GREENVILLE-SPARTANBURG INTERNATIONAL AIRPORT

2040 WINGSPAN

A VISION FOR THE FUTURE

DECEMBER 2019

AIRPORT MASTER PLAN UPDATE

CHAPTER 6: ALTERNATIVES

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Table of Contents

Chapter 6 - Alternatives

List of Tables

Chapter 6 - Alternatives

List of Figures

Chapter 6 - Alternatives

6. Alternatives

The Alternatives chapter documents a variety of development alternatives to accomplish the recommended facility improvements identified in Chapter 5, *Facility Requirements.* These alternatives are reviewed, refined, and evaluated across multiple evaluation factors, including documented stakeholder engagement and Airport input, to determine a series of independent recommended improvements to enhance the efficiency of the Greenville-Spartanburg International Airport (GSP or Airport) while meeting prescribed safety standards, facilitating demand projections, and minimizing environmental and community impacts.

This chapter is organized around a series of development alternative graphics, often evolving between themselves and across the chapter sections. These alternatives depict opportunities to address airport design considerations and pre-position the Airport to facilitate future aeronautical demands. Airside alternatives are considered first followed by an evaluation of other components, including the passenger terminal area, landside access, air cargo, general aviation (GA), westside and southside aviation properties, support facilities, and non-aviation land uses.

Alternatives for each functional area are broadly identified initially and select alternatives are then further considered, refined, and scored based on prescribed evaluation factors. Preferred alternatives are then selected to collectively represent the unconstrained 20-year development plan for the Airport.

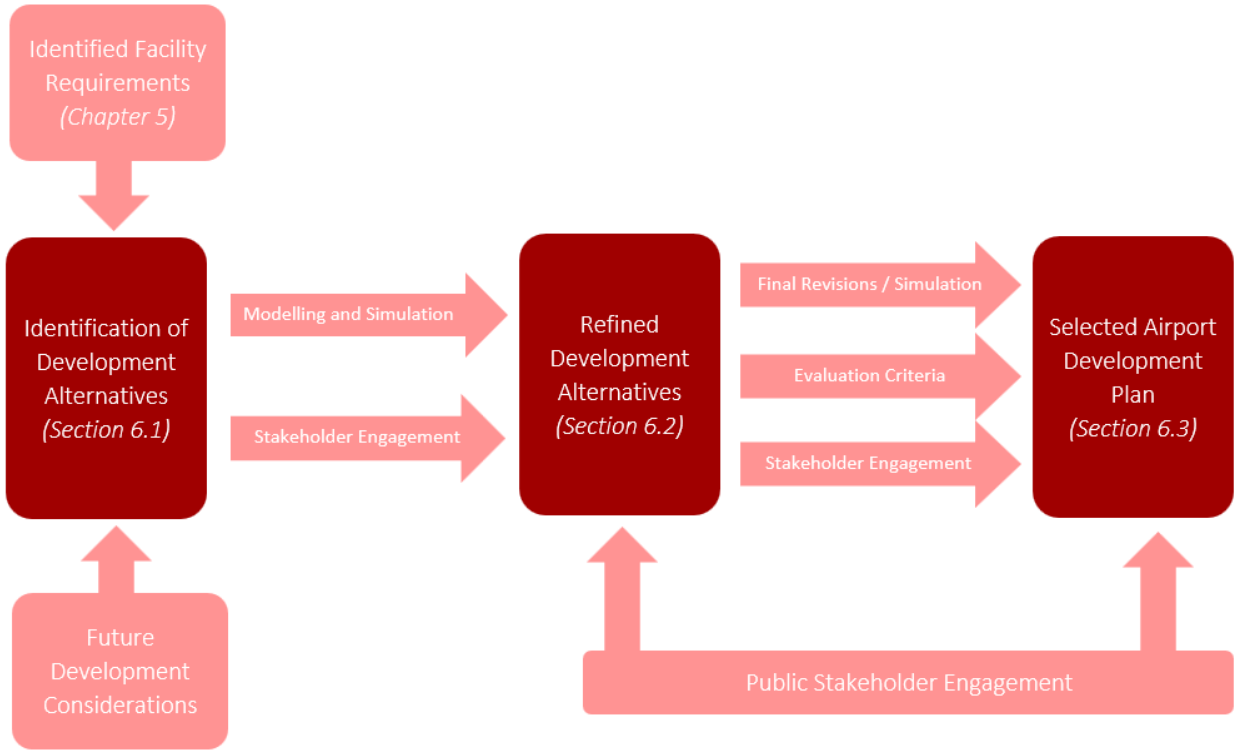
6.1. IDENTIFICATION OF DEVELOPMENT ALTERNATIVES

The following sections will broadly identify initial development alternatives intended to meet known facility requirements as well as additional considerations brought to light by Airport staff and other Airport stakeholders as part of this master plan's public involvement program. Alternatives are grouped in the following functional areas of the Airport and its environs:

- Airside
- Terminal Airside
- Landside Access and Parking
- Air Cargo Facilities
- General Aviation Facilities
- Other Aviation Development Properties
- Support Facilities
- Non-Aviation Land Uses (discussed in Section 6.2.3)

Figure 6-1 provides a flow chart expressing the alternatives development process – the initial identification of development alternatives, elimination and refinement of retained alternatives, and final revision and selection of the preferred airport development plan.

Figure 6-1: Alternative Identification and Refinement Flow Chart



Source: McFarland Johnson, 2018

The identification, evaluation, elimination, refinement, reevaluation, scoring and eventual selection of preferred development plans for each of the functional areas of the Airport was a significant undertaking. The project team engaged in this Master Plan, along with Airport staff, advisory committees, and stakeholder groups, spent countless hours contemplating and reviewing growth opportunities at GSP. The product of that collective effort which spanned nearly seven months is expressed in this chapter.

6.1.1. Airside Alternatives

The airside alternatives presented in the following sections are focused strictly on the movement areas of the airfield and explore the ability to better meet geometric standards prescribed by the FAA and provide the airfield facilities required to meet aeronautical demand over the 20-year planning period and beyond.

Airside alternatives are primarily concerned with improving geometry issues to better meet airport design standards, provide for specific demands of aircraft type, or otherwise support a more safe and efficient airfield. The facility requirements, as identified in Chapter 5, *Facility Requirements*, existing issues, and other considerations that triggered the development of the airside alternatives are discussed below for each area of the airfield.

- **Parallel Runway:** The previous airport master plan investigated a parallel runway south of Runway 4-22 as redundancy measure to lessen the impacts to operations from closures to the primary runway. In like manner, this master plan investigated a future parallel runway

to provide a more efficient airfield as operations by airlines, cargo operators, and GA aircraft increase over time. A parallel runway would better separate traffic and lessen the impact of primary runway closures for rehabilitation. Considerations for terrain and local environmental resources were included in the placement of the proposed parallel runway. The length of the parallel runway was dependent on meeting Runway Protection Zone (RPZ) land control requirements while providing enough length to provide an adequate redundancy for the aircraft frequently operating at GSP.

- **Crossfield Taxiway:** Crossfield taxiway alternatives were necessary to support the proposed parallel runway. Considerations for critical aircraft requirements, terrain, and operational efficiency and redundancy were considered for the development of these alternatives.

- **Taxiways E and F:** Taxiways E and F currently do not meet FAA geometry standards to avoid wide expanses of pavement, co-located rapid exit taxiways, multiple taxiway crossings, and direct access taxiways as defined in FAA Advisory Circular (AC) 150/5300-13A*, Airport Design*. The taxiway pavement in this area is in poor condition, which was taken into consideration for the development of this alternative. Additionally, these taxiways are not frequently used by aircraft accessing the Air Carrier Apron as the majority of arriving airlines miss these exit taxiways and are required to exit via Taxiways D or G.

- **Taxiway L2:** Taxiway L2 currently does not meet FAA geometry standards to avoid direct access taxiways. Since Taxiway L2 connects to Taxiway D without requiring pilots to make a distinct turn, it is considered direct access. Since the apron area to the south of Taxiway L2 is currently used for air cargo operations and, when able, to provide for parking positions for aircraft that are scheduled to remain overnight (RON) and the area north has limited aircraft movement capabilities as is, any alternative proposing a shift in Taxiway L2 considered impacts to operations on the associate aprons.

- **Taxiway Fillets:** The existing airfield provides appropriate taxiway filleting for a Taxiway Design Group (TDG)-5 aircraft, which operate at the Airport regularly, in most critical areas of the airfield. However, fillet widening may be warranted at specific intersections to better facilitate movements of widebody aircraft or should aircraft meeting TDG-6 standards begin operating at GSP.

- **Apron Edge Taxilane:** Between Taxiways L3 and L6 there is limited pavement to support aircraft moving between the Transient Apron and the GA Apron. To address this, a series of alternatives were developed to expand the pavement of the connector taxiways to Taxiway L, the connector taxiway between the Transient and the GA Apron. Relocation of the apron edge taxilane to be in-line and fully connected to the commercial apron edge taxilane will provide for better mobility of aircraft about the GSP campus as well as provide a small expansion to the GA apron area.

- **Approach Lighting System:** Runway 4 is currently equipped with a 2,400-ft Approach Lighting System with Sequence Flashers II (ALSF-2) to support CAT II and III approaches. To improve the operational flexibility and efficiency of the Airport, an alternative proposing an ALSF-2 to support Runway 22 was developed.

- **Runway Entrance/Exit Taxiway:** An alternative was developed based on the potential benefit of constructing a runway entrance/exist taxiway between Taxiways G and J.

- **90-degree Apron Entrance:** Currently, Taxiway L9 intersects the North Cargo Apron at an angle, which limits the parking capabilities for large cargo aircraft. By straightening the taxiway entrance to a 90-degree intersection, an additional cargo aircraft parking spot will be made available full time.

Table 6-1 identifies the initial airside alternatives developed, geometric/facility requirements each is intended to address, and the associated figure for each. The facility requirements were supplemented to include future development considerations identified through public stakeholder comments. Figure 6-2 through Figure 6-22 depict the initial airside alternatives developed. The considerations for each alternative functional area are listed below with the resulting details shown in respective figures. Further discussion of the alternatives selected for further refinement included in Section 6.2.2.

- **Parallel Runway:** Three initial alternatives were reviewed for a parallel runway at the Airport. The parallel runway proposes an associated full-length parallel taxiway in each scenario and each is paired with a series of crossfield taxiway alternatives to connect the runway to the existing airfield (as shown in Figure 6-5 through Figure 6-7).

- **Crossfield Taxiway:** Three initial alternatives were reviewed for crossfield taxiways to support the proposed parallel runway south of Runway 4-22. The variation in crossfield taxiway layouts were developed to accommodate operations by ADG-III (supportive of commercial service aircraft) aircraft accessing different parts of the airfield.

- **Taxiways E and F:** Five initial alternatives were developed to address the non-standard conditions.

- **Taxiway L2:** Two initial alternatives were developed to address this non-standard direct access condition.

- **Taxiway Fillets:** One initial alternative was developed to show the widening of Taxiways A, B, J, and K to meet TDG-6 standards to allow more efficient movement of widebody aircraft.

- **Apron Edge Taxilane:** Four initial alternatives were developed to construct an apron edge taxilane between the General Aviation and Air Carrier Aprons. Variations among alternatives seek to accommodate operations by aircraft ranging from TDG-2 to TDG-4.

- **Approach Lighting System:** One initial alternative proposing the installation of a 2,400-ft ALSF-2 to support precision approaches to Runway 22 be developed.

- **Runway Entrance/Exit Taxiway:** One initial alternative was developed to enhance the efficiency of operations at the Airport by constructing an additional entrance and exit taxiway between Taxiways G and J.

- **90-degree Apron Entrance:** One initial alternative was developed to reconfigure Taxiway L9 to maintain a 90-degree intersection angle with the North Cargo Apron. Currently, Taxiway L9 is angled which limits the parking capabilities for large cargo aircraft on the North Cargo Apron.

Table 6-1: Identified Airside Alternatives

Geometry/Facility Requirement	Initial Alternatives	Figure
Parallel Runway	6,000' RWY – 3,872' SE of RWY 4-22	Figure 6-2
	6,500’ RWY – 4,300’ SE of RWY 4-22	Figure 6-3
	7,000' RWY – 4,300' SE of RWY 4-22	Figure 6-4
Crossfield Taxiway	ADG-III dual parallel on Transient Apron	Figure 6-5
	ADG-III dual parallel off Transient Apron	Figure 6-6
	Split ADG-III dual parallel - Transient/Cargo Apron	Figure 6-7
Wide Expanse of Pavement	TWY F Removal	Figure 6-8
	TWY E & F Removal	Figure 6-9
Co-Location of Rapid Exit Taxiway	Relocate TWY F South	Figure 6-10
	Remove TWY E & F, Add 90° TWY	Figure 6-11
Direct Access	Relocate TWY F North	Figure 6-12
Direct Access	Relocate TWY L2 South	Figure 6-13
	Relocate TWY L2 North	Figure 6-14
Taxiway Fillet	Fillet Widening for TDG-6 on TWY A/B/J/K	Figure 6-15
Apron Edge Taxilane	TDG-2 TWY Between TWY L4 and GA Apron	Figure 6-16
	TDG-3 TWY Between TWY L4 and GA Apron	Figure 6-17
	TDG-3/2 TWY Between TWY L4 and TWY L6	Figure 6-18
	TDG-4/3 TWY Between TWY L4 and TWY L6	Figure 6-19
Approach Lighting System	2,400' ALSF-2 in RWY 22 Approach Zone	Figure 6-20
Runway Entrance/Exit Taxiway	TWY H Development	Figure 6-21
90° Apron Entrance	TWY L9 Realignment	Figure 6-22

Note: ADG = Airplane Design Group; TDG = Taxiway Design Group; TWY = Taxiway; ALSF-II = Approach Lighting System with Sequence Flashing Lights.
Source: McFarland Johnson, 2018

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Figure 6-2: Parallel Runway Alternative 1

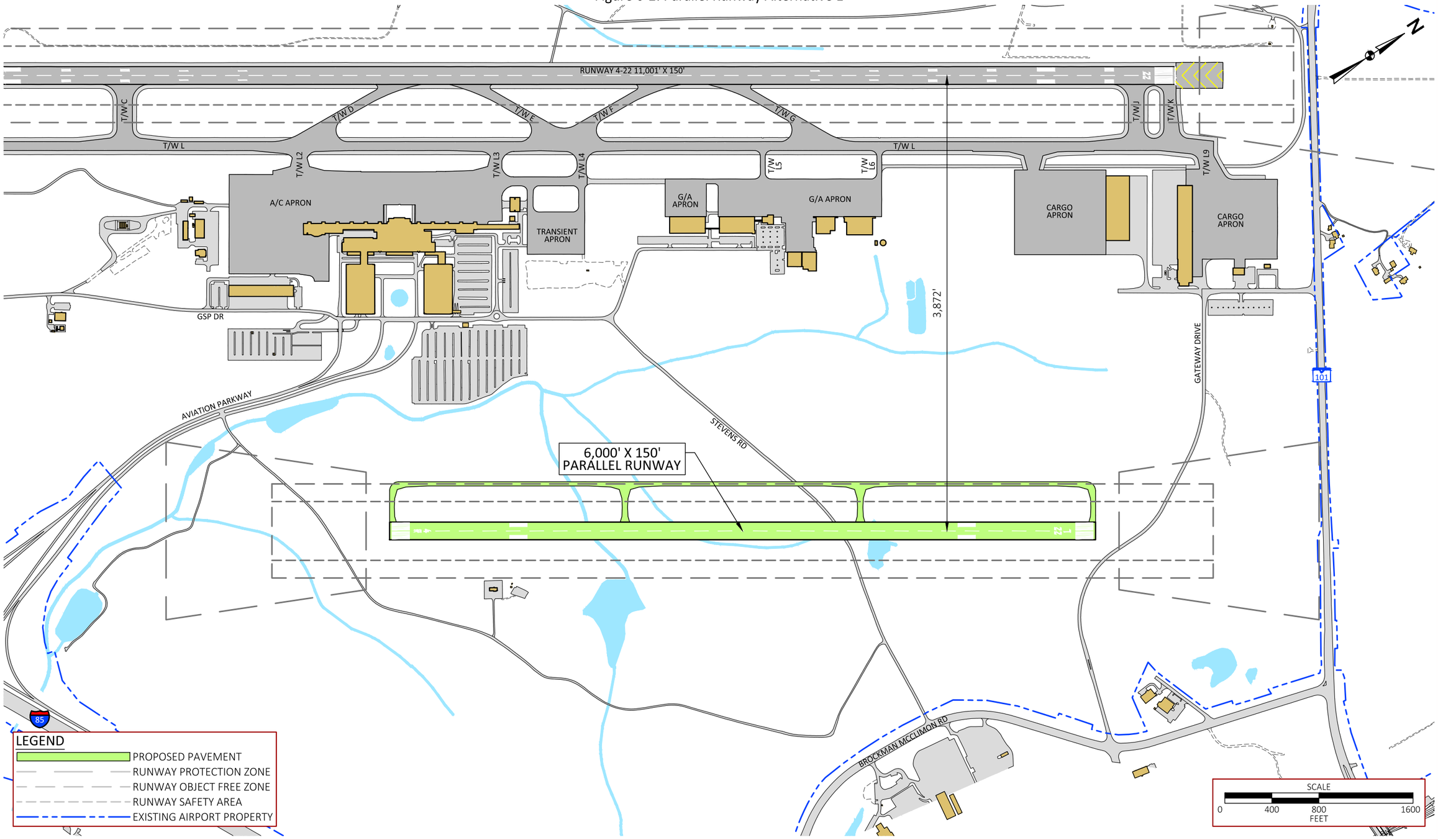

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Figure 6-3: Parallel Runway Alternative 2

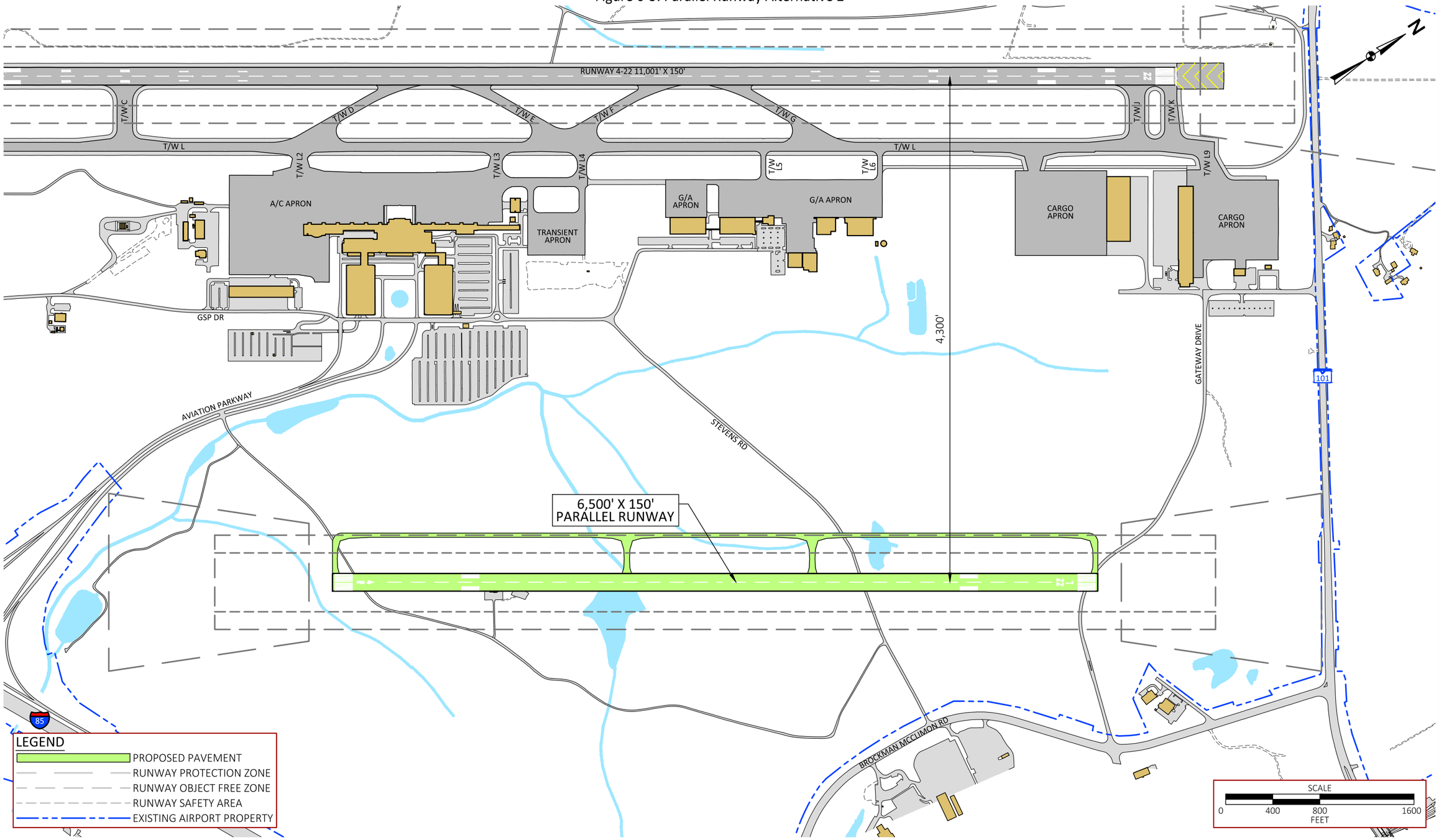

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Figure 6-4: Parallel Runway Alternative 3

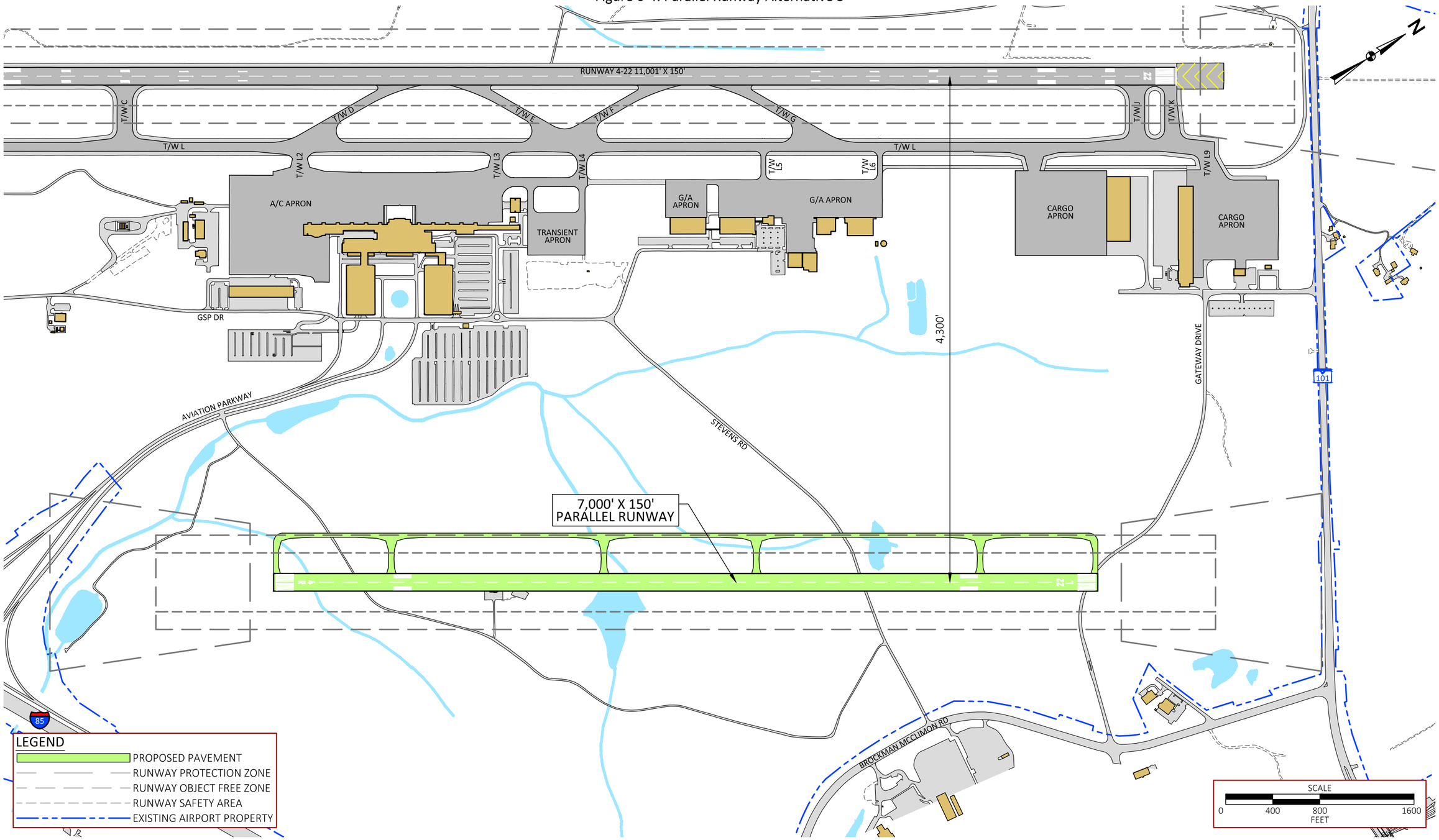

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Figure 6-5: Crossfield Taxiway Alternative 1

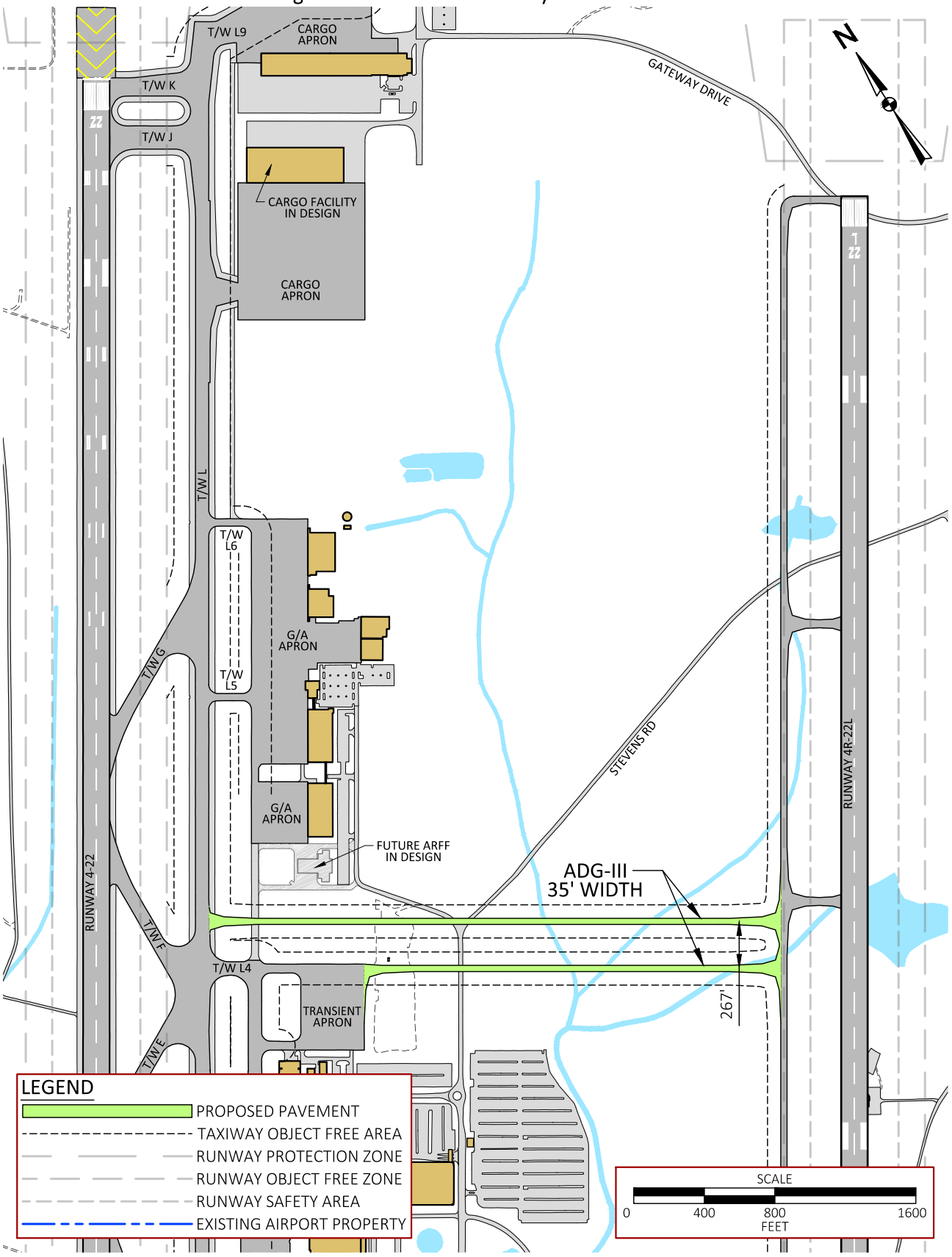

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Figure 6-6: Crossfield Taxiway Alternative 2

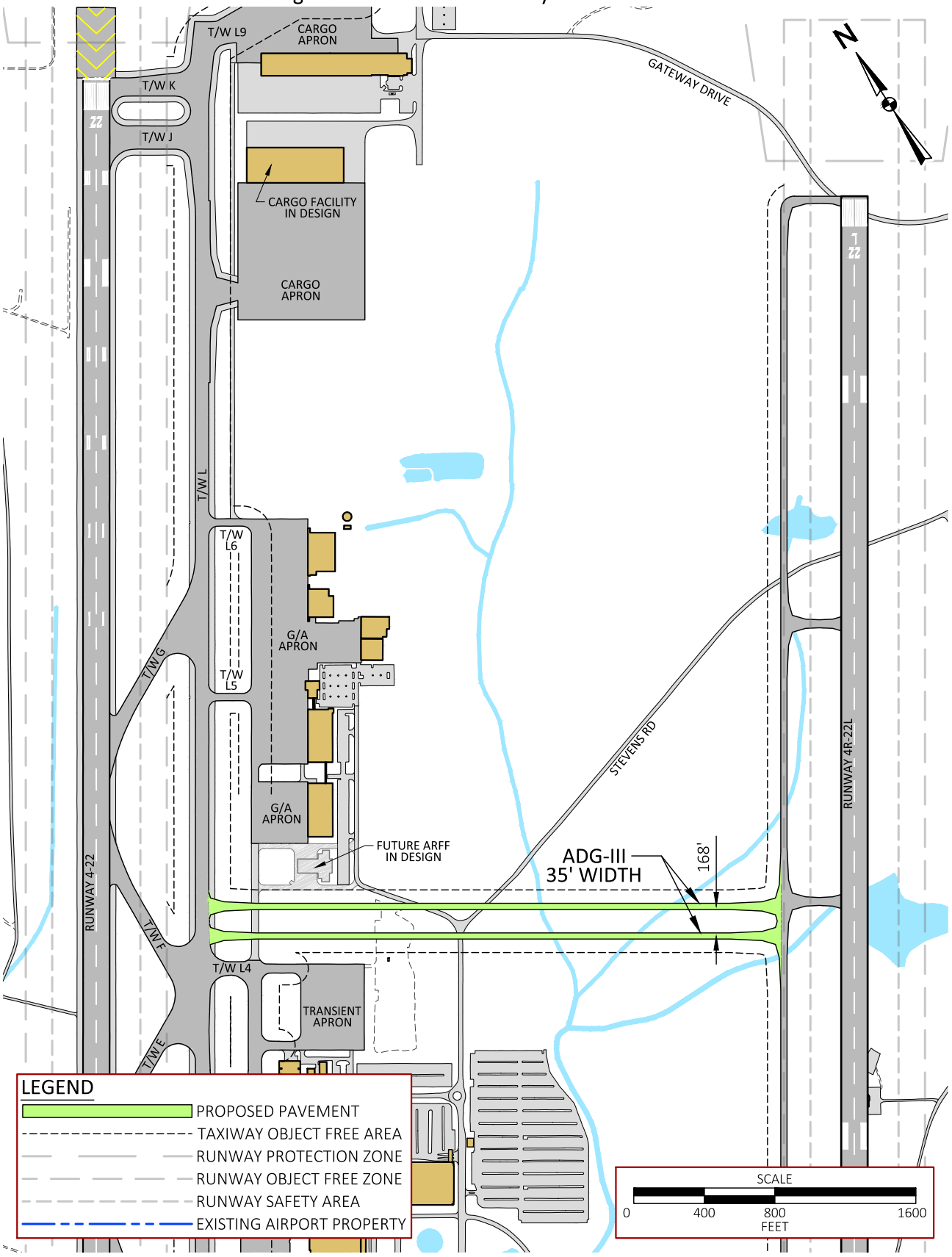

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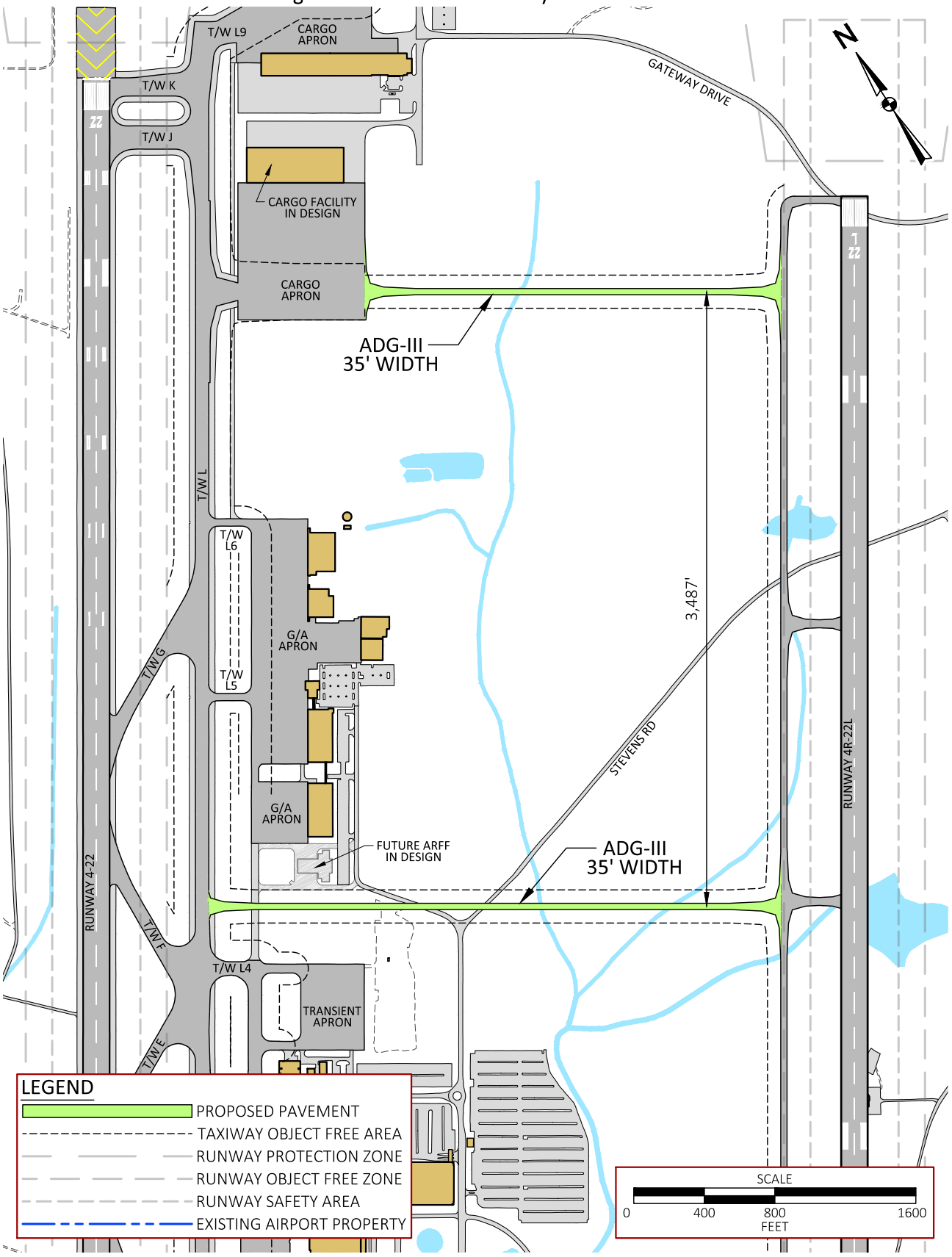
Figure 6-7: Crossfield Taxiway Alternative 3



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LEGEND
PROPOSED PAVEMENT
REMOVED PAVEMENT
AIRPORT PROPERTY LINE

N

Figure 6-8: Taxiway F Removal

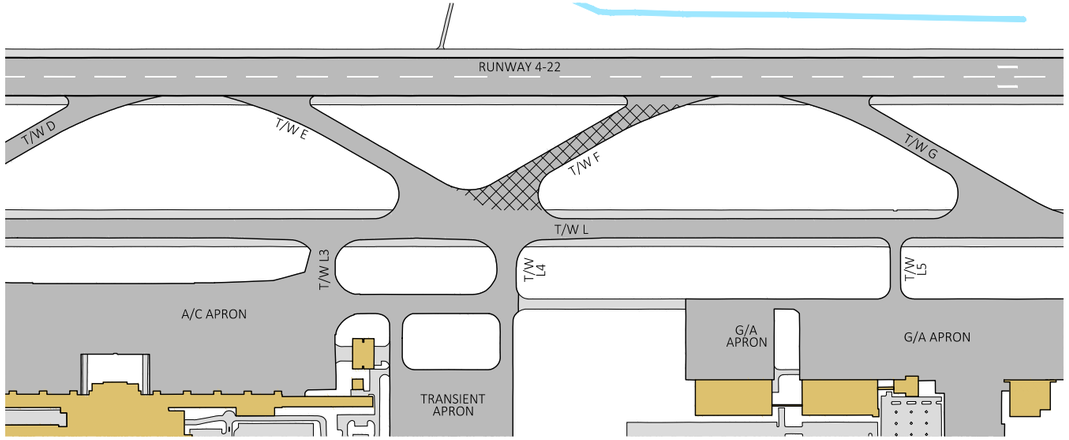


Figure 6-9: Taxiway E & F Removal

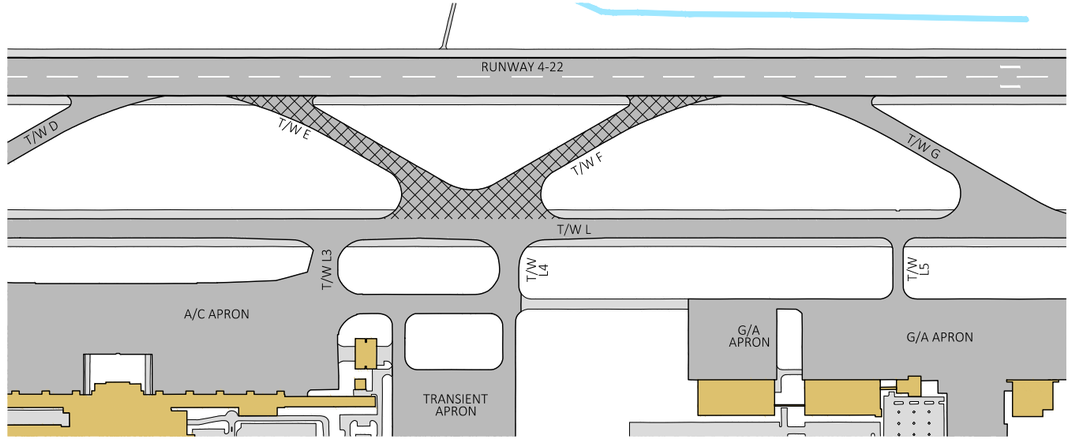


Figure 6-10: Relocated Taxiway F South

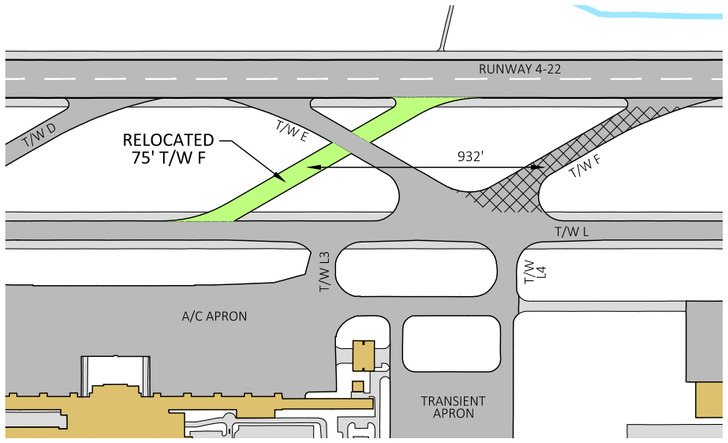


Figure 6-11: Taxiway E & F Replacement with 90° Connector Taxiway

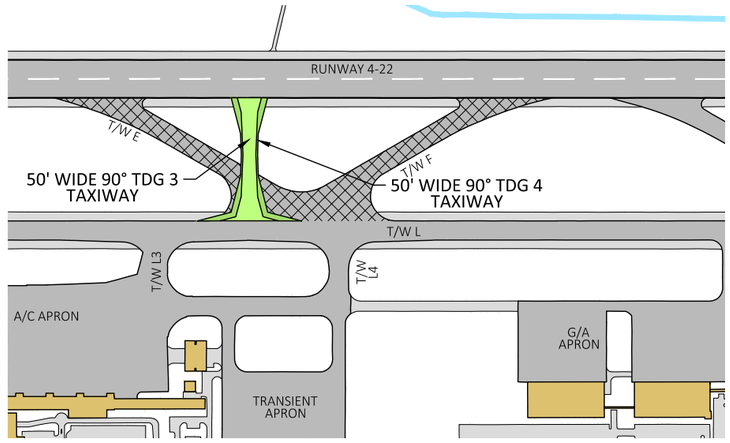
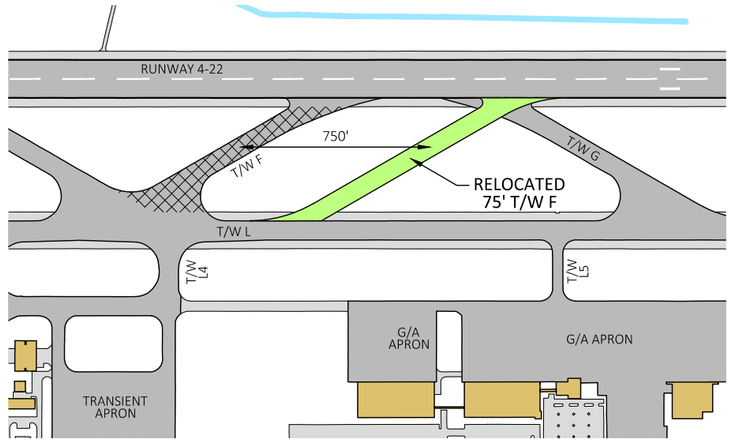


Figure 6-12: Relocated Taxiway F North



SCALE
0 300 600 1200
FEET

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Figure 6-13: Relocated Taxiway L2 South

