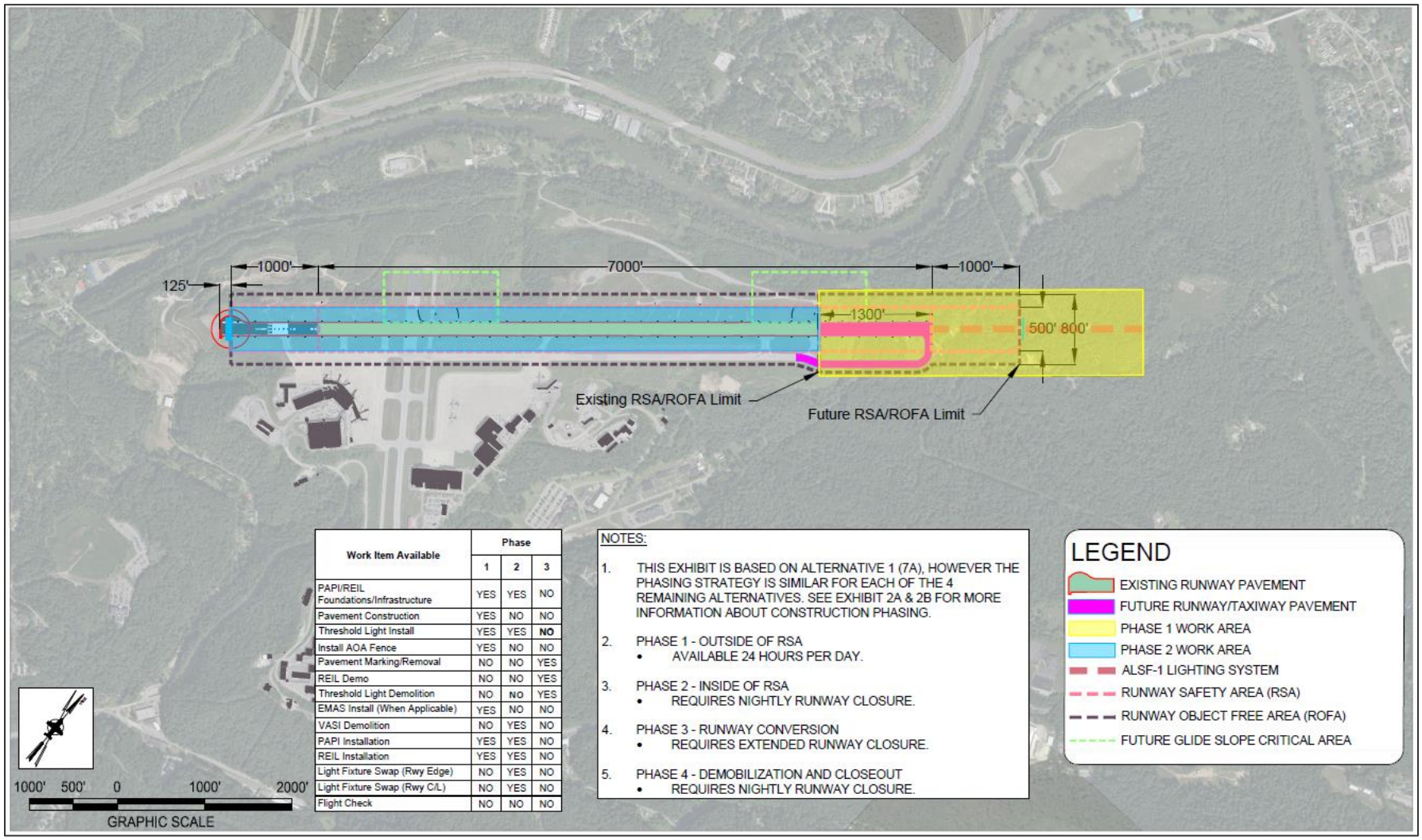
- Timing and duration of reduced approach minimums due to loss of ALS;
- The existing ALS may need to be decommissioned for several months, based on the practicality of maintaining the system during construction.
- Timing and duration of loss of ILS approach due to NAVAID relocation and commissioning;
- Overall duration of construction contract due to project phasing and complexity;
- Duration, number, and nature of runway closures required for construction within the RSA.

The construction phasing would be broken into four phases and include the following major projects in each phase:

- Phase 1: Work conducted outside of the RSA, which allows the runway to be available 24 hours per day
- Phase 2: Working conducted inside the RSA, which requires nightly runway closures
- Phase 3: Runway conversion, which requires runway closure for an extended amount of time
- Phase 4: Demobilization and closeout, which requires nightly runway closure

A conceptual layout of construction phasing plan is shown in **Exhibit 18, *Construction Phasing Plan***.

EXHIBIT 18 CONSTRUCTION PHASING PLAN



Work Item Available	Phase		
	1	2	3
PAPI/REIL Foundations/Infrastructure	YES	YES	NO
Pavement Construction	YES	NO	NO
Threshold Light Install	YES	YES	**NO**
Install AOA Fence	YES	NO	NO
Pavement Marking/Removal	NO	NO	YES
REIL Demo	NO	NO	YES
Threshold Light Demolition	NO	NO	YES
EMAS Install (When Applicable)	YES	NO	NO
VASI Demolition	NO	YES	NO
PAPI Installation	YES	YES	NO
REIL Installation	YES	YES	NO
Light Fixture Swap (Rwy Edge)	NO	YES	NO
Light Fixture Swap (Rwy C/L)	NO	YES	NO
Flight Check	NO	NO	NO

Source: ADCI analysis.

The overall construction phasing is expected to be similar for each of the four alternatives, especially the timing and duration associated with the reduced approach minima and ILS approach. However, the operational impacts and the overall duration of construction are expected to vary with each alternative, mostly due to the requirements for runway closures.

The four alternatives were ranked based on the severity of the construction phasing for each alternative and result in the following:

- Alternative 1: Has the lowest construction phasing impacts (green) to the airfield since there is no EMAS installation on either end of the runway. The complexity of the construction and phasing would be less complicated, and the overall duration of construction would be reduced.
- Alternatives 2 and 3: Have moderate construction phasing impacts (yellow) to the airfield since each alternative contains EMAS on one runway end. The complexity of construction phasing would become more complicated and the overall duration of construction would increase compared to Alternative 1. Runway closures would likely have to be coordinated for EMAS work on one end of the runway, as well as ALS and NAVAID installation and implementation on both ends.
- Alternative 4: Has the most severe construction phasing impacts (red) to the airfield with the installation of EMAS on both runway ends, in addition to ALS and NAVAID installation and implementation. When compared to Alternatives 1 through 3, this option would require the highest complexity of construction and phasing and would require multiple runway closures for construction within the RSA.

Construction phasing for each alternative is summarized **Table 10, *Construction Phasing Evaluation Summary***.

