of three indicating "all standards met and/or all impacts positive." This simplified, non-weighted score was then correlated with a circle symbol to easily visually convey an overall assessment of each alternative, see **Table 6.2.1**.

Table 6.2.1: Alternative Evaluation Scoring and Rating Standards

Rating	Evaluation of Impact	Score
	0	No standards met and/or all impacts negative
	1	Few standards met and/or Most impacts negative
	2	Most standards met and/or Most impacts positive
	3	All standards met and/or all impacts positive

Source: C&S Engineers, Inc.

6.3 Alternative Development Opportunities by Area

Individual alternatives for each opportunity area were developed based on advisory input from meetings with LNAA and project stakeholders. A summary of these meetings is below:

- Project Advisory Group (PAG) meeting on August 15, 2017 consisting of community members and LNAA staff.
- A preliminary alternatives development discussion with LNAA staff on August 16, 2017.
- Follow on discussions of preliminary alternatives were also held with LNAA staff in September, October and November 2017.
- A Project Advisory Group meeting (#4) was held in December 2017 to review alternatives.

The ideas and input suggested during these meetings have been incorporated into the development alternatives discussion.

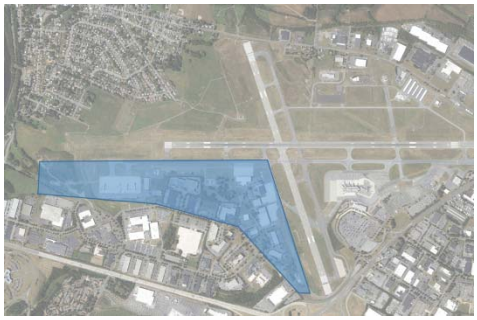
Utility Assessment Considerations

In consideration of utility capacities in the areas of the airport where alternatives are proposed, the following summarizes utilities as they relate to the general areas of the Airport for development. This information will be used as input for the evaluation of alternatives and serves to inform the implementation of the preferred alternative program. Utility considerations that are impacted by specific development projects are noted within the discussion regarding each opportunity area, as necessary.

East Side – Air Carrier Terminal Area

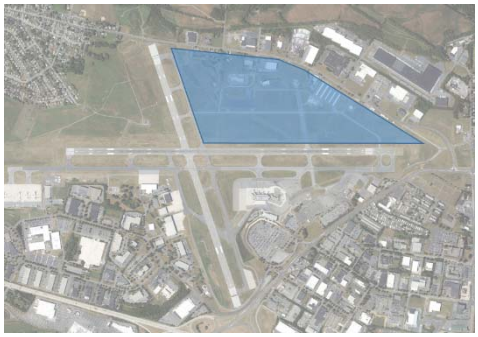
As landside circulation, passenger processing, and gate capacity needs will not necessitate significant changes in the current facility footprint, no major expansion of utility capacity will be needed. There are also two hangar buildings that are not planned to be expanded, or may be relocated, so no additional utilities will be needed. Since any redevelopment is likely to incorporate more recent energy-efficient technologies and equipment, this would also mitigate any utility expansion needs.

South Side – Cargo/FBO/Corporate Aviation Area



This sector of the Airport is developed and built-out with corporate general aviation- and air cargo-related facilities along a developed corridor in Hanover Township. Additional properties proposed to be acquired in this area are also developed with existing buildings. Proposed expansion of apron areas, particularly for the Air Cargo area, will necessitate stormwater mitigation, but should not require significant upgrading of other utility items such as electricity for lighting. However, major existing utilities in the area will require analysis for potential relocation as it relates to development; i.e. the existing Buckeye Pipeline that runs adjacent to the existing Air Cargo ramp.

North Side – Light General Aviation



This area of the Airport is limited to general aviation, with a series of T-hangar buildings and an aircraft parking apron. As general aviation demand of this type is forecasted to be limited, and facilities such as T-hangars typically create less additional utility demand than other airport facilities, utility capacity should be adequate. Additionally, development to the north of Race Street after any proposed land acquisitions will entail refurbishment or replacement of existing buildings, and not create a need for increased utility capacities. So long as LVIA's airfield remains in its existing general configuration, there is little need for utility expansion.