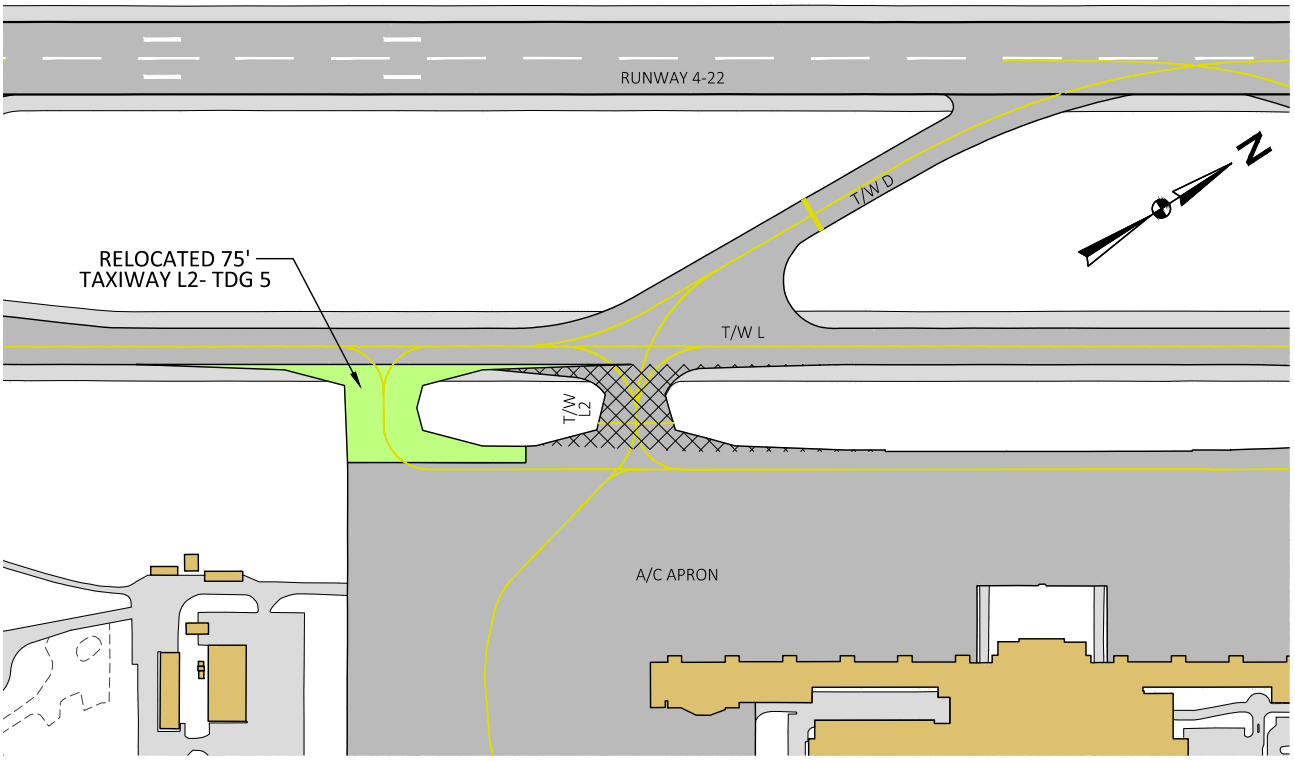

Figure 6-14: Relocated Taxiway L2 North

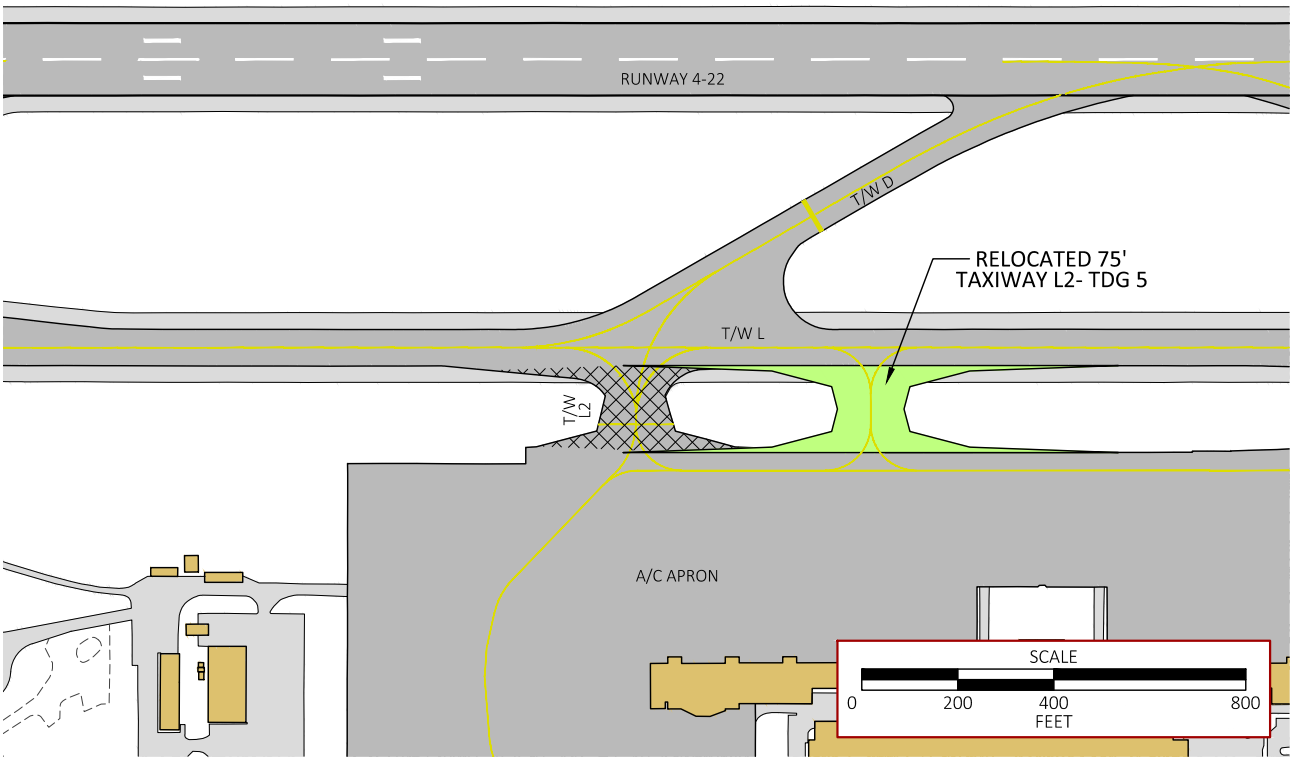

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Figure 6-15: Taxiway Fillet Widening for TDG 6 on Taxiway A/B/J/K

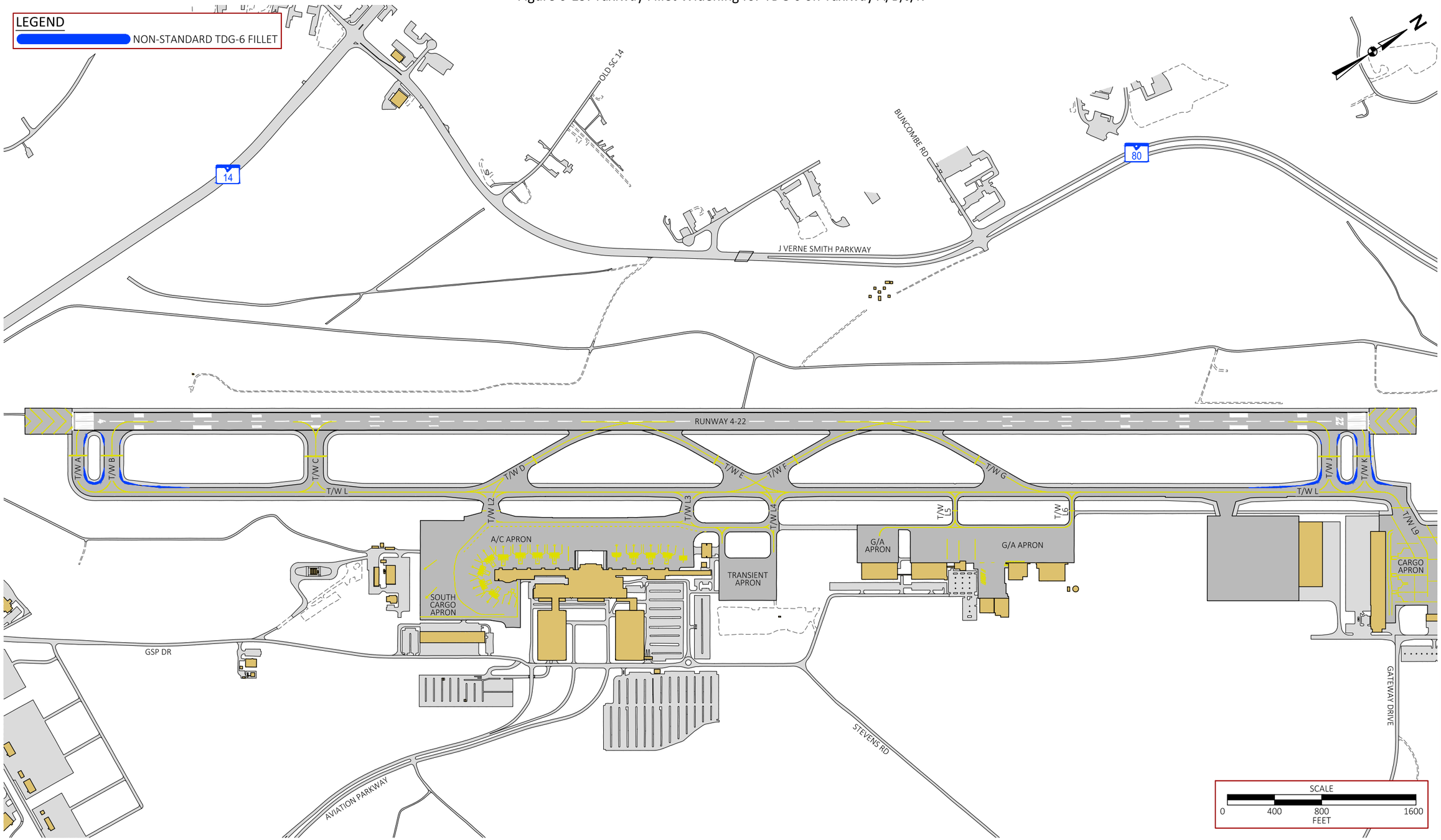

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Figure 6-16: Apron Edge Taxilane Alternative 1

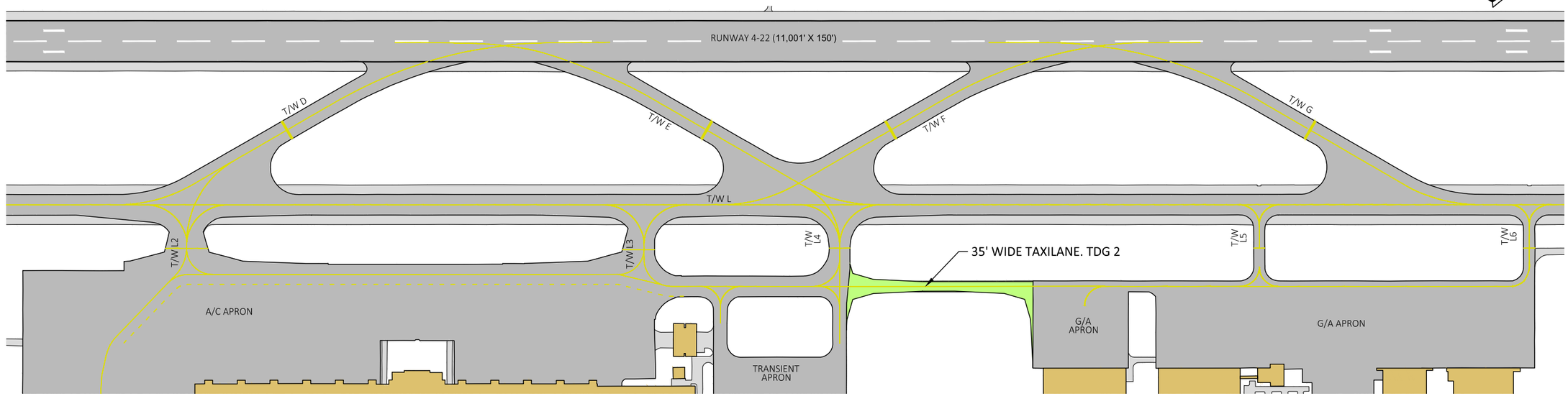
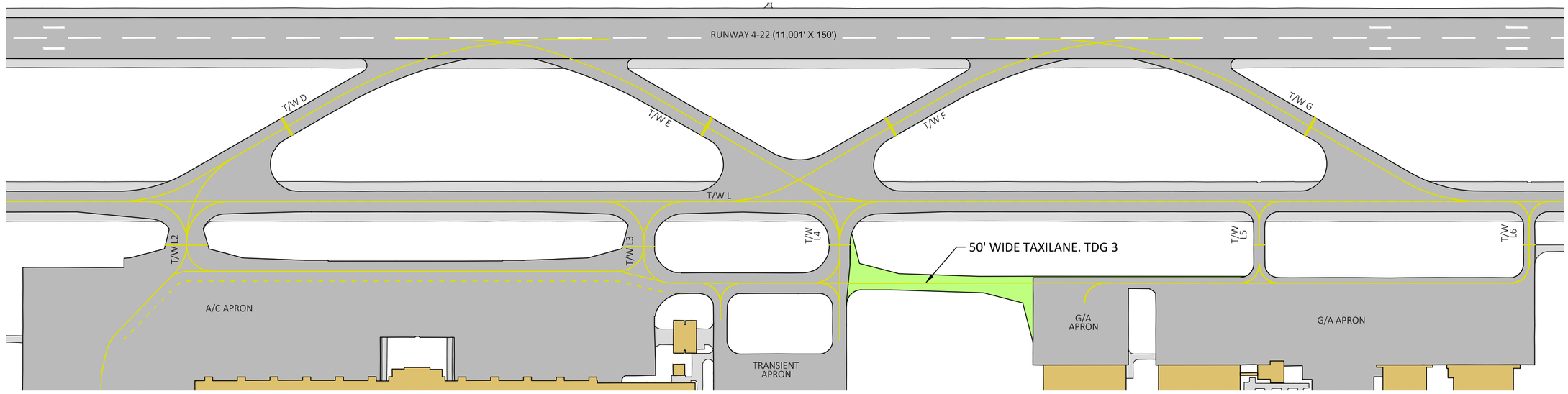


Figure 6-17: Apron Edge Taxilane Alternative 2



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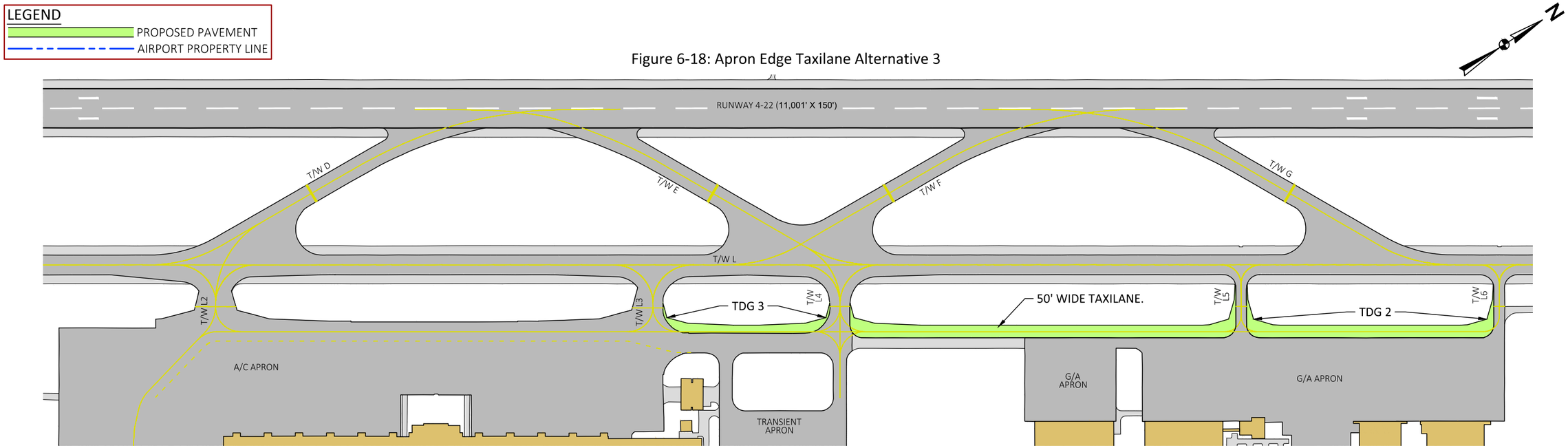

Figure 6-18: Apron Edge Taxilane Alternative 3

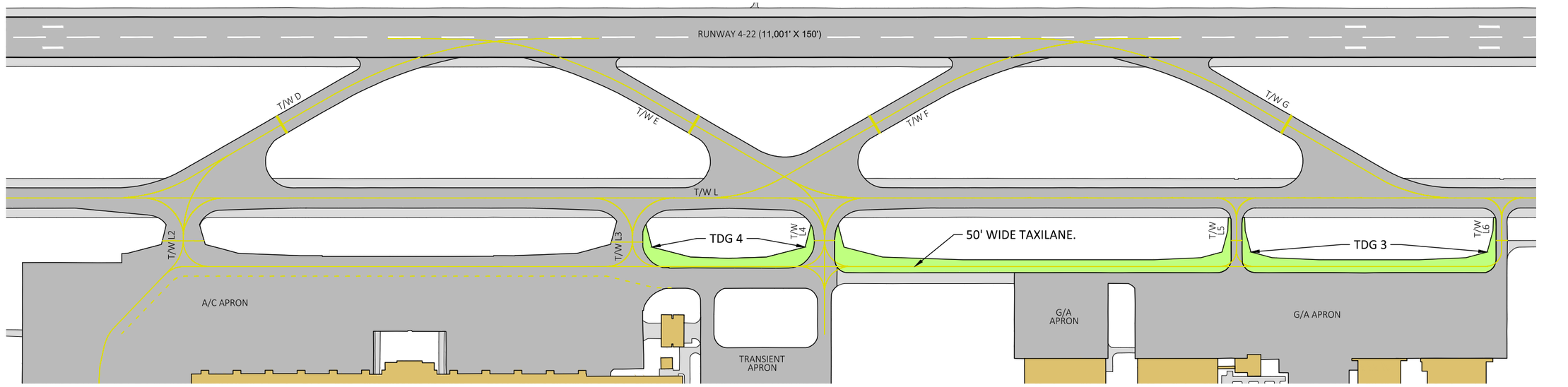

Figure 6-19: Apron Edge Taxilane Alternative 4

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Figure 6-20: Runway 22 ALSF-II

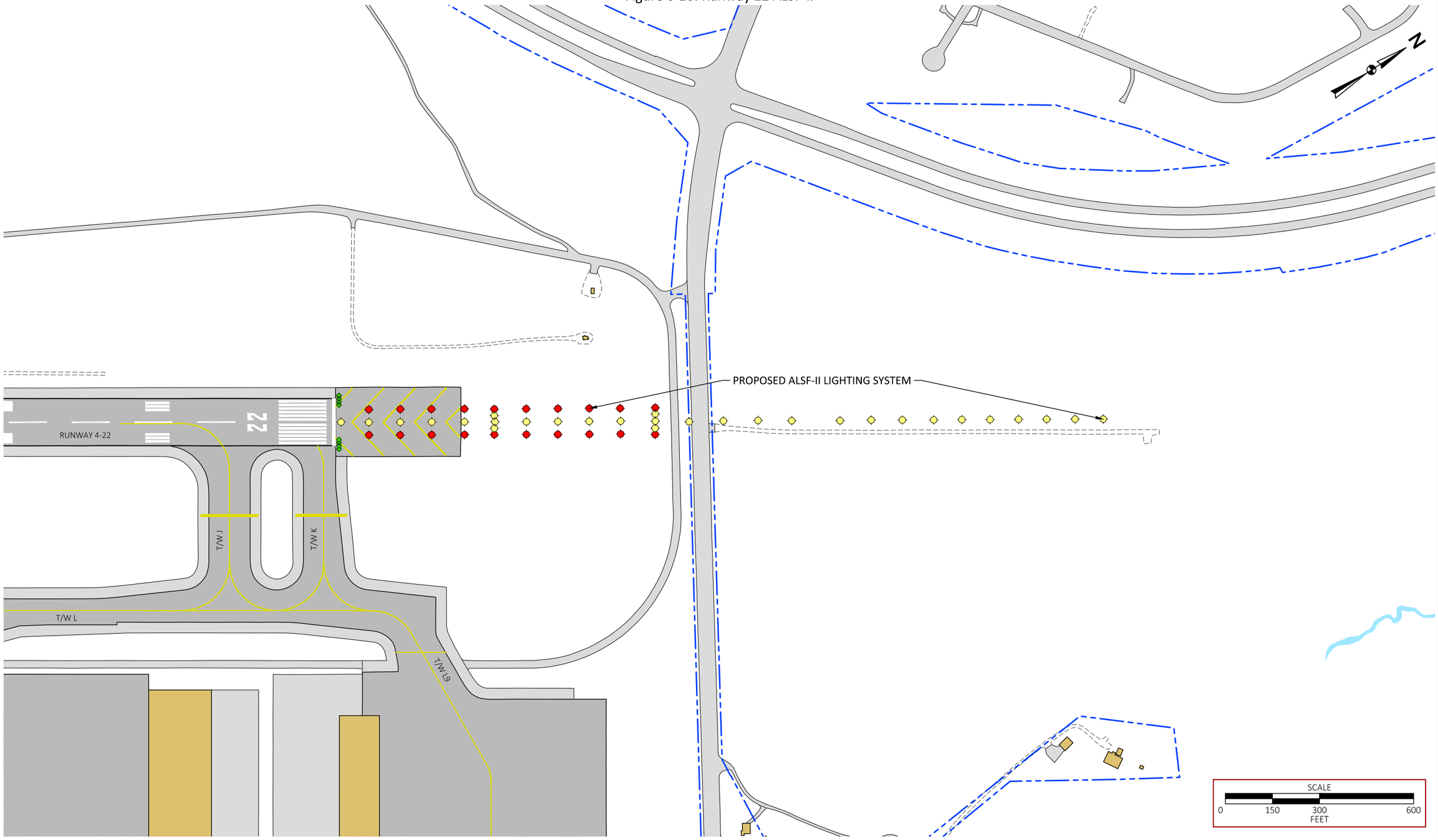

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Figure 6-21: Taxiway H Alternative

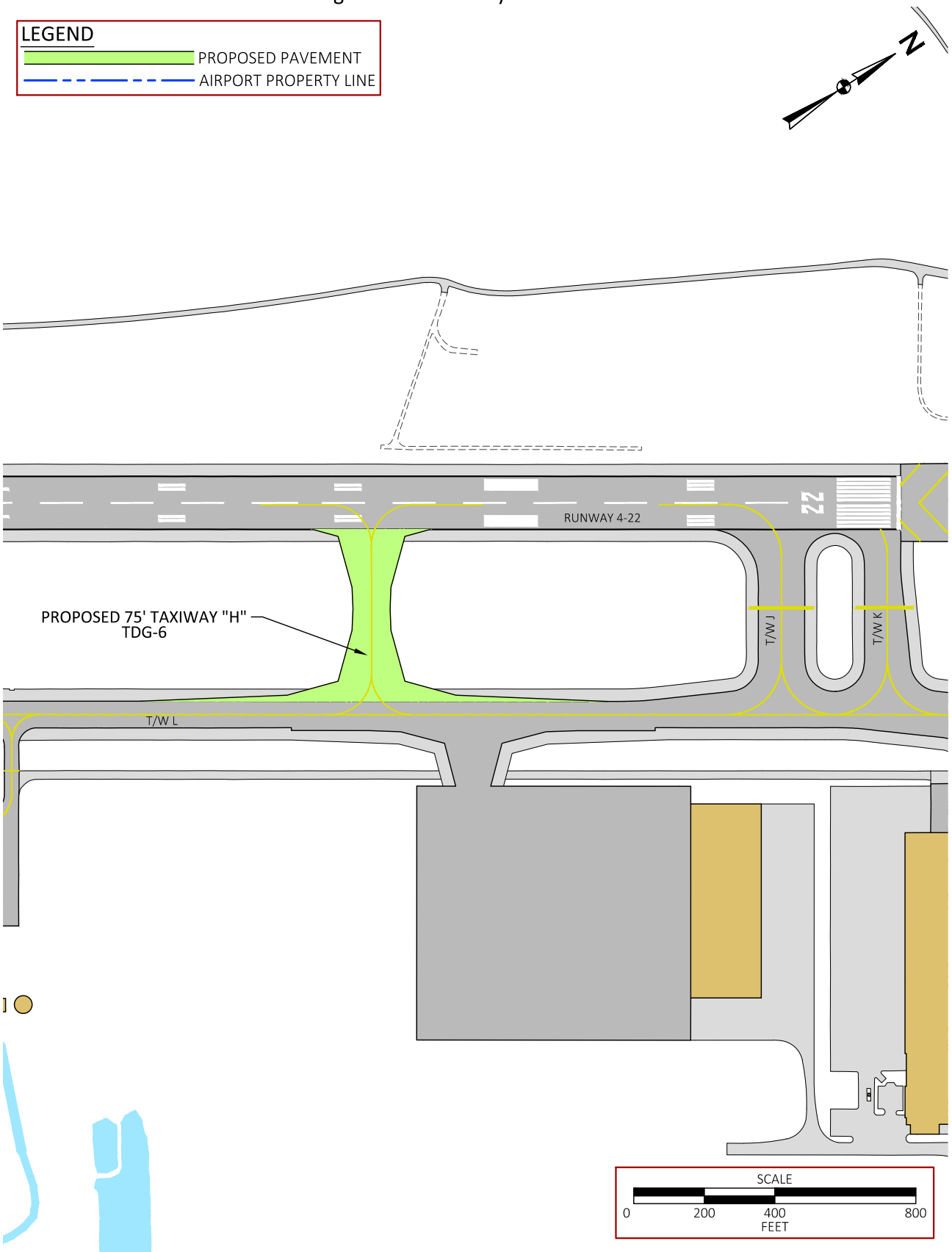

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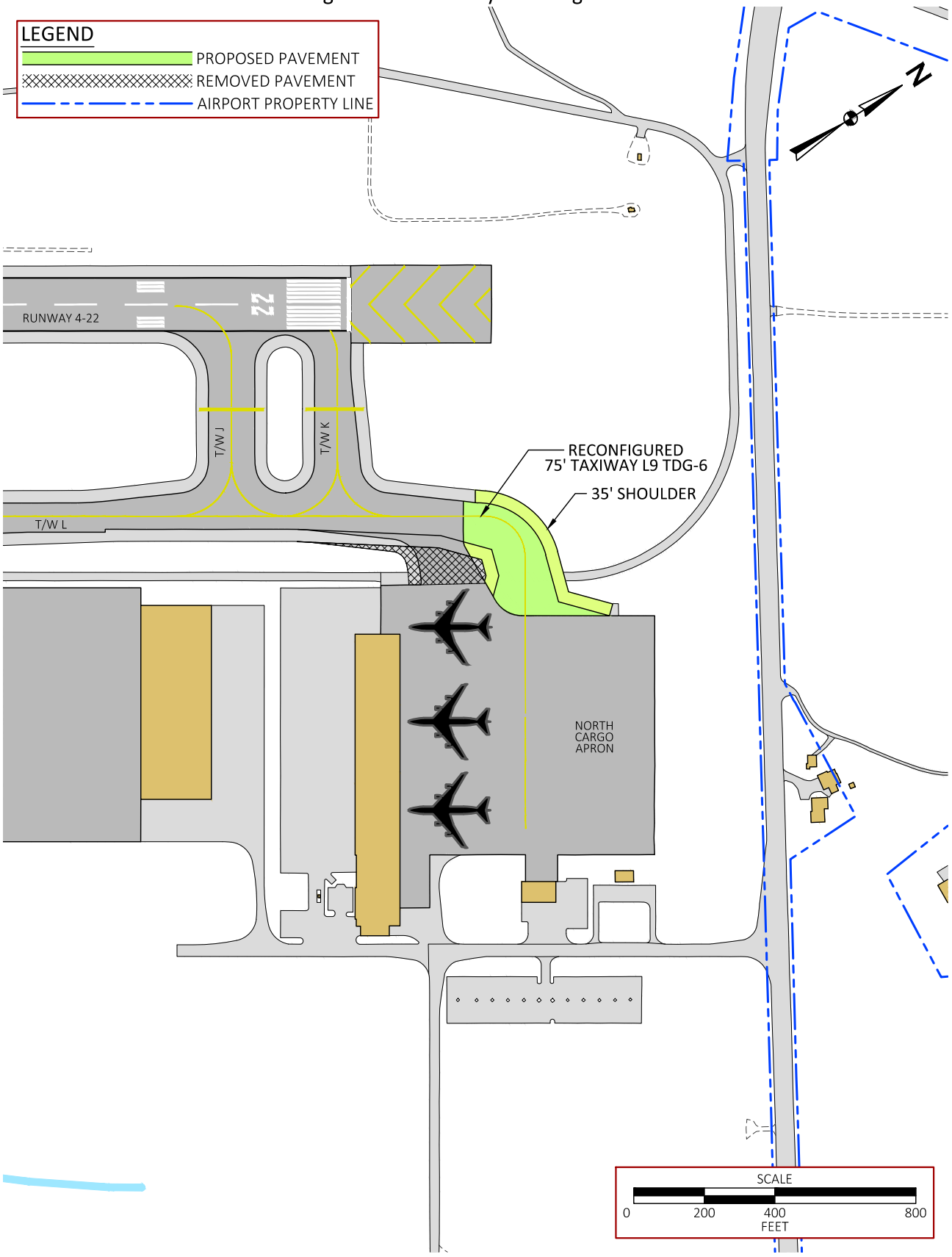
Figure 6-22: Taxiway L9 Realignment



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6.1.2. Terminal Airside Alternatives

The terminal airside alternatives presented in the following sections focus on the commercial terminal apron area, gated aircraft positions, and ancillary airside terminal building requirements anticipated across the planning period and beyond. Care was taken to develop a multitude of terminal/apron configurations to express the overall utility of existing pavement and terminal-reserved lands within the terminal campus, which includes the South Cargo Apron, Concourse A and its supporting apron, Concourse B and its supporting apron, and the Transient Apron area. Additionally, most development concepts include ground boarding and international variations to evaluate the flexibility of proposed layouts. These alternatives were then further refined and paired as discussed in Section 6.2.2.

The linear and Concourse A focused terminal growth plan that was presented in the Airport's previous master plan was seen during the course of this master plan to unnecessarily encumber high-strength concrete apron areas currently used as the South Cargo apron and would eventually encounter lateral growth limitations by the Airport maintenance yard. Although, linear development alternatives were prepared, so too were hammer head designs, rotunda designs, and other non-linear options.

Additionally, considering the anticipated relocation of Airport Traffic Control Tower (ATCT) and the Aircraft Rescue and Firefighting (ARFF) facilities at GSP, a strong desire to develop a balanced terminal system between the concourses was recognized. As such, alternatives for expansion to Concourses A and B were explored for their ability to work in unison to provide for anticipated future needs while maximizing the utility of existing Airport facilities. Additional considerations that supplemented the development of the terminal airside alternatives are discussed below.

- Gated Aircraft Parking Positions: Chapter 5 identifies a requirement of 15 total passenger boarding gates by 2037. Should the Airport reach 2 million annual enplanement passengers (MAEP), 18 total gates will be required. At 3.5 MAEP, 28 total gates will be required. With 13 existing gates at the Airport, alternatives were development to ensure gate requirements are met throughout the planning period and beyond.

- Widebody Capable Positions: Variations of alternatives were developed to create gate layouts that are compatible with widebody aircraft. This allows for the exploration of how widebody aircraft could be accommodated on the Air Carrier Apron and at a gated hardstand.

- Balanced Terminal Development: Consideration was given to ensure terminal expansion alternatives would remain balanced around the GSP Grand Hall and not disproportionally allocate air traveler activity to any one concourse. This included ensuring development would not impact the efficiency of the Airport's existing facilities. In addition, the provision for a baggage claim expansion in front of Concourse B identified in the 2010 terminal study is shown in all terminal airside alternatives.

- RON Positions: The Airport is realizing a strong demand for RON parking. Once air cargo activity on the South Cargo Apron is relocated to the Air Cargo Apron upon its completion, the South Cargo Apron's high strength pavement will be underutilized. The value of this

pavement to provide for aircraft hardstand positions is included in terminal development alternatives. Any alternatives proposing lateral development of Concourse A considered impacts to this apron area. Potential RON positions within future development layouts for both concourses were included in the development of terminal airside alternatives.

- **De-Icing Areas:** The ability to introduce aircraft de-icing areas to the Air Carrier Apron was investigated as part of terminal airside alternative development. The Airport currently does not have a designated de-icing area and aircraft are de-iced at passenger boarding gates. By integrating a centralized de-icing facility into the future terminal development plan, the Airport will ensure the needs of operators are met efficiently while fully managing runoff of de-icing fluids as operations increase throughout the planning period.

- **Expansion of Ground Storage Equipment (GSE) Apron:** Consideration for an increase in GSE storage space was part of the terminal airside alternative development process. As operations from airlines increase at the Airport, the need for GSE storage will increase. To effectively use valuable apron space for aircraft movement and ensure operator needs are met throughout the planning period, potential expansions of GSE storage areas are shown in several terminal airside alternatives.

- **Terminal 2 Integration:** With aviation forecasts extending beyond the 20-year planning period, a terminal layout that will ultimately support a second terminal to accommodate passenger growth beyond 3 MAEP is included in the development of terminal airside alternatives.

Table 6-2 recognizes each of the Concourse A, Concourse B, and future second terminal alternatives. Figure 6-23 to Figure 6-38 depict the terminal airside alternatives developed. The groupings of each set of terminal airside alternatives are described below with the resulting details shown in respective figures. Further discussion of the alternatives selected for further refinement included in Section 6.2.2.

The following initial alternative groupings were developed for Concourse A. The expansion of the pavement edge of the Air Carrier Apron is included in all appropriate Concourse A alternatives.

- **A1 Alternatives:** This set of initial alternatives were developed with a lateral terminal expansion of Concourse A with narrowbody ground boarding and widebody variations shown. Each alternative provides GSE storage expansion and includes an exit walkway connecting arriving passengers directly to the existing baggage claim area.

- **A2 Alternative:** This initial alternative shows a linear expansion of Concourse A. The existing concourse width would be increased to provide additional room for concessions.

- **A3 Alternatives:** This set of initial alternatives shows the expansion of Concourse A using a rotunda with narrow and widebody variations shown. The international boarding variation would require a shorter rotunda extension to accommodate widebody positions.

- **A4 Alternatives:** This set of initial alternatives were developed with a hammerhead-style expansion of Concourse A with narrow and widebody variations shown. The international

boarding variation would require an offset hammerhead design to accommodate widebody positions.

- **A5 Alternative:** This alternative shows an angled and lateral expansion of Concourse A in an widebody configuration only.

- **A6 Alternatives:** These initial alternatives show L-shaped expansions of Concourse A east and south with both narrow and widebody variations. The ground variation proposes less holdroom space.

The following initial alternative groupings were developed for Concourse B. The expansion of portions of the northern part of the Air Carrier Apron is included in all appropriate Concourse B alternatives.

- **B1 Alternatives:** These initial alternatives were developed with a short, L-shaped terminal expansion of Concourse B with narrow and widebody variations shown.

- **B2 Alternatives:** These alternatives were developed with a longer, L-shaped expansion of Concourse B with narrow and widebody variations shown. These scenarios require additional pavement expansion to support more parking gates and hardstand ground boarding positions.

- **B3 Alternatives:** This set of alternatives shows a short, L-shaped expansion of Concourse B partnered with the development of Terminal 2 with narrow and widebody variations. A walkway connector is shown between the Concourse C expansion and Terminal 2 in both scenarios.

Table 6-2: Identified Terminal Airside Alternatives

Focus	Initial Alternatives	Figure
Concourse A	Terminal Alternative A1 – Ground	Figure 6-23
	Terminal Alternative A1 – International	Figure 6-24
	Terminal Alternative A2	Figure 6-25
	Terminal Alternative A3 – Ground	Figure 6-26
	Terminal Alternative A3 – International	Figure 6-27
	Terminal Alternative A4 – Ground	Figure 6-28
	Terminal Alternative A4 – International	Figure 6-29
	Terminal Alternative A5 – International	Figure 6-30
	Terminal Alternative A6 – Ground	Figure 6-31
	Terminal Alternative A6 – International	Figure 6-32
Concourse B	Terminal Alternative B1 – Ground	Figure 6-33
	Terminal Alternative B1 – International	Figure 6-34
	Terminal Alternative B2 – Ground	Figure 6-35
	Terminal Alternative B2 – International	Figure 6-36
Terminal 2	Terminal Alternative B3 – Domestic	Figure 6-37
	Terminal Alternative B3 – International	Figure 6-38

Source: McFarland Johnson, 2018

Figure 6-23: Terminal Alternative A1 - Ground

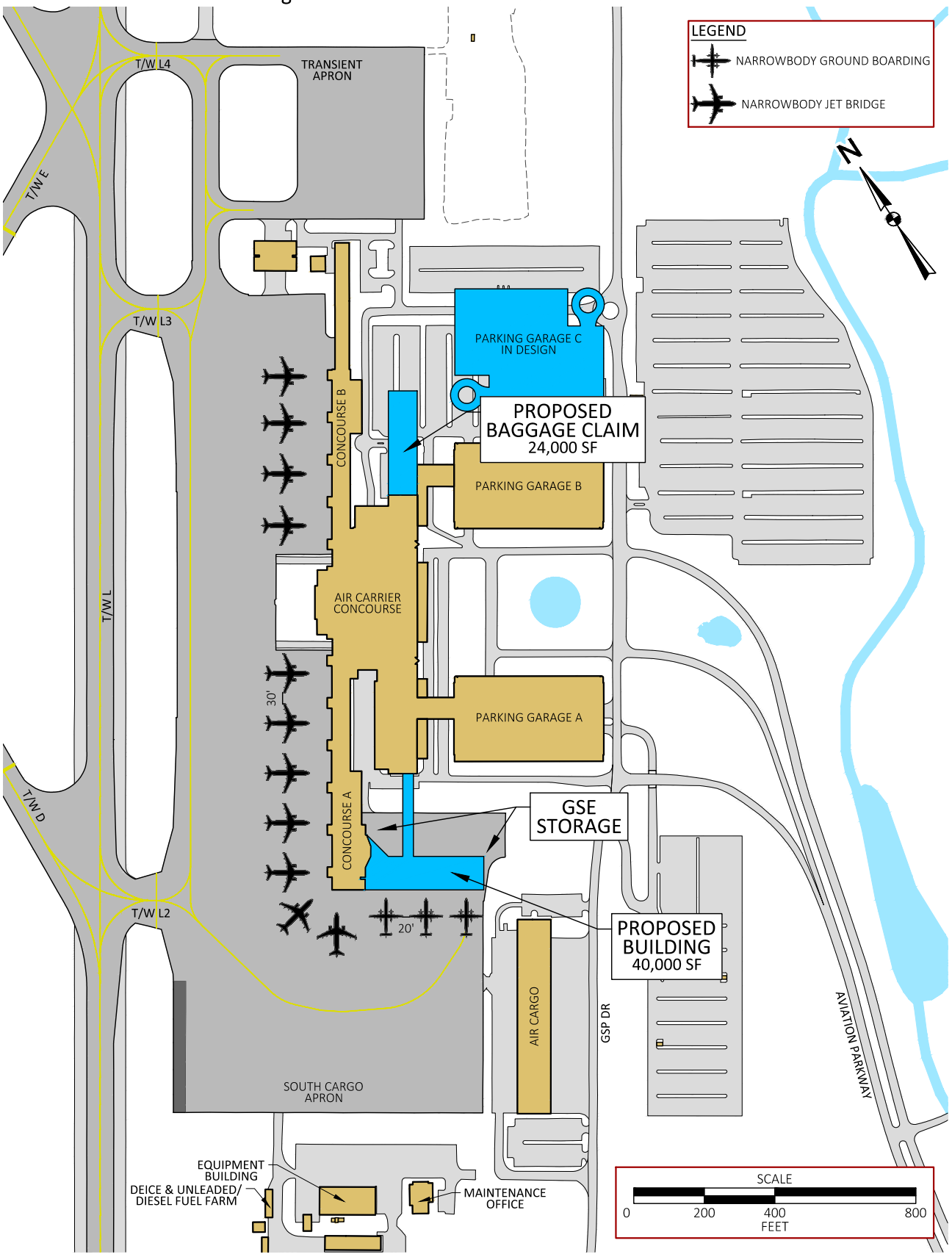

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Figure 6-24: Terminal Alternative A1 - International

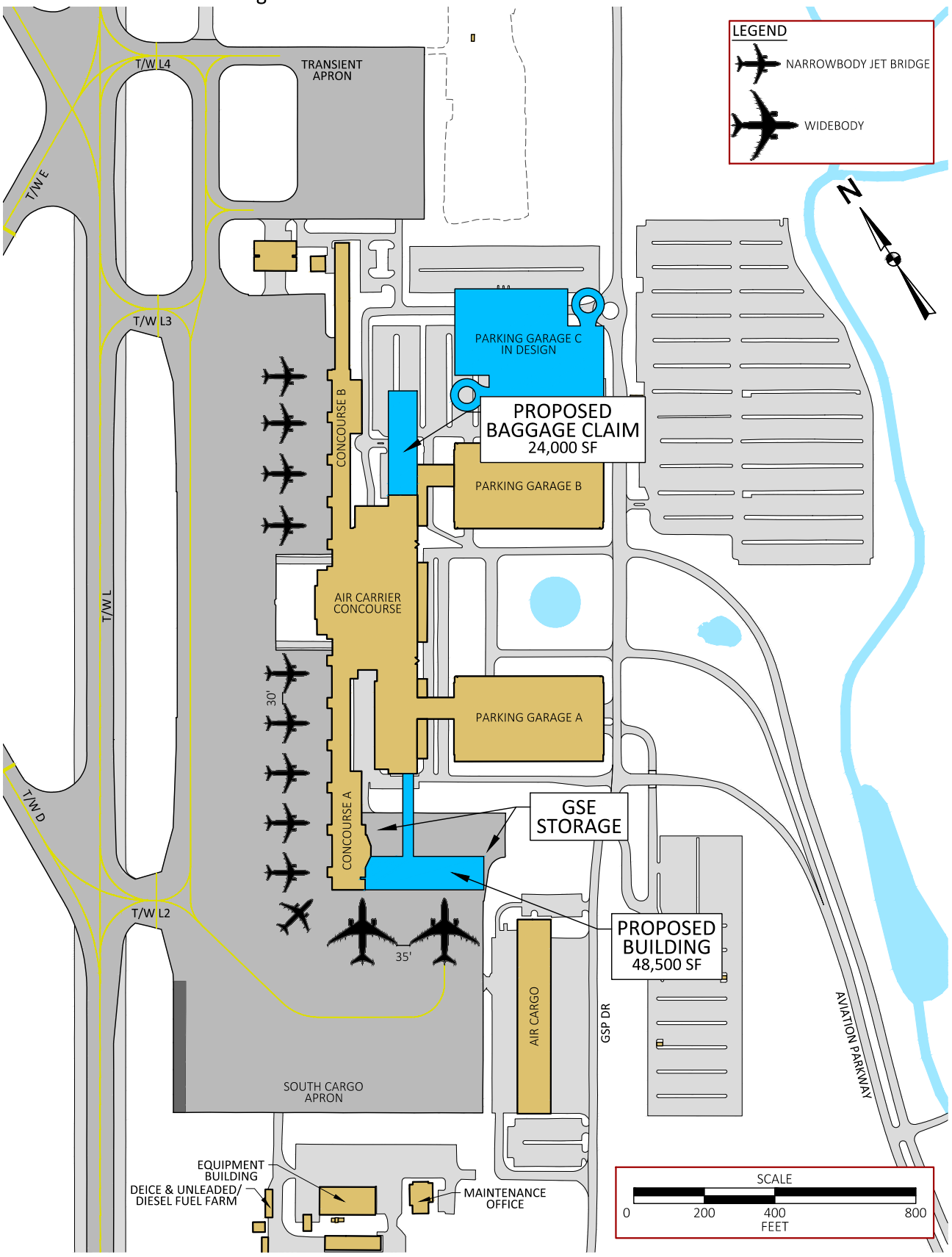

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Figure 6-25: Terminal Alternative A2