TABLE 10 CONSTRUCTION PHASING EVALUATION SUMMARY

Alternative	Construction Phasing
1	Least Complex
2	Moderate Complexity
3	Moderate Complexity
4	Most Complex

Source: ADCI analysis.

7.2.8 Implementation Time Frame

Implementation time frame was an important consideration in the evaluation of the four alternatives. Like the considerations for construction phasing, the implementation time frame was found to be similar for each of the four alternatives. However, the overall duration of construction will vary slightly within each alternative, mostly due to the earthwork requirements for cut and fill operations off the Runway 23 end. The alternatives were ranked based on the severity of the implementation time frame for each alternative, with the shortest construction time frame ranking the lowest in severity and the longest construction time frame ranking the highest in severity. The usage of this criteria resulted in the following:

- Alternative 1: Ranked as the longest in duration (red) for implementation time frame. Although it would contain the least amount of construction because there is no EMAS involved, it also would contain the greatest earthwork quantities due to the longer RSAs, and thus resulted in the longest implementation time frame.
- Alternatives 2 and 3: Both ranked as moderate (yellow) in duration for implementation time frame. The complexity and construction of the project was considered moderate due to the installation of one EMAS bed. In addition, the earthwork associated with Alternatives 2 and 3 was considered moderate. Due to these two factors, the implementation time frame was considered moderate in duration from a construction perspective and ranked in the middle.
- Alternative 4: Ranked as the shortest in duration (green) for implementation time frame. Although this alternative would have the highest complexity and construction phasing due to the installation of EMAS beds on both runway ends, the alternative would require the least amount of earthwork and thus resulted in the shortest implementation time frame.

Implementation time frame for each alternative is summarized **Table 11, *Implementation Time Frame Evaluation Summary***.

TABLE 11 IMPLEMENTATION TIME FRAME EVALUATION SUMMARY

Alternative	Implementation Time Frame
1	Longest Time Frame
2	Moderate Time Frame
3	Moderate Time Frame
4	Shortest Time Frame

Source: ADCI analysis.

7.2.9 EMAS Service Reliability

EMAS service reliability is a significant factor in determining the future of Runway 05-23 at CRW due to the ever-changing EMAS industry and EMAS providers. Alternative 1 does not require EMAS, Alternatives 2 and 3 have an EMAS on one end, and Alternative 4 has EMAS on both ends.

Zodiac Aerospace, the only EMAS provider in the U.S., has recently announced it will no longer manufacture EMAS. In fact, the EMAS that is currently under construction for Runway 05 at CRW is the last EMAS that will be produced by Zodiac. Runway Safe, another EMAS manufacturer, has the ability to manufacture a different type of EMAS but was sued by Zodiac (formerly ESCO) in recent years. A settlement reached in 2016 precludes Runway Safe from manufacturing EMAS for an unknown number of years. It is also unknown at this time whether Runway Safe will be able to service or replace EMASs previously constructed and installed by Zodiac. If, and when, Runway Safe is able to operate in the U.S., it is uncertain whether they will use differing materials that may require a different EMAS bed length further complicating the useful life of any EMAS bed installed at CRW by Zodiac. There is currently much uncertainty in the EMAS industry, which further complicates the service reliability of installing EMAS at the Airport.

Given the uncertainty regarding the availability of EMAS, the FAA is requesting that airports with EMAS systems submit an operating plan in the event the EMAS is used and cannot be replaced due to the product being unavailable at this time. This uncertainty heavily weighs on the evaluation of the alternatives in this study and was highly regarded when determining a preferred alternative. The most likely operating plan at CRW would be a reduction in runway length to provide a full-dimension RSA, thus decreasing the operational capability of an airport.

These developments make it clear that having just one or no EMAS providers put airports with EMAS at risk of losing air service due to reduced runway length. This risk is particularly high at an Airport like CRW that has only one runway. As a result, the evaluation of alternatives considered the declared distances that would be available if the proposed EMAS could not be used. **Table 12, *Declared Distances without EMAS (in feet)***, lists the declared distances that would be available for each alternative in such a case.

TABLE 12 DECLARED DISTANCES WITHOUT EMAS (IN FEET)

DECLARED DISTANCES	ALT 1		ALT 2		ALT 3		ALT 4	
	RWY 05	RWY 23	RWY 05	RWY 23	RWY 05	RWY 23	RWY 05	RWY 23
TORA/TODA	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
LDA	7,000	7,000	7,000	6,600	6,600	7,000	6,600	6,600
ASDA	7,000	7,000	7,000	6,600	6,600	7,000	6,600	6,600

Notes: 1. TORA = Takeoff Run Available; TODA = Takeoff Distance Available; LDA = Landing Distance Available; ASDA = Accelerate-Stop Distance Available.
2. Distances that would be reduced if the EMAS was unusable are shown in red.

Sources: 2018 Interim Runway Safety Area Study; Landrum & Brown analysis.

Alternative 1 has no EMAS and the air service risk for this alternative is nonexistent (green). As a result, this analysis is not applicable to Alternative 1 and its declared distances would remain unchanged.

Alternative 2 has an EMAS on the Runway 05 end. If this EMAS was unavailable, the Runway 23 LDA and ASDA would have to be reduced to 6,600 feet to provide a 1,000-foot long RSA beyond the runway end. Runway 23 is the preferred operating direction for CRW and aircraft are taking off uphill, which increases takeoff length requirements. As a result, this alternative would have a high risk of losing air service in the event the EMAS is unavailable (red).

Alternative 3 has EMAS on the Runway 23 end. If this EMAS was unavailable, the Runway 05 LDA and ASDA would have to be reduced to 6,600 feet to provide a 1,000-foot long RSA beyond the runway end. Runway 05 operations occur less often than the Runway 23 direction and aircraft are taking off downhill, which reduces runway length requirements. Thus, the air service risk would be lower but still considered moderate for this alternative if the EMAS is unavailable (yellow).

Alternative 4 has EMAS on both runway ends, resulting in a high risk of losing air service in the Runway 23 direction (similar to Alternative 2) but less of a risk in the Runway 05 direction (similar to Alternative 3). The air service risk for Alternative 4 would therefore be high (red) like Alternative 2.

The air service risk for each alternative is summarized **Table 13, *Air Service Risk Evaluation Summary***.

TABLE 13 AIR SERVICE RISK EVALUATION SUMMARY

Alternative	Air Service Risk
1	No air service reliability risk
2	Could lose runway length in 23 direction
3	Could lose runway length in 05 direction
4	Could lose runway length in 05 and 23 directions

Source: Landrum & Brown analysis.

One of the main objectives of this study is to provide a certain air service capability comparable to the airfield amenities available prior to the 2015 slope failure. The preferred alternative selected in this study should meet the main objectives of this study in all facets, including situations where the EMAS may not be available for future use.