West Side – Undeveloped Greenfield

This is the sole area not currently developed at the Airport. Since appropriate incremental development in the other three areas around the airfield will accommodate most future facility requirements, the only anticipated development in this area are conventional (bulk) hangars. As demand and conditions dictate, the utilities available and capacities they can serve will require additional analysis as part of the design effort. Requirements will depend on the nature and scale of facilities

proposed. Particularly, water and sewer would need to be coordinated with jurisdictions such as the Borough of Catasauqua to the west, which controls utilities in this area. For example, hangars would require increased stormwater management, but with some water, sewer, and potentially power and telecommunications extensions.

Airfield Alternatives

Airfield alternatives were developed based on the facility requirements and FAA needs developed in Section 5. Since many of the airfield alternatives from the previous master plan have not been implemented, overall airfield conditions have not changed, and the analyses as part of the facility requirements evaluation determined the demand remains, many of those alternatives were reviewed and incorporated into this analysis. Airfield alternatives were developed within existing Airport boundaries (except for any required land acquisition for RPZ's or safety areas as part of their development) and show necessary runway and taxiway design concepts consistent with that of forecasted demand. Airfield alternatives are summarized below and can be seen in **Figures 6.3.1 – 6.3.5**.

Runway 6-24 Alternative

The previous master plan conducted an extensive evaluation of extension alternatives for Runway 6-24 on both ends of the runway. Ultimately, the preferred alternative that is shown on the existing Airport Layout Plan (ALP) (approved on 12/21/2004) shows an ultimate runway length of 10,000 feet extended entirely on the Runway 6 end to the southwest. This proposed an initial extension of 1,000 feet, followed by an additional 1,400 feet to increase the existing 7,600 feet to the ultimate length of 10,000 feet.

Discussions with users and a review and reassessment of the design aircraft indicate 10,000 feet remains the appropriate length for the primary runway through the planning period. Differing from previous implementation strategies, this alternative is not recommending a phased approach. **Figure 6.3.1** shows the runway extension as one project. The efficiencies achieved through the economies of scale result in lower overall project costs. Other project benefits include shorter overall operational disruption and compliance with standards (e.g., RPZ acquisition).

This project is expected in the 11 - 22 year planning period and is estimated to cost $21 million, exclusive of land acquisition.

Runway 13-31 Alternatives

The previous master plan also conducted an extensive evaluation of numerous alternatives for Runway 13-31. Since the last master plan, an Engineered Material Arresting System (EMAS) was installed on both runway ends. It is now in compliance with current Runway Safety Area (RSA) standards. The project was necessitated by constraints due to adjacent roadways with the 31 end having a major intersection at Airport Road and Route 22.

While the design requirements for a D-IV airfield suggest a secondary runway that is 100% of the primary runway's length, an extension to 10,000 feet is not feasible given terrain in the area. Since the primary runway is not yet 10,000 feet, alternatives to meet the existing 7,600 feet were evaluated. This is 100 more feet than what is shown on the existing ALP (approved on 12/21/2004).

As a result of the terrain and roadway constraints, two alternatives to extend the runway were evaluated, both to the Runway 13 end. One is an extension to 7,600 feet with EMAS; and the other an extension to 7,600 feet without EMAS, assuming a standard RSA on the 13 end. Both alternatives require tunneling Race Street under the runway or bridging the runway over Race Street. Given the previous study, road abandonment or relocation were not considered options.

Figures 6.3.2 and **6.3.3** depict these two alternatives. The option without EMAS extends an additional 812 feet to the west therefore creating larger impacts and requiring additional property acquisition compared to the option with EMAS This project is expected in the 11 – 22 year planning period and is estimated to cost $46.2 million for the EMAS alternative and $53.7 million for full RSA implementation, exclusive of land acquisition.

The EMAS project was completed in 2015/16 and has a useful life of approximately 20 years. Because no immediate need exists for a runway extension at this time, any consideration to extend it should come at the end of the EMAS's useful life in in 2035.