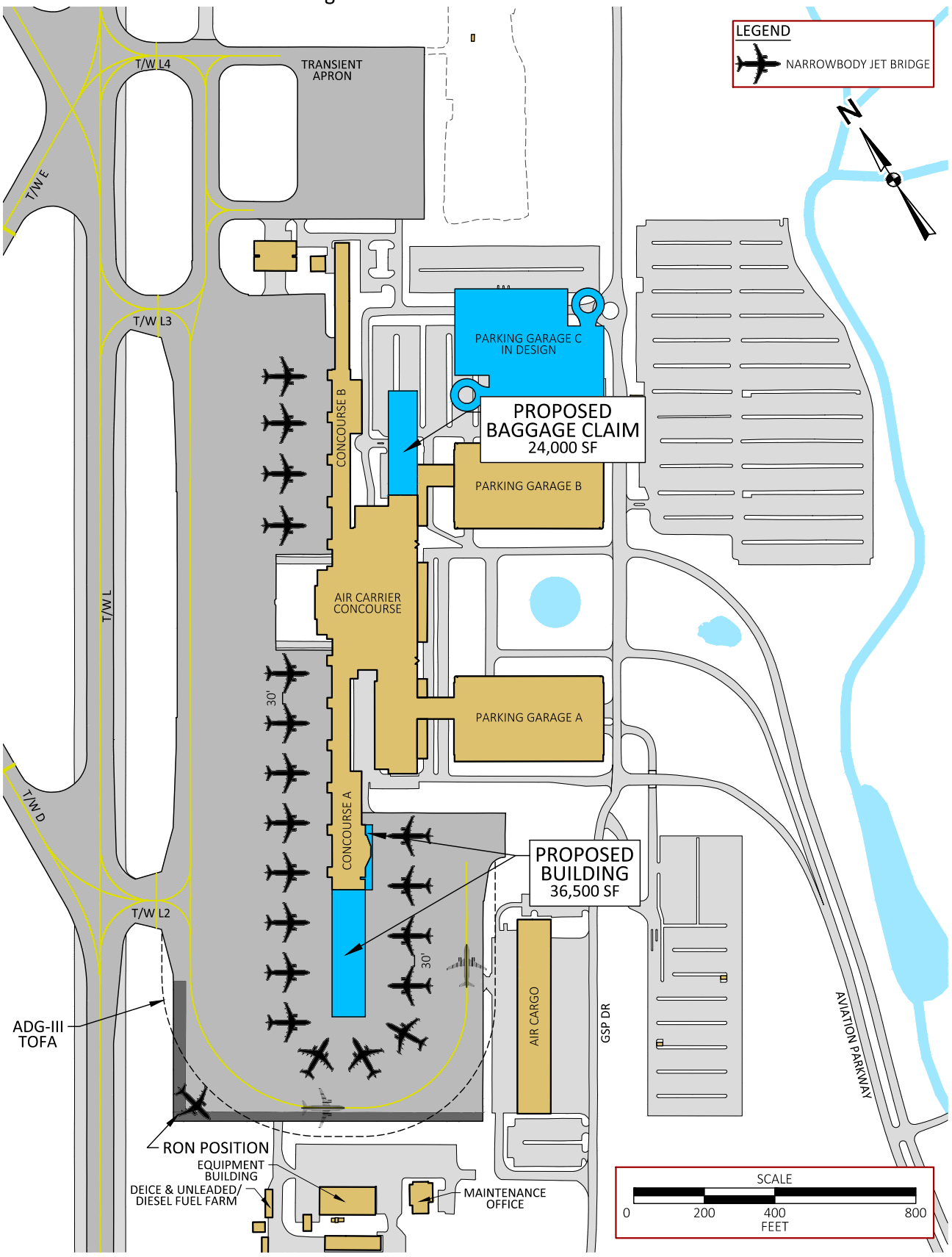

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Figure 6-26: Terminal Alternative A3 - Ground

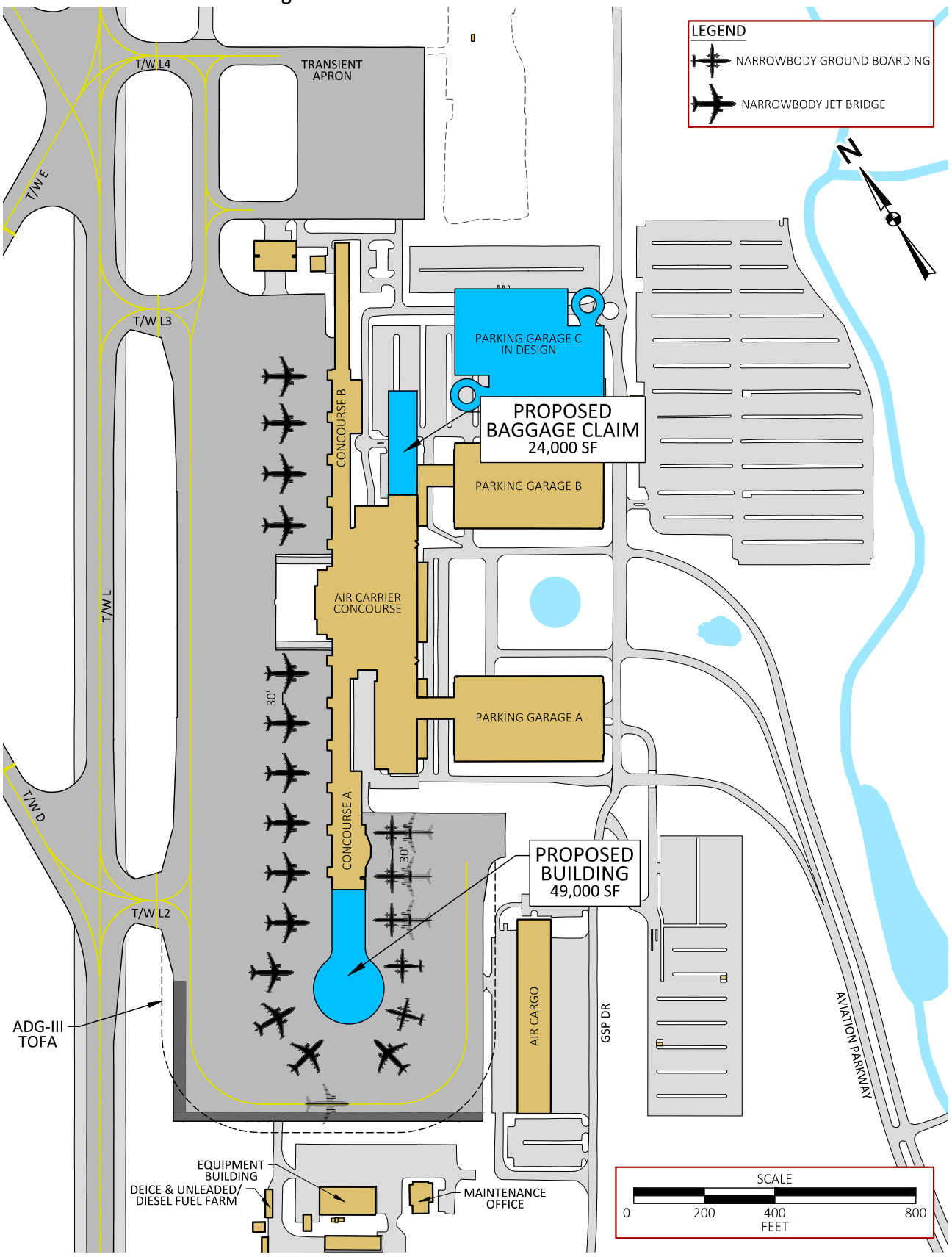

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Figure 6-27: Terminal Alternative A3 - International

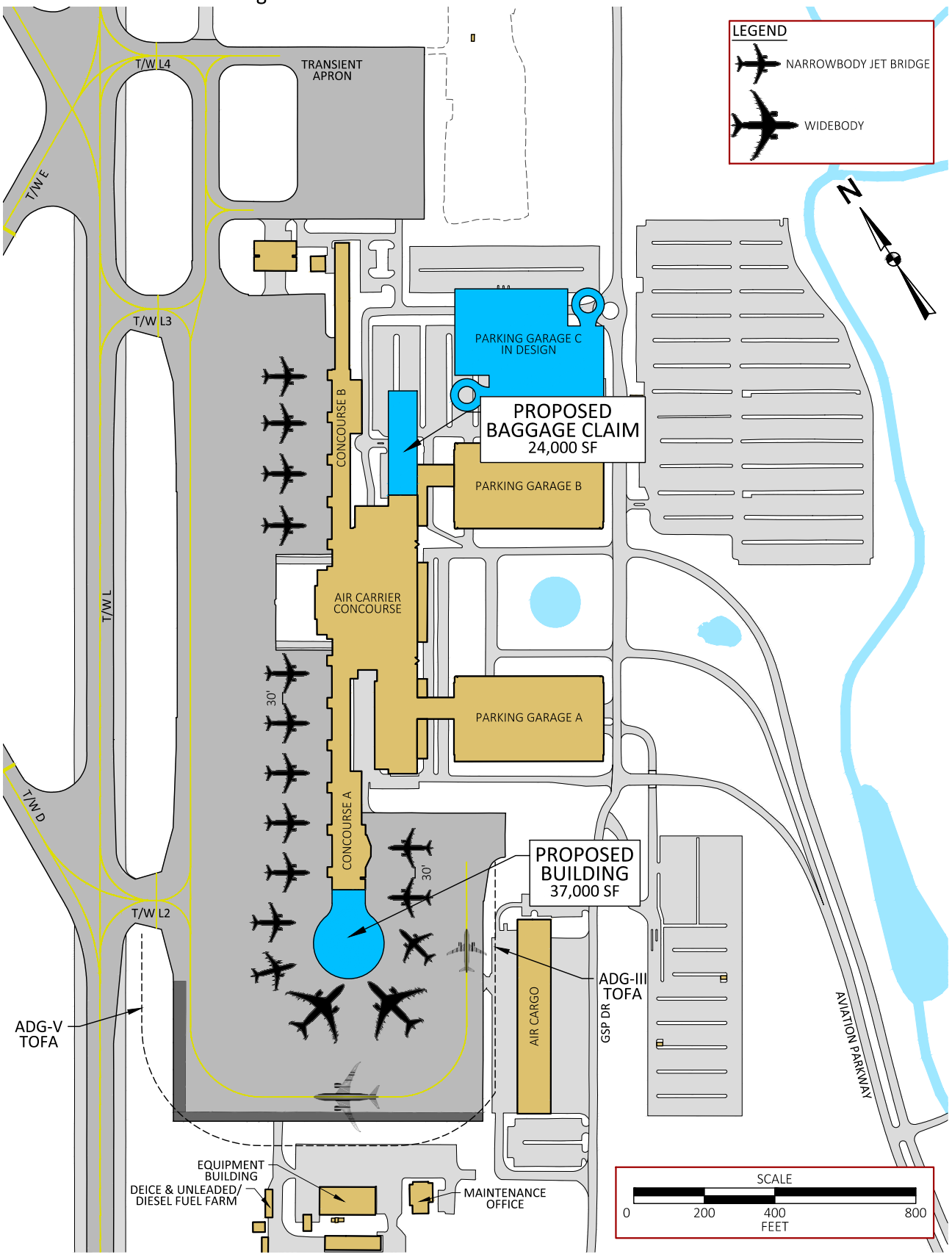

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Figure 6-28: Terminal Alternative A4 - Ground

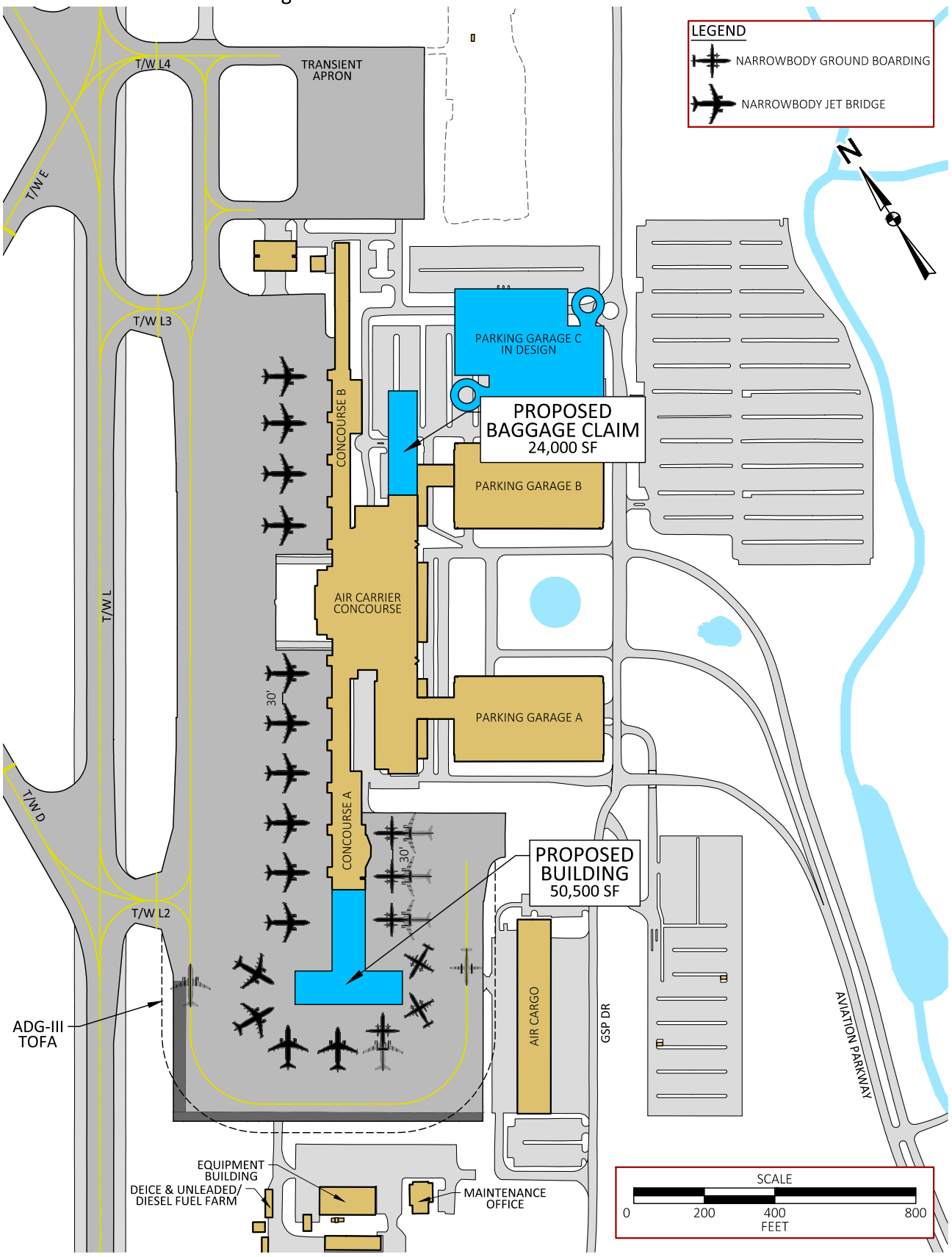

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Figure 6-29: Terminal Alternative A4 - International

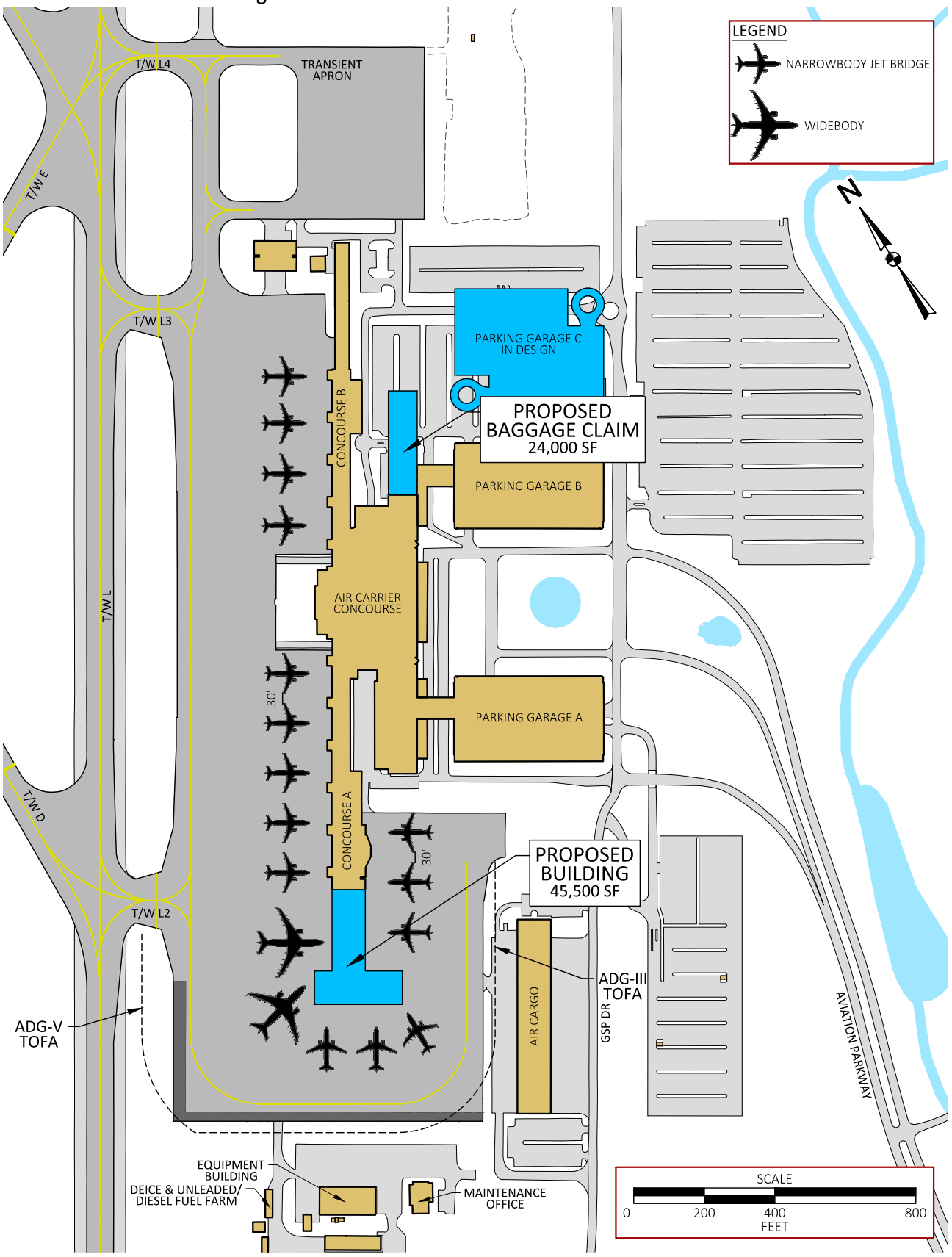

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Figure 6-30: Terminal Alternative A5 - International

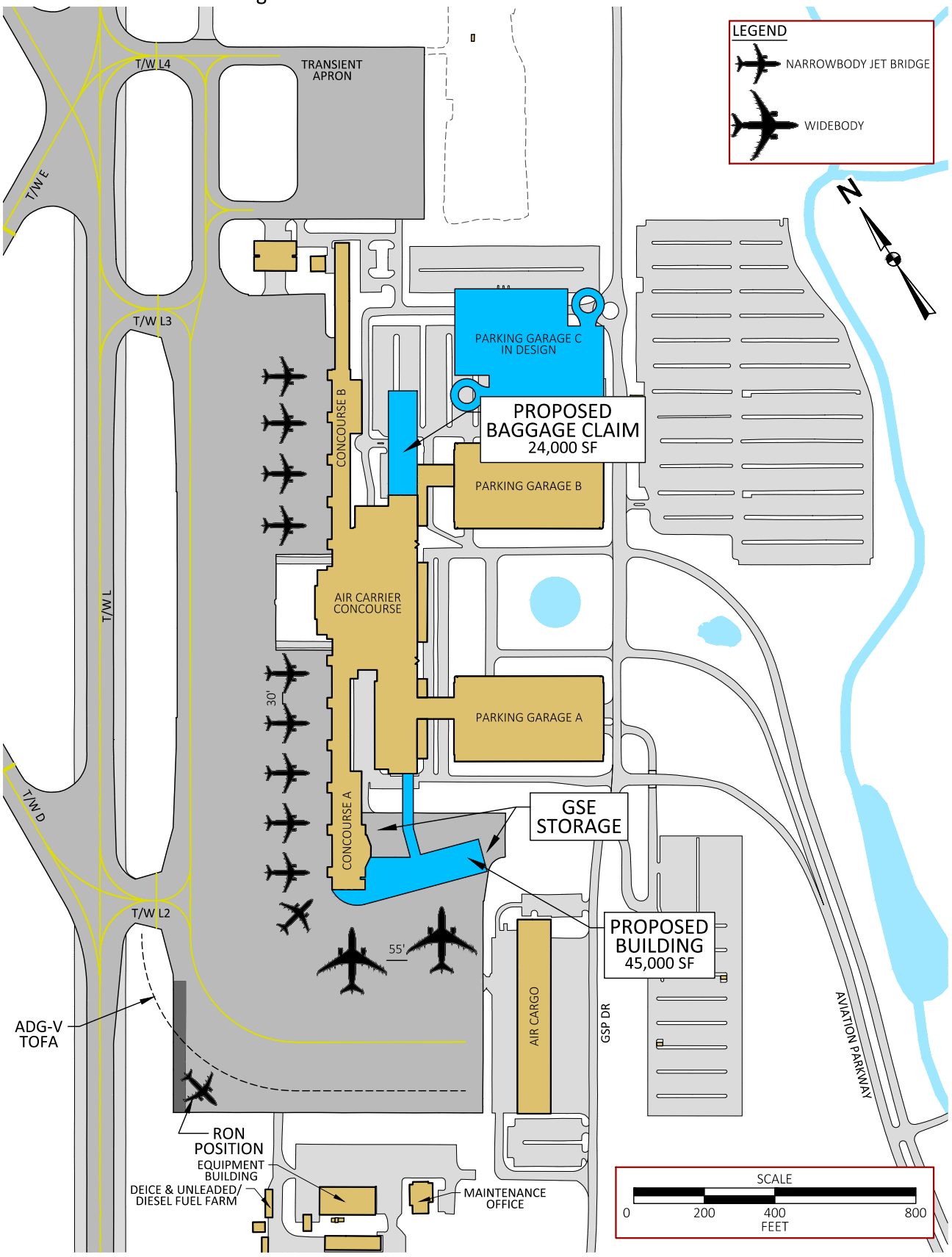

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Figure 6-31: Terminal Alternative A6 - Ground

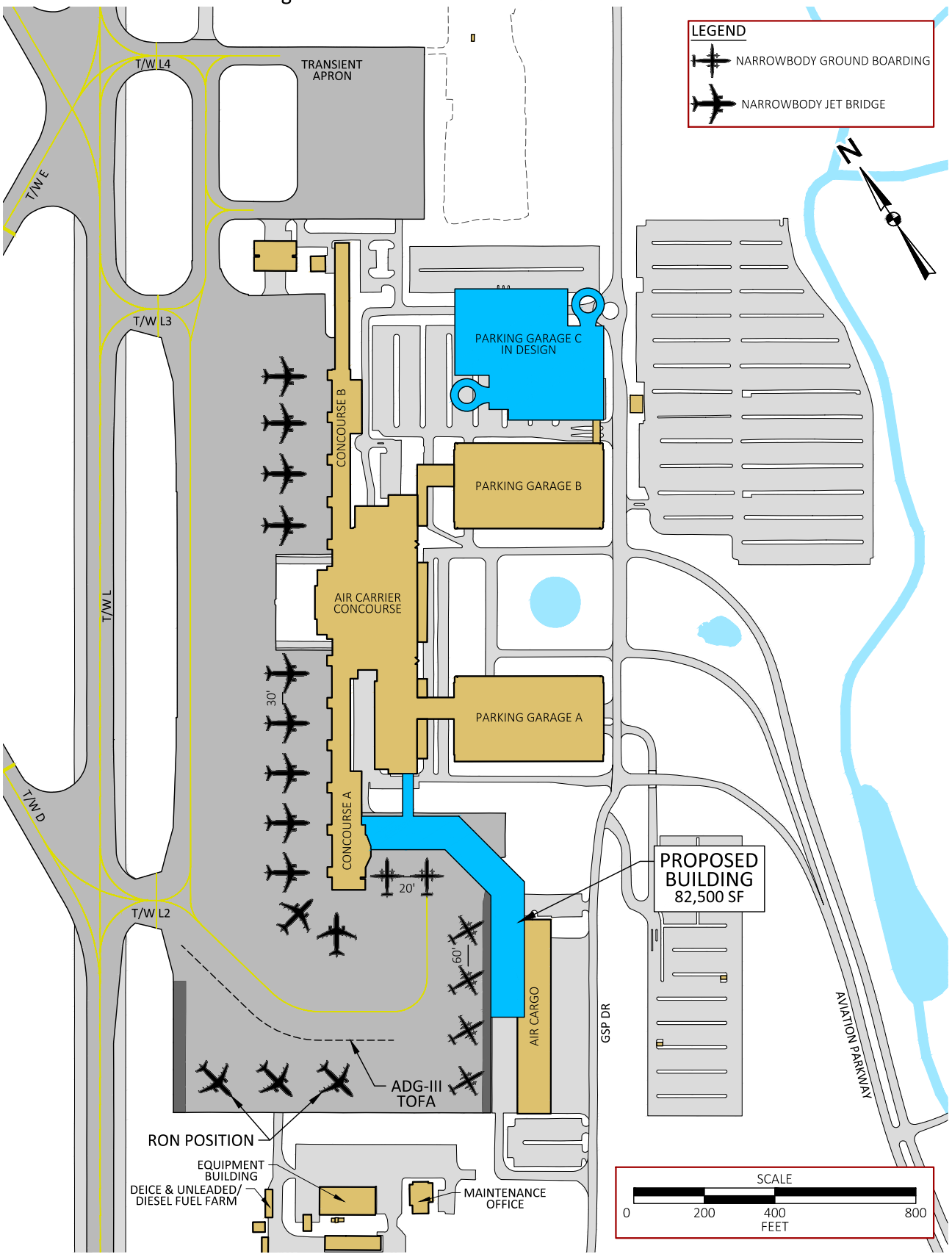

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Figure 6-32: Terminal Alternative A6 - International

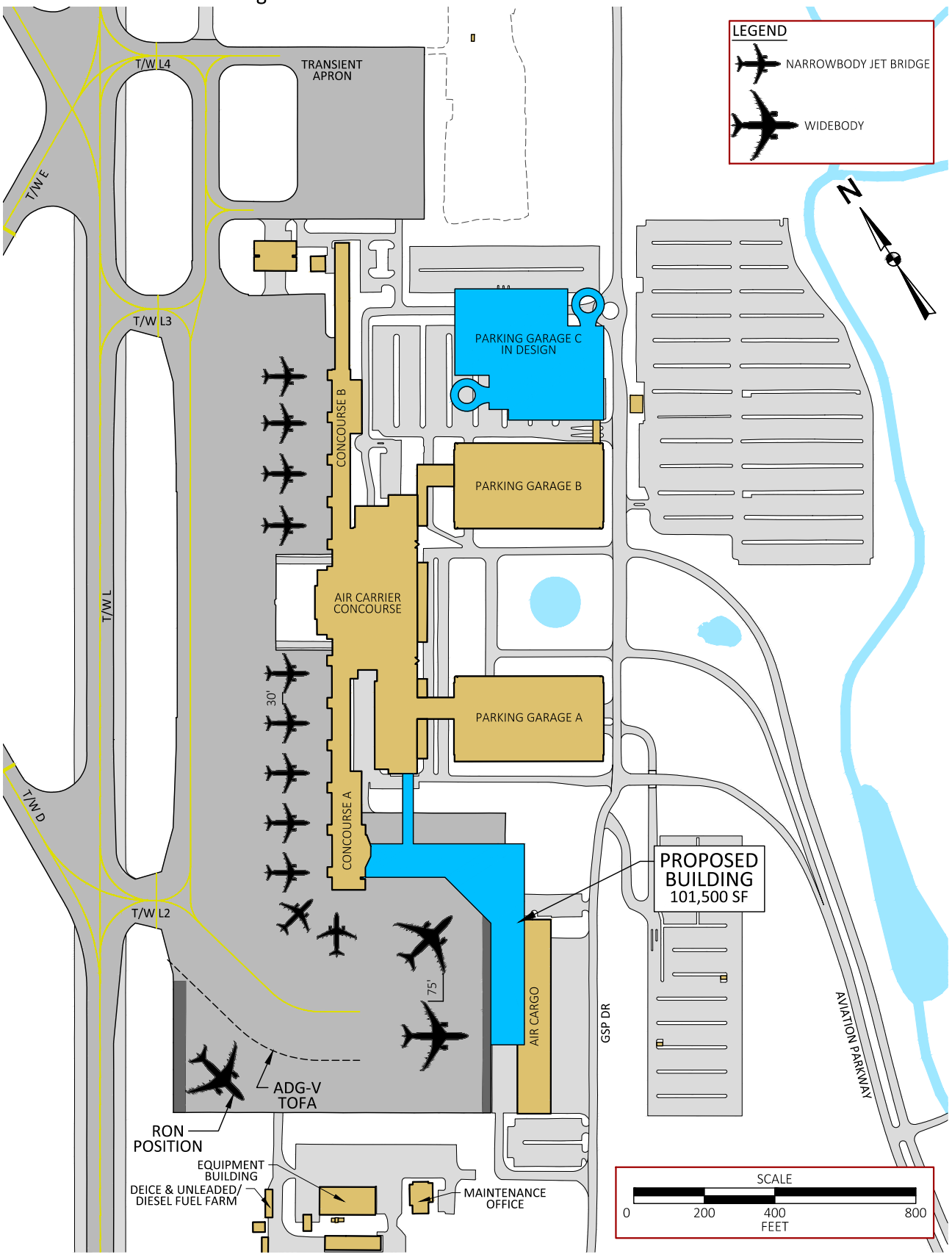

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Figure 6-33: Terminal Alternative B1 - Ground

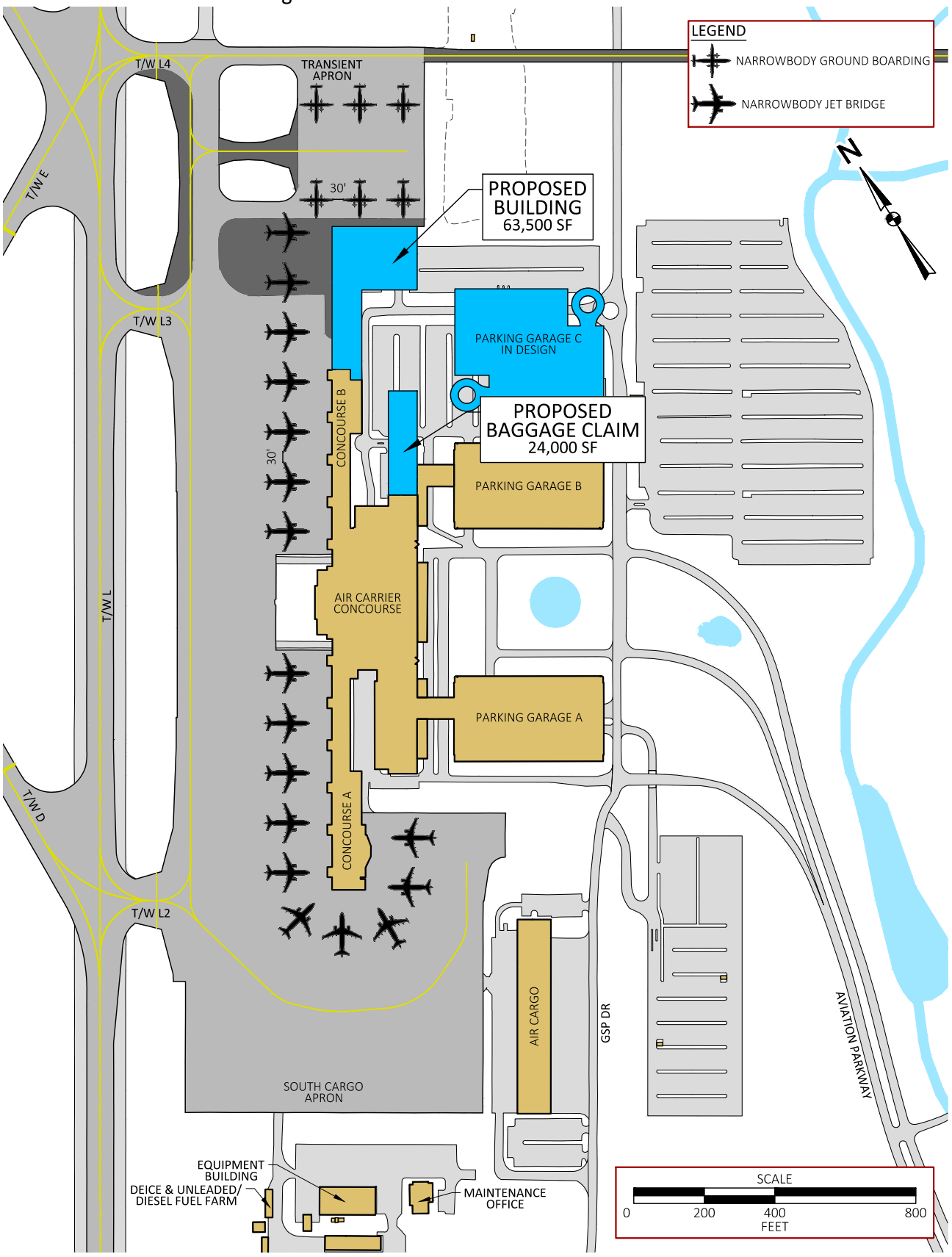

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Figure 6-34: Terminal Alternative B1 - International

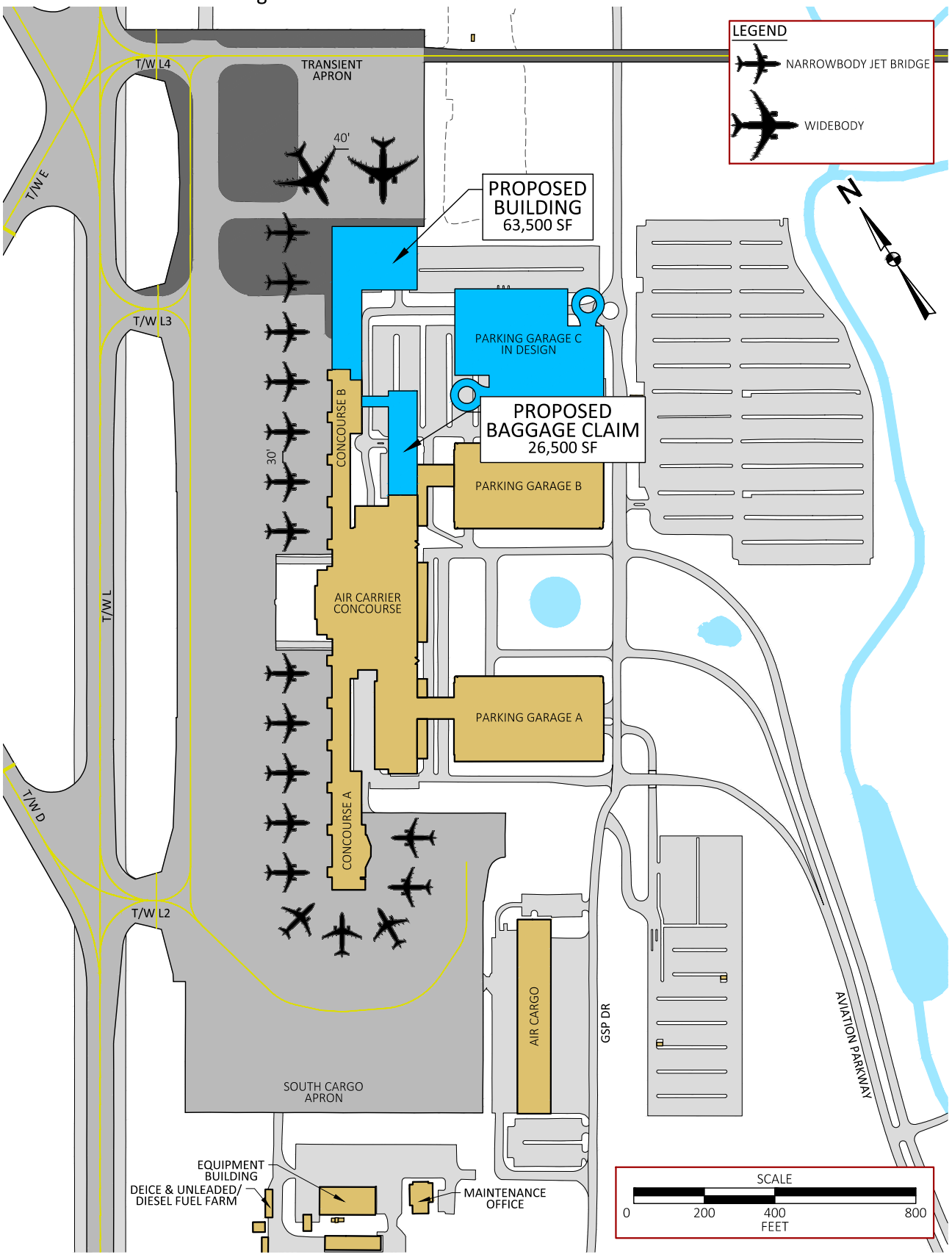

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Figure 6-35: Terminal Alternative B2 - Ground

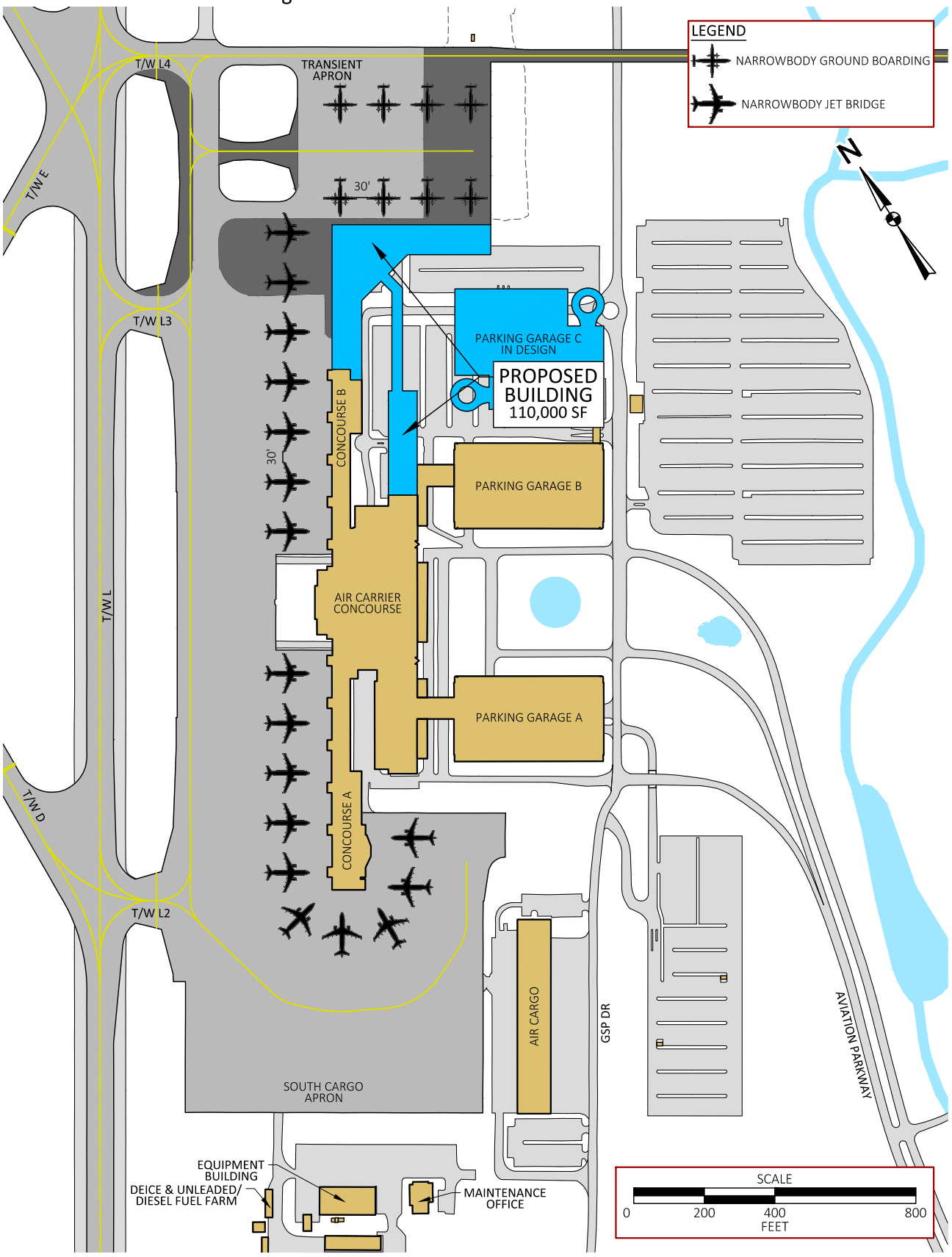

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Figure 6-36: Terminal Alternative B2 - International