7.2.10 Selection of Preferred Alternative

The four alternatives were evaluated against one another using the results of each evaluation criteria discussed in Sections 7.2.1 through 7.2.9 to determine the preferred alternative moving forward. Some criteria categories were not considered in the final evaluation since there was no differentiation between alternatives within that category. The following categories were not used to determine the preferred alternative due to this reason:

- Runway 23 RPZ Impacts: All alternatives contain severe Runway 23 RPZ impacts to Coonskin Park so there was no differentiation between the alternatives in this category
- Environmental and local impacts: All alternatives differed slightly but all four alternatives were considered to have severe impacts in this category.
- NAVAID Siting: All alternatives posed moderate challenges with siting NAVAIDs so this criteria was not used in the overall final evaluation.

The remaining evaluation criteria were considered in determining a preferred alternative. Differentiation of each alternative within those categories is summarized in **Table 14**, ***Summary of Final Evaluation Criteria***.

Alternative 1 was found to have the least amount of Runway 05 impacts, the least complex construction phasing, and no air service risk due to EMAS. However, it would require higher obstruction clearing than Alternatives 2 and 4, the highest fill volume/highest cost, and the longest construction time frame.

Alternative 2 was found to have the lowest obstruction clearing requirements, but the highest Runway 05 RPZ impacts. It ranks mid-range for fill volumes, cost, phasing complexity, and implementation time frame. This alternative would have the highest air service risk due to having an EMAS on the Runway 05 end.

Similar to Alternative 1, Alternative 3 was found to have the least amount of Runway 05 impacts, but the highest obstruction clearing requirements. It ranks mid-range for fill volume, phasing complexity, and implementation time frame. The analysis shows that it has the second highest cost and moderate air service risk due to having an EMAS on the Runway 23 end.

Alternative 4 is similar to Alternative 2 in that it was found to have the lowest obstruction clearing requirements, but the highest Runway 05 RPZ impacts. It has the lowest fill volumes/cost and the shortest construction time frame. The provision of EMAS on both ends results in it having the most complex construction phasing and the highest air service risk.

In terms of the first six evaluation criteria related to impacts, cost, and construction issues, all of the alternatives could be implemented. The biggest issue of the seven evaluation criteria is air service risk. As previously mentioned, the EMAS industry is facing a time of uncertainty in the coming years and EMAS may not be available if CRW needs to repair or replace an EMAS. Alternatives 2 and 4 pose the highest risk of losing air service in the preferred operating direction due to the EMAS service reliability issue. Alternatives 2 and 4 would have to sacrifice needed runway length if an EMAS went out of service and could not be repaired or replaced in the future. Alternative 1 offers no service reliability risk since an EMAS is not required and Alternative 3 offers minimal risk since losing air service in the secondary operating configuration is better than losing air service in the preferred operating configuration. As a result, Alternatives 2 and 4 are not considered viable alternatives.

The final remaining alternatives are therefore Alternatives 1 and 3. The two alternatives were compared against each other to determine the preferred alternative. Alternatives 1 and 3 have similar RPZ impacts, obstruction clearing requirements, and cost. Alternative 1 is estimated to require more fill so this alternative would require a slightly longer implementation time frame, whereas Alternative 3 has one EMAS so construction phasing is somewhat more complex. The EMAS in Alternatives 3 would require replacement after 20 years due to its aging lifespan, thus increasing the cost associated with the alternative. Over the next 20 years, it is also uncertain whether EMAS technology will be available

to be replaced (this issue caused the elimination of Alternatives 2 and 4). This uncertainty could result in decreased runway length available for CRW users. For these reasons, Alternative 1 was selected as the preferred alternative and is recommended moving forward.

TABLE 14 SUMMARY OF FINAL EVALUATION CRITERIA

Alt.	Runway 5 RPZ	Obstructions	Fill Volume	Cost (millions)	Construction Phasing	Implementation Time Frame	EMAS Service Reliability
1	Church property; 440' LF of roads	426,600 CY of terrain; 45 acres of vegetation clearing	17.0M cubic yards	$168	No EMAS so least complex	Longest	No service reliability risk
2	One business; 1,130 LF of roads	362,700 CY of terrain; 38 acres of vegetation clearing	15.0M cubic yards	$163	EMAS on one end so moderate complexity	Moderate	Highest risk of losing some air service in preferred operating direction
3	Church property; 440' LF of roads	426,600 CY of terrain; 45 acres of vegetation clearing	15.6M cubic yards	$168	EMAS on one end so moderate complexity	Moderate	Some risk of losing some air service in secondary operating direction
4	One business; 1,130 LF of roads	362,700 CY of terrain; 38 acres of vegetation clearing	12.9M cubic yards	$159	EMAS on two ends so most complex	Shortest	Highest risk of losing some air service in preferred operating direction

Notes: Table only shows results that differentiate the alternatives.
Sources: Landrum & Brown Team analysis.

8 NAVAID Modeling

TO BE PROVIDED AFTER APPROVAL OF THE PREFERRED ALTERNATIVE

9 Environmental Overview

The National Environmental Policy Act (NEPA) significantly affects airport planning by requiring that environmental impacts of proposed airport development be considered early and throughout the planning process. Environmental feasibility is as important as economic or engineering feasibility in determining how an airport will be developed. Environmental factors must be considered during the deliberation and analysis of alternatives to avoid the selection of a concept that is later rejected because of its environmental impacts.

This section provides a preliminary overview of the environmental conditions surrounding CRW and the alternatives described in this RSA Study. The overview is provided, not to resolve potential environmental issues, but to identify the scale of potential issues and identify areas that need additional investigation. Existing data, including maps of the airport area, prior environmental reports, and publicly available information from Federal, state, and local agencies were used to document environmental resources in and around the Airport site. Data gaps or environmental resources that may need additional study, investigation, or analysis were identified. The information collected for this environmental overview will serve to support the decision-making process and to aid future NEPA reviews.

9.1 Environmental Impact Categories

This preliminary overview identifies potential environmental issues associated with RSA Study alternatives. The FAA examines the NEPA environmental impact categories to determine applicability for its actions. As identified in FAA Order 1050.1F, the NEPA environmental impact categories are:

- Air Quality
- Biological Resources
- Climate
- Coastal Resources (Coastal Barriers and Coastal Zones)
- Department of Transportation Act Section 4(f) Resources
- Farmlands
- Hazardous Materials, Solid Waste, and Pollution Prevention
- Historical, Architectural, Archeological, and Cultural Resources
- Land Use
- Natural Resources and Energy Supply
- Noise and Noise-Compatible Land Use
- Socioeconomics, Environmental Justice, and Children’s Environmental Health and Safety Risks
- Visual Effects
- Water Resources
- Wetlands
  - Floodplains
  - Surface Water
  - Groundwater
  - Wild and Scenic Rivers

9.2 Area of Investigation

The RSA Study area of investigation provides a geographic area within which the environmental features that potentially could be impacted by the RSA alternatives are identified. The RSA Study area of investigation does not confirm that impacts will occur to an environmental resource rather that the potential for impacts exists.