Taxiways Alternatives

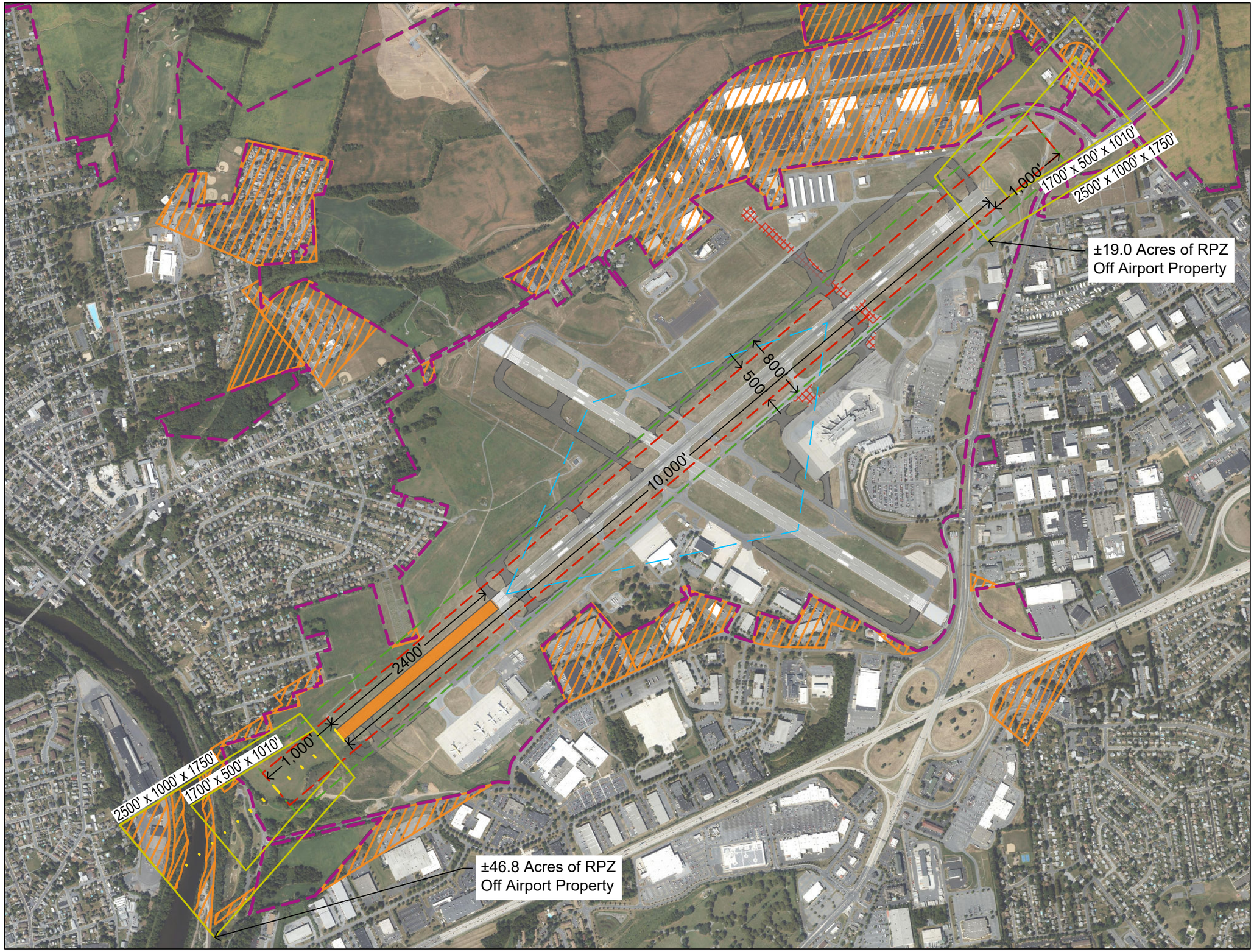
Multiple taxiway alternatives were developed based on user input for efficiency of airfield operations and airfield design standards. These include full parallel taxiways to both runways as well as stub taxiways to help promote capacity and efficiency of operations on an airfield that has a diverse fleet mix size from small general aviation aircraft to large commercial aircraft supporting the transport of passengers and air cargo.