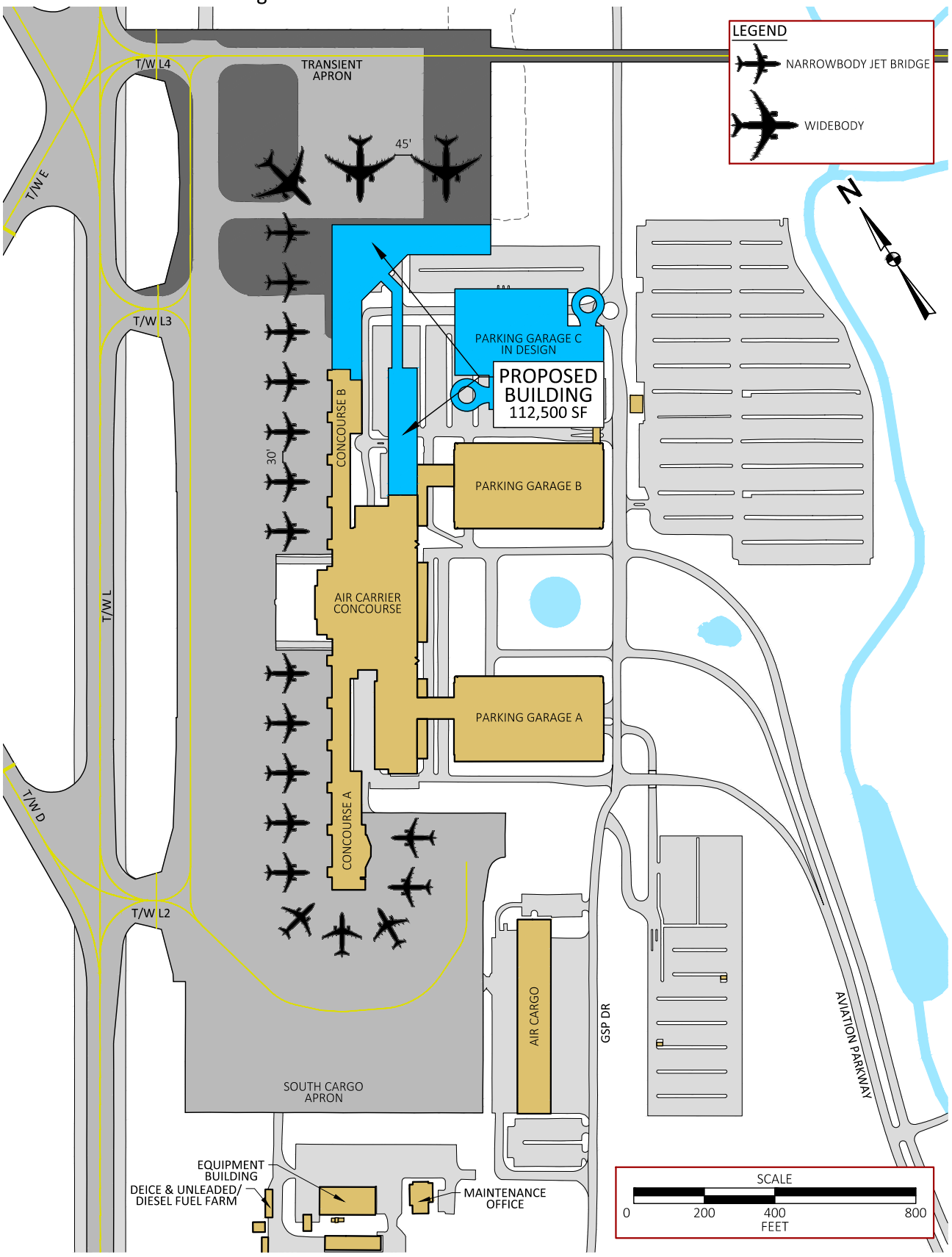

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Figure 6-37: Terminal Alternative B3 - Domestic

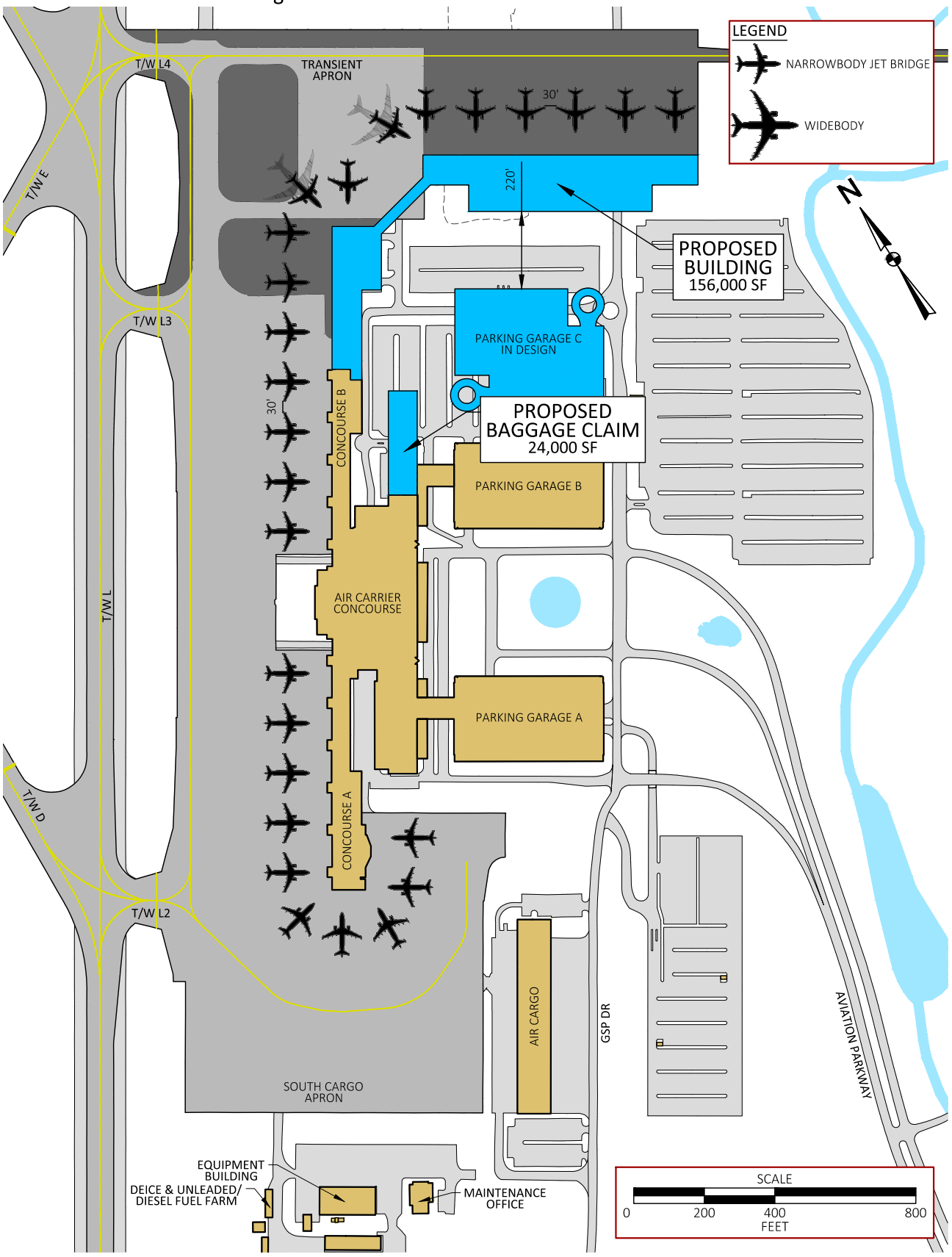

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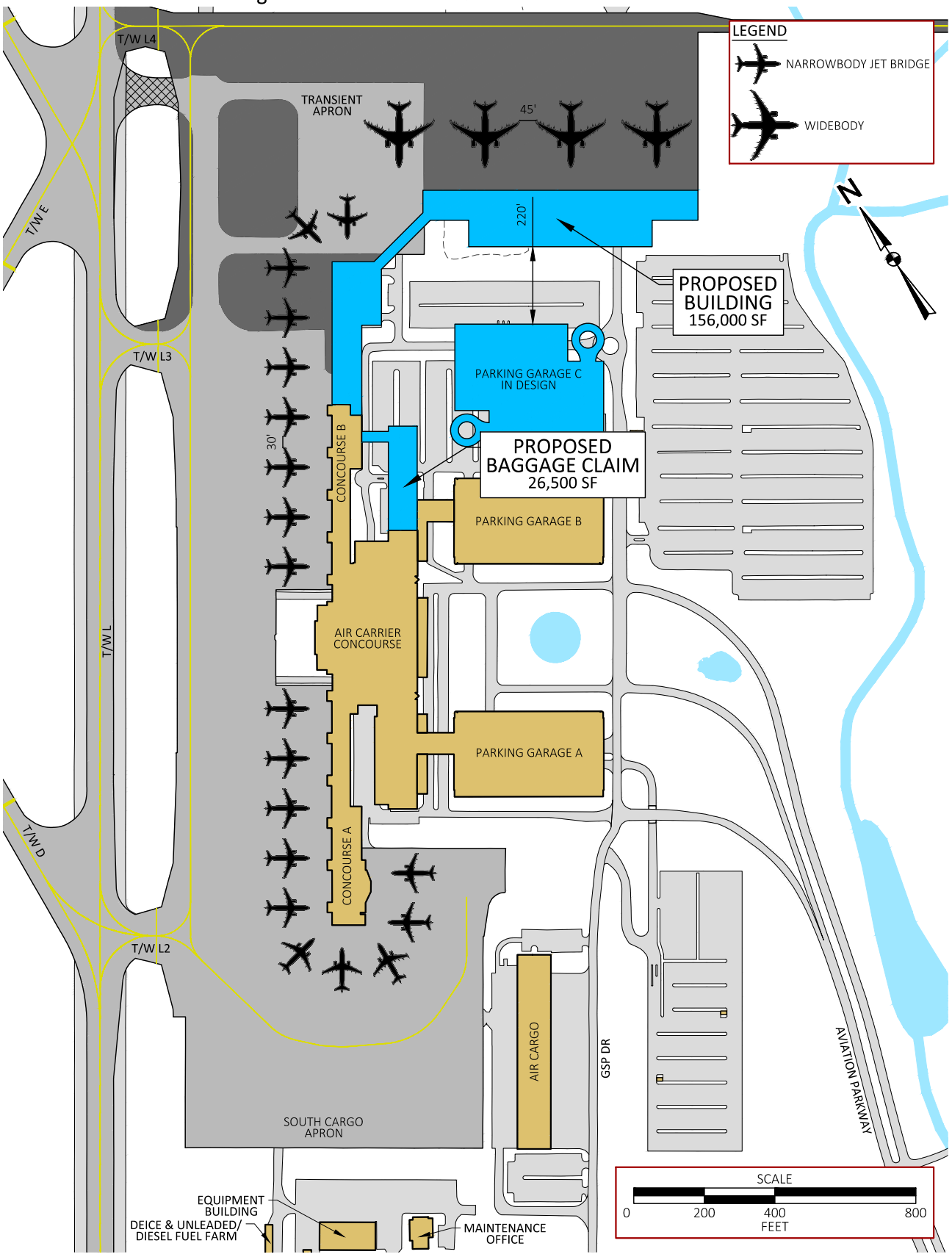
Figure 6-38: Terminal Alternative B3 - International



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6.1.3. Landside Access and Parking Alternatives

Landside access alternatives were explored based on the findings of the roadway and circulation assessment and vehicular traffic analysis presented in Chapter 5, *Facility Requirements* and detailed in **Appendix B**. Landside access alternatives are broadly focused on three categories: 1) maintaining the existing roadway network to the greatest extent possible, 2) constructing an entirely new ingress and egress, and 3) separating GA access from Aviation Parkway to further segregate airport traffic utilizing the airport roadways.

In all alternatives, GSP Drive is proposed to be realigned and interchange with Aviation Parkway south and east of existing intersections of those roadways. This proposed interchanged is explored in both fly-over and multi-lane traffic circles in the presented alternatives. Where Aviation Parkway crosses sections of GSP Drive near Garage A and Garage B, these alternatives explore removing the intersection condition to allow for a continual flow of traffic and/or propose single-lane roundabouts to permit continuous traffic flow. No alternative presents full-stop intersections when exploring improvements to the Airport's internal roadways. Additional considerations that supplemented the development of landside alternatives are discussed below.

- **Level of Service (LOS) at 3.5 MAEP:** The landside alternatives were developed with the considerations to achieve a LOS for landside access of A or B at 3.5 MAEP.

- **Inhibit Cut-Through Traffic:** Considerations to reduce the amount of non-airport related traffic using landside access roadways was included in the development of the landside alternatives. The majority of this cut through traffic uses GSP Drive, one of the Airport's main internal roadways, to traverse Airport property. To address this, each alternative shows the ultimate deactivation of Stevens Road, a small but vital roadway allowing for significant through traffic.

- **Segregate Traffic:** The landside alternatives seek to segregate traffic by type and destination. Considerations to segregate traffic accessing parking, terminal curbside, and GA facilities were included in the development of these alternatives.

- **Maintain Campus Aesthetic:** Considerations for the visual appeal of the existing roadway network and the Airport's desire to maintain aesthetics were included in the development of these alternatives.

- **Additional Parking Capacity:** All landside access alternatives depict parking layouts which are compatible with the proposed access roadways. The additional lots shown are required to meet the parking demand for the planning period. A third parking garage (Parking Garage C) is under design adjacent to Parking Garage B, where the existing daily parking lot is. Accommodating this facility and increased passenger demand throughout the planning period will require an increase in surface lot capacity. Additionally, the employee lot will be relocated and is expected to require at least 400 spaces. These parking capacity requirements were included in the development of landside alternatives.

Table 6-3 identifies each of the initial landside access alternatives developed. **Figure 6-39** to **Figure 6-51** depict the initial landside access alternatives developed. The groupings of each set of landside

access alternatives are described below with the resulting details shown in respective figures. Further discussion of the alternatives selected for further refinement included in Section 6.2.2.

- **Existing Roads and GA Access:** This set of alternatives maintains the majority of the existing access to the Airport on Aviation Parkway and provides access to and from GA facilities. These alternatives show variations in the use of a two-lane roundabout compared to fly-over exit/entrance ramps to and from Aviation Parkway. In addition, the segregation of traffic approaching the terminal curb lane and accessing parking facilities varies among this set of alternatives.

- **New Approach and GA Access:** This set of alternatives proposes a new approach to the Airport by reconfiguring Aviation Parkway. These alternatives also provide access to and from GA facilities. These alternatives show variations in the use of a two-lane roundabout compared to fly-over exit/entrance ramps to and from Aviation Parkway. In addition, the segregation of traffic approaching the terminal curb lane and accessing parking facilities varies among this set of alternatives.

- **New Approach and No GA Access:** This set of alternatives proposes a new access to the Airport by reconfiguring Aviation Parkway. These alternatives do not provide access to or from GA facilities. These alternatives show variations in the use of a two-lane roundabout compared to fly-over exit/entrance ramps to and from Aviation Parkway. In addition, the segregation of traffic approaching the terminal curb lane and accessing parking facilities varies among this set of alternatives.

Table 6-3: Identified Landside Access Alternatives

Focus	Initial Alternatives	Figure
Existing Roads and GA	Landside Access Alternative 1A	Figure 6-39
	Landside Access Alternative 1B	Figure 6-40
	Landside Access Alternative 1C	Figure 6-41
	Landside Access Alternative 1D	Figure 6-42
	Landside Access Alternative 1E	Figure 6-43
New Approach and GA	Landside Access Alternative 2A	Figure 6-44
	Landside Access Alternative 2B	Figure 6-45
	Landside Access Alternative 2C	Figure 6-46
	Landside Access Alternative 2D	Figure 6-47
No GA Access	Landside Access Alternative 3A	Figure 6-48
	Landside Access Alternative 3B	Figure 6-49
	Landside Access Alternative 3C	Figure 6-50
	Landside Access Alternative 3D	Figure 6-51

Source: McFarland Johnson, 2018

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Figure 6-39: Landside Access Alternative 1A

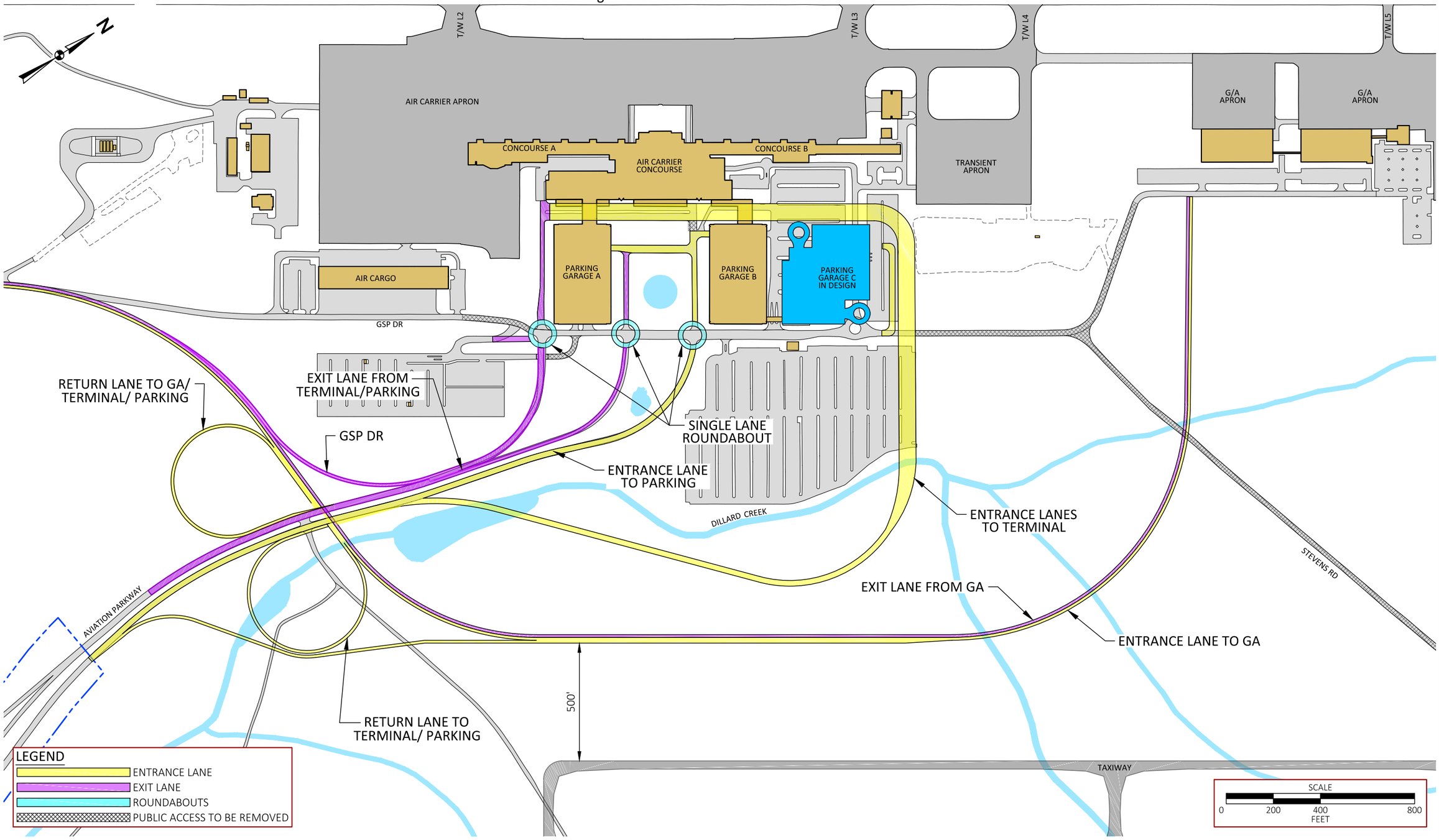

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Figure 6-40: Landside Access Alternative 1B

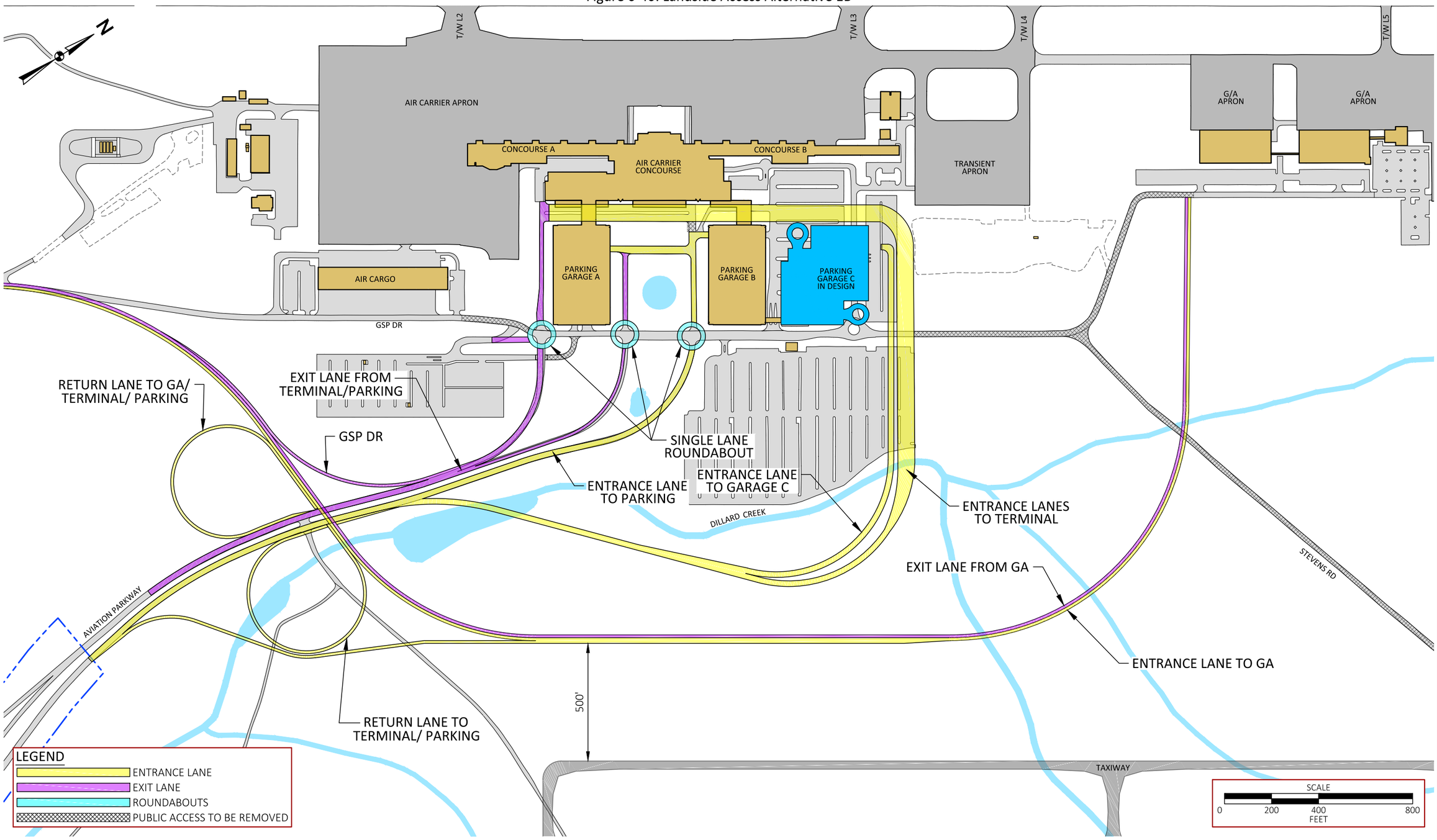

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Figure 6-41: Landsite Access Alternative 1C

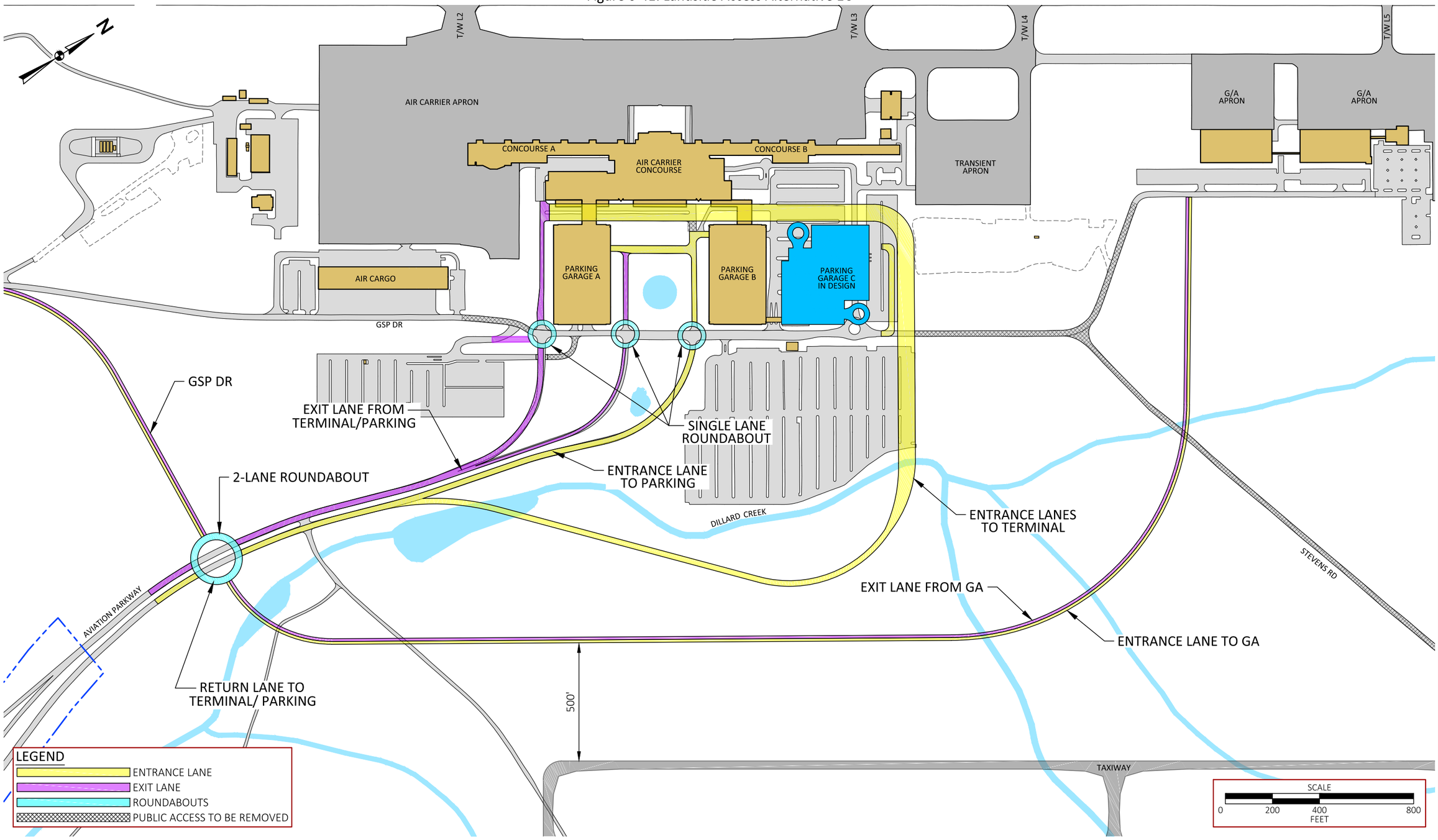

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Figure 6-42: Landside Access Alternative 1D

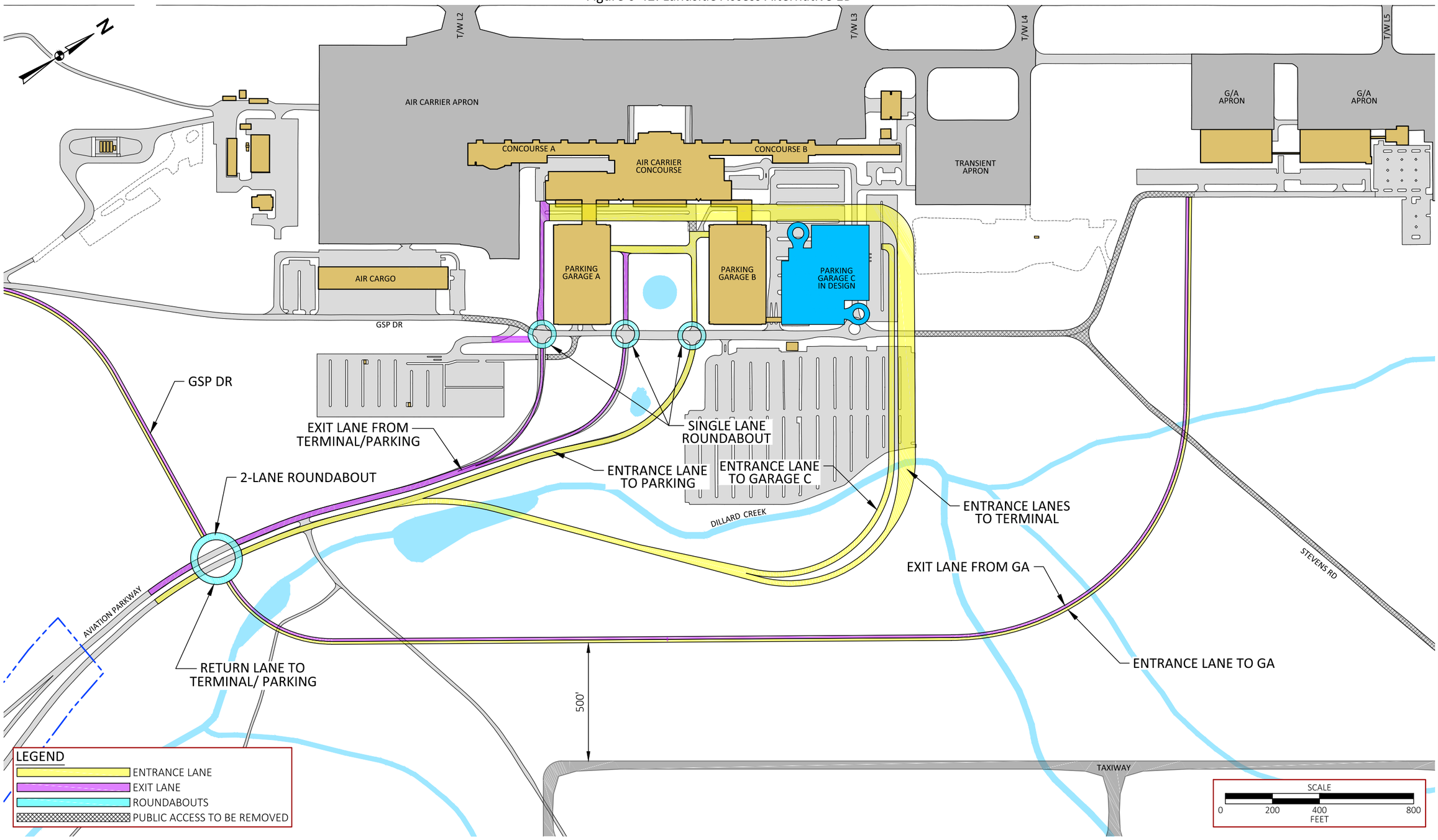

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Figure 6-43: Landside Access Alternative 1E

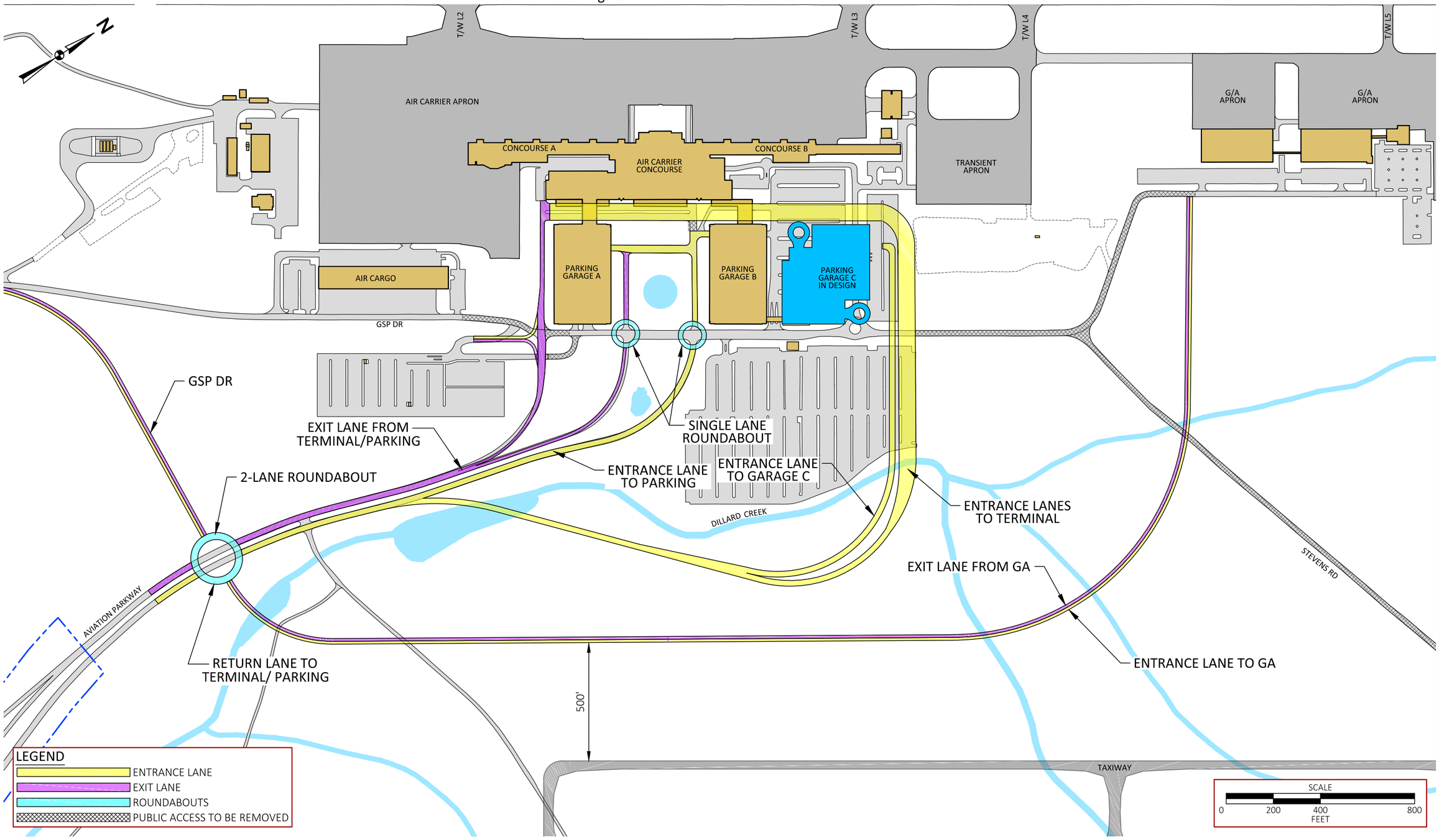

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Figure 6-44: Landside Access Alternative 2A

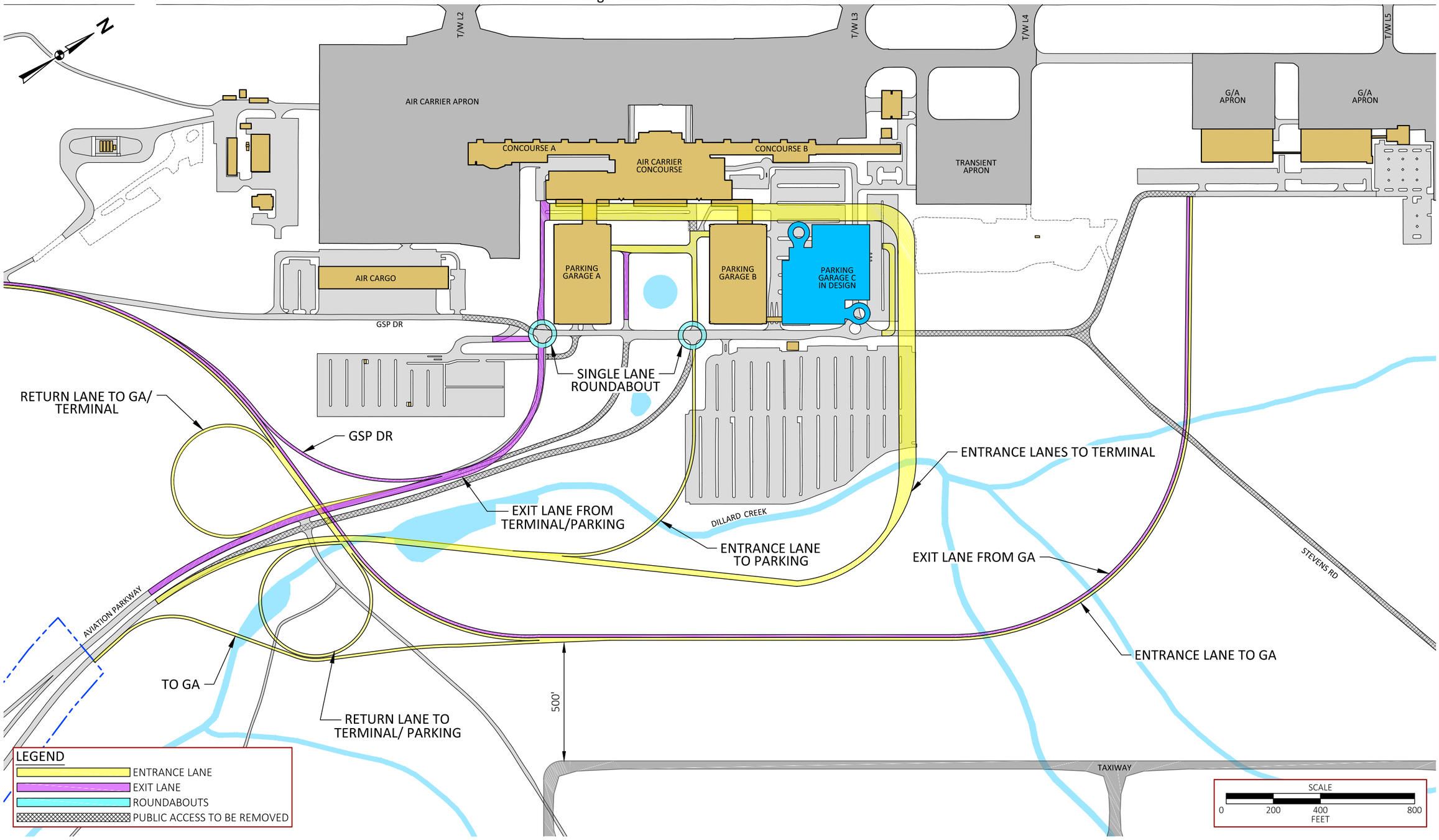

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Figure 6-45: Landside Access Alternative 2B

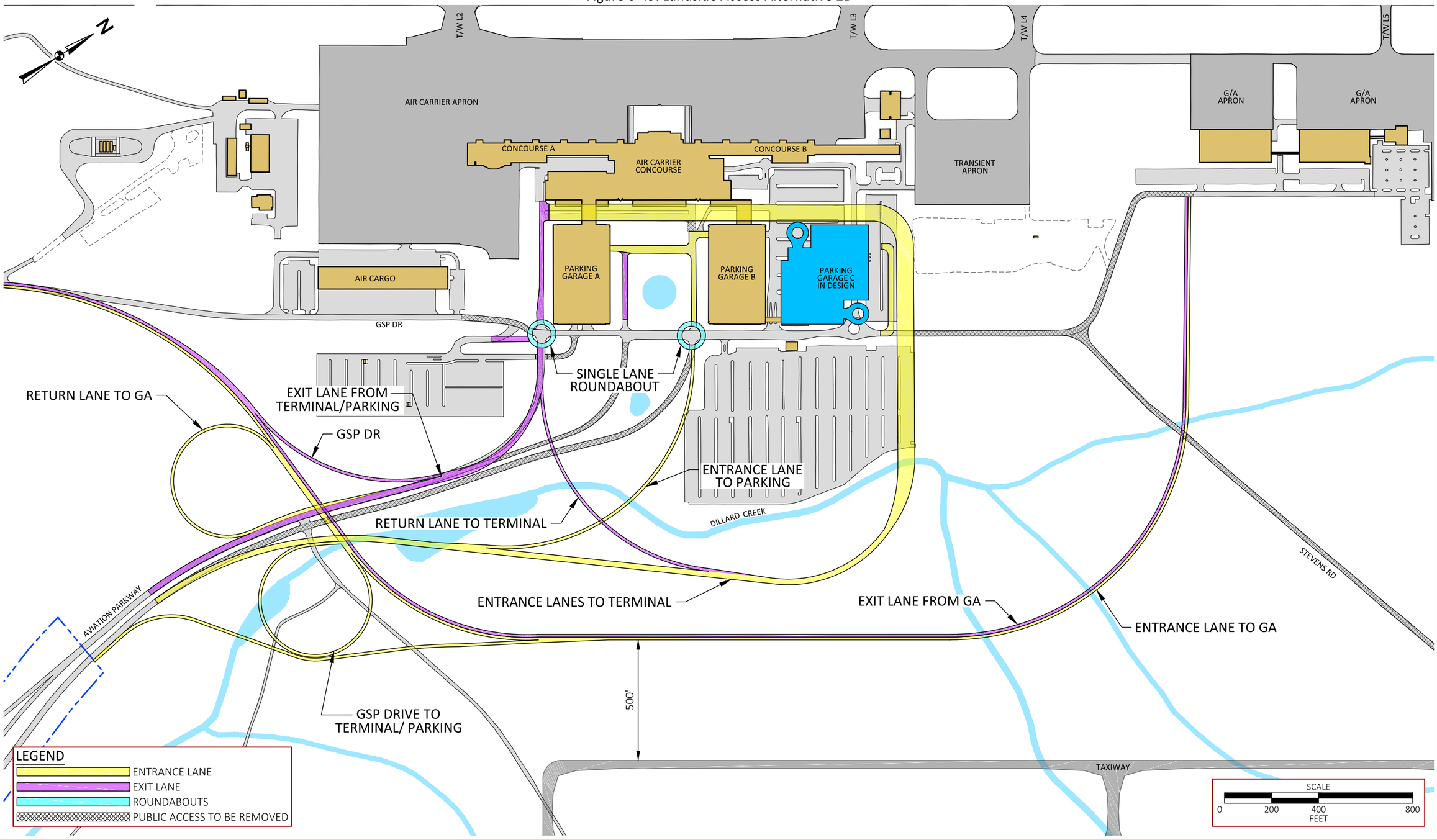

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Figure 6-46: Landside Access Alternative 2C