The area of investigation includes areas where potential direct impacts may result from construction and ground disturbance activities. The area of investigation also includes a larger area where indirect impacts such as noise or visual impacts may result from the RSA alternatives.

9.3 Air Quality

9.3.1 Existing Conditions

The Airport is located in Kanawha County, West Virginia. According to the U.S. Environmental Protection Agency (EPA) Green Book, in the past Kanawha County's levels of fine particulate matter ($PM_{2.5}$) exceeded the Federal standards defining healthful air quality. On April 30, 2014, the EPA determined the area had attained the standard for $PM_{2.5}$ and was re-designated as a maintenance area. West Virginia has prepared a state implementation plan that sets forth the strategy intended to maintain the quality of the air relevant to the Federal air quality standards. Kanawha County was determined to be in attainment for all other Federally-regulated air quality standards in effect at the time of the preparation of this document.

9.3.2 Summary of Air Quality Considerations

Two primary laws apply to air quality: NEPA and the Clean Air Act including the 1990 Amendments (CAA). The use of construction equipment and vehicles for the development of the RSA Study alternatives would cause emissions of ($PM_{2.5}$). As such, the project would be subject to the General Conformity provisions under the CAA, which are required to ensure compliance with the West Virginia state implementation plan. In addition to the CAA, the impacts of any potential proposed project would require assessment under the provisions of NEPA to determine compliance to the Federal air quality standards, referred to as the National Ambient Air Quality Standards (NAAQS).

In order to determine the potential impact to regional air quality, an assessment of air quality would need to be prepared in accordance with FAA Orders 5050.4B and 1050.1F to determine the net emissions resulting from construction and operation of the preferred alternative and any alternative under consideration in a NEPA document.

An emissions inventory would need to be prepared for each project alternative, including the no-build alternative. A General Conformity evaluation would be required to determine net emissions from construction and implementation. Emissions of $PM_{2.5}$ on a project level are evaluated based on the rate of emissions of $PM_{2.5}$ and its precursor pollutants, SOx, NOx, and VOC. The net emissions of $PM_{2.5}$ and the precursor pollutants would be evaluated and compared against the minimum threshold of 100 tons per year. If emissions exceed applicable *de minimis* thresholds, dispersion analysis may be required for the air quality assessment. Because of the large quantities of fill that may be needed, it would be important to determine the locations where the fill may come from in order to estimate potential vehicles trips to the construction site.

CRW was awarded a grant through the Voluntary Low Emissions Program (VALE). Through this program CRW installed ground power units and pre-conditioned air to each jet bridge to reduce emissions. If the Air Quality General Conformity evaluation finds net emissions of the pollutants of concern are above the minimum threshold of 100 tons per year, VALE credits could be applied to reduce emissions below the threshold to meet General Conformity requirements under the Clean Air Act.

9.4 Biological Resources

9.4.1 Existing Conditions

Biological resources include fish, wildlife, plants, and their respective habitats. A biotic community is an assemblage of living things residing together, including both plants and animals. The Endangered Species Act of 1973 (ESA), as amended, provides for the protection of certain plants and animals, as well as the habitats in which they are found.

Information from the U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation (IPaC) system was obtained to determine the species list that could be affected by the RSA Study alternatives. According to the USFWS, there are 15 Federal and state listed species of plants and animals found in Kanawha County as shown in **Table 15**. Many of the rivers in Kanawha County are designated as critical habitat for the Diamond Darter fish, however, none of these rivers are known to exist on Airport property. It should be noted that the bald eagle is no longer protected under the ESA; however, the species remains protected under the Bald and Golden Eagle Protection Act, which prohibits the disturbance of a bald or golden eagle or its nest.

TABLE 15 LIST OF THREATENED, ENDANGERED, AND CANDIDATE SPECIES

TAXONOMIC GROUP	COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS
Mammal	Gray bat	*Myotis grisescens*	Endangered
Mammal	Indiana bat	*Myotis sodalis*	Endangered
Mammal	Northern long-eared bat	*Myotis septentrionalis*	Threatened
Mammal	Virginia Big-eared Bat	*Corynorhinus townsendii virginianus*	Endangered
Fishes	Candy Darter	*Etheostoma osburni*	Endangered
Fishes	Diamond Darter	*Crystallaria cincotta*	Endangered
Clams	Clubshell	*Pleurobema clava*	Endangered
Clams	Fanshell	*Cyprogenia stegaria*	Endangered
Clams	Northern Riffleshell	*Epioblasma torulosa rangiana*	Endangered
Clams	Pink Mucket (pearlymussel)	*Lampsilis abrupta*	Endangered
Clams	Rayed Bean	*Villosa fabalis*	Endangered
Clams	Sheepnose	*Plethobasus cyphyus*	Endangered
Clams	Snuffbox	*Epioblasma triquetra*	Endangered
Clams	Spectaclecase mussel	*Cumberlandia monodonta*	Endangered
Clams	Tubercled Blossom (pearlymussel)	*Epioblasma torulosa torulosa*	Endangered

Source: USFWS Information for Planning and Conservation (IPaC) website, https://ecos.fws.gov/ipac/location/QT24ZQAOGJBUHB2SNWSD7O7HRY/resources, Accessed February 7, 2019.

9.4.2 Summary of Biological Resources Considerations

FAA Order 1050.1F states that a significant impact to biological resources would occur when "the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) determines that the action would be likely to jeopardize the continued existence of a Federally-listed threatened or endangered species or would result in the destruction or adverse modification of Federally designated critical habitat."

Field surveys would need to be conducted to identify the presence of any of the threatened and endangered species in areas of potential disturbance associated with the alternatives under consideration. The RSA Study alternatives would include the clearing of vegetation and tree removal. Field surveys would include investigation of potential for Indiana bat summer roost trees. If summer roost trees are found in areas that may be cleared, potential mitigation may recommend that tree removal only occur within the dates established by the USFWS of September 15 to April 15.

Field surveys would also need to investigate aquatic species particularly in the Coonskin Branch. The RSA Study alternatives may have the potential to directly impact portions of the Coonskin Branch. Species of concern would need to be verified. While best management practices (BMPs) would be employed to limit stormwater runoff during construction that could impact aquatic species into the Elk River coordination with the USFWS and the West Virginia Division of Natural Resources (WVDNR) should be initiated upon the commencement of any formal NEPA environmental review to determine potential indirect impacts downstream.

9.5 Climate

9.5.1 Existing Conditions

Research has shown there is a direct correlation between fuel combustion and greenhouse gas (GHG) emissions. In terms of U.S. contributions, the General Accounting Office (GAO) reports that "domestic aviation contributes about three percent of total carbon dioxide emissions, according to EPA data," compared with other industrial sources, including the remainder of the transportation sector (20 percent) and power generation (41 percent). The International Civil Aviation Organization (ICAO) estimates that GHG emissions from aircraft account for roughly three percent of all anthropogenic GHG emissions globally.