Runway 13-31 Taxiway Alternatives include a full parallel on the west side 400 feet from the runway to taxiway centerline. Currently, only Taxiway J and the B3 stub exist on this side on the runway. As shown in **Figure 6.3.4**, the estimated cost of this taxiway is $14.2 million. The taxiway portion to the north would facilitate hangar development identified on the previous ALP and being considered as part of this Master Plan. The taxiway portion to the south would allow access to aircraft moving between the FBO to Runway 31 without having to crossover the runway via Taxiway A and B. Grading and drainage challenges pose the potential for a significant increase in the cost estimate to construct the southern portion of this proposed taxiway. This should be further evaluated when this alternative is implemented.

An additional taxiway alternative shown on **Figure 6.3.4** looks at two options for accessing the terminal apron from Taxiway B. A prior access taxiway was closed as a result of line of sight issues from the ATCT. All aircraft now use taxiway stub B3 to get to the RW-31 end. An addition of a taxiway stub on the west end of the terminal apron would provide ATCT with another option for aircraft ingress and egress to the terminal apron. The two options are shown in the figure. The cost estimate for the northern stub is $2 million and the smaller, southern stub is $1.1 million. Since both provide the same operational efficiency improvements, the cheaper of the two alternatives is recommended in the near term 0 - 5 years of the planning period.

Runway 6-24 Taxiway Alternatives include a full parallel on the north side 400 feet from the runway to taxiway centerline extending to 600 feet separation on the 24 end to accommodate the critical area of the Glide Slope. In addition, various stub and bypass taxiways are shown for efficiency improvements. As shown on **Figure 6.3.5**, the estimated cost of the northern parallel taxiway with stubs on the north side is $18.7 million. The three stub improvements shown on the south side are estimated to cost $3 million.

All Runway 6-24 taxiway alternatives are recommended, but can be phased. The southern stubs are recommended in the 0 - 5 year planning period and could be combined with the terminal apron taxiway stub recommend in the Taxiway 13-31 alternatives. The full parallel on the north side could be phased during the 6 – 10 year period with the following priorities: first phase from Taxiway B north (timing dependent on north side development being considered) and second phase from Taxiway B south.



Legend

- Existing Property Line
- Proposed Property Acquisition
- Proposed Runway
- Proposed Taxiway
- Proposed Demolition
- Runway Safety Area
- Runway Object Free Area
- Runway Protection Zone
- Runway Visibility Zone