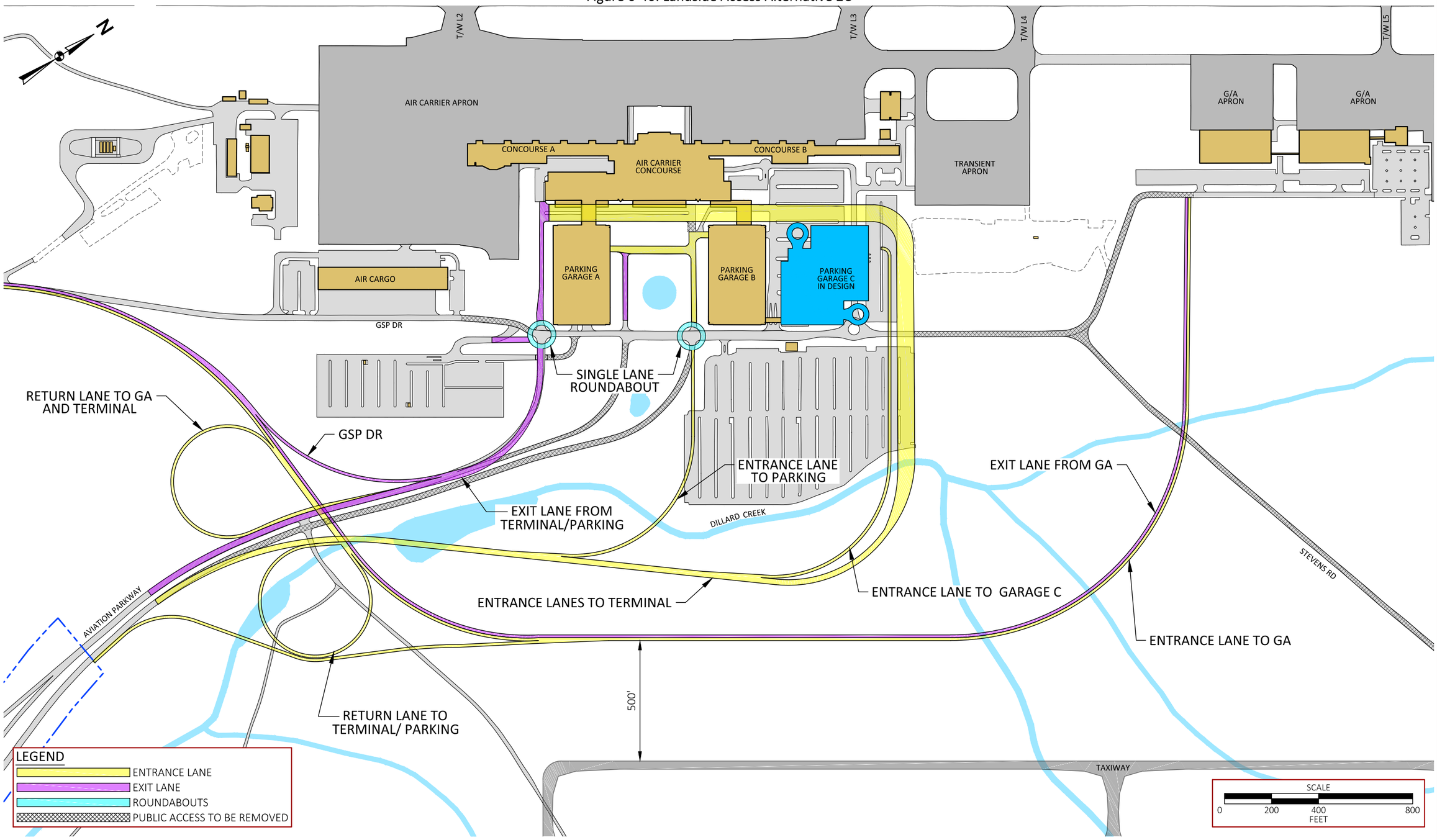

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Figure 6-47: Landside Access Alternative 2D

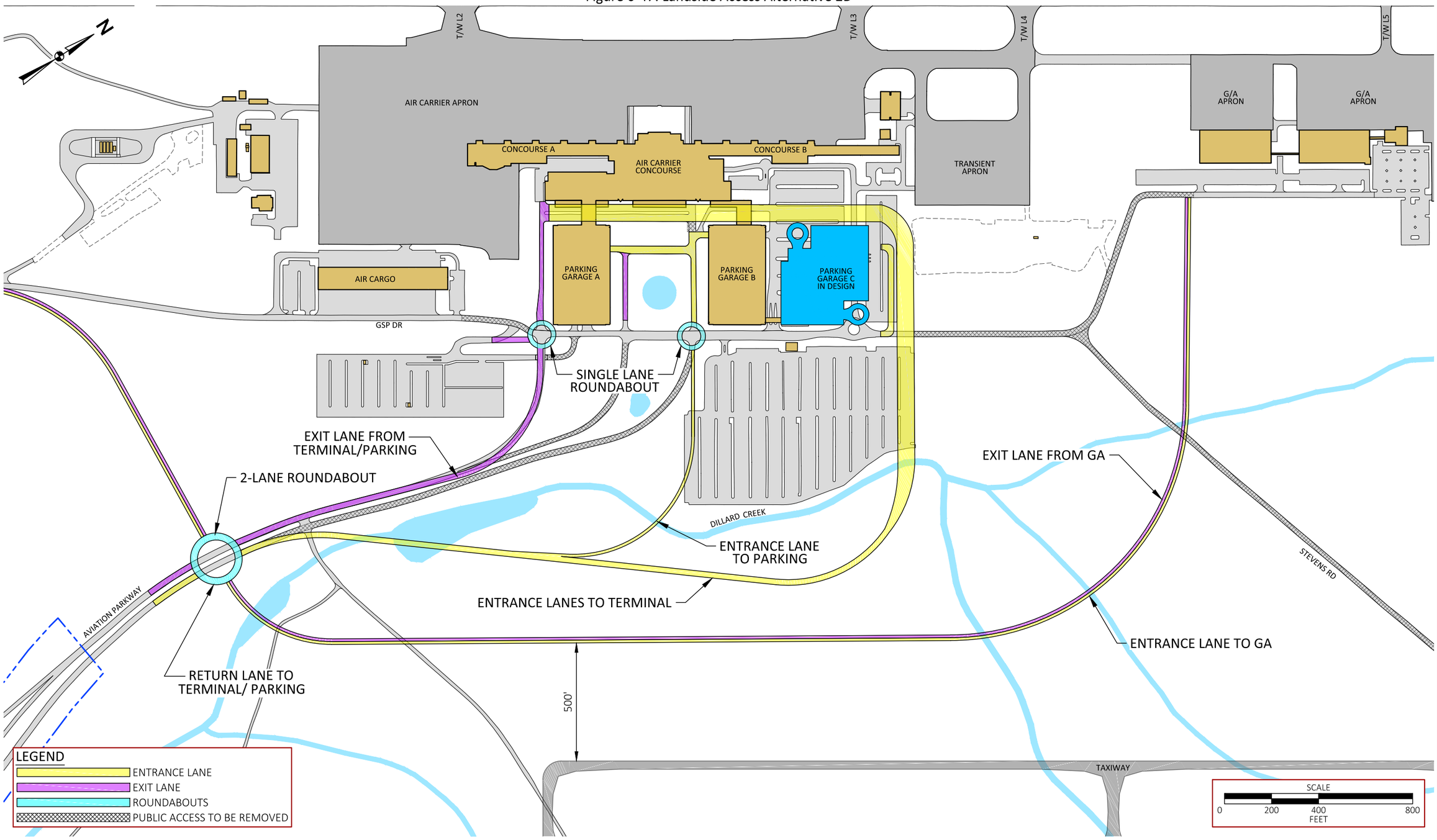

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Figure 6-48: Landside Access Alternative 3A

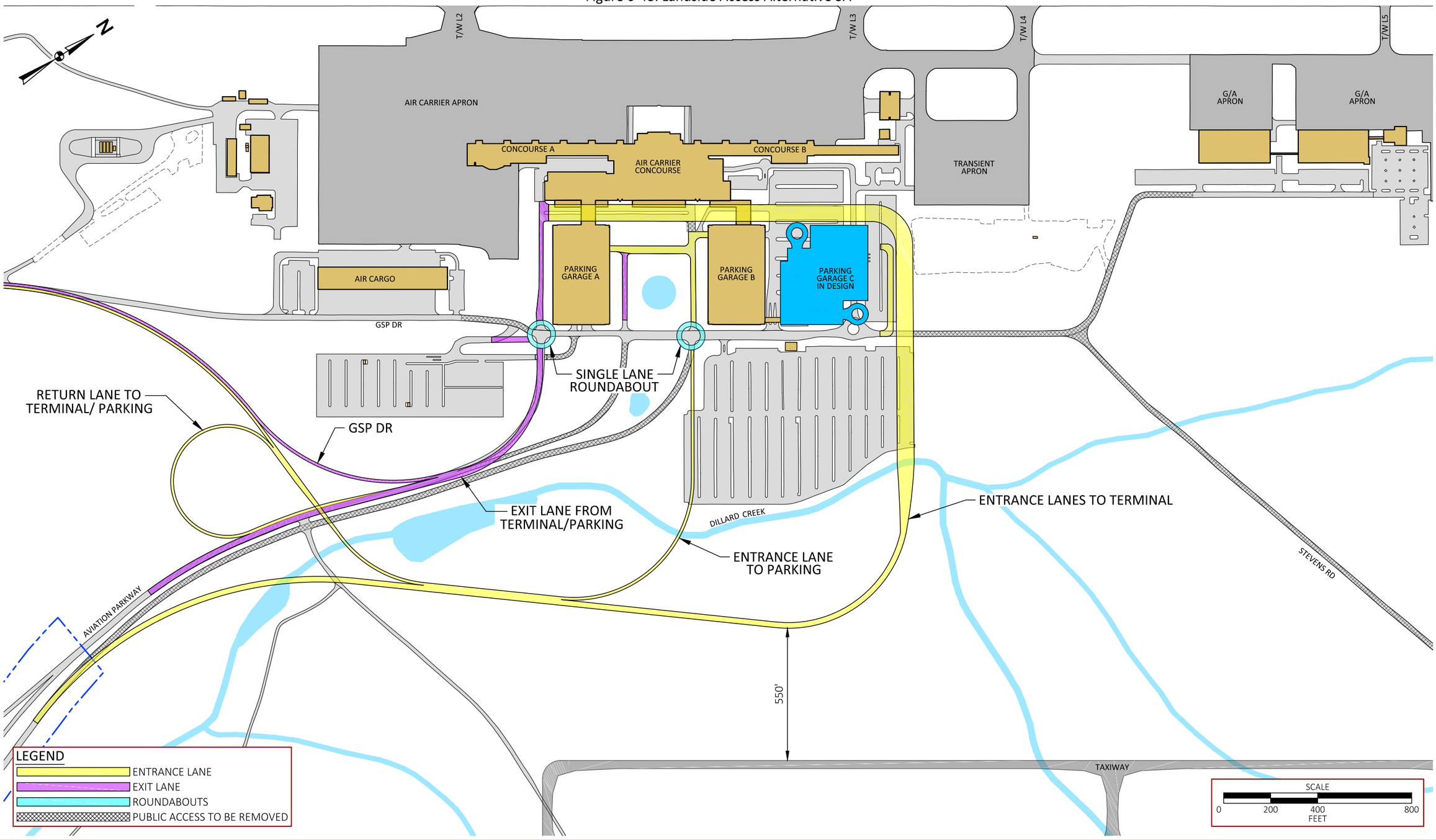

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Figure 6-49: Landside Access Alternative 3B

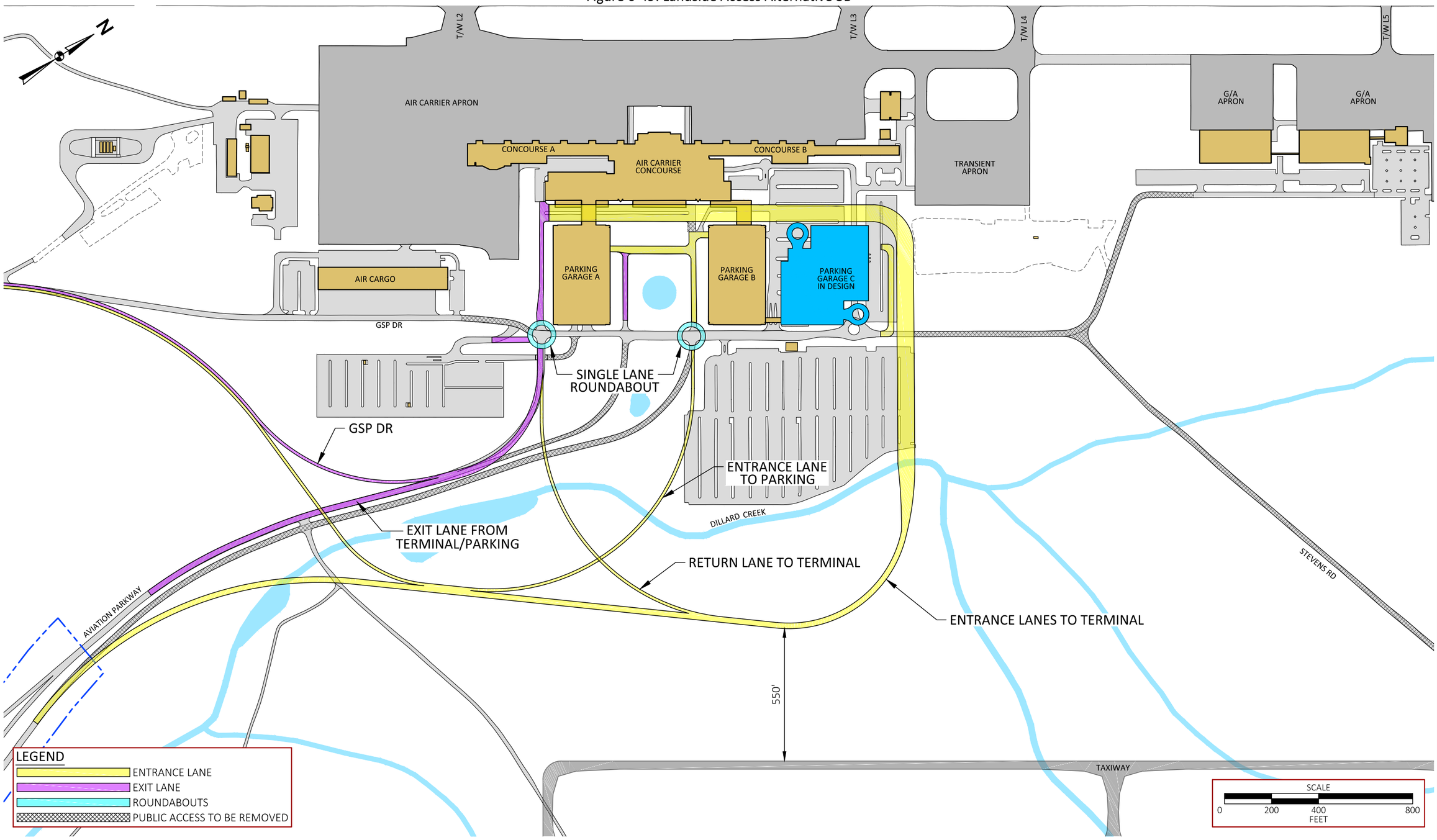

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Figure 6-50: Landside Access Alternative 3C

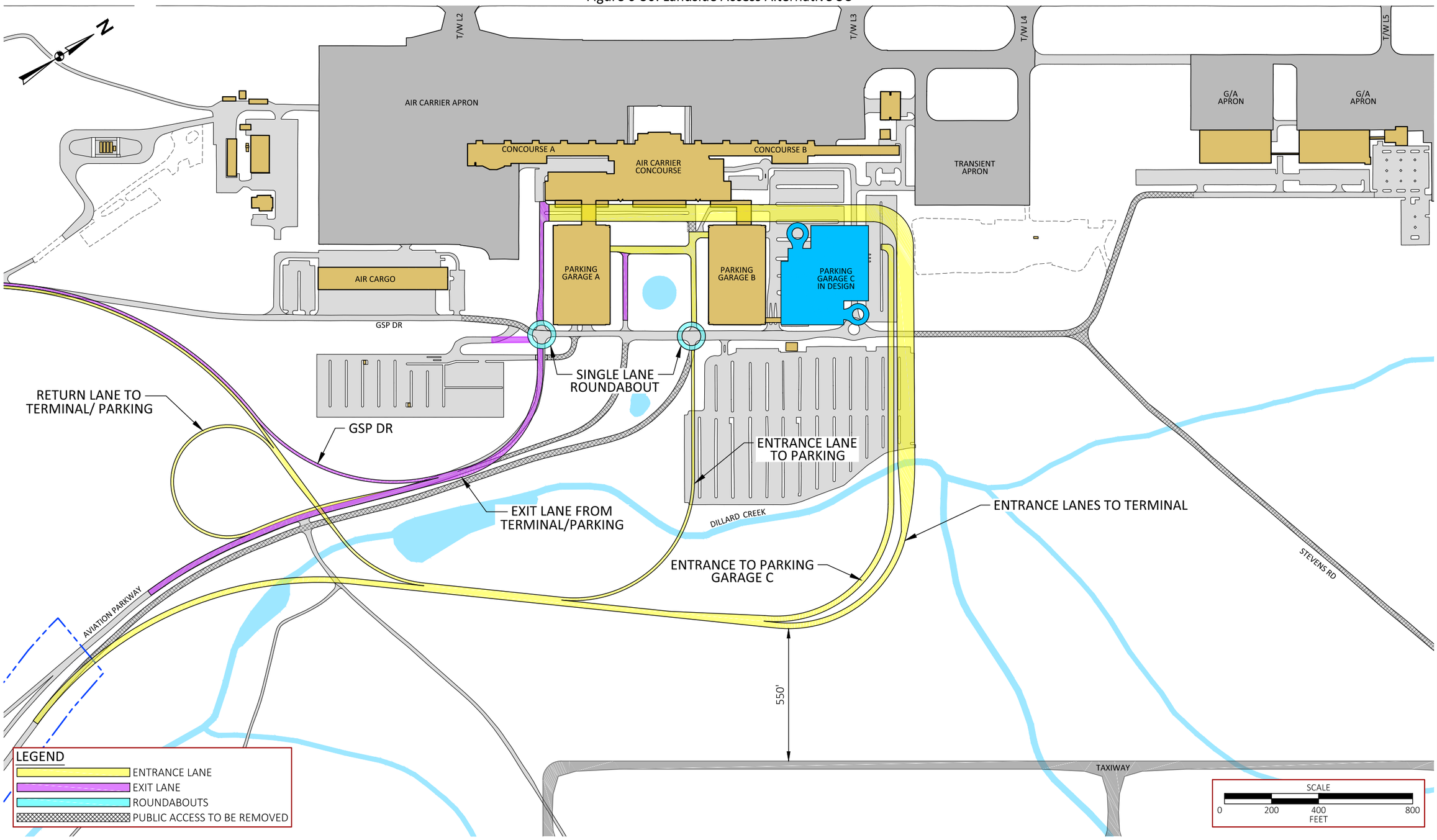

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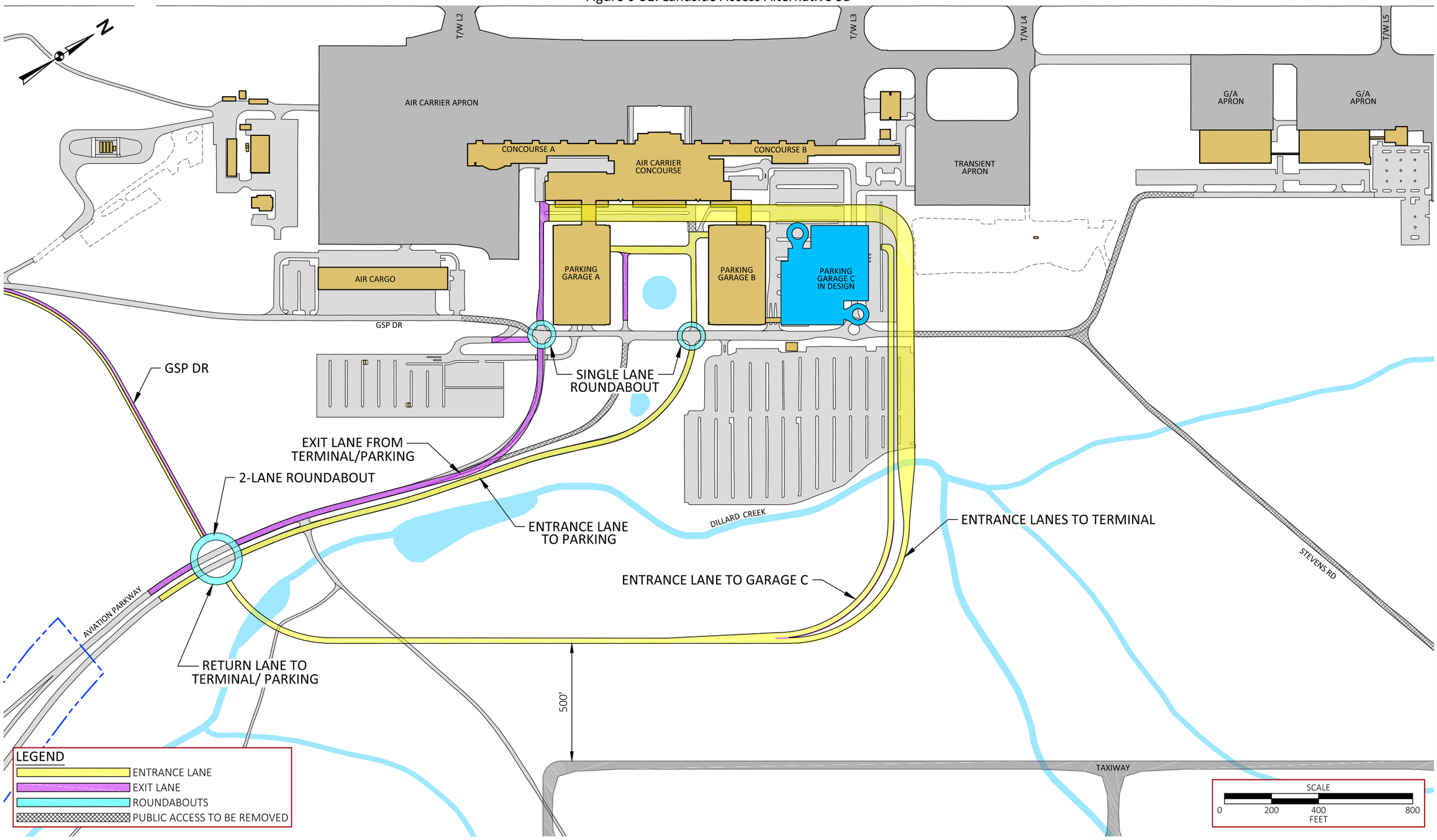
Figure 6-51: Landside Access Alternative 3D



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6.1.4. Air Cargo Facility Alternatives

Growth in air cargo at GSP has been significant in recent years and continues at a very high rate. Alternatives identified for additional air cargo facilities at GSP focus on expansion of the recently designed cargo apron planned to support current international air cargo operations. This planned development, located south of the North Cargo apron, has immediate and long-term potential to support air cargo activities at the Airport. Additionally, some limited future expansion to the existing North Cargo apron is possible. Should air cargo activities require additional facilities beyond that which can be accommodated in the air cargo development area, additional facilities are explored in the West Side Aviation Development Area discussed in a later section of this chapter.

Initial air cargo development alternatives explore the ability to build out the current air cargo operations area being developed and address the facility requirements and other considerations discussed below.

- Air Cargo Apron: Air cargo apron alternatives were designed with a central taxilane allowing aircraft nose-in parking to buildings on both sides. Apron size is a function of simultaneously parked aircraft being provided for in each alternative.

- Air Cargo Building: Air cargo buildings alternatives were designed to match the air cargo apron layout and to minimize distance to aircraft parking positions. Upwards of 260,000 square feet of air cargo building space is anticipated to be required by the end of the planning period and is provided for, at a minimum, in these alternatives. Air cargo building dimensions range laterally to match air cargo apron dimensions and are represented at a typical 200-foot depth for air cargo processing facilities.

- Access Roads: Providing dedicated access to the air cargo development area from the adjacent roadway network which is segregated from the Airport's commercial terminal roadway network is common in each air cargo development alternative as each provides direct and convenient access to Highway 101. One alternative proposes utilizing the existing roadway connecting the North Cargo Apron to Highway 101, while the largest two alternatives propose relocating that roadway slightly east to allow for grade optimization in air cargo apron design while providing the most direct route to all air cargo development areas.

- Truck and Auto Docking/Parking: Ample truck docking and parking and private vehicle parking is provided for in each of the air cargo development alternatives. Landside parking lots adjacent to proposed air cargo buildings provide sufficient depth to allow for both truck docking, automobile parking, and circulation.

- Logistics Park: Airside Cargo Alternatives 2 and 3 consider development of a logistics park to support air cargo activity.

Table 6-4 details the initially identified alternatives for air cargo facility development. Figure 6-52 to Figure 6-54 depict the developed air cargo alternatives.

Figure 6-52: Airside Cargo Alternative 1

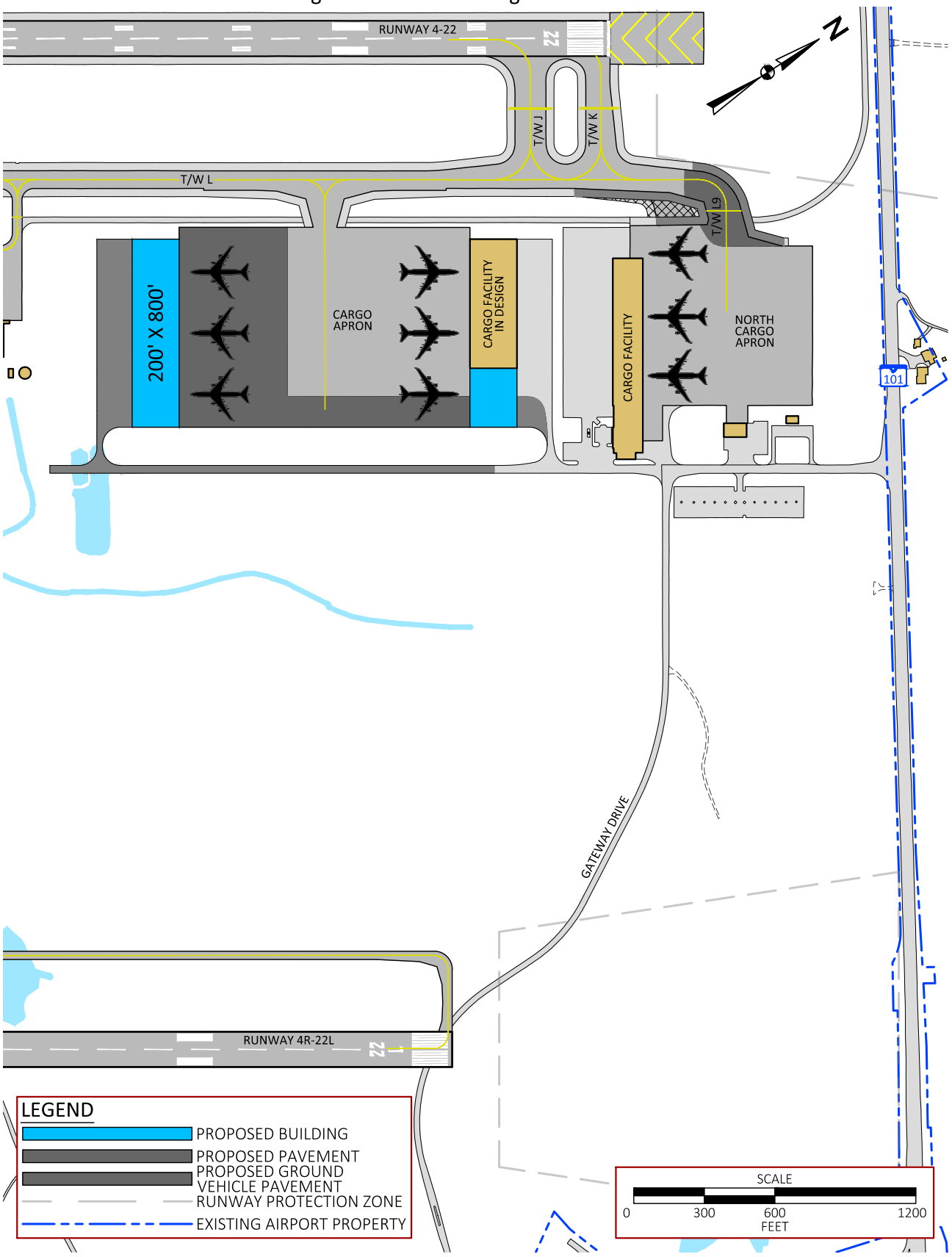

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Figure 6-53: Airside Cargo Alternative 2

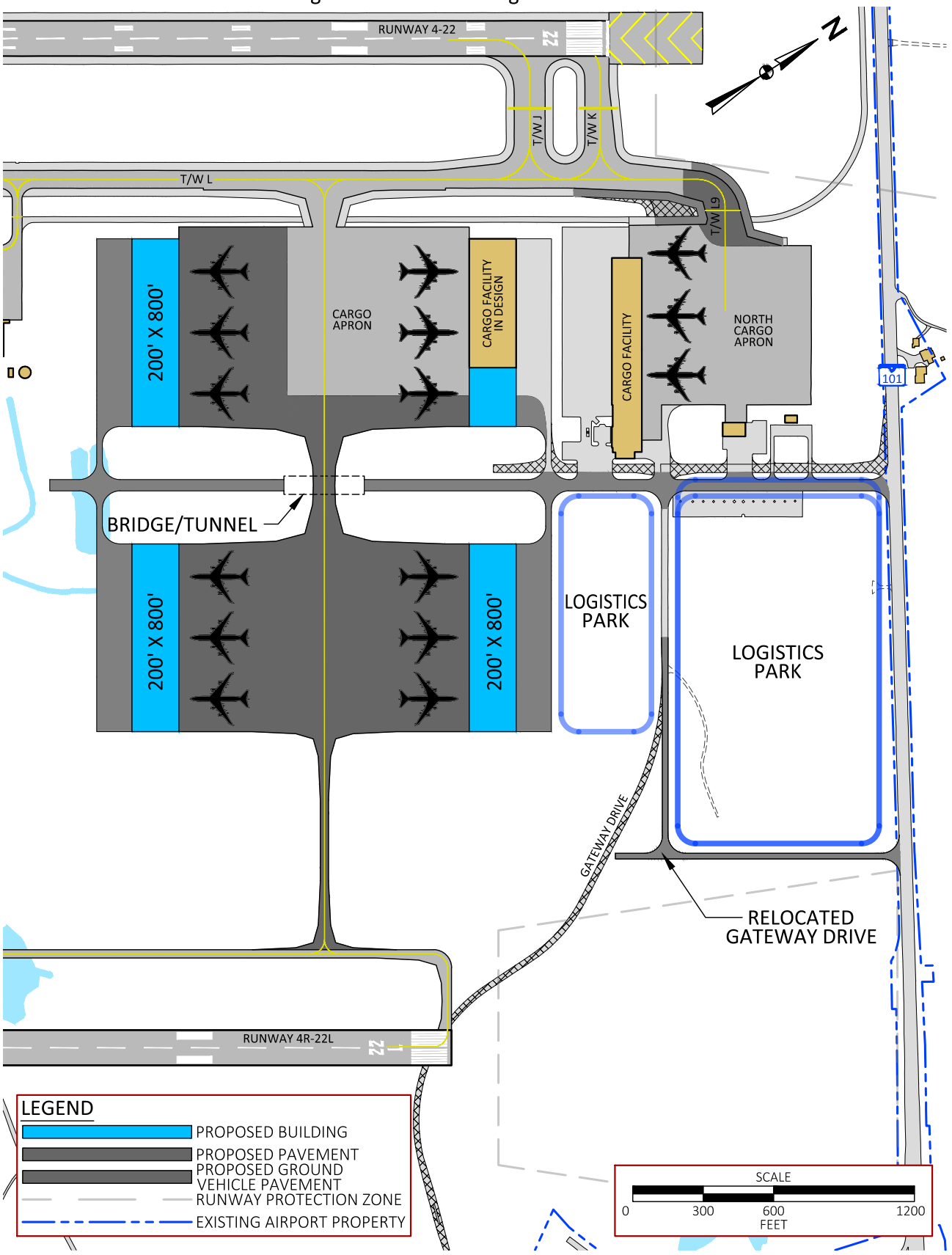

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Figure 6-54: Airside Cargo Alternative 3

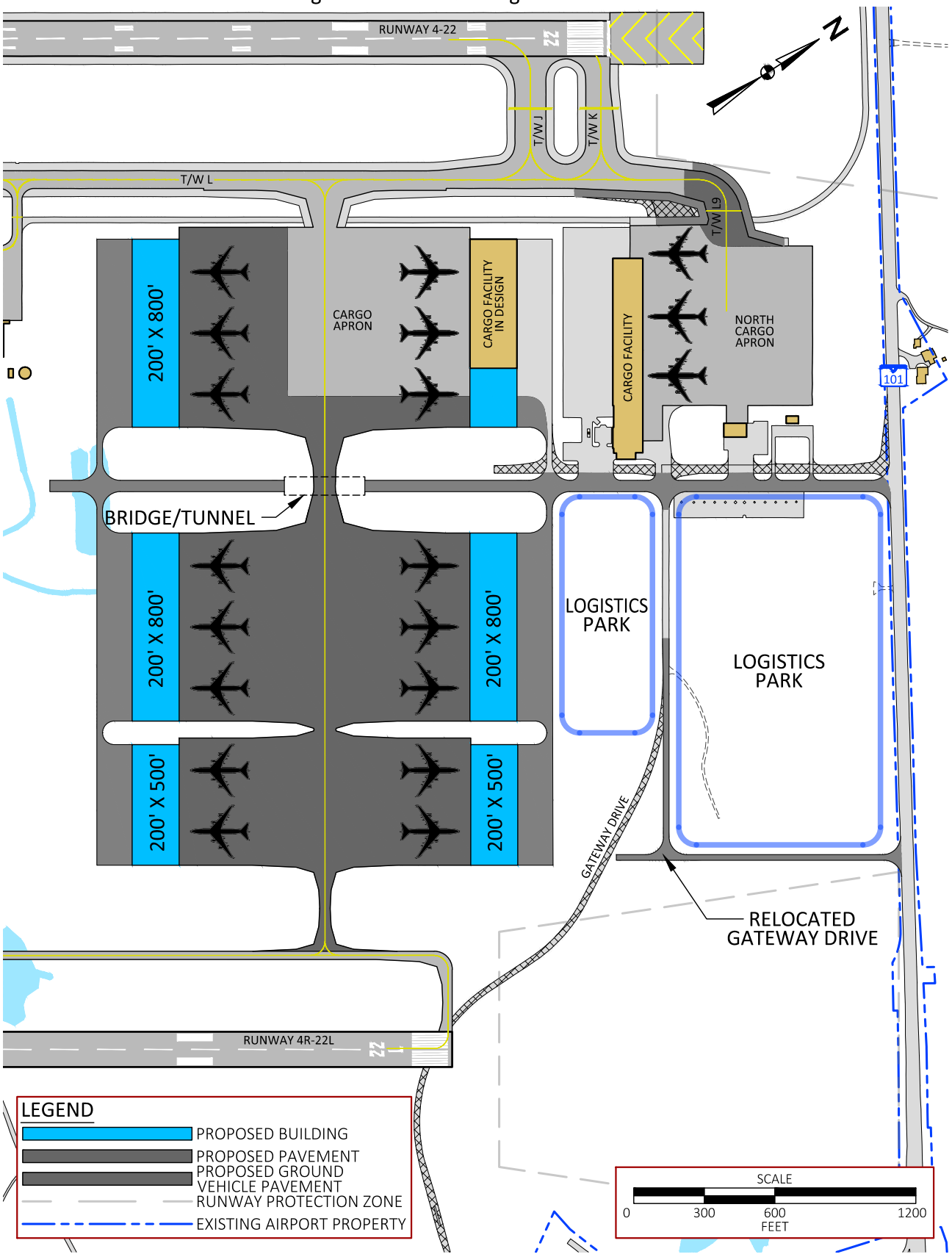

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Table 6-4: Identified Air Cargo Facility Alternatives

Focus	Initial Alternatives	Figure
Air Cargo Expansion	Air Cargo Alternative 1	Figure 6-52
	Air Cargo Alternative 2	Figure 6-53
	Air Cargo Alternative 3	Figure 6-54

Source: McFarland Johnson, 2018

6.1.5. General Aviation Facility Alternatives

The existing GA facilities at GSP are generally adequate to meet existing levels of activity but have little ability to support additional levels of traffic, especially based aircraft. Although GA activity is not forecasted to grow as quickly as commercial enplanements or air cargo operations, GA activity is also more difficult to predict. As GSP continues to capitalize on its appeal to GA operators, especially business jet operators, which present the strongest growing segment of GA activity, plans should be established beyond the forecasted GA need to pre-position the Airport to respond to unforeseen demands as they arise and in a manner consistent with the broader airport vision. Additionally, recognizing the future need to construct a new and updated Airport Traffic Control Tower (ATCT) at GSP, the Federal Aviation Administration (FAA) has identified a potential site near the existing GA area. This facility as well as the already designed Aircraft Rescue and Fire Fighting (ARFF) building are both identified within the GA development alternatives. The following facility requirements and other considerations guided the development of GSP GA facility development alternatives.

- **GA Apron Needs:** Additional aircraft apron is required to support general aviation activity in the future. Aircraft apron is required both for the parking and storage of transient and based aircraft, and to support requirements of future hangar demand. Facility requirement considerations suggested up to 4,100 square yards of GA apron is likely to be required for aircraft storage as well as an additional amount to match future hangar area. Each GA alternative presented provides a phaseable approach to providing expanded apron spaces capable of supporting both parked aircraft and hangar and circulation needs.

- **Operational Flexibility:** The need for operational flexibility was explored in the development of GA facility alternatives. One alternative presented limits access to ADG III aircraft in certain areas while the other alternative provides access to ADG III aircraft across the proposed GA campus.

- **Hangar Needs:** Facility requirements suggest up to 70,000 square feet of additional hangar space could be required in the future. GSP's current GA hangar facilities are exclusively large clearspan hangars capable of housing multiple aircraft. The alternative which provides ADG III access across the GA campus depicts similar large clear span hangars, while the alternative providing for areas exclusive to ADG II and smaller aircraft shows a variety of smaller hangars suitable for a variety of individual aircraft.

- **GA Terminal Building Needs:** As demand for GA facilities expand, so too will the demand on the GA terminal building. All GA Alternatives provide for the ability to double the existing FBO building size in its current location.

Table 6-5 presents anticipated facility requirements for the year 2065. Table 6-6 presents the initially identified development alternatives for the GA development area. Figure 6-55 and Figure 6-56 depict the identified GA development alternatives.

Table 6-5: General Aviation Facility Requirements

2037 Facility Requirements	Anticipated 2065 Requirements
12,000+ SF of Conventional Hangar	An additional 80,000 SF potentially required
1,000+ SY of Aircraft Apron	An additional 4,100 SY potentially required
1,000+ SF of FBO Terminal Building	An additional 4,100 SF potentially required

Note: SF = Square Feet; SY = Square Yards; FBO = Fixed-base Operator.
Source: McFarland Johnson, 2018

Table 6-6: Identified General Aviation Facility Alternatives

Focus	Initial Alternatives	Figure
ADG III Design	GA Development Area Alternative 1	Figure 6-55
Mixed Aircraft Design	GA Development Area Alternative 2	Figure 6-56

Note: ADG = Airplane Design Group.
Source: McFarland Johnson, 2018

6.1.6. Other Aviation Development Properties

West Side Aviation Development Area

Approximately 100 acres of land at grade with Runway 4-22 exists west of Runway 22 and east of J. Verne Smith Parkway. This property is identified for aviation use in the Airport's 2013 Land Use Management Plan and was indicated on the Airport's previous ALP to be best suitable for heavy maintenance, repair, and overhaul (MRO) and/or air cargo type activities. Consistent with that plan, two alternatives were identified for the future development of this area. The following considerations guided the development of facility development alternatives in this area.

- **Maximize Developable Parcel:** Each alternative seeks to maximize the developable airfield-accessible area of the West Side Aviation Development Area while providing for adequate area for stormwater features or grading outfalls.

- **Consider Glide Slope Critical Area:** To provide access to the Runway 22 end from any development on the runway's west side, the glide slope critical area must be traversed. West Side Aviation Development Alternatives explore two methods for interacting with the glide slope critical area. One alternative proposes developing fully within the critical area and imposing operational controls on taxiing aircraft to preclude unintended glide slope signal disruption, while the other avoids the critical area to the greatest extent possible.

- **Operational Flexibility:** The need for operational flexibility was explored in the development of West Side Aviation alternatives. One alternative presented limits access to Group V aircraft in certain areas while the other alternative provides access to Group IV aircraft explicitly.