9.5.2 Summary of Climate Considerations

Per FAA Order 1050.1F, the discussion of potential climate impacts should be documented in a separate section of the NEPA document, distinct from air quality. Where the proposed action or alternative(s) would result in an increase in GHG emissions, the emissions should be assessed either qualitatively or quantitatively.

Changes in GHG emissions may occur from the RSA Study alternatives due to emissions from construction vehicles and any changes in aircraft, automobile traffic, or ground support equipment that may occur. The net change in GHG emissions should be calculated and disclosed in the relevant NEPA document either qualitatively or quantitatively. There is currently no threshold of significance for GHG emissions per FAA requirements.

9.6 Coastal Resources

9.6.1 Existing Conditions

The state of West Virginia is landlocked; there are no areas designated as being protected by the Coastal Zone Management Act or the Coastal Barrier Resources Act within the RSA Study area of investigation.

9.6.2 Summary of Coastal Resources Considerations

Because of the location of CRW, no significant adverse coastal resource impacts are expected with the construction and implementation of any of the RSA Study alternatives.

9.7 Department of Transportation Act Section 4(f) Resources

9.7.1 Existing Conditions

The Federal statute that governs impacts in this category is commonly known as the Department of Transportation (DOT) Act of 1966, Section 4(f) provisions. Section 4(f) of the DOT Act was re-codified and renumbered as Section 303(c) of U.S. Code Title 49 (49 USC). FAA Orders 5050.4B and 1050.1F continue to refer to this statute as Section 4(f) to avoid confusion. Section 4(f) protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f) provides that the Secretary of Transportation (Secretary) may approve a transportation project requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge, or land of an historic site of national, state, or local significance, only if there is no feasible and prudent alternative to using that land and the project includes all possible planning to minimize harm resulting from the use. Parks may also be protected under Section 6(f) of the National Park Service Land and Water Conservation Fund (LWCF) Act, which contains provisions for the protection of Federal investments in land and water resources. The LWCF Act discourages the conversion of parks or recreational facilities to other uses.

Coonskin Park is located within the RSA Study area of investigation. The Park was created over 50 years ago and includes areas of woodlands, hiking and biking trails, disk golf, an 18-hole par three golf course, an Olympic size pool, picnic shelters, tennis courts, and other amenities associated with a park.

9.7.2 Summary of Department of Transportation Act Section 4(f) Resource Considerations

Impacts to a Section 4(f) resource from a proposed action or alternative can result in two types of use: physical or constructive. A physical use would occur if the proposed action or alternative(s) would involve an actual physical taking of Section 4(f) property through purchase of land or a permanent easement, physical occupation of a portion or all of the property, or alteration of structures or facilities on the property. A constructive use would occur when the impacts of a project on a Section 4(f) property are so severe that the activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired. The concept of constructive use is that a project that does not physically use the resource, may still, by means of noise, air pollution, water pollution, or other impacts, dissipate its aesthetic value, harm its wildlife, restrict its access, and take it in every practical sense.

The RSA Study alternatives, including the preferred alternative, have the potential to physically use a portion of the existing Coonskin Park including the potential loss of hiking trails and picnic shelters. The limits of the physical use should be determined for the NEPA process.

Where an action would involve the use of a Section 4(f) property, Section 4(f) requires that prior to approving the action, the FAA must determine that there is no feasible or prudent alternative that would avoid the use of the Section 4(f) property and that the project includes all possible planning to minimize harm resulting from the use. As defined in 23 CFR § 774.17, “all possible planning” means that all reasonable measures to minimize harm or mitigate adverse impacts must be included in the project.

If an adverse effect is found, it must be avoided or mitigated. One of the means of resolving adverse effects may be to prepare a Memorandum of Agreement (MOA). The MOA serves four purposes: (1) specifies the mitigation or alternatives agreed to by the consulting parties, (2) identifies who is responsible for carrying out the specified measures, (3) identifies participation and comments, and (4) serves as an acknowledgement by the signatories that, in their collective view, the FAA and Sponsor has taken into account the effects of the proposed action.

A Section 4(f) Statement may be required to demonstrate that there is no prudent and feasible alternative to using Section 4(f) resources. The Section 4(f) Statement would also outline the coordination that has occurred and the measures proposed to mitigate the physical use of the Section 4(f) resources. Coordination with the FAA, Department of Interior, the Kanawha County Parks and Recreation Commission, and other stakeholders would need to be conducted as part of any Section 4(f) Statement and NEPA documentation process.

9.8 Farmlands

9.8.1 Existing Conditions

The Farmland Protection Policy Act (FPPA) or 1981 was enacted to minimize the extent to which Federal actions and programs contribute to unnecessary and irreversible conversion of farmland to non-agricultural uses. The Council on Environmental Quality (CEQ) Memorandum on the Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA also urges the FAA to analyze the effects of a proposed action on any prime or unique farmland within the NEPA analysis. Here, the land making up the airfield and terminal areas has been highly disturbed by past development activity. Additionally, there are no areas on airport property or in the area of investigation currently being used for agriculture.

9.8.2 Summary of Farmlands Considerations

FAA Order 1050.1F states that the study area for farmlands is typically limited to the construction footprint of the project. Since no Airport property is currently being used as farmland, no impacts to prime or unique farmland are expected to occur under any of the proposed alternatives. For any proposed alternative that includes development on unpaved surfaces, the FAA may require coordination with the U.S. Department of Agriculture (USDA) National Resources Conservation Service (NRCS). As part of this agency coordination, Form AD-1006 “Farmland Conversion Impact Rating” may be required to document that no impacts to prime or unique farmland will occur.

9.9 Hazardous Materials, Pollution Prevention, and Solid Waste

9.9.1 Existing Conditions

Primary laws passed governing the handling and disposal of hazardous materials, solid waste and pollution prevention include: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); Resource Conservation and Recovery Act (RCRA); Pollution Prevention Act (PPA); Toxic Substances Control Act (TSCA); and the Oil Pollution Act (OPA). Specifically, the purpose of CERCLA is to conduct an increasingly complex series of evaluations of Federally-listed suspected hazardous waste sites to determine if those sites pose sufficient threats to human health and the environment to become eligible for Federally-funded investigation and clean up.

The West Virginia Department of Environmental Protection (WVDEP) maintains a record of all underground storage tanks (USTs) in the state. This database shows two USTs are currently located at the Airport. One is maintained by the CWVRAA (Facility ID 2002400) and the other is maintained by the West Virginia Air National Guard (Facility ID 2002402). The most recent leak occurred at the West Virginia Air National Guard facility in 2005 and was fully remediated by 2008. No known sites have been identified near the Airport property that are being remediated under CERCLA. Furthermore, there are no properties listed on the National Priority List (NPL) on or surrounding Airport property.