N

Not To Scale

Lehigh Valley International Airport
Master Plan Update

Runway 6 Extension

Runway Alt. 1
Figure 6.3.1

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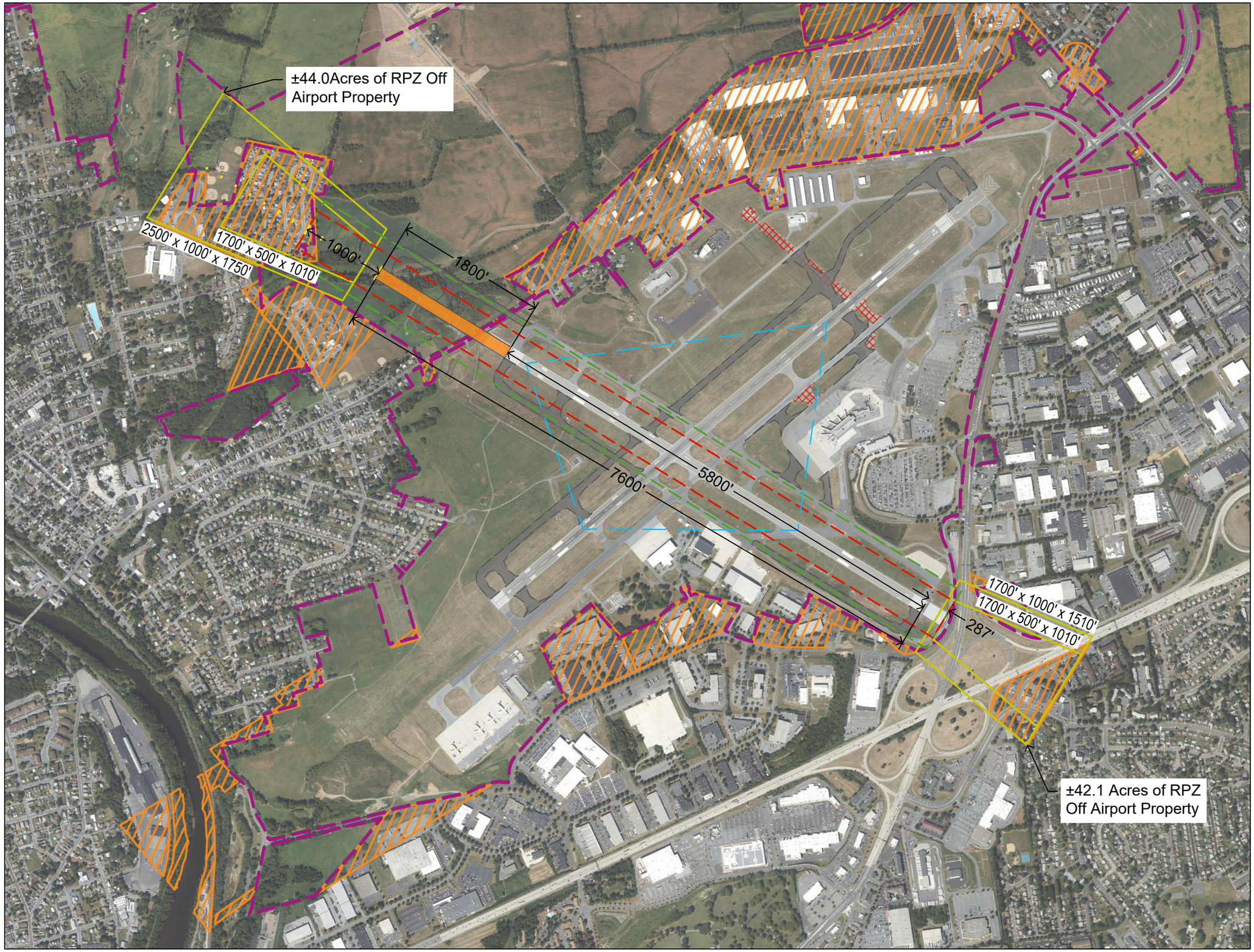

Legend

- Existing Property Line
- Proposed Property Acquisition
- Proposed Runway
- Proposed Taxiway
- Proposed Demolition
- Runway Safety Area
- Runway Object Free Area
- Runway Protection Zone
- Runway Visibility Zone

N

Not To Scale

Lehigh Valley International Airport
Master Plan Update

Runway 13 Extension with EMAS

Runway Alt. 2
Figure 6.3.2

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±61.6 Acres of RPZ
Off Airport Property

2500' x 1000' x 1750'

1700' x 500' x 1010'

1000'

2612'

7600'

8412'

1000'

1700' x 1000' x 1510'

1700' x 500' x 1010'

±38.4 Acres of RPZ
Off Airport Property

Legend

- Existing Property Line
- Proposed Property Acquisition
- Proposed Runway
- Proposed Taxiway
- Proposed Demolition
- Runway Safety Area
- Runway Object Free Area
- Runway Protection Zone
- Runway Visibility Zone