Figure 6-55: GA Development Area Alternative 1

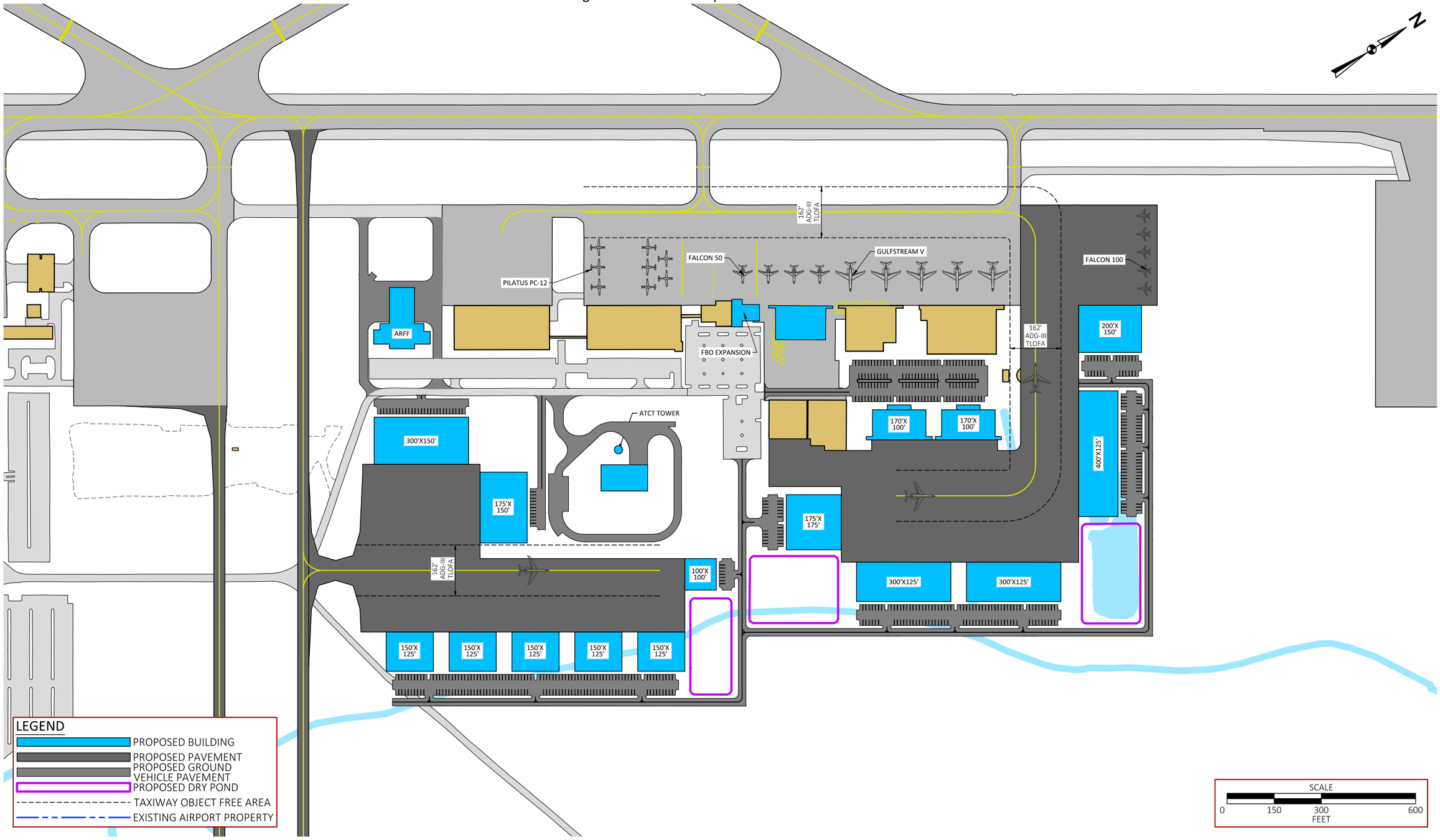

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Figure 6-56: GA Development Area Alternative 2

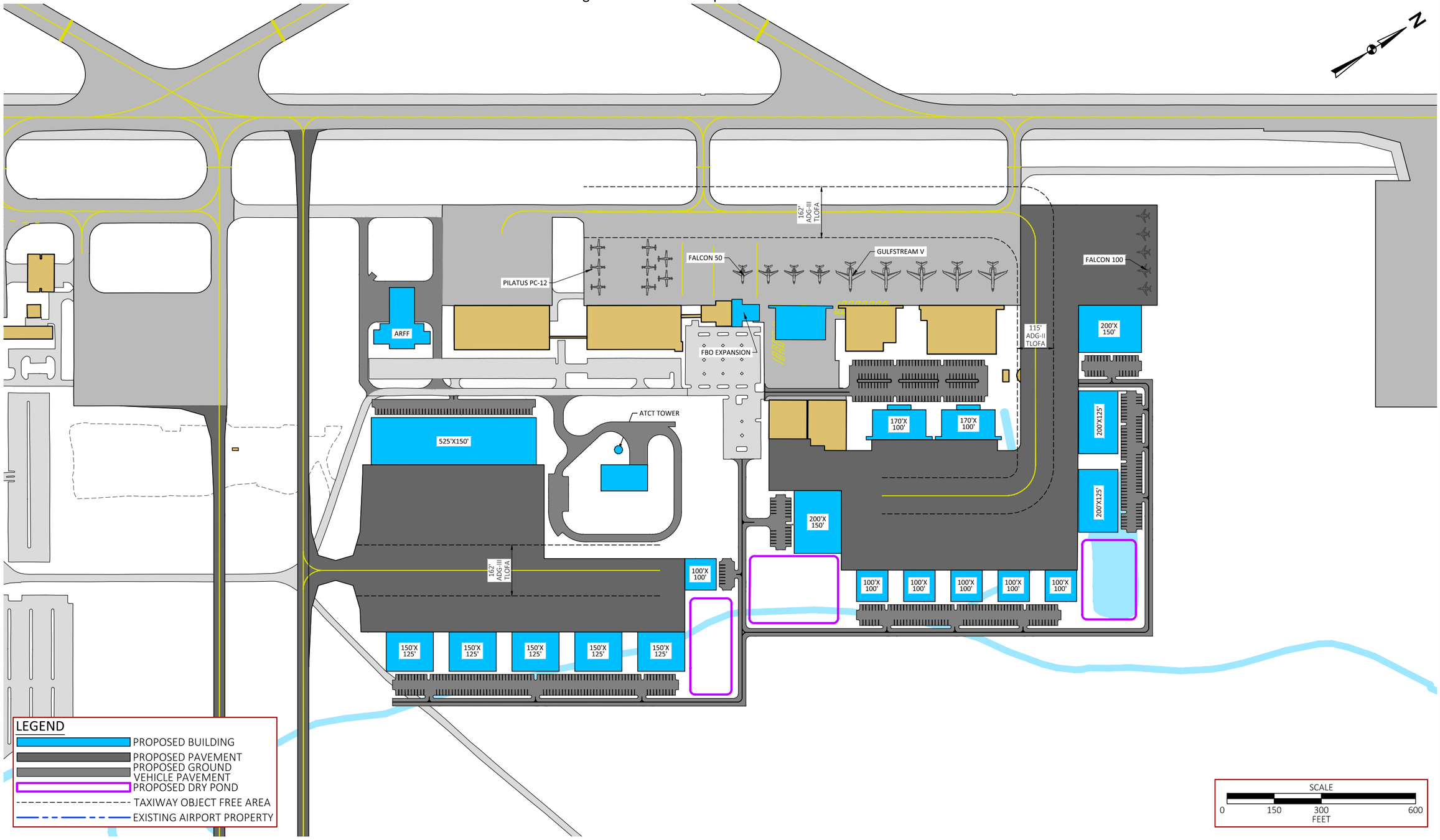

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Table 6-7 list the identified westside aviation facility alternatives and Figure 6-57 and Figure 6-58 depict each graphically.

Table 6-7: Identified West Side Aviation Facility Alternatives

Focus	Initial Alternatives	Figure
MRO/Air Cargo Development Opportunities	West Side Aviation Development Area Alternative 1	Figure 6-57
	West Side Aviation Development Area Alternative 2	Figure 6-58

Source: McFarland Johnson, 2018

South Side Aviation Development Area

Approximately 13 acres of land exists on the southside of the airfield, east of the Runway 4 end, which was identified as having potential for aeronautical development despite being nearly 50 feet lower in elevation than Taxiway L. Discussion with Airport staff and the Technical Advisory Committee (TAC) for this master plan indicated that this property is marketable to commercial aircraft MRO operators focusing on narrowbody aircraft. As a result of existing topography, this site is only connectible to the larger airfield through the commercial air carrier apron and, potentially, through a newly constructed Taxiway L1 connector approximately 400 feet north of the Taxiway C and Taxiway L intersection.

Table 6-8 lists the identified southside aviation facility alternative and Figure 6-59 depicts the alternative graphically.

Table 6-8: Identified South Side Aviation Facility Alternatives

Focus	Initial Alternatives	Figure
Commercial Narrowbody MRO Development Opportunities	South Side Aviation Development Area 1	Figure 6-59

Source: McFarland Johnson, 2018

6.1.7. Support Facility Alternatives

Support facility requirements documented in Chapter 5, *Facility Requirements* include the replacement of both the ATCT and ARFF building, expansion to the airfield maintenance area to include additional service bays, concrete apron, expanded chemical storage and diesel/gas storage, a building for fuel truck maintenance, and an additional building for miscellaneous airfield maintenance equipment. Further, to support future MRO operations, a possible location for ground run-up enclosure (GRE) is also explored. Table 6-9 reviews identified support facility requirements and expresses support facility goals. Table 6-10 presents the initially identified development alternatives for support facility area. Figure 6-60 through Figure 6-62 depict the support facility alternatives.

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Figure 6-57: Westside Aviation Development Area 1

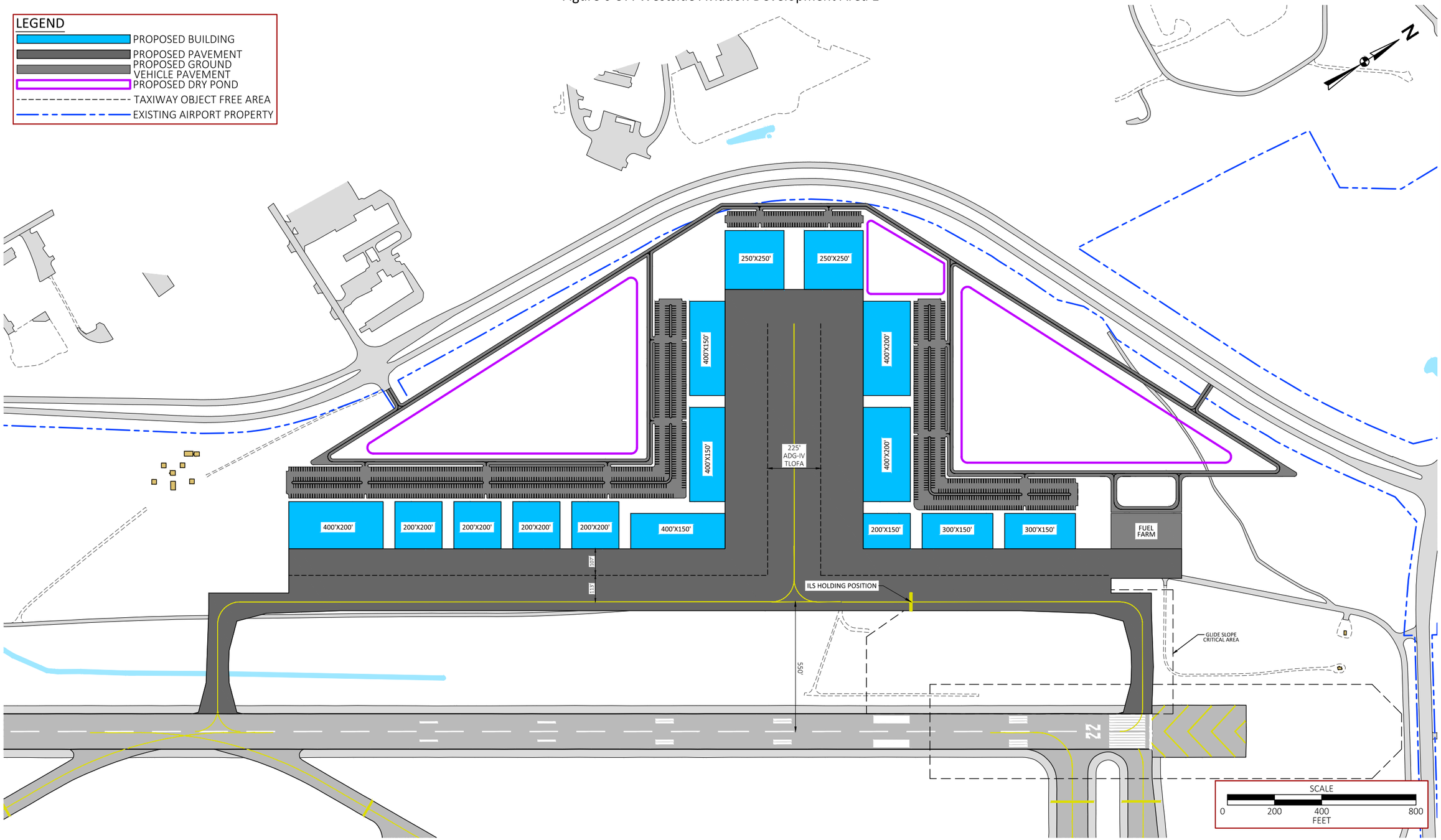

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Figure 6-58: Westside Aviation Development Area 2

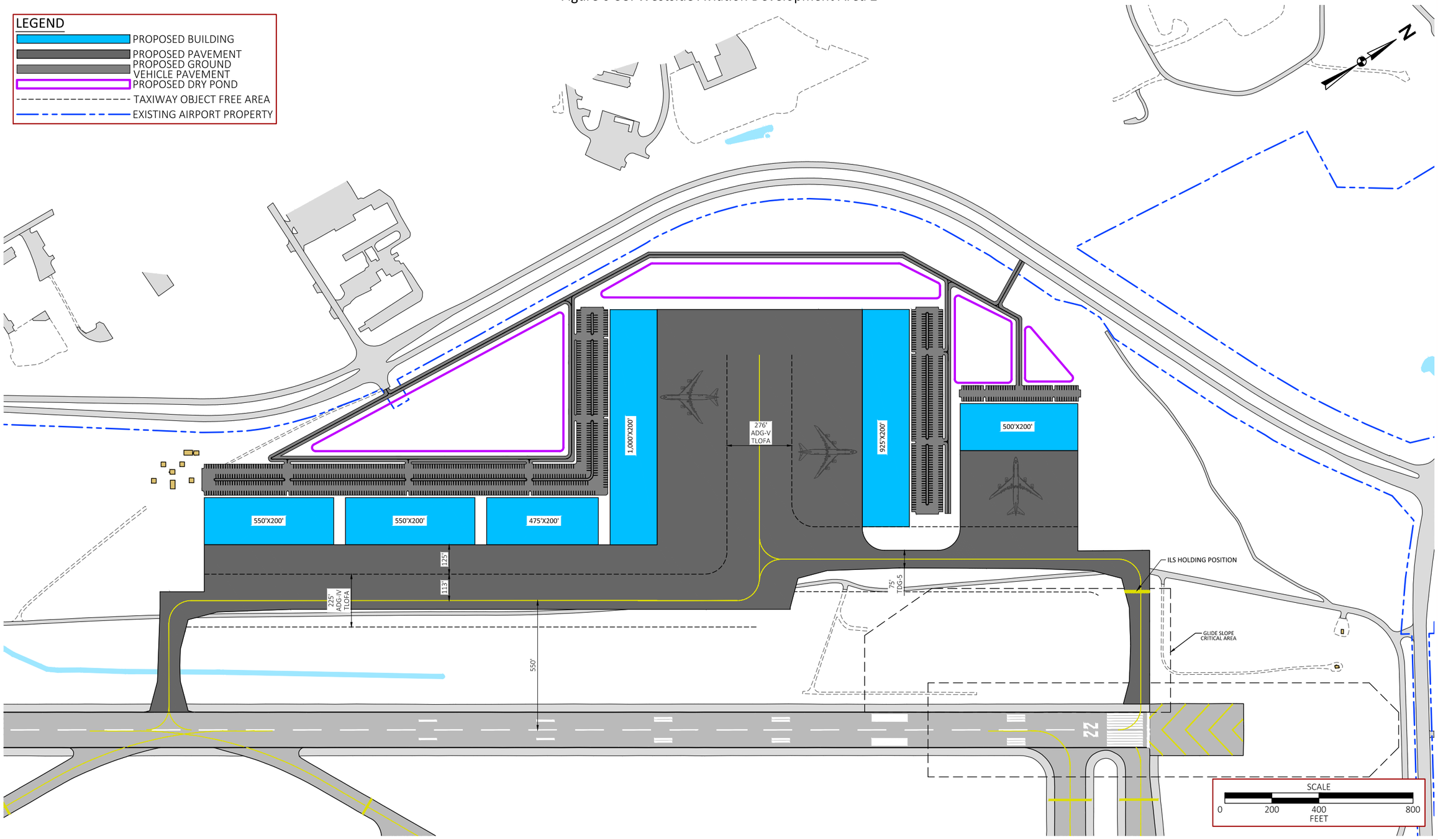

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Figure 6-59: Southside Aviation Development Area 1

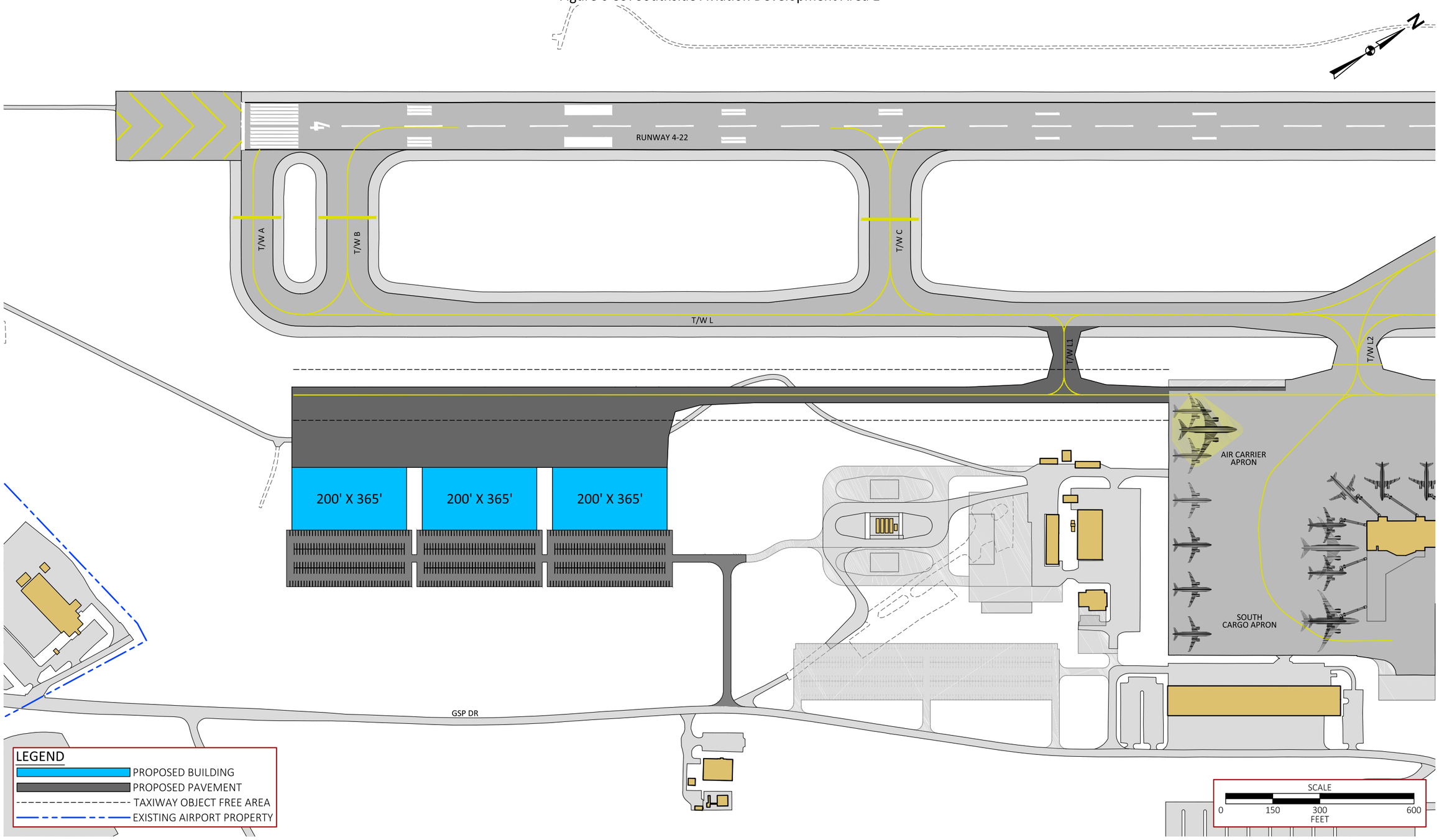

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Figure 6-60: Fuel Farm Expansion Alternative

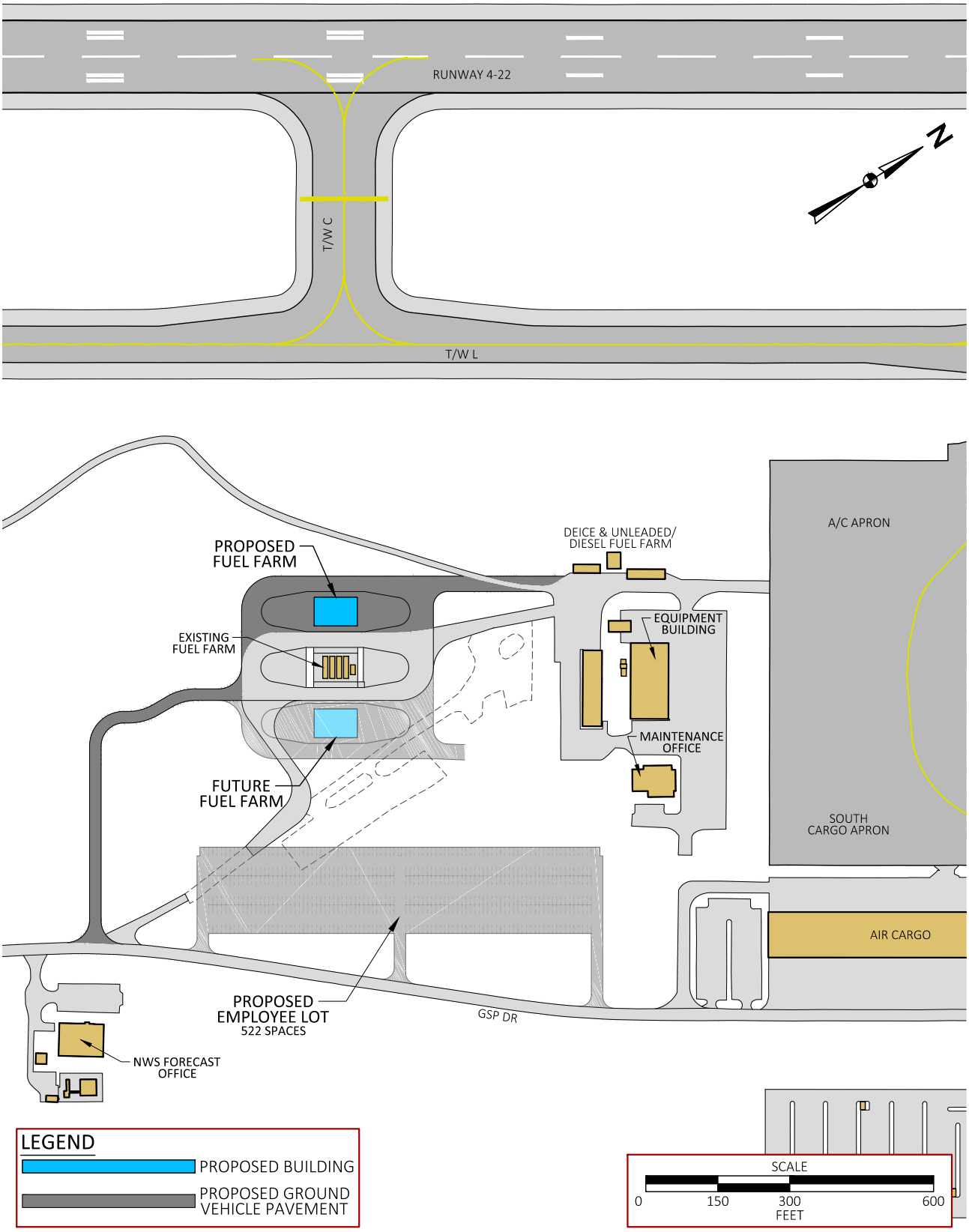

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Figure 6-61: Maintenance Yard Expansion

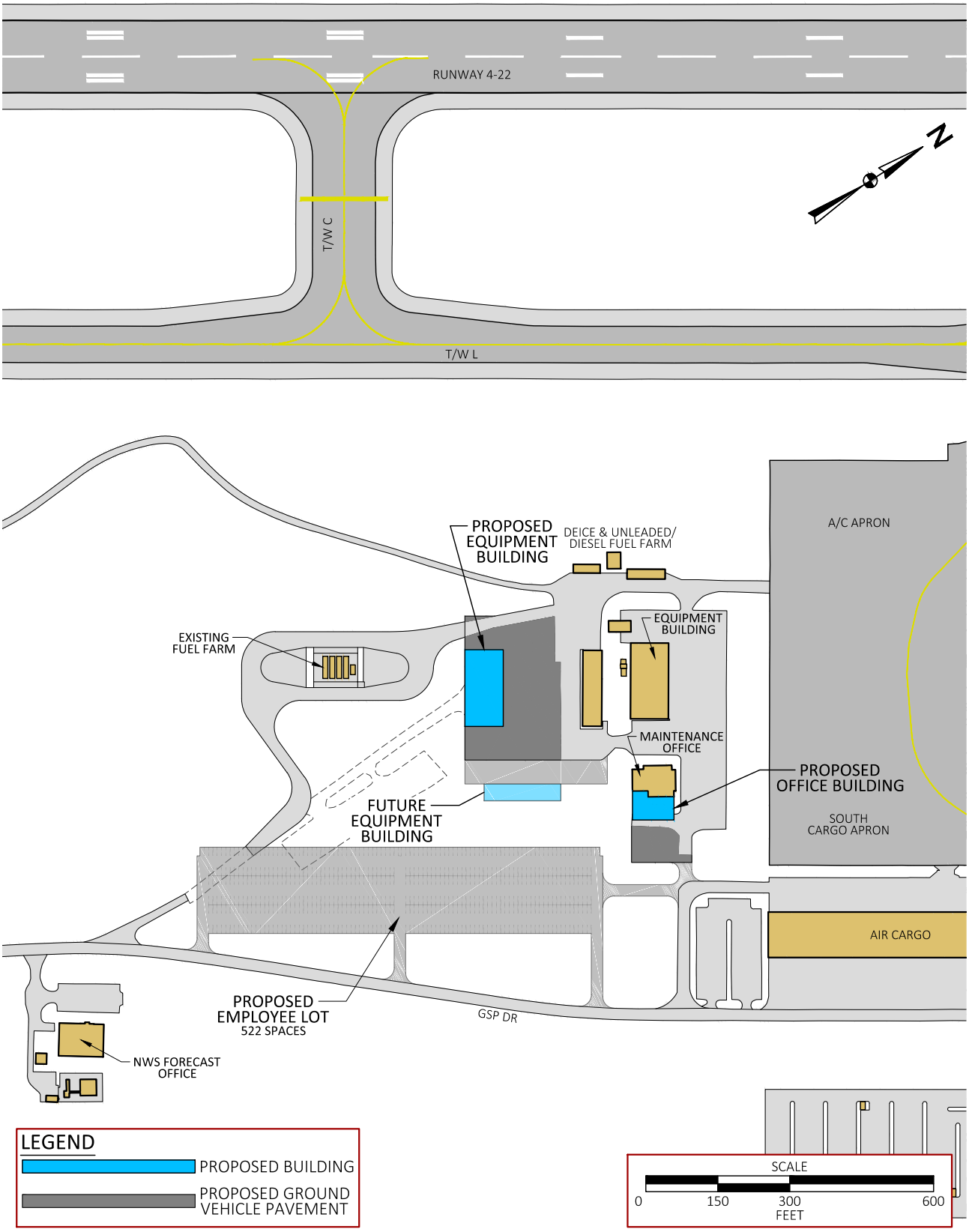

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Figure 6-62: Potential Ground Run Up Enclosure Site

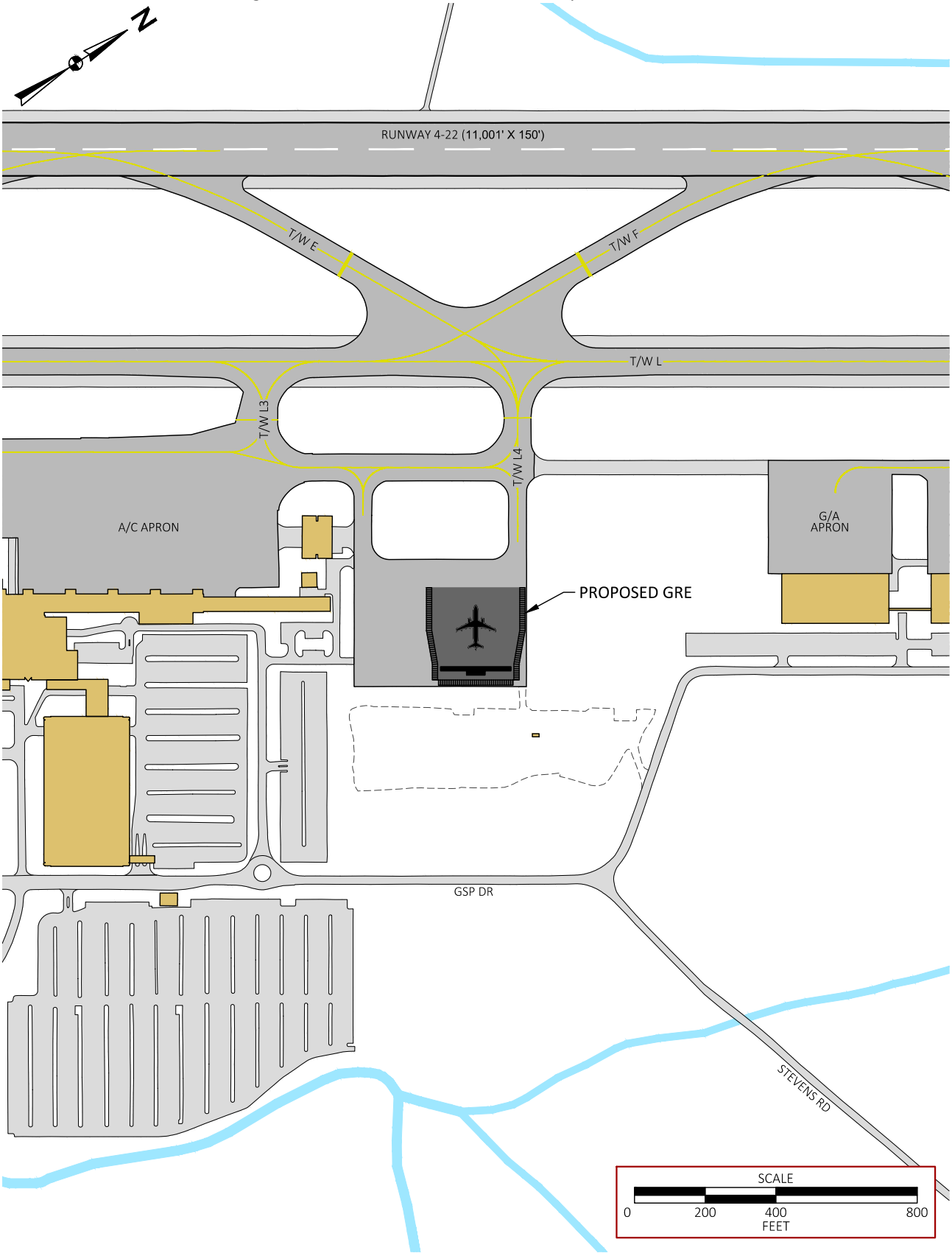

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Table 6-9: Support Facility Requirements

Geometry/Facility Requirement	Notes
ATCT Relocation	Proposed Site Identified
ARFF Relocation	Proposed Site Identified & Building Designed
+2-3 Service/Maintenance Bays	To provide dedicated vehicle maintenance bays
Expanded Diesel/Gas Storage	–
Expanded Chemical Storage	–
New Building for Fuel Truck Maintenance	To provide space specific to the maintenance of fuel trucks and miscellaneous fueling equipment
New Building for Misc. Equipment	To ensure all equipment has under-roof storage
Expanded/New Fuel Farm for Jet-A fuel	–
Expanded Concrete Maintenance Apron	–
Future Expansion of Maintenance Offices	–

Source: McFarland Johnson, 2018

Table 6-10: Identified Support Facility Alternatives

Focus	Initial Alternatives	Figure
Fuel Farm Expansion	Fuel Farm Expansion Alternative	Figure 6-60
Maintenance Yard Expansion	Maintenance Yard Expansion	Figure 6-61
Ground Run Up Enclosure	Potential Ground Run Up Enclosure Site	Figure 6-62

Source: McFarland Johnson, 2018

6.2. REFINEMENT AND EVALUATION OF DEVELOPMENT ALTERNATIVES

6.2.1. Evaluation Criteria

The evaluation factors used to compare development options were selected based on specific considerations associated with the Airport. The preferred alternatives are selected based on assessed criteria, stakeholder discussion, and their compatibility with one another and the overall airport environment. Collectively, the individual preferred alternatives create the overall preferred airport development concept as presented in Figure 6-92 at the end of this chapter.

- Airside Alternatives
  - Facility Rqmts. /Capacity Benefits
  - Environmental Impact
  - FAA Standards
  - Operational Efficiency
  - Development Cost
  - Development Flexibility
- Terminal Airside Alternatives
  - Facility Rqmts. /Capacity Benefits
  - Environmental Impact
  - FAA Standards
  - Operational Efficiency/Flexibility
  - Constructability
  - Development Cost
  - Future Expansion Potential

- Landside Access and Parking Alternatives
  - Facility Rqmts. /Capacity Benefits
  - Environmental Impact
  - Level of Service
  - Operational Efficiency/Flexibility
  - Constructability
  - Development Cost
- Air Cargo Alternatives
  - Facility Rqmts. /Capacity Benefits
  - Environmental Impact
  - FAA Standards
  - Operational Efficiency
  - Constructability
  - Development Cost
  - Future Expansion Potential
- General Aviation Alternatives
  - Facility Rqmts. /Capacity Benefits
  - Environmental Impact
  - FAA Standards
  - Operational Efficiency
  - Development Cost
  - Development Flexibility
  - Land Use Compatibility
  - Revenue Generation Potential

6.2.2. Refined Alternatives and Evaluation

The following sections will discuss the advancement and refinement of selected alternatives relative to each of the functional development areas of the Airport, as well as evaluate the refined alternatives and identify a series of preferred alternatives. All alternatives are evaluated against others in their functional area relative to the focus of the improvement being considered, as well as a "No Build" alternative.

Airside Alternatives

Of the airside alternatives presented in Section 6.1.1, the majority were retained. Those further refined are as follows:

- Parallel Runway: The two parallel runway alternatives providing the longest runway length were retained. These alternatives both provide for 4,300-foot separation between runways thereby enabling simultaneous precision instrument approach/departure operations, and each are capable of supporting operations by the largest aircraft operating at GSP. While the 6,500-foot runway length option would provide for fully standard runway protection zones (RPZ) off each runway end, the 7,000-foot runway length option would push the future Runway 4R RPZ south such that Aviation Parkway would cross its southwestern most corner. Calculation of critical aircraft operational performance suggest that the additional 500 feet of runway provided for in the 7,000-foot runway alternative could increase load factors by up to four percent (over 80 percent of maximum takeoff weight for the 747-8F).

- Crossfield Taxiway: All of the crossfield taxiway alternative concepts were retained, but each was refined to provide for ADG V aircraft, thereby ensuring that the future parallel runway is fully accessible and usable by widebody aircraft, including the current and future design aircraft the Boeing 747-400F and 747-800F, respectively.

- **Apron Edge Taxilane:** The initial apron edge taxilane alternative 3 depicted in **Figure 6-18** was retained and refined to provide for TDG-3 aircraft from Taxiway L3 to Taxiway L6.

The retained and refined airside alternatives are identified in **Table 6-11**. **Figure 6-63** through **Figure 6-66** present the refined airfield development alternatives, all other airside alternatives were retained as depicted in Section 6.1.1.

Table 6-11: Retained and Refined Airside Alternatives

Geometry/Facility Requirement	Initial Alternatives	Refinement	Figure
Parallel Runway	6,500’ RWY – 4,300’ SE of RWY 4-22	None	Figure 6-3
	7,000' RWY – 4,300' SE of RWY 4-22	None	Figure 6-4
Crossfield Taxiway	Dual Parallel on Transient Apron	ADG V Design	**Figure 6-63**
	Dual Parallel on Expanded Transient Apron	ADG V Design	**Figure 6-64**
	Split Dual Parallel – Transient/Cargo Apron	ADG V Design	**Figure 6-65**
Wide Expanse of Pavement Co-Location of Rapid Exit Taxiway Direct Access	TWY E & F Removal	None	Figure 6-9
	Remove Taxiway E & F, Add 90° TWY	None	Figure 6-11
Direct Access	TWY L2 South	None	Figure 6-13
	TWY L2 North		Figure 6-14
Taxiway Fillet	Fillet Widening for TDG-6 on TWY A/B/J/K	None	Figure 6-15
Apron Edge Taxilane	TDG 3/2 TWY Between TWY L4 and TWY L6	TDG-3 Only	**Figure 6-66**
Approach Lighting System	2,400' ALSF-II in Runway 22 Approach Zone	None	Figure 6-20
Runway Entrance/Exit Taxiway	Taxiway H Development	None	Figure 6-21
90-Degree Apron Entrance	Taxiway L9 Realignment	None	Figure 6-22

Notes: RWY = Runway, TWY = Taxiway

Source: McFarland Johnson, 2018

Figure 6-63: Refined Crossfield Taxiway Alternative 1

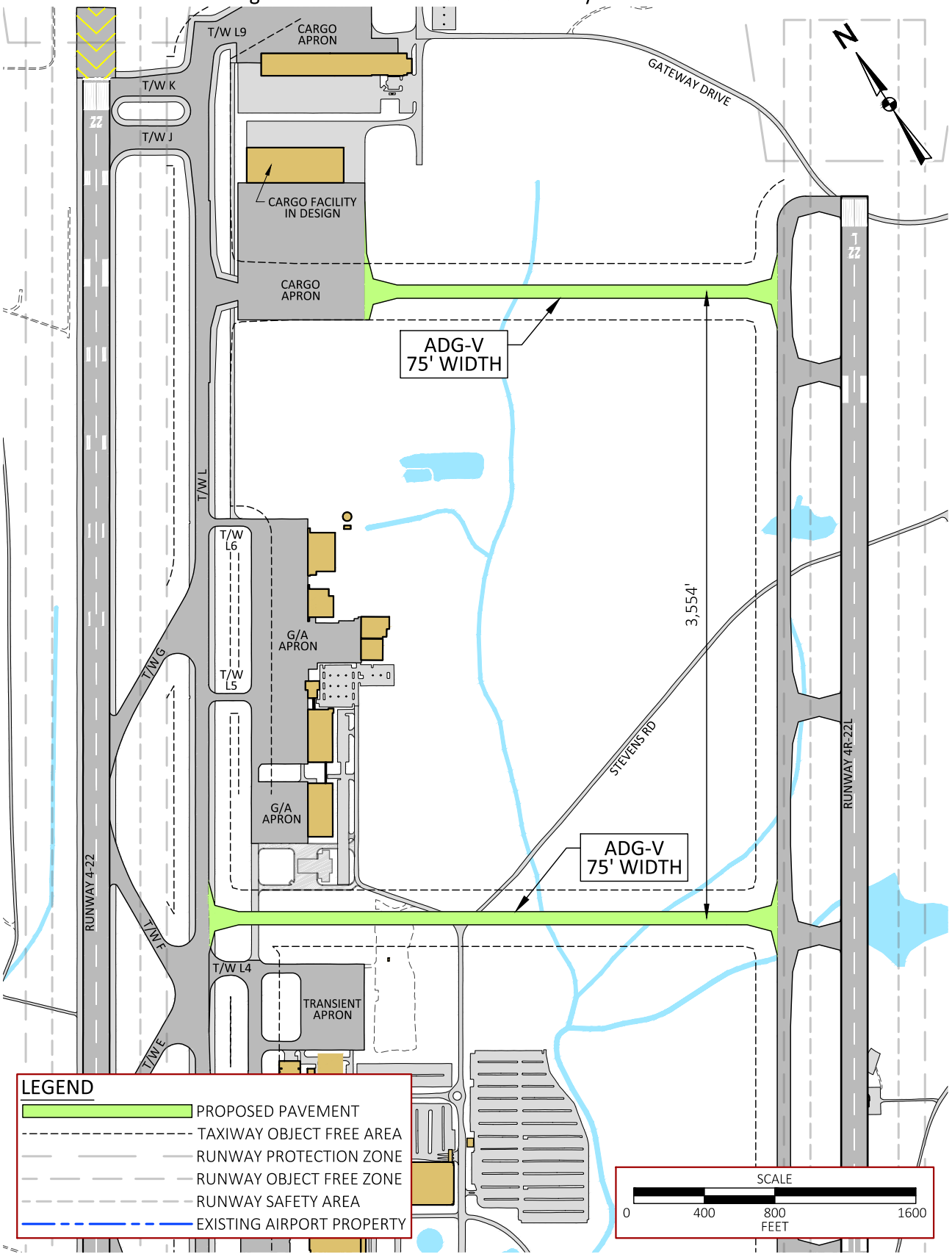

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Figure 6-64: Refined Crossfield Taxiway Alternative 2

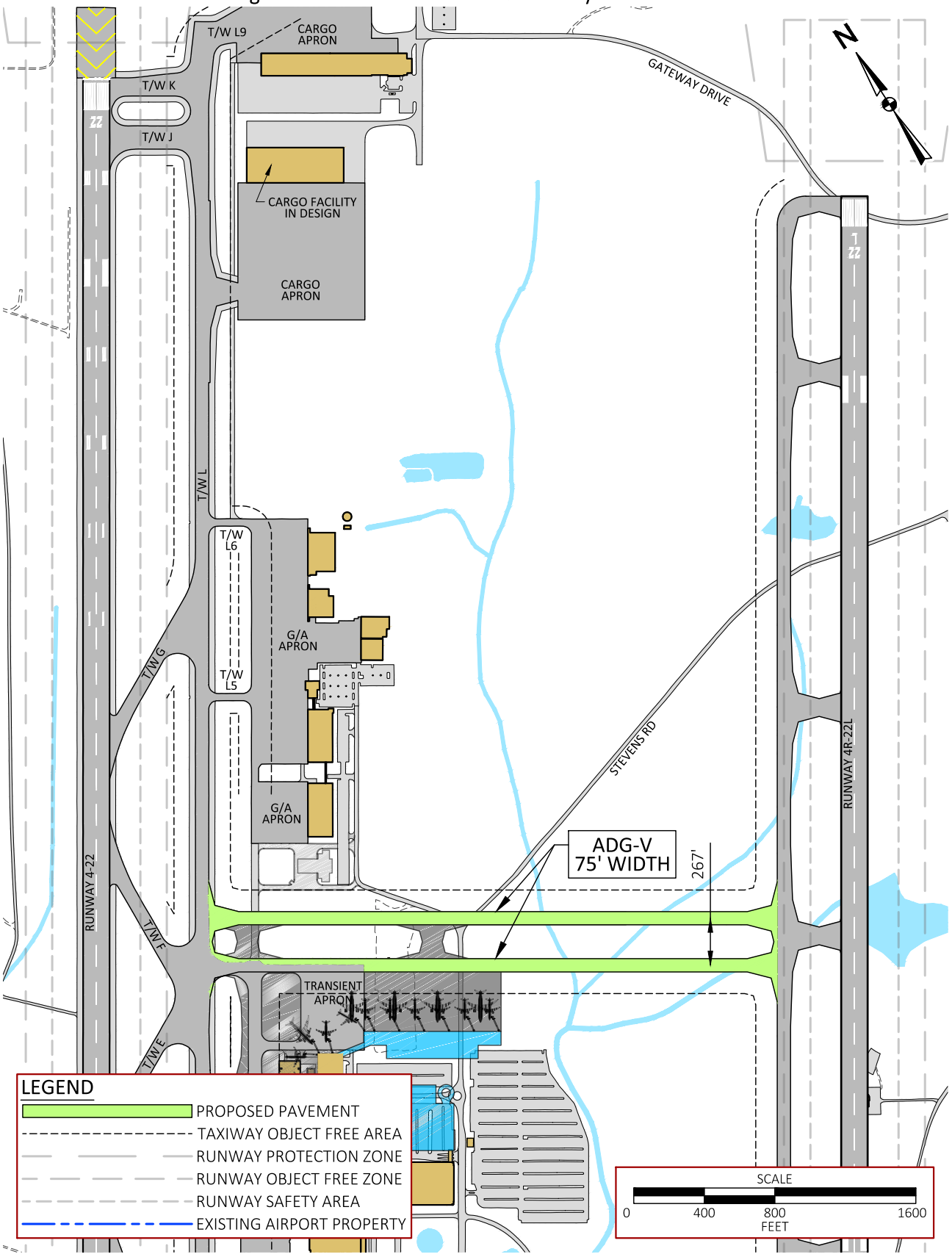

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Figure 6-65: Refined Crossfield Taxiway Alternative 3