It is necessary to evaluate the potentially hazardous waste impacts from any of the proposed projects, including the potential to disturb contaminated soil or existing USTs.

9.9.2 Summary of Hazardous Materials, Pollution Prevention, and Solid Waste Considerations

The potential impacts from hazardous materials would be evaluated as part of the NEPA documentation process for each of the specific alternatives under consideration. The FAA has not established a significance threshold for Hazardous Materials, Solid Waste, and Pollution Prevention, however, some factors to be considered when evaluating whether this is a significant impact include whether the proposed action would have the potential to:

- Violate applicable Federal, state, tribal, or local laws or regulations regarding hazardous materials and/or solid waste management
- Involve a contaminated site
- Produce an appreciably different quantity or type of hazardous waste
- Generate an appreciably different quantity or type of solid waste or use a different method of collection or disposal and/or would exceed local capacity
- Adversely affect human health and the environment.

Additional investigations, such as environmental due diligence audits or environmental site assessments, may need to be performed due to the potential to disturb any possible soil contaminants from past uses. Coordination with the WVDEP and EPAs may be necessary.

It is not anticipated that the any of the RSA Study alternatives would generate an unmanageable volume of solid waste or affect the existing solid waste management program at CRW.

9.10 Historical, Architectural, Archeological, and Cultural Resources

9.10.1 Existing Conditions

The National Historic Preservation Act of 1966 (NHPA) and the Archeological and Historic Preservation Act of 1974 are the primary Federal laws governing the preservation of historic and prehistoric resources, encompassing art, architecture, archaeological and other cultural resources. Section 106 of the NHPA requires that, prior to approval of a Federal or Federally-assisted project, or before the issuance of a license, permit, or other similar approval, Federal agencies take into account the effect of the project on properties that are on or eligible for listing on the National Register of Historic Places (NRHP).

The NRHP has established criteria for determining historic significance. These criteria require a property to have integrity of location, design, setting, materials, workmanship, feeling, and association. Additionally, properties must be at least 50 years old, remain fairly unaltered, and meet one or more of the following National Register criteria for significance, identified as Criterion A through D:

- A. Property is associated with events that have made a significant contribution to the broad patterns of our history.
- B. Property is associated with the lives of persons significant in our past.
- C. Property embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- D. Property has yielded, or is likely to yield, information on prehistory or history.

This project also falls under the purview of the West Virginia State Historic Preservation Office (SHPO), which is responsible for the identification, protection and preservation of prehistoric resources and historic buildings, sites, and cultural resources throughout West Virginia.

A review of NRHP records maintained by the National Park Service (NPS) and local government websites was conducted to identify historic properties. There are no properties listed on the NRHP in the area of investigation.

9.10.2 Summary of Historical, Architectural, Archeological, and Cultural Resources Considerations

A Section 106 assessment would be included in the NEPA documentation on whether the proposed alternatives would physically destroy or alter any historic properties; require removal of any properties from its historic location; introduce an atmospheric, audible or visual feature to the area that would diminish the integrity of any property's setting; or through transfer, sale, or lease, diminish the long-term preservation of any property's historic significance that Federal ownership or control would otherwise ensure. A determination in accordance with 36 CFR 800.4 and 36 CFR 800.5 would need to be included in the NEPA documentation. The SHPO maintains a list of all historic properties within Kanawha County that is updated periodically as properties are nominated. This list should be reviewed when conducting environmental analysis for any of the proposed alternatives to ensure there are no new properties nominated on or near Airport property.

At this time it is anticipated that none of the RSA Study alternatives would directly or indirectly impact any structures listed on the NRHP. The natural environment of the area of investigation is mountainous and characterized by ridges, steep slopes and narrow swales. While it is unlikely there are any cultural or archaeological resources are in the area of investigation additional field surveys may be needed. Coordination with the SHPO would be required to confirm a finding of no historic properties affected.

9.11 Land Use

9.11.1 Existing Conditions

The Airport is located six miles east of downtown Charleston in an urbanized area, immediately surrounded by residential, commercial, and industrial land uses. The land areas proposed for development are owned by the Airport.

9.11.2 Summary of Land Use Considerations

Special guidance relevant to land use is given in the NEPA implementing regulations, which require consideration of "[p]ossible conflicts between the proposed action and the objectives of Federal, regional, state, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned." The impacts on land use may include indirect impacts such as the disruption of communities, relocation, induced socioeconomic impacts, and impacts to land uses protected under DOT Act Section 4(f). The CEQ regulations (40 CFR 1506.2(c)) recognize that certain inconsistencies may exist between the proposed Federal action and any approved state or local plan or law, however where an inconsistency exists, the NEPA document should reconcile its action with the plan or law

While the CWVRAA has no jurisdiction over the adoption or enforcement of local zoning regulations, as the Project Sponsor it is required to provide written assurance to the FAA that appropriate action has been or will be taken, to the extent reasonable, to restrict the use of land adjacent to, or in the immediate vicinity of the Airport, to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft. Land use and zoning for land use compatibility is the responsibility of local jurisdictions around the Airport and the CWVRAA should undertake all efforts to ensure that these local jurisdictions will undertake such actions, to the extent reasonable.

9.12 Natural Resources and Energy Supply

9.12.1 Existing Conditions

The Airport is located six miles east of downtown Charleston. The City of Charleston and surrounding region has adequate access to natural resources and energy for development of the RSA Study alternatives.

9.12.2 Summary of Natural Resources and Energy Supply Considerations

FAA Order 1050.1F directs that the use of natural resources needs to be examined if "the action would have the potential to cause demand to exceed available or future supplies of these resources." For most airport actions, natural resource consumption will not exceed available or future supplies.

The RSA Study alternatives, including the preferred alternative, would increase the demand for energy supply due to the need for additional airfield lighting and would have the potential to relocate underground and above ground utilities. It is unlikely that energy use for construction and implementation of any of the alternatives would have a significant adverse impact to natural resources and energy supply. Construction of the proposed alternatives is not likely to cause a substantial demand for natural resources or energy that cannot be met by the local supply. It is not anticipated that scarce or unusual materials would be required to construct any of the proposed alternatives.

9.13 Noise and Noise-Compatible Land Use

9.13.1 Existing Conditions

A review of past environmental studies, previous noise contours prepared for CRW, recent aerial photographs, and local government websites was conducted to identify noise-sensitive land uses within the RSA Study area of investigation and the extent that future noise may impact the area. There were no residences, public schools, nursing homes, hospitals, libraries, or religious institutions within the RSA Study area of investigation. Coonskin Park was within the RSA Study area of investigation.