N

Not To Scale

Lehigh Valley International Airport
Master Plan Update

Runway 13 Extension with Full RSA/ROFA

Runway Alt. 3
Figure 6.3.3

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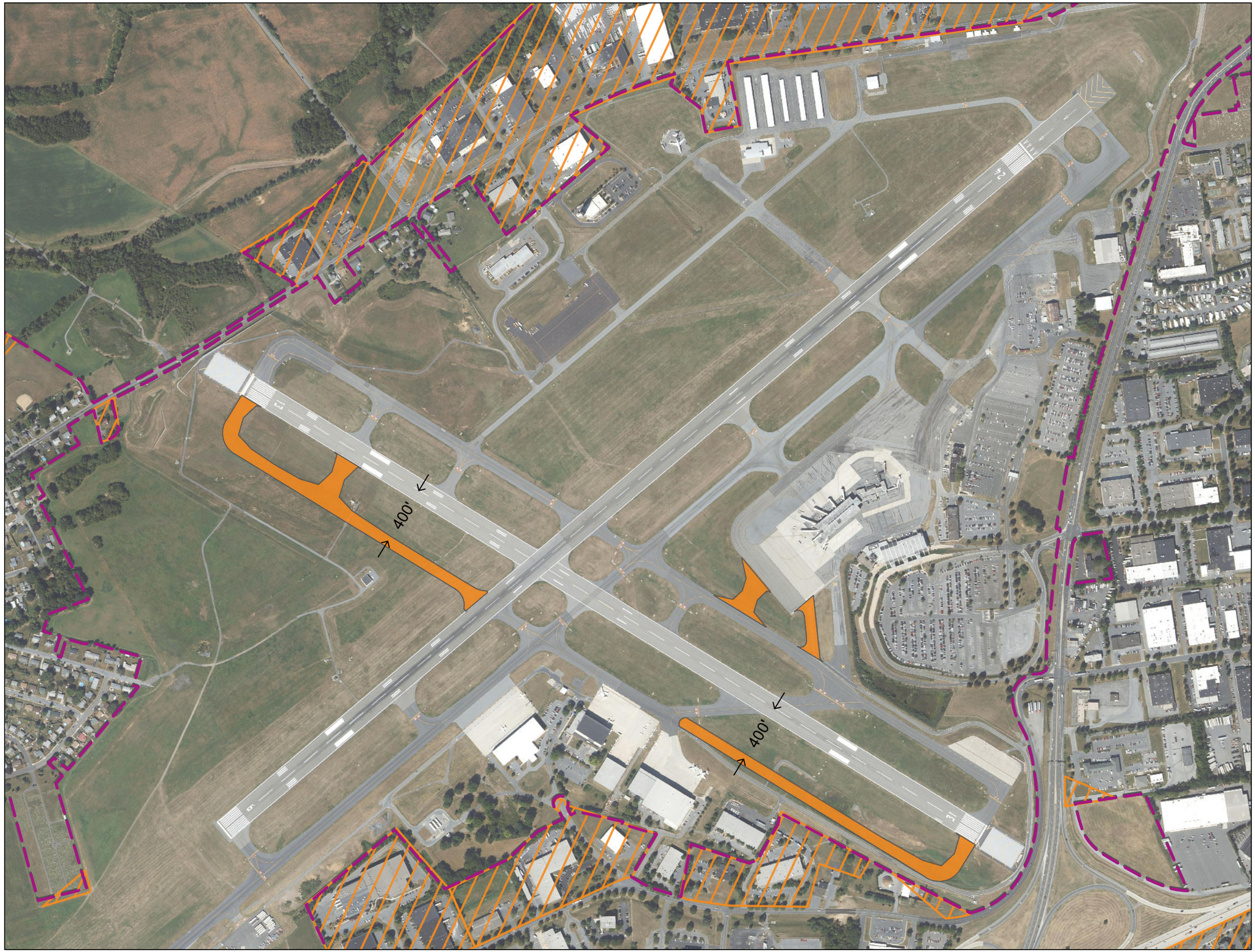

Legend

- Existing Property Line
- Proposed Property Acquisition
- Proposed Taxiway

N

Not To Scale

Lehigh Valley International Airport
Master Plan Update

Runway 13-31
Full Parallel

Taxiway Alt. 1
Figure 6.3.4

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Legend

- Existing Property Line
- Proposed Property Acquisition
- Proposed Taxiway

N

Not To Scale

Lehigh Valley International Airport
Master Plan Update

Runway 6-24
Full Parallel

Taxiway Alt. 2
Figure 6.3.5

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