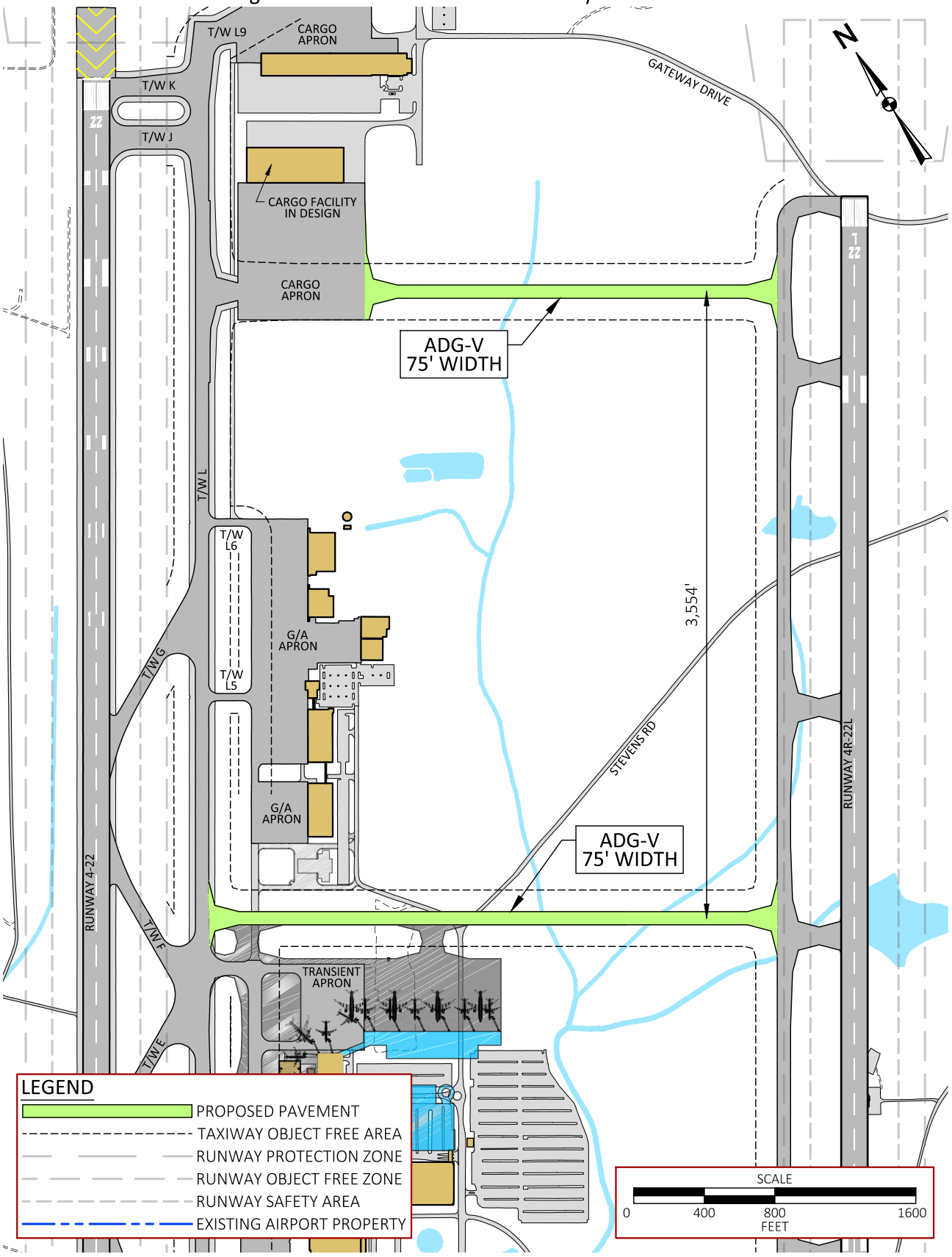

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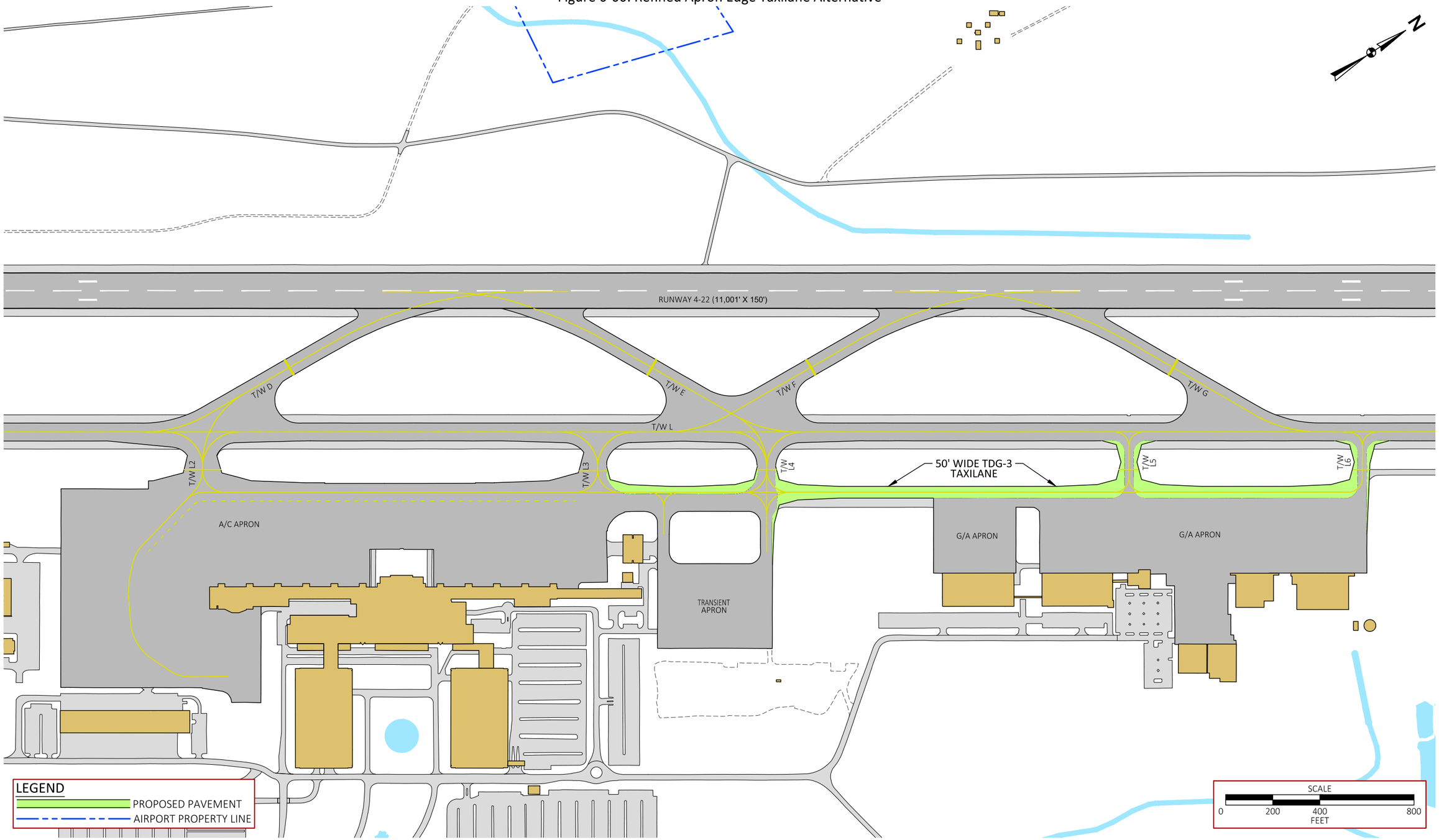
Figure 6-66: Refined Apron Edge Taxilane Alternative



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Evaluation

Through direct engagement with Airport staff and the TAC organized specifically for this effort, the retained and refined airfield alternatives were scored using the airfield evaluation criteria previously presented. Each alternative was scored individually but ranked against similar alternatives as well as a no build alternative. **Table 6-12** depicts the results of that analysis and identification of the high scoring alternatives.

Table 6-12: Airfield Alternative Evaluation

Airfield Alternative	Facility Requirement	Environmental Impact	FAA Standards	Operational Efficiency	Development Cost	Development Flexibility	TOTAL
6,500' RWY – 4,300' SE of RWY 4-22	1	2	3	2	2	3	13
7,000' RWY - 4,300' SE of RWY 4-22	3	1	2	3	2	3	14
No Build	0	3	0	0	3	2	8
Refined Dual Parallel on Transient Apron	3	2	3	3	3	2	15
Refined Dual Parallel on Expanded Transient Apron	3	2	3	2	3	2	16
Refined Split Dual Parallel - Transient/Cargo Apron	3	2	3	3	3	3	17
No Build	0	3	0	0	3	0	6
TWY E & F Removal	3	3	3	1	3	3	19
Remove TWY E & F, Add 90° TWY	3	2	3	2	2	3	17
No Build	0	3	0	3	3	0	9
TWY L2 South	3	2	3	1	2	1	12
TWY L2 North	3	2	3	2	2	2	14
No Build	3	3	3	3	3	3	18
Fillet Widening for TDG-6 on TWY A/B/J/K	3	2	3	3	2	3	16
No Build	3	3	3	2	3	3	17
TDG 3 TWY Between TWY L4 and TWY L6	3	2	3	3	2	2	15
No Build	0	3	3	1	3	1	11
2,400' ALSF-2 in RWY 22 Approach Zone	3	2	3	3	2	3	16
No Build	0	3	3	1	3	3	13
TWY H Development	3	2	3	3	2	3	16
No Build	0	3	3	1	3	3	13
TWY L9 Realignment	3	2	3	3	2	3	16
No Build	0	3	3	1	3	3	13

Notes: RWY = Runway, TWY = Taxiway

Source: McFarland Johnson, 2018

Figure 6-67 depicts each of the preferred identified alternatives to cumulatively present the preferred airside development plan for GSP.

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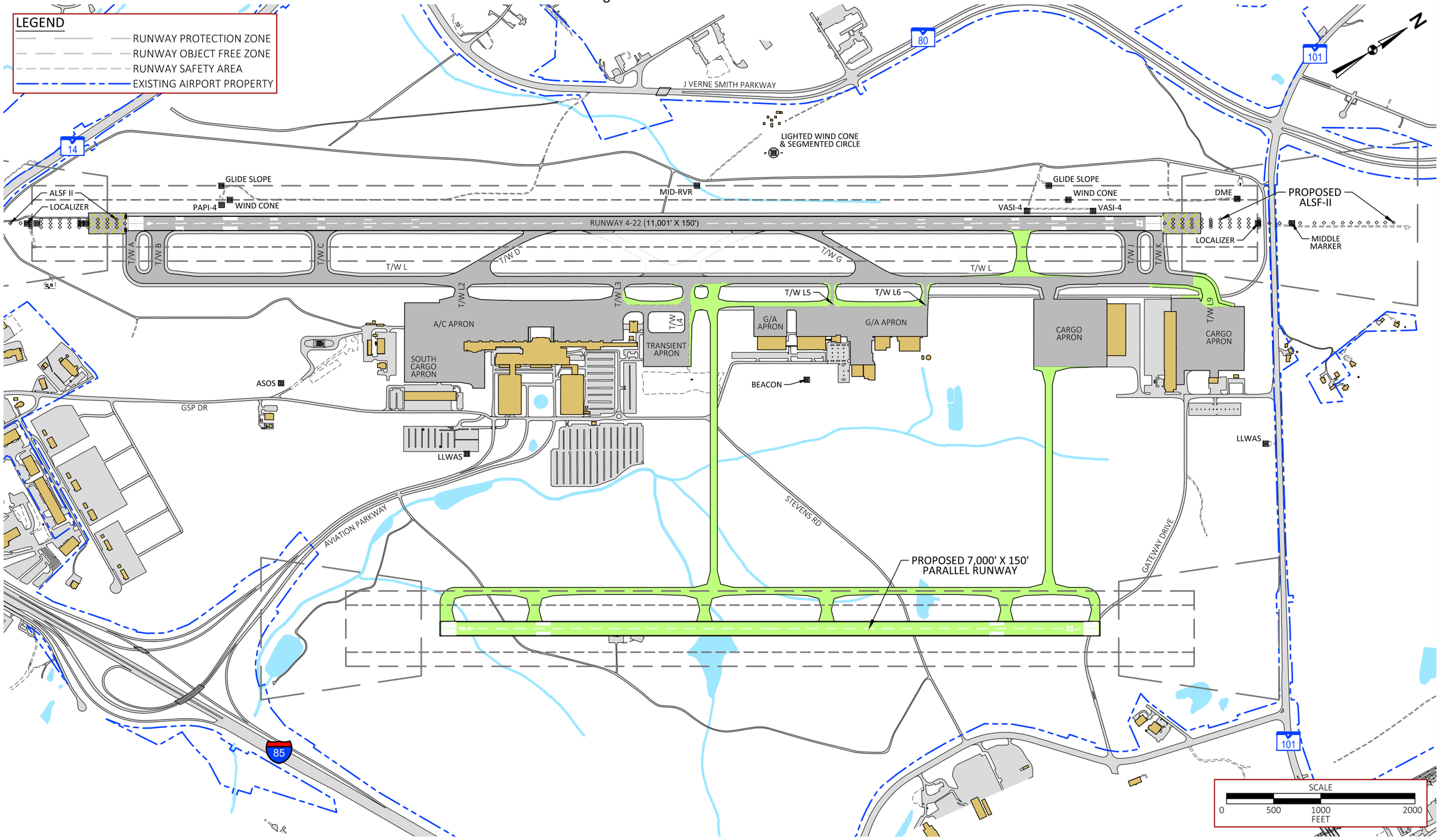
Figure 6-67: Preferred Airfield Alternative



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Terminal Airside Alternatives

Of the terminal airside alternatives presented in Section 6.1.2, three Concourse A alternatives, two Concourse B alternatives, and one Terminal 2 long-range alternative were retained for refinement. Additionally, two new alternatives were developed as part of the refinement of terminal airside alternatives. One explores a blended Concourse A/B expansion alternative, while the other examines the ability to additionally integrate Terminal 2 in the long-term. These refinements and new concepts are as follows:

- **Concourse A:** Concourse A development alternatives A1-Ground, A3-International, and A4-International were retained and refined for further analysis. In all refinements, building footprints were optimized, RON parking positions identified, hardstand position B4.5 is outfitted with a gate to become Gate B5, and the proposed Concourse B side baggage claim was reduced slightly. Further, both international alternatives were refined to reflect ample GSE storage potential inherent to each alternative.

- **Concourse B:** Concourse B development alternative B1-Ground and B2-Ground were retained and refined for further analysis. Each was refined to optimize building footprint, identify RON parking positions and resize Concourse B side baggage claim.

- **Blended:** This new blended alternative presents concepts A1-Ground and B1-Gound together reflecting a terminal with 18 gated narrowbody hardstands (three of which could flex to support two international widebody aircraft), four ungated narrowbody hardstand positions, six narrowbody RON positions (two of which could be flexed to support a single widebody aircraft), and expanded GRE yard with support building.

- **Terminal 2:** One future Terminal 2 alternative was retained and refined to separate the apron edge taxilane from the Crossfield taxiway and permit dual use of taxiway pavements. Additionally, the newly developed blended alternative as discussed above was included with the Terminal 2 concept as a new long-term terminal alternative.

Table 6-13 tabulates these new and refined alternatives.

Table 6-13: Retained and Refined Terminal Airside Alternatives

Focus	Initial Alternatives	Refinement	Figure
Concourse A	Terminal Alternative A1 – Ground	Reduced building size / Identified RON and deicing positions / Resized proposed baggage claim / Hardstand B4.5 becomes gated	**Figure 6-68**
	Terminal Alternative A3 – International	Reduced building size / Relocated widebody flex gates / Identified RON positions / Expanded GSE apron / Resized proposed baggage claim / Hardstand B4.5 becomes gated	**Figure 6-69**

	Terminal Alternative A4 – International	Modified building footprint / Relocated widebody flex gates / Optimized gate potential / Expanded GSE Apron / Resized proposed baggage claim / Hardstand B4.5 becomes gated	Figure 6-70
Concourse B	Terminal Alternative B1 – Ground	Reduced building size / Identified RON positions / Expanded GSE apron / Resized proposed baggage claim	Figure 6-71
	Terminal Alternative B2 – Ground	Increased building size / Expanded apron Identified RON positions / Expanded GSE apron / Resized proposed baggage claim	Figure 6-72
Blended	New Terminal Alternative A1/B1 – Ground	Paired refined A1 and B1 Alternatives	Figure 6-73
Terminal 2	Terminal Alternative B3 – International	Separated apron taxilane from crossfield taxiway	Figure 6-74
	New Terminal Alternative B3	Paired A1 and B1 with Terminal 2 concept	Figure 6-75

Source: McFarland Johnson, 2018

The short-listed alternatives were selected and refined based on detailed review and consideration of the planning team and Airport stakeholders. Stakeholder and community engagement is documented at the end of this report. Maximizing the aeronautical utility of existing pavements on the air carrier apron, providing for long term growth in commercial activity, and maintaining a commitment to the Airport's aesthetic and park-like feel were central considerations. Also, the desire to maintain a balanced distribution of gates across the terminal concourses also became a guiding consideration of this effort as the alternatives were refined.

Figure 6-68 through Figure 6-75 present the refined terminal airside alternatives.

Figure 6-68: Refined Terminal Alternative 1

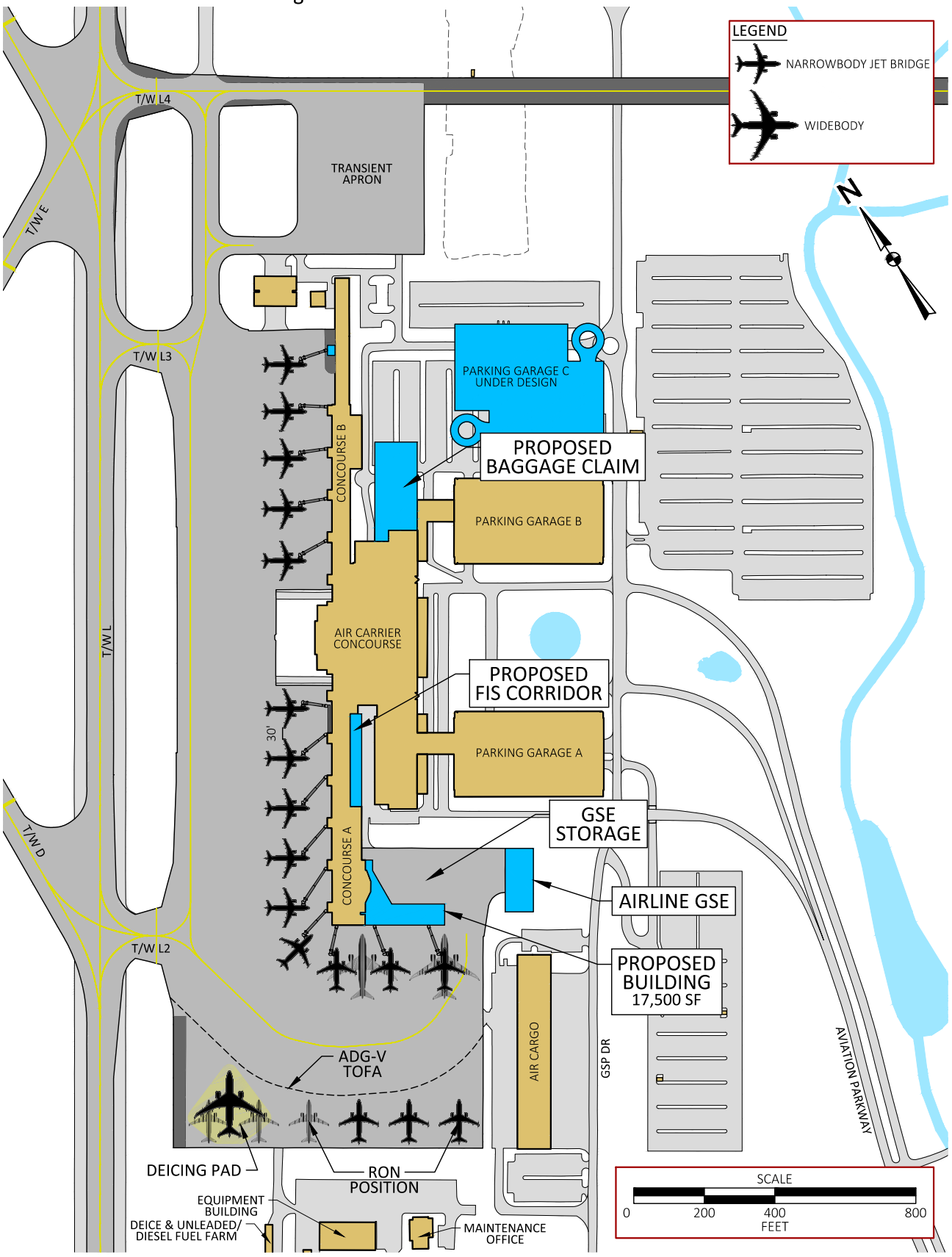

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Figure 6-69: Refined Terminal Alternative 2

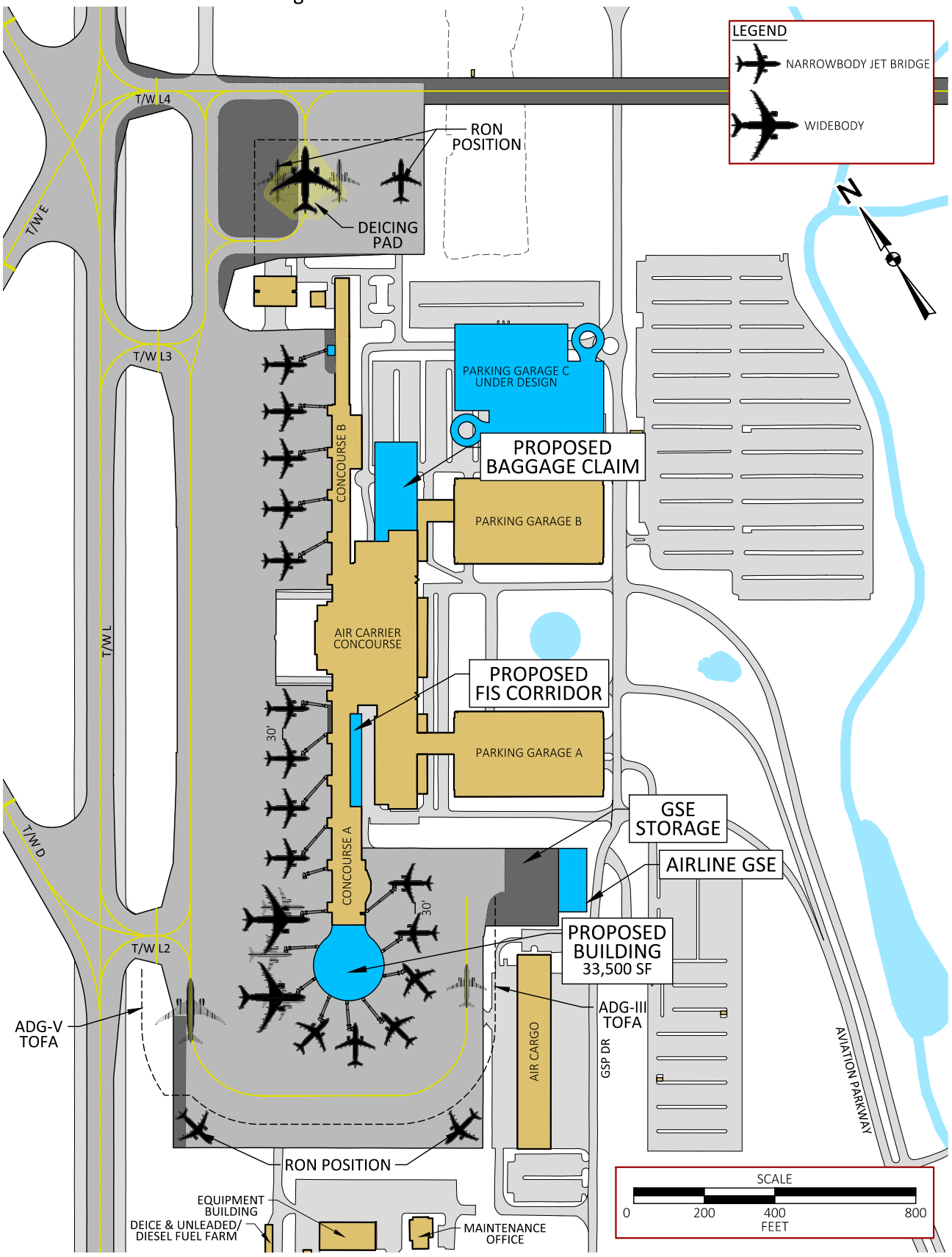

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Figure 6-70: Refined Terminal Alternative 3

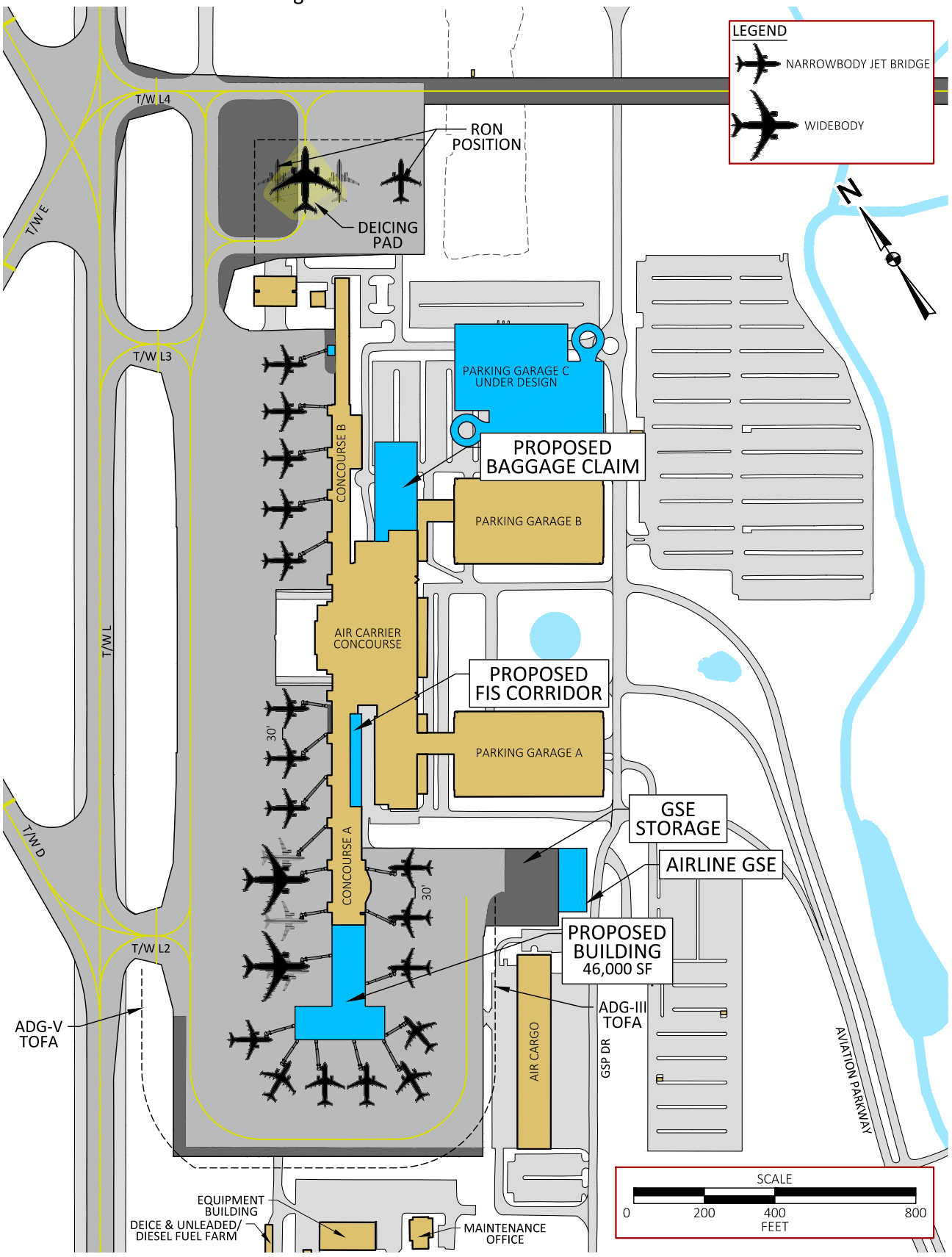

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Figure 6-71: Refined Terminal Alternative 4

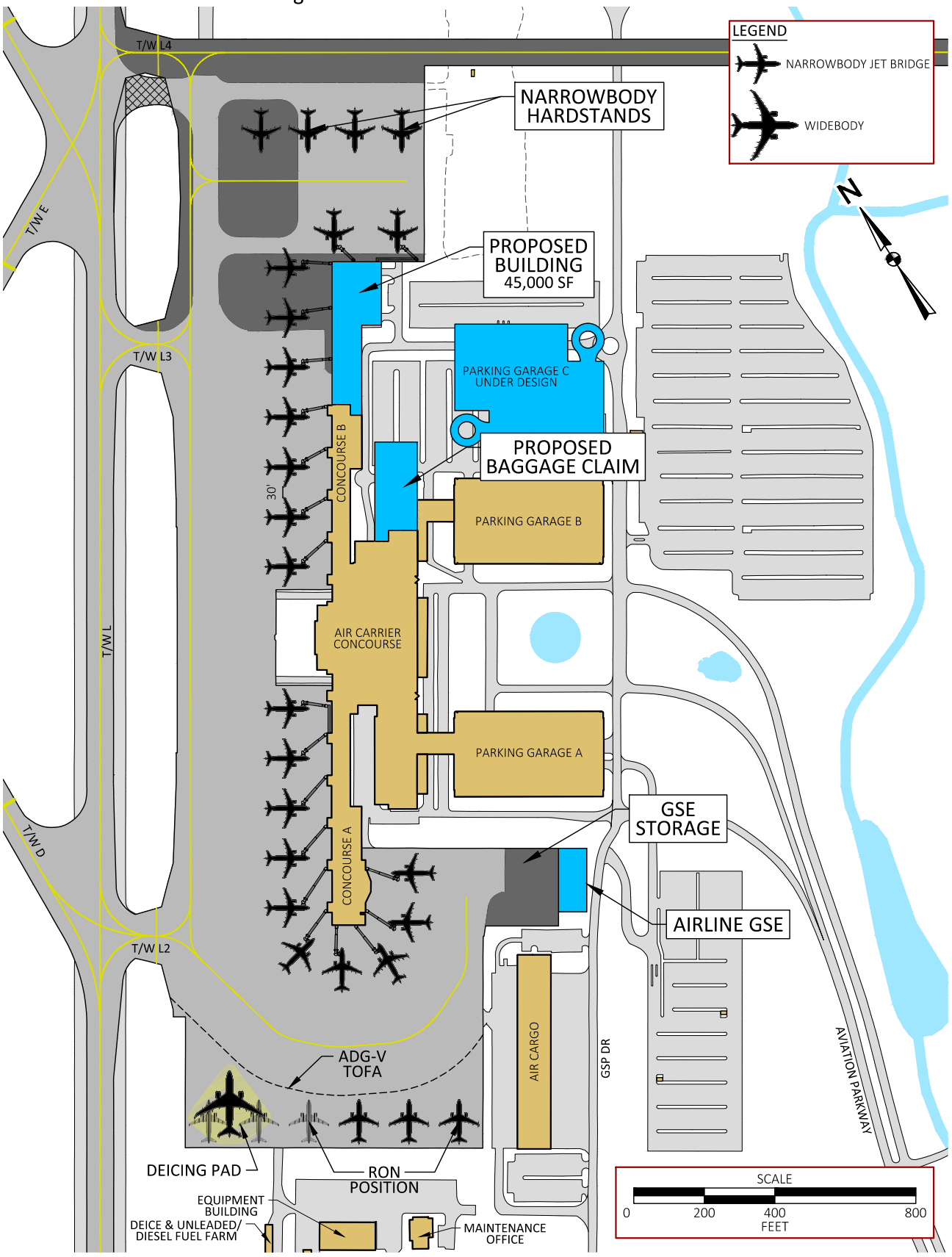

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Figure 6-72: Refined Terminal Alternative 5

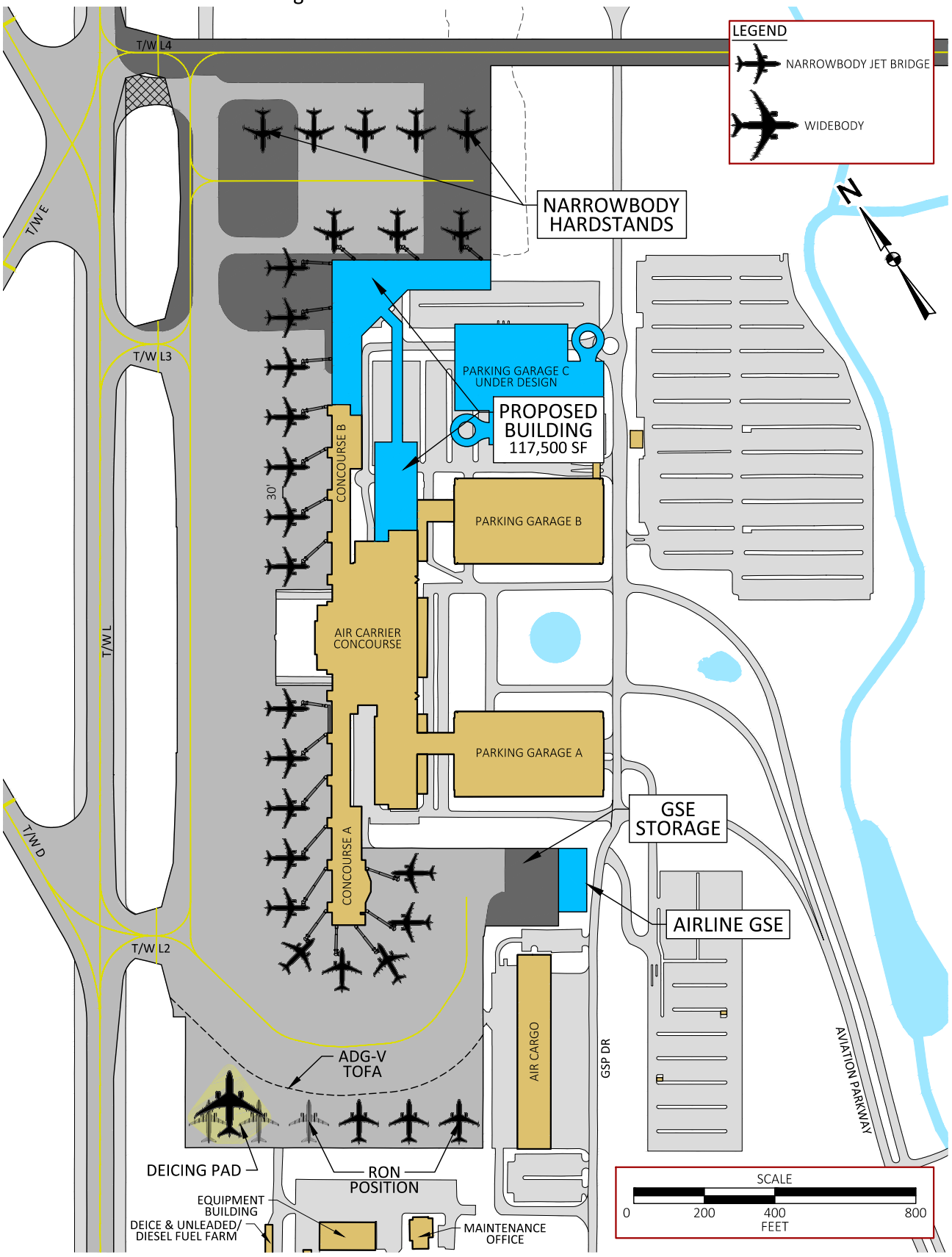

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Figure 6-73: Refined Terminal Alternative 6

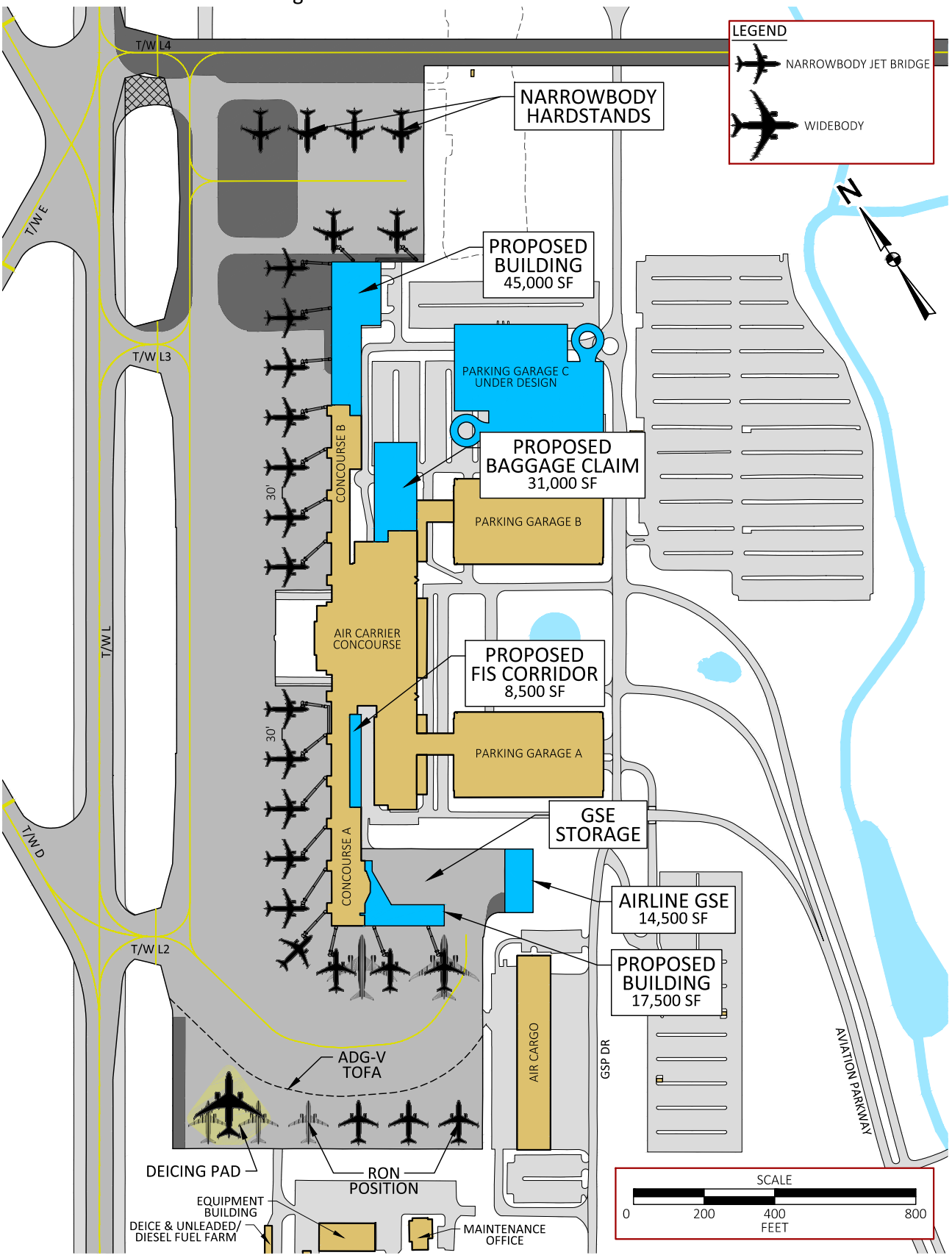

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Figure 6-74: Beyond Planning Period Alternative 1

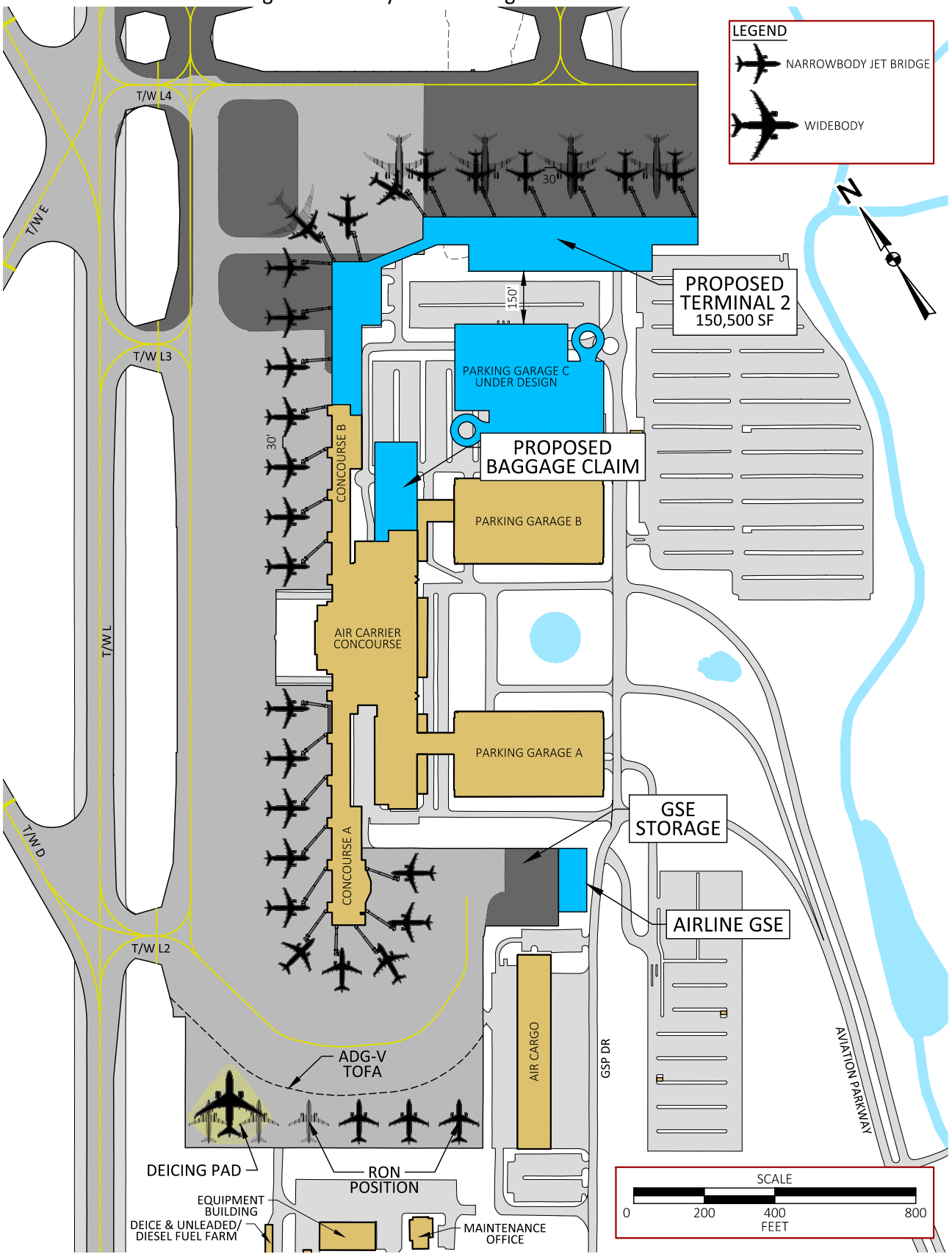

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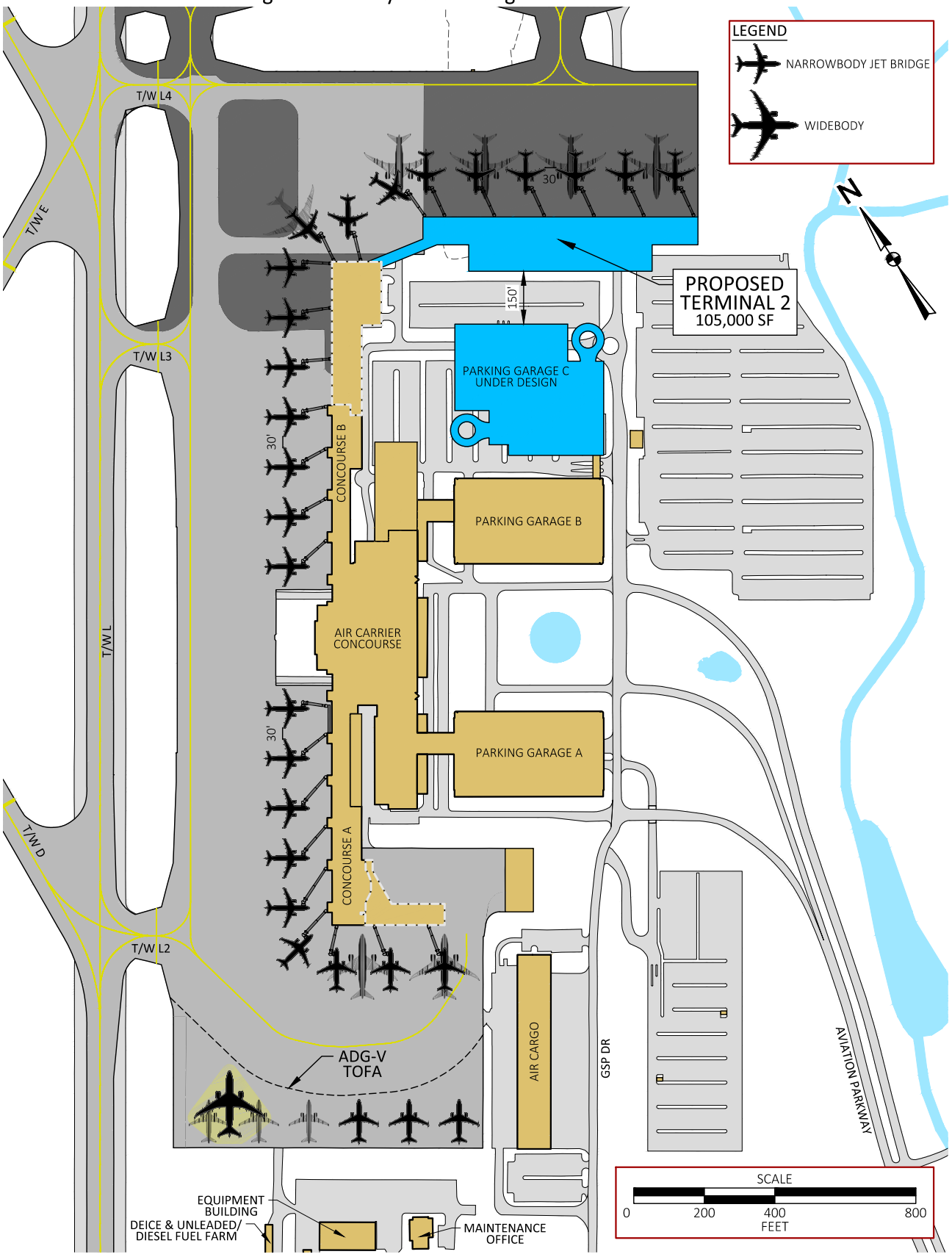
Figure 6-75: Beyond Planning Period Alternative 2



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Evaluation

Through direct engagement with Airport staff and the TAC, the retained and refined terminal airside alternatives were scored using the airfield evaluation criteria previously presented. Terminal airside alternatives were not considered against a no build alternative as the current terminal airside is not equipped to support anticipated future levels of traffic. Additional hardstand and gated aircraft positions will be required to support commercial airline activity in the future. All terminal airside alternatives depict the addition of gated aircraft positions at the two ungated hardstand positions, Gate A0.5 and Gate B4.5. The addition of these gates in the near-term planning period is imperative to support new air carrier entrants to the GSP market forecast during this master plan effort.