9.13.2 Summary of Noise and Noise-Compatible Land Use Considerations

The FAA has identified land use compatibility guidelines relating types of land use to airport sound levels. These guidelines, which are codified in 14 CFR Part 150, show the compatibility parameters for residential, public (schools, churches, nursing homes, hospitals, and libraries), commercial, manufacturing and production, and recreational land uses. All land uses within areas below 65 Day Night Average Sound Level (DNL) are considered compatible with airport operations.

FAA Order 1050.1F states that noise will have a significant impact if, "the action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe."

All of the RSA Study Alternatives, including the preferred alternative, would extend the existing runway. This may cause noise impacts to areas that do not currently experience them. As part of the NEPA process a noise analysis would need to be conducted to determine the potential impacts due to any alternatives under consideration. If a noise increase was determined to be a significant impact, as defined in FAA Order 1050.1F, to any of the surrounding properties, mitigation would need to be provided.

9.14 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

9.14.1 Existing Conditions

CRW is the largest airport in the state and contributes approximately $7.7 million in economic output to the region and provides 78 full-time jobs with a labor income of $4.2 million. It also contributes to the regional economy through its operations and the operations of supporting industries. Employers who maintain staff on site have over 1,200 workers, including airlines, tenants, other businesses, and the CWVRAA. These jobs pay $49 million in labor income and generate an estimated $116 million in economic activity for the region.

The composition of the RSA Study area of investigation was reviewed to determine whether minority populations, low-income populations, or Indian tribes are present. The U.S. Census's American Community Survey (ACS) data and Aviation Environmental Design Tool (AEDT) Version 2d was used to identify census block groups within the RSA Study area of investigation. Then, AEDT determined which census block groups are composed of 50% or more minority populations and/or 50% or more low income populations based on the census data. According to the data, there were no environmental justice populations identified within the RSA Study area of investigation. Further, there is nothing to indicate that there is a minority population present that is meaningfully greater than the minority population percentage in the general population of the geographic area under analysis.

9.14.2 Summary of Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks Considerations

A significance threshold has not been established for socioeconomic impacts, environmental justice, and children's environmental health and safety risks. However, factors to consider when reviewing a potential action include:

- The potential to induce substantial economic growth in an area, either directly or indirectly
- Disruption or division of the physical arrangement of an established community
- Extensive relocation when sufficient replacement housing is unavailable
- Extensive relocation of community businesses that would cause severe economic hardship for affected communities
- Disruption to local traffic patterns and substantial reduction in the levels of service of roads serving an airport and its surrounding communities
- Produces a substantial change in the community tax base
- Impacts to the physical or natural environment that affect an environmental justice population in a way that the FAA determines are unique to the environmental justice population and significant to that population
- Lead to a disproportionate health or safety risk to children

The RSA Study Alternatives are not expected to exceed any of the socioeconomic, environmental justice, and children's environmental health and safety risk factors listed above. However, the NEPA process would specifically determine if there would be any impacts due to the relocation of residents or existing businesses or impacts due to the potential closure of Coonskin Drive associated with any of the alternatives under consideration.

CRW has been and continues to be a major factor in attracting business to the Central West Virginia region. Any new development is likely to produce positive socioeconomic benefits associated with new jobs and increased tax revenues.

9.15 Visual Effects

9.15.1 Existing Conditions

CRW is currently illuminated by various types of lighting on the airfield and for landside facilities. Lighting that emanates from the airfield includes runway, apron, and navigational lighting such as hold position lights, stop-bar lights, and runway and taxiway signage. Airfield lighting is located along taxiways and ramps for guidance during periods of low visibility, and to assist aircraft movement on the airfield. Aircraft lighting, such as landing lights, position and navigation lights, beacon lights, and vehicle lighting are other types of light sources on the airfield. Lights for landside facilities include buildings, roadways, and parking facilities. CRW is located six miles east of Charleston, an urbanized area, which is comprised of other development that is lighted and contributes to the overall light emissions in the area.

9.15.2 Summary of Visual Effects Considerations

FAA Order 1050.1F states that the visual effects environmental impacts category, including light emissions, deals with the extent to which the proposed action would have the potential to: 1) produce light emissions that create annoyance or interfere with normal activities; 2) affect the visual character of the area due to light emissions, including the importance, uniqueness and aesthetic value of the affected visual resources; 3) affect the nature of the visual resources or visual character of the area, including the importance, uniqueness and aesthetic value of the affected visual resources; 4) contrast with the visual resources and/or the visual character of the existing environment; or 5) block or obstruct the views of visual resources, including whether those resources would still be viewable from other locations. Although there are no Federal special purpose laws or requirements specific to light emissions and visual effects, there are special purpose laws and requirements that may be relevant. In addition to NEPA, laws protecting resources that may be affected by visual effects include sensitive wildlife species, Section 106 of the NHPA, Section 4(f) of the DOT Act, and Section 6(f) of the LWCF Act. The FAA has not established a significance threshold for Light Emissions or for Visual Character per FAA Order 1050.1F, Exhibit 4-1.

Construction and operation of the RSA Study alternatives, including the preferred alternative, would cause additional lights to be located at the Airport. In addition, the extended runway would cause the extension of the ALSF-1 Lighting system into Coonskin Park. The NEPA documentation would need to determine if the additional lights and lighting system would have an impact on human activity or on the use or characteristics of any protected properties.

9.16 Wetlands

9.16.1 Existing Conditions

The USACE and the EPA define wetlands as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." E.O. 11990, Protection of Wetlands, DOT Order 5660.1A, the Rivers and Harbors Act of 1899, and the Clean Water Act (CWA) address activities in wetlands. E.O. 11990 requires Federal agencies to ensure their actions minimize the destruction, loss, or degradation of wetlands. It also assures the protection, preservation, and enhancement of the nation's wetlands to the fullest extent practicable during the planning, construction, funding, and operation of transportation facilities and projects.

According to the National Wetlands Inventory (NWI) database accessed on the USFWS website, there are no wetlands in the RSA Study area of investigation that would be impacted by construction or operation of any of the RSA Study Alternatives including the preferred alternative.

9.16.2 Summary of Wetlands Considerations

The natural environment of the area of investigation is mountainous and characterized by ridges, steep slopes and narrow swales. While it is unlikely there are any wetland resources in the area of investigation, wetland delineations may be needed particularly in the area of the Coonskin Branch location. If any wetlands and/or streams are identified and are connected to jurisdictional waters, they would be regulated by the USACE. If not, any potential wetlands and/or streams would likely constitute isolated wetlands and would fall under the regulation of the WVDEP. The USACE will make the ultimate decision as to their status.

The FAA typically requires mitigation for non-jurisdictional streams under E.O. 11990 which lays out the Federal government's "no net loss" policy for wetlands. E.O. 11990 requires the FAA to make a written finding that an airport did not construct on a wetland unless, "(1) there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use." This finding must be made either in the Finding of No Significant Impact (FONSI) or the Record of Decision (ROD), and the documentation necessary to support the finding must be contained in the NEPA document.

9.17 Floodplains

9.17.1 Existing Conditions

Floodplains are defined by E.O. 11988, Floodplain Management, as "the lowland and relatively flat areas adjoining inland and coastal waters including flood-prone areas of offshore islands, including at a minimum, that area subject to a one-perfect or greater chance of flooding in any given year" (i.e., the area inundated by a 100-year flood). U.S. DOT Order 5650.2 defines the beneficial values served by floodplains to include "natural moderation of floods, water quality maintenance, groundwater recharge, fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture,

aquaculture, and forestry." Federal Emergency Management Agency (FEMA) maps are the primary reference for determining the extent of the base floodplain.

The 100-year flood has been adopted by FEMA as the base flood for floodplain management purposes. There are no areas of the 100-year floodplain that occur on or adjacent to Airport property. According to FEMA, the Airport is located on Flood Insurance Rate Maps (FIRM) Panel 54039C0426E and 54039C0427E. There is a 100-year floodplain associated with the Elk River.

9.17.2 Summary of Floodplains Considerations

Floodplain impacts would only be considered significant relative to NEPA if a proposed Federal action results in one or more of the following impacts:

- A high likelihood of loss of human life;
- Substantial encroachment-associated costs or damage, including adversely affecting safe airport operations or interrupting aircraft services (e.g., interrupting runway or taxiway use, placing another facility such as a NAVAID out of service, placing utilities out of service, etc.); or
- A notable adverse impact on the floodplain's natural and beneficial floodplain values.

It is anticipated that the floodplain associated with the Elk River would be avoided during construction and BMPs would be employed to limit runoff and erosion to ensure there would be no direct impacts to the floodplain. However, the NEPA process and documentation would identify any specific impacts to floodplains associated with any of the RSA Study Alternatives, including the preferred alternative.

9.18 Surface Waters

9.18.1 Existing Conditions

Surface waters include streams, rivers, lakes, ponds, estuaries, and oceans. A portion of Coonskin Branch which feeds into the Elk River is location in the RSA Study area of investigation.

Stormwater discharges are regulated by the National Pollutant Discharge Elimination System (NPDES) per the CWA. In West Virginia, the requirements are met through NPDES Individual Permits, General Permits, and Stormwater Permits as administered by the WVDEP, Division of Water and Waste Management. Currently, the Airport operates in accordance with all applicable requirements.

9.18.2 Summary of Surface Waters Considerations

FAA Order 1050.1F states that a significant impact on surface waters exist if the action would:

- Exceed water quality standards established by Federal, state, local, and tribal regulatory agencies; or
- Contaminate public drinking water supply such that public health may be adversely affected.

Additional factors to be considered when evaluating whether this is a significant impact on surface water include whether the proposed action would have the potential to:

- Adversely affect natural and beneficial water resource values to a degree that substantially diminishes or destroys such values
- Adversely affect surface waters such that the beneficial uses and values of such waters are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated
- Present difficulties based on water quality impacts when obtaining a permit or authorization

Potential future surface water impacts are associated with the creation of additional impervious surfaces due to the construction of the RSA Study Alternatives, including the preferred alternative. Several permits, approvals, or certifications associated with surface water may be required prior to development of the proposed projects, such as a NPDES Construction Stormwater General Permit. Coordination with USACE and the WVDEP, Division of Water and Waste Management would need to be conducted to confirm any potential impact to Coonskin Branch and determine potential mitigation measures.

9.19 Groundwater

9.19.1 Existing Conditions

The geology of the Airport property is from the Paleozoic and Pennsylvanian eras (299 to 318 million years ago) and is mainly comprised of sandstone, shale, clay, coal, and limestone. There are no EPA-designated sole source aquifers on or surrounding the Airport.

9.19.2 Summary of Groundwater Considerations

Since there are no EPA-designated sole source aquifers on Airport property, it is not required to consult with the EPA on groundwater and aquifer contamination. It is unlikely that any of the RSA Study Alternatives, including the preferred alternative, would exceed groundwater quality standards or contaminate a public water supply. If a significant impact from any proposed projects is identified, then coordination with the WVDEP, Division of Water and Waste Management must occur to create a Groundwater Protection Plan.

9.20 Wild and Scenic Rivers

9.20.1 Existing Conditions

The Wild and Scenic Rivers Act of 1968 provides protection for certain free-flowing rivers, which have “outstanding or remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values.” The 1979 Environmental Message Directive on Wild and Scenic Rivers (August 2, 1979) from the President, directs Federal agencies to avoid or mitigate adverse effects on rivers identified in the Nationwide Rivers Inventory (NRI) as having potential for designation under the Wild and Scenic Rivers Act. The NRI is a listing of more than 3,400 free-flowing river segments that are believed to possess one or more outstanding remarkable natural or cultural values judged to be of more than local or regional significance.

According to the NRI database accessed on the U.S. Department of the Interior, NPS website, there are no NRI river segments or rivers designated as part of the National Wild and Scenic River System within Kanawha County.

9.20.2 Summary of Wild and Scenic Rivers Considerations

Construction and operation of any of the RSA Study Alternatives, including the preferred alternative, are not anticipated to impact a Wild or Scenic River, or river segment under study for inclusion in the Wild and Scenic River System, an NRI river segment, or an otherwise eligible river.

9.21 NEPA Strategy

FAA Advisory Circular 150/5070-6B states, “The purpose of considering environmental factors in airport master planning is to help the sponsor thoroughly evaluate airport development alternatives and to provide information that will help expedite subsequent environmental processing. By using existing maps of the airport area, prior environmental documents, and the Internet, planners and environmental specialists can get an excellent overview of sensitive environmental resources in and around the airport.”

Based on this environmental overview, a NEPA environmental review document would be required prior to development of any of the RSA Study Alternatives including the preferred alternative, in order to identify and quantify the potential adverse environmental impacts.

There are three levels of NEPA analysis:

- Categorical Exclusion (CATEX) – applies to those actions that have been found (under normal circumstances) to have no potential for significant environmental impact.
- Environmental Assessment (EA) – applies to those actions that have been found by experience to sometimes have significant environmental impacts. The list of actions normally requiring an environmental assessment can be found in FAA Order 1050.1F. Upon review of the EA findings, the FAA either issues project approval in the form of a FONSI or directs the preparation of an EIS to further investigate potential environmental impact before project approval can be granted.
- Environmental Impact Statement (EIS) – applies to those actions that have been found by experience to usually have significant adverse environmental impacts. The FAA may issue a ROD after the Final EIS has been released.

The RSA Study alternatives and the preferred alternative all focus on extending the runway and creating a RSA to meet FAA guidelines. Coordination with the FAA will be needed to determine the appropriate type of environmental document as required by NEPA.