Table 6-14 depicts the scoring of the refined terminal airside alternatives and identification of the high scoring alternatives.

Table 6-14: Terminal Airside Alternative Evaluation

Terminal Airside Alternative	Facility Requirements	Gate Considerations	Environmental Impacts	FAA Standards	Operational Efficiency	Constructability	Development Cost	Balanced Terminal	TOTAL
Refined Terminal Alternative 1	2	0	3	3	3	3	3	2	19
Refined Terminal Alternative 2	2	1	3	3	2	3	2	1	17
Refined Terminal Alternative 3	3	1	3	3	2	2	1	1	16
Refined Terminal Alternative 4	3	2	2	3	3	2	1	3	19
Refined Terminal Alternative 5	3	3	1	3	3	2	1	1	17
Refined Terminal Alternative 6	3	3	2	3	3	2	1	3	20
Beyond Planning Period Alternative 1	3	3	2	3	2	2	2	2	19
Beyond Planning Period Alternative 2	3	3	2	3	3	2	1	3	20

Source: McFarland Johnson, 2018

Refined Terminal Alternative 6 and Beyond Planning Period Alternative 2 were identified as the preferred alternatives for future terminal growth at GSP. Figure 6-76 presents both preferred terminal airside alternatives.

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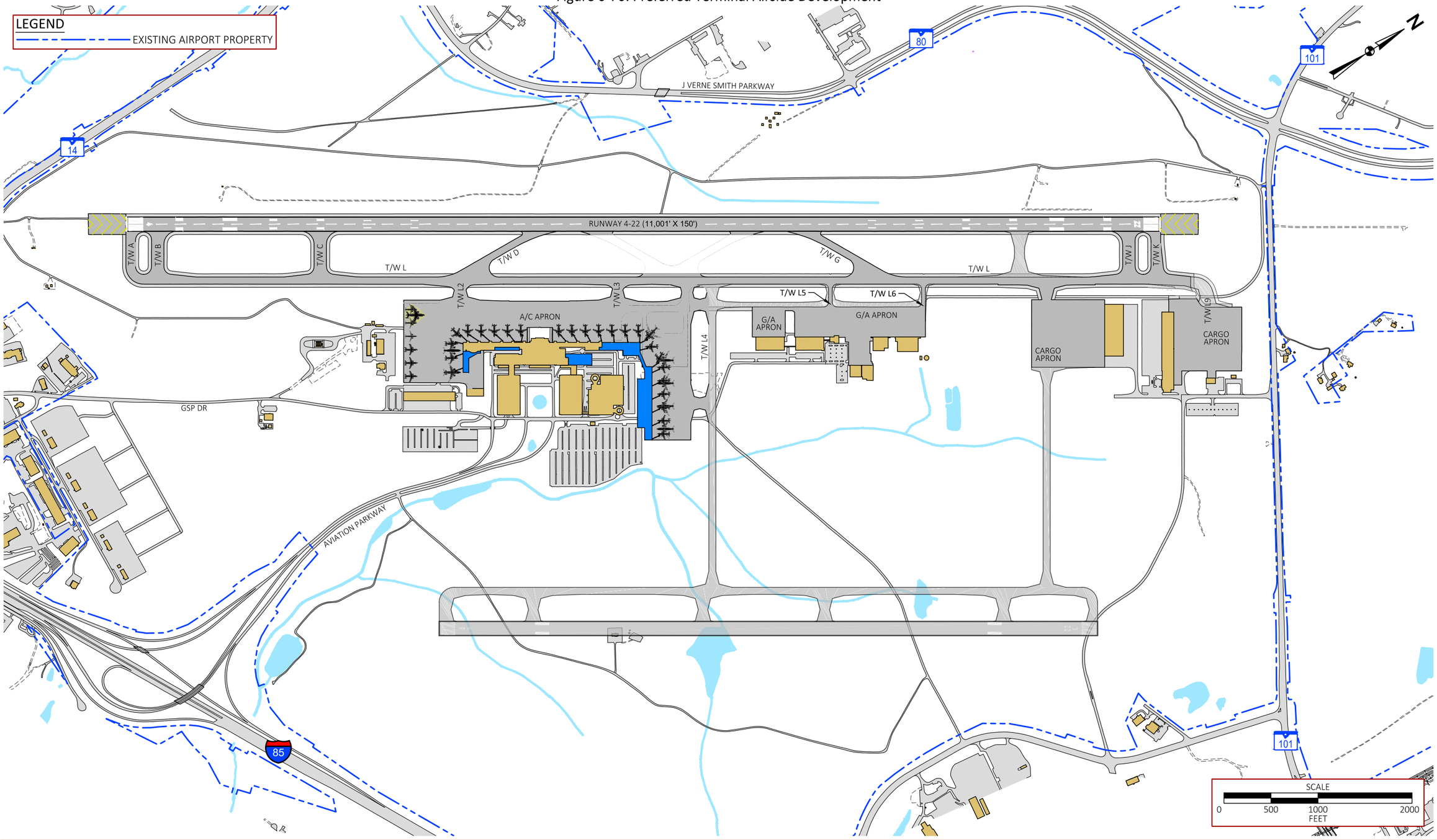
Figure 6-76: Preferred Terminal Airside Development



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Landside Access Alternatives

Of the landside access alternatives presented in Section 6.1.3, only two were retained and further refined and one was developed as a new concept as follows:

- **Existing Roads and GA:** Landside Access Alternative 1E, as depicted in **Figure 6-43** was retained and refined to minimize environmental consequences around Dillard Creek, optimize traffic separation, better integrate with Garage C, provide expanded surface parking opportunity and optimize its egress flow. Additionally, a new landside access alternative was developed, Landside Access Alternative 1F, which builds on Landside Access Alternative 1E by blending the GA access road with the future ingress route to the terminal curb loop. This road then splits off prior to the terminal loop road turning west and gaining elevation to meet the future Terminal 2 curb. GA access would be provided underneath the future crossfield taxiway and GA traffic would egress below the terminal loop road before blending back with the terminal loop road entrance lanes and out to the future 2-lane roundabout.

- **New Approach and GA:** Landside Access Alternative 2D was retained and refined to minimize environmental consequences around Dillard Creek, optimize traffic separation, better integrate with Garage C, provide expanded surface parking opportunity, and optimize its egress flow.

These refined landside access alternatives are discussed in **Table 6-15**.

Table 6-15: Retained and Refined Landside Access Alternatives

Focus	Initial Alternative	Refinement	Figure
Existing Roads and GA	Landside Access Alternative 1E	Ingress to terminal splits west of Dillard Creek / Ingress to Garage C revised to separate private vehicle and rental car returns earlier on the access roadways / GA access road realigned / Overflow lot expanded into future surface parking / Egress from expanded overflow parking lot to Aviation Parkway realigned	**Figure 6-77**
	New – Landside Access Alternative 1F	This alternative blends the GA access road with the terminal entrance road before splitting and providing GA access underneath the crossfield taxiway. Egress from GA road to Aviation Parkway would be provided underneath the terminal entrance road as it curves and elevates to become parallel with the future Terminal 2 location.	**Figure 6-78**
New Approach and GA	Landside Access Alternative 2D	GA access road realigned / Entrance lanes to terminal realigned around Dillard Creek / Ingress to terminal splits west of Dillard Creek / Ingress to Garage C revised to	**Figure 6-79**

Focus	Initial Alternative	Refinement	Figure
		separate private vehicles and rental car returns earlier on the access roadways / Expanded surface parking shown / Proposed water features identified	

Source: McFarland Johnson, 2018

The landside access alternatives considered for further evaluation and scoring are depicted in **Figure 6-77** through **Figure 6-79**.

Evaluation

Through direct engagement with Airport staff and the TAC, the landside access alternatives considered herein were scored using the airfield evaluation criteria previously presented. Alternative 2D was dismissed as traffic simulation modeling revealed its inability to maintain a high LOS when considering the anticipated vehicular activity to support three MAEP. Additionally, abandoning useful portions of the existing ingress and egress roadway network to add little capacity does not make fiscal sense. Alternative 1F and 1E were further evaluated and it was found that Alternative 1F provides for a higher LOS through 3 MAEP and better operational efficiency of traffic than Alternative 1E. Furthermore, Alternative 1F is cheaper to construct as a separate roadway dedicated to GA access is not provided. **Table 6-16** details the results of the landside access alternative evaluation.

Table 6-16: Landside Access Alternative Evaluation

Terminal Airside Alternative	Environmental Impacts	Integrity of Aesthetics	Level of Service	Operational Efficiency	Constructability	Development Cost	Future Expansion Potential	TOTAL
Landside Access Alternative 1E	3	3	2	2	3	2	2	17
New – Landside Access Alt 1F	3	3	3	3	3	3	2	20
Landside Access Alternative 2D	1	1	0	2	2	1	3	10
No Build	3	3	0	0	3	3	0	12

Source: McFarland Johnson, 2018

Landside Access Alternative 1F was identified as the preferred landside access alternative. The following sections focus in on curbside design considerations and opportunities to efficiently connect airport parking facilities with the terminal building.

Curbside Design Alternatives

To maximize the utility and throughput at the terminal curb of the preferred landside access alternative identified above, three lane configurations were explored. **Figure 6-80** through **Figure 6-82** depict the terminal curbside lane configurations explored.

Figure 6-77: Refined Landside Access Alternative 1E

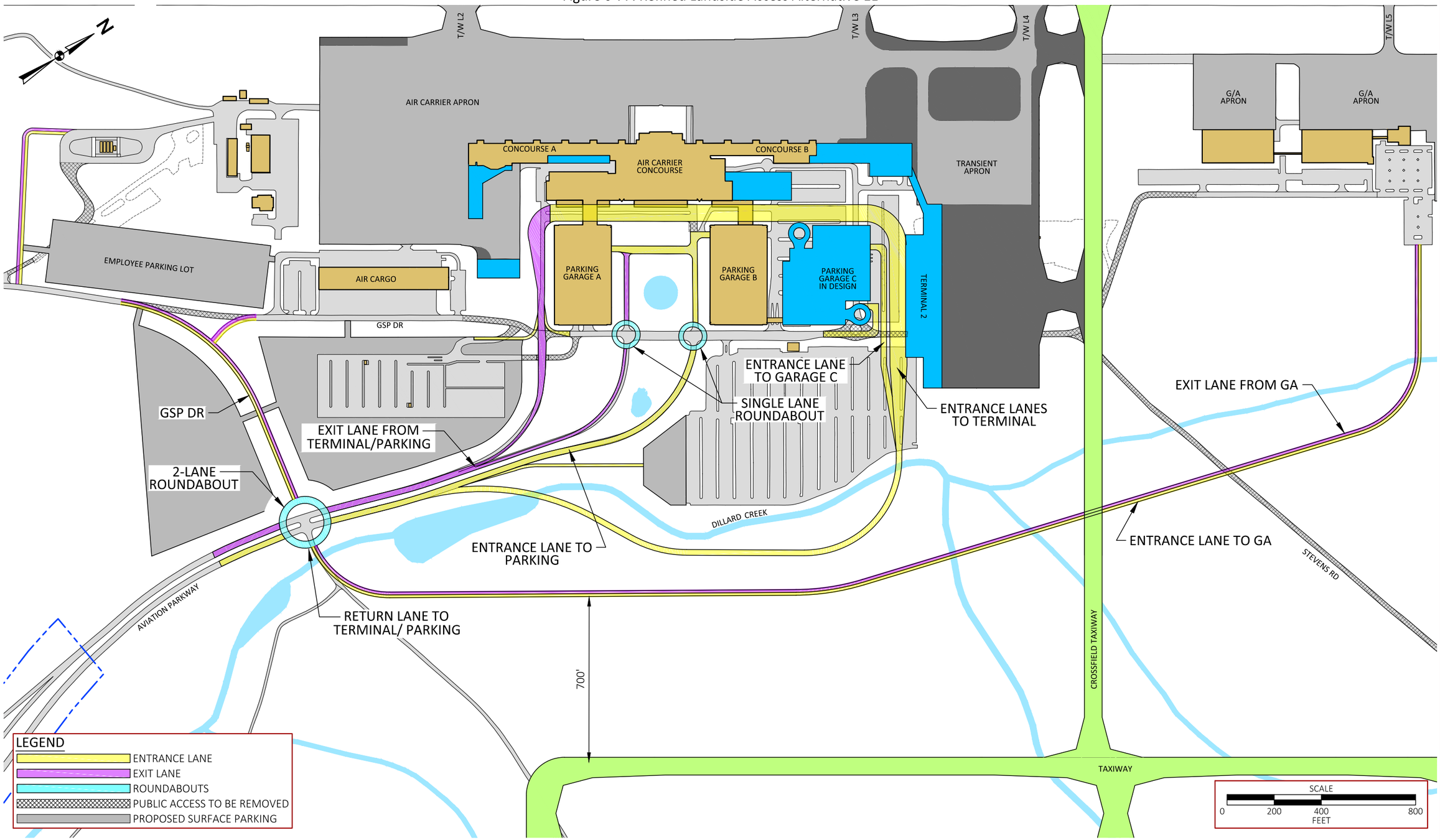

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Figure 6-78: New Landside Access Alternative 1F

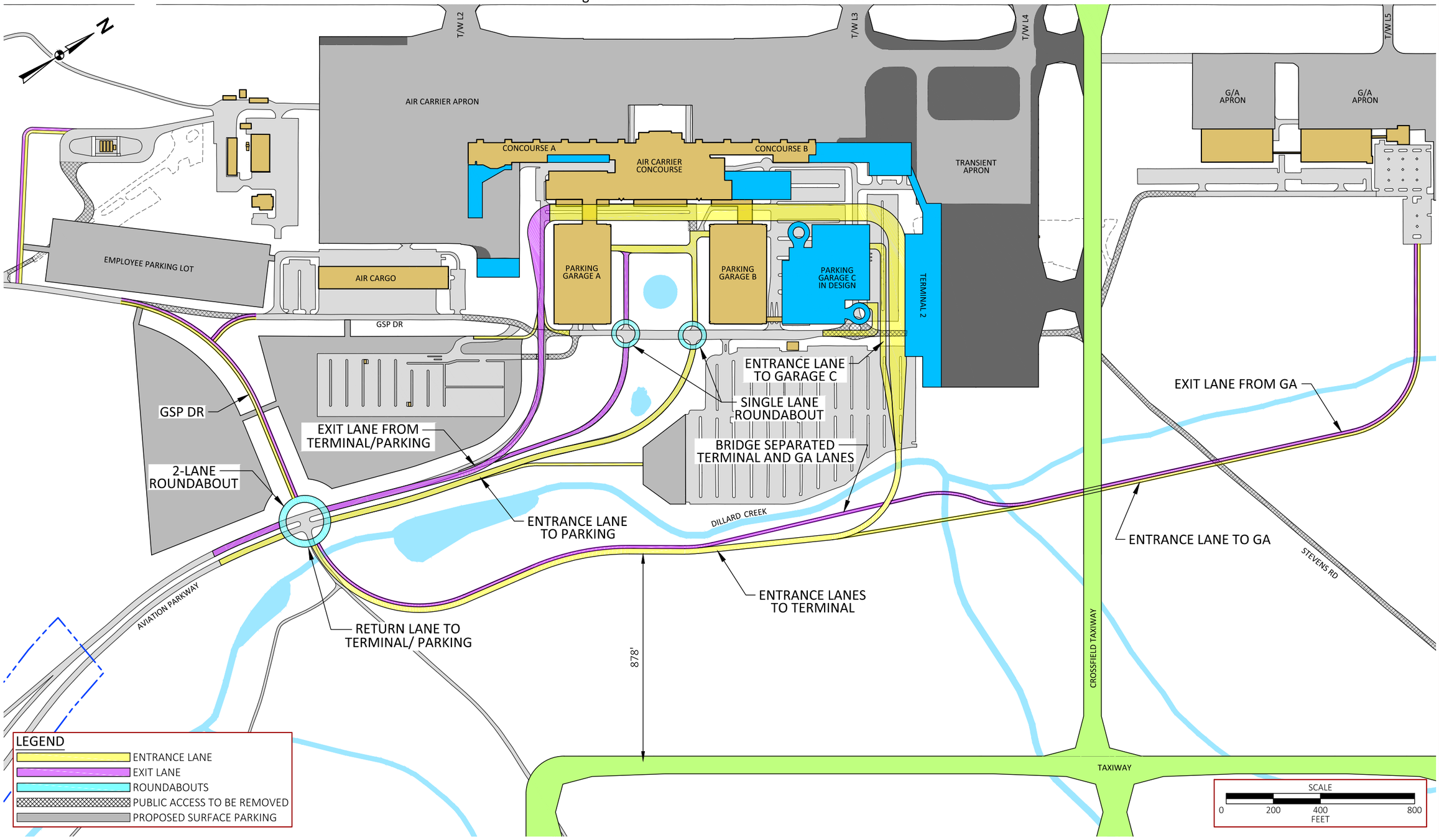

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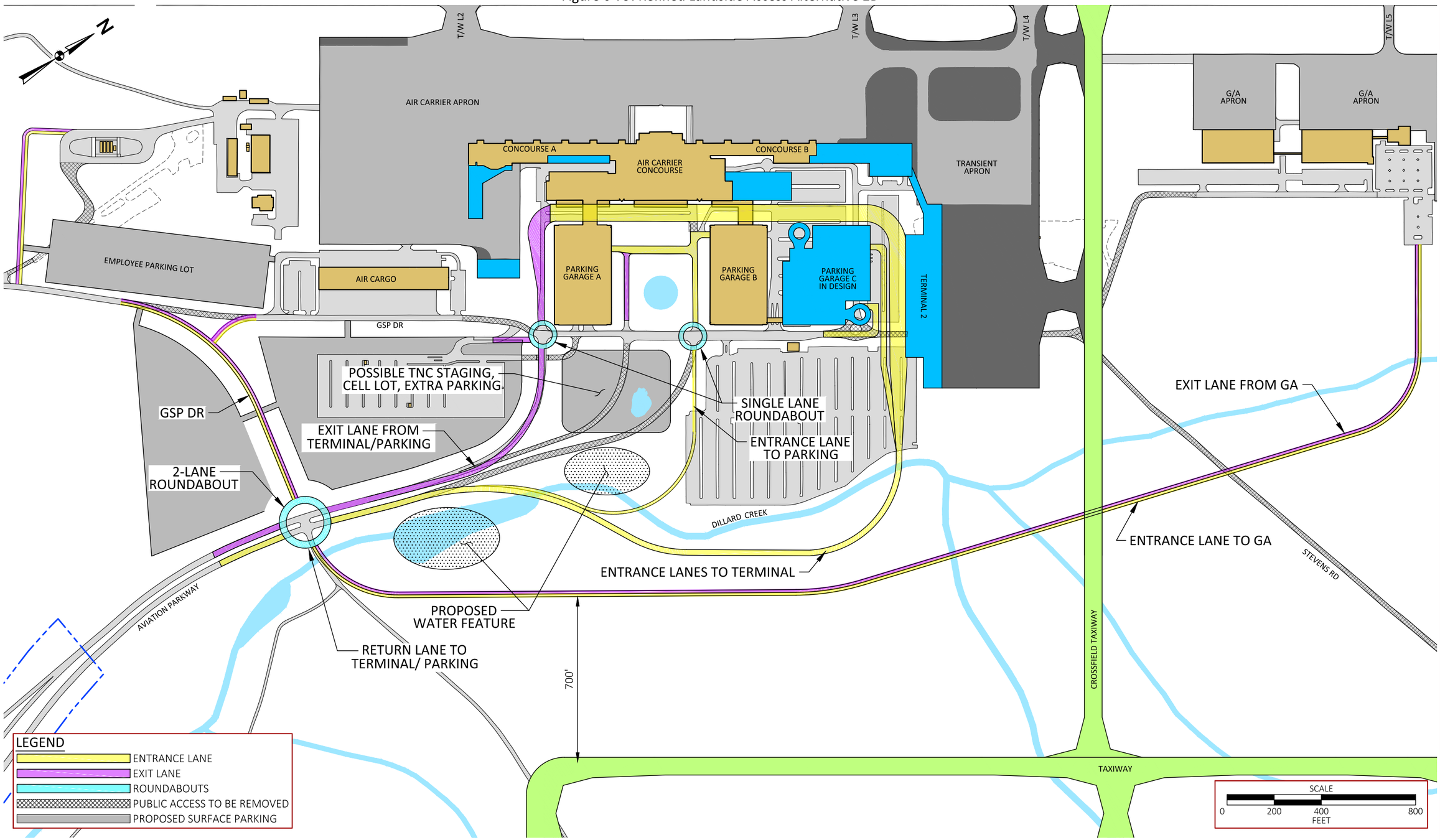
Figure 6-79: Refined Landside Access Alternative 2D



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- **Inside Loading/Unloading Lanes:** Terminal Lane Alternative 1, presented in **Figure 6-80,** suggests restriping the existing curbside traffic lanes to reflect two passenger loading/unloading lanes against both the terminal curb and the existing pedestrian island such that the passenger side of a car would not open into a vehicle through lane. This would improve safety and traveler expectations.

- **Relocated Pedestrian Island:** Terminal Lane Alternative 2, presented in **Figure 6-81**, suggests relocating the pedestrian island to the east in order to provide two loading/unloading lanes, one maneuvering lane which could also be used as a loading/unloading lane during periods of peak demand, and one through lane. On the other side of the pedestrian island this alternative suggests one loading/unloading land and one through lane. In this alternative, inner lanes closest to the terminal would be reserved for privately owned vehicles while lanes on the outside of the pedestrian island would be for commercial vehicles. This alternative also provides for a bus staging area accessible from the commercial lanes of the terminal loop road and egresses near the existing Garage A entrance.

- **No Pedestrian Island:** Terminal Lane Alternative 3, presented in **Figure 6-82,** suggests removing the pedestrian island entirely and providing three loading/unloading lanes, one maneuvering land, and two through lanes.

The preferred curbside layout is Terminal Lane Alternative 1 in the short-term with a phased approach to Terminal Lane Alternative 2 in the long-term.

Personal Rapid Transit Considerations

Airports around the world are realizing new opportunities to solve airport-related transportation problems using personal rapid transit and group rapid transit (PRT/GRT) systems compared to the traditional shuttle bus model to connect passenger access across the terminal campus. To provide seamless connectivity between all future surface parking lots and terminals at GSP in the future, multiple PRT/GRT track alignments were developed. The dedicated track or guideways considered are shown in **Figure 6-83** through **Figure 6-85**, while **Figure 6-86** explores a semi-integrated route where PRT vehicles would share personal vehicle lanes within parking lots and at the terminal curb.

- **Original Concept:** PRT Alignment Alternative 1, presented in **Figure 6-83**, shows the original working concept for PRT at GSP which would provide surface pick-up and drop-off stations inside Economy Lot A to connect passengers to and from the northside of the terminal's non-secure wing via an elevated guideway.

- **Expanded Original:** PRT Alignment Alternative 2, presented in **Figure 6-84**, expands on PRT Alignment Alternative 1 by expanding dedicated tracks to integrate proposed surface lots on the south side of Aviation Parkway via an elevated guideway. In addition, PRT Alignment Alternative 2 includes consideration for Terminal 2 by offering a pick-up and drop-off station on the west side of its core. This alternative allows for potential multi-modal connections to the Greenville Downtown area or any development within Tract G of the Airport's property.

- **Full Loop:** PRT Alignment Alternative 3, presented in Figure 6-85, explores the ability to provide a full loop from the outer edges of each surface lot and all terminals in the future with two in-terminal stations for each terminal. Under this concept, elevated guideways would be required to traverse terminal top spaces and provide vertical circulation from terminal-top PRT stations to the terminal.

- **Shared Roadway:** PRT Alignment Alternative 4, presented in Figure 6-86, presumes dedicated tracks will not be required for PRT systems at GSP in the future and that PRT vehicles would be capable of sharing the roadway with other vehicles and with pedestrians in slow-speed surface lot areas. Below-grade crossings of major arterial roads within the terminal landside access network are proposed for PRT routes to maintain continual traffic flow on these roadways. This alternative presents two possible alignment options that are not mutually exclusive. One track alignment would require an elevated guideway between Garage B and C to access a PRT station near the terminal, while the other track would be developed at-grade and utilize mostly existing paved surfaces.

PRT/GRT Feasibility

The feasibility of PRT/GRT compared to shuttle bus operation is a function of initial capital costs plus operational costs of each system compared over time. Though it is expected that a PRT/GRT system would provide a more enjoyable experience and higher level of service for users, the high initial capital costs and relatively low operating costs of this system should be weighed against the low capital costs and relatively high operating costs of a bus system to determine how long it would take for one system to be less costly than the other.

Current shuttle bus operations require an upfront capital cost of approximately $105,000 with annual operating costs of $250,000 per bus. This includes the capital costs for bus shelters at the various existing and proposed lots and the operating costs associated with leasing the buses and fuel. Using a ratio of buses in service today and current parking demand it was determined that five busses will be needed by 2025 with incremental increases in line with enplanement growth. Assuming a PRT/GRT system would be implemented once the Airport has constructed proposed surface lots, when it would be most useful, six buses would be in operation. At this point, which is estimated to be in 2025, three additional bus shelters would need to be built at a cost of $35,000 each. From 2025 to 2035, the Airport it is estimated that the Airport will have spent $16.1 million on the bus system, including capital and operating costs.

PRT/GRT systems can vary in their initial capital cost but are generally much cheaper to operate than busses, resulting in lower life-cycle cost. The capital costs for the PRT/GRT system would include retrofitting the existing bus shelters in 2025 and building three new PRT/GRT stations. In addition, the cost of infrastructure including tunnels and curb-style tracks is included in the capital cost estimates. PRT/GRT vehicles cost approximately $350,00 each and incur an annual operating cost of about $60,000. Assuming the demand for carriages reflects the same seating capacity provided by the bus system to meet enplanement growth, 11 carriages would be needed in 2025. From 2025 to 2035, it is estimated that the Airport will have spent between $15.4 and $16 million for Options 1 and 2 of Alternative 4, respectively.

Based on assumptions for initial capital costs and operating costs of bus and PRT/GRT systems, it is estimated that a PRT/GRT would cost less after 11 years of operation.

Figure 6-80: Terminal Curbside Lane Configuration Alternative 1

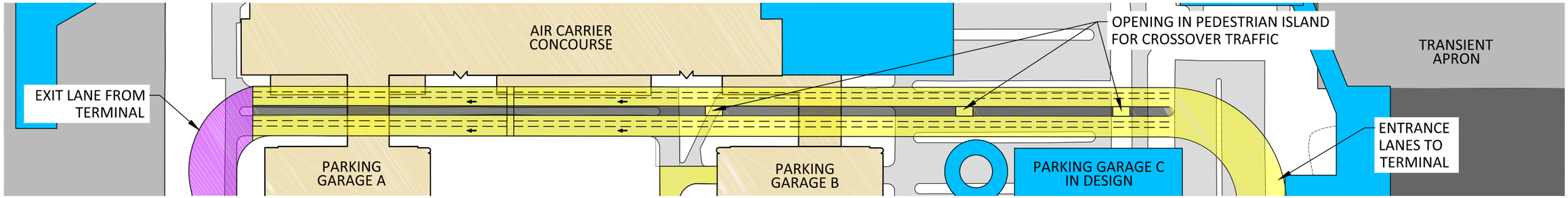
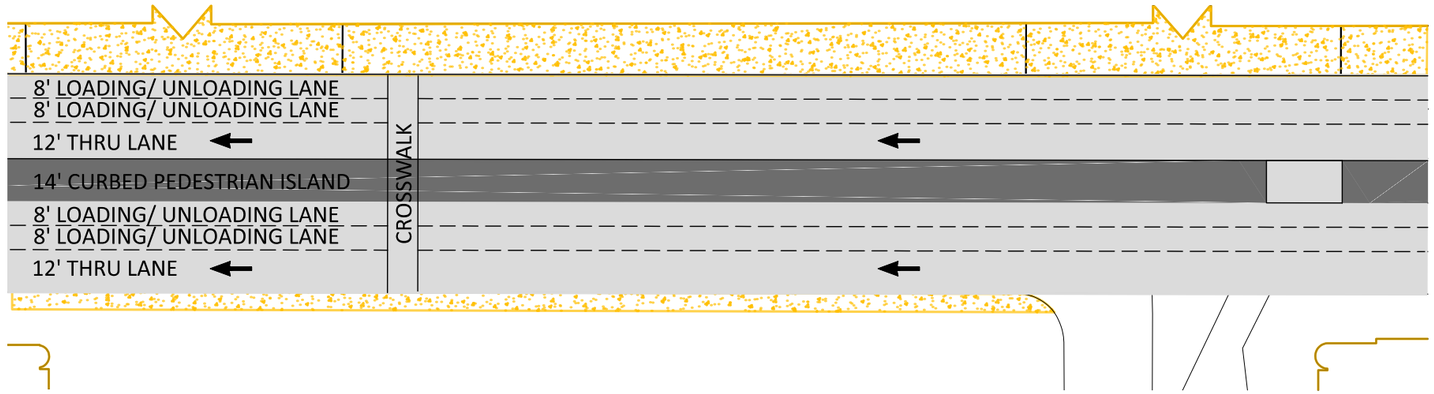
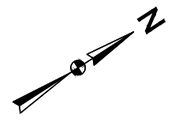


Figure 6-80: Terminal Curbside Lane Configuration Alternative 1





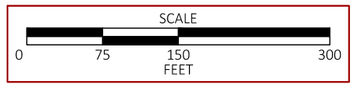


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Figure 6-81: Terminal Curbside Lane Configuration Alternative 2

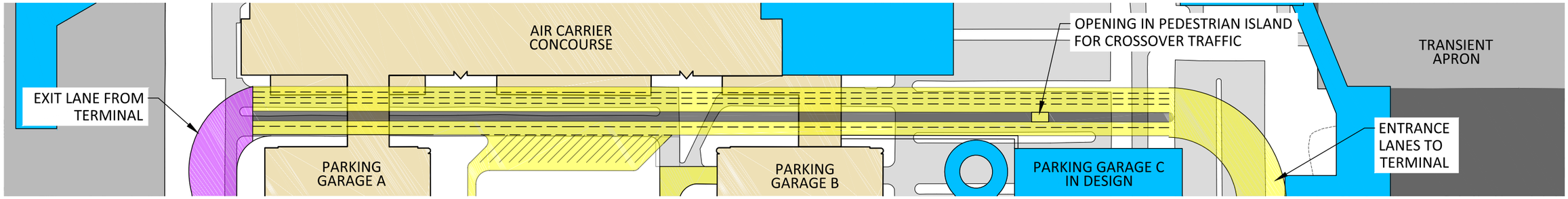

Figure 6-81: Terminal Curbside Lane Configuration Alternative 2

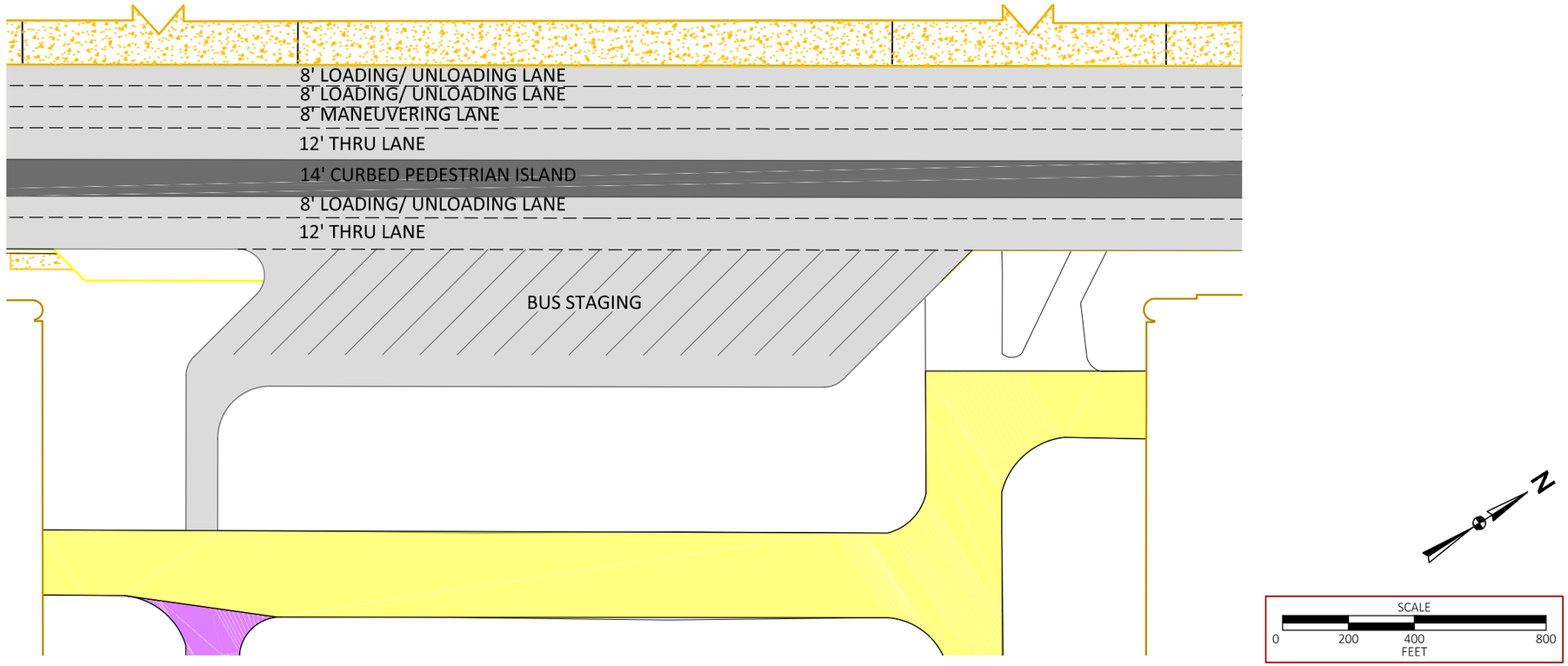

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Figure 6-82: Terminal Curbside Lane Configuration Alternative 3

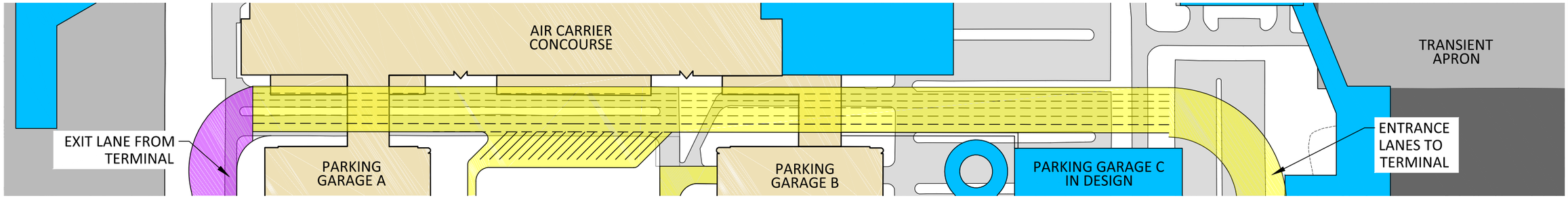

Figure 6-82: Terminal Curbside Lane Configuration Alternative 3

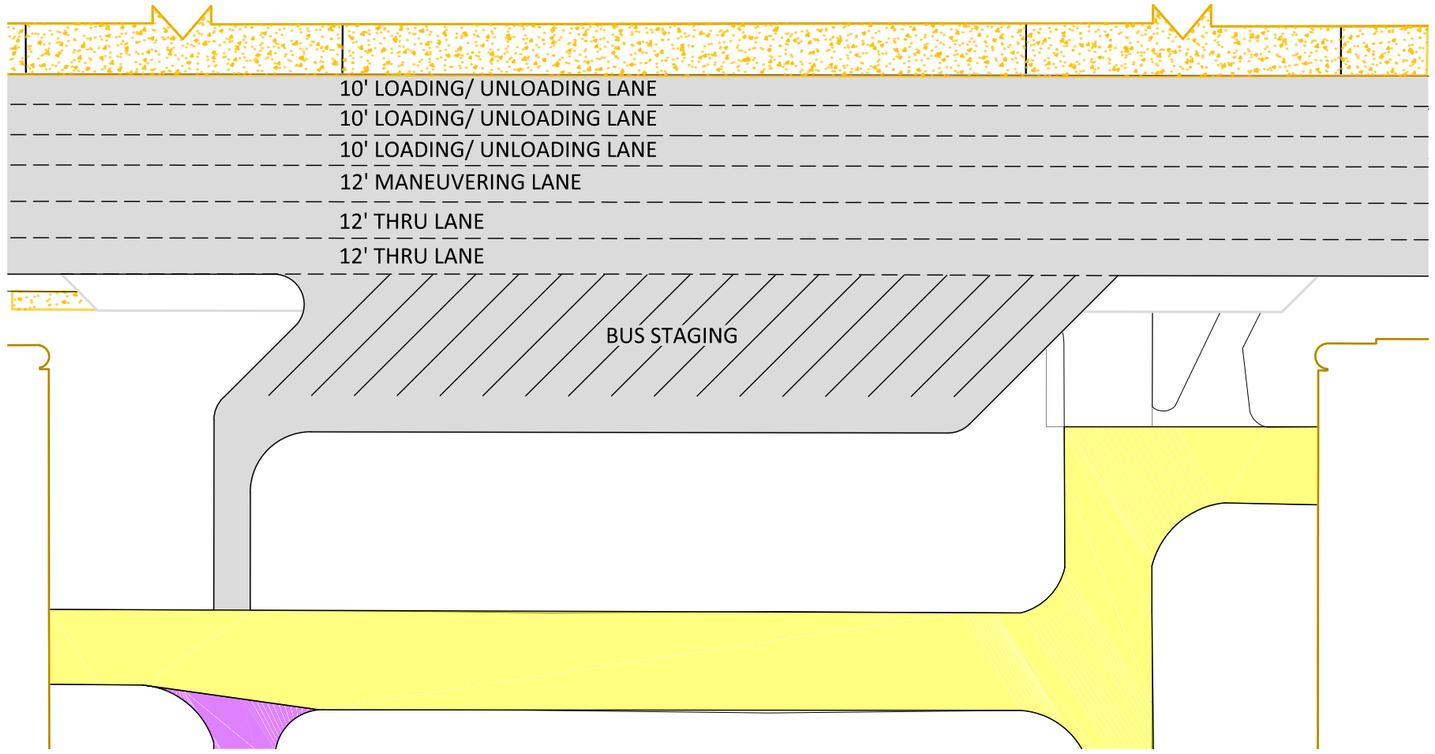

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Figure 6-83: PRT Alignment Alternative 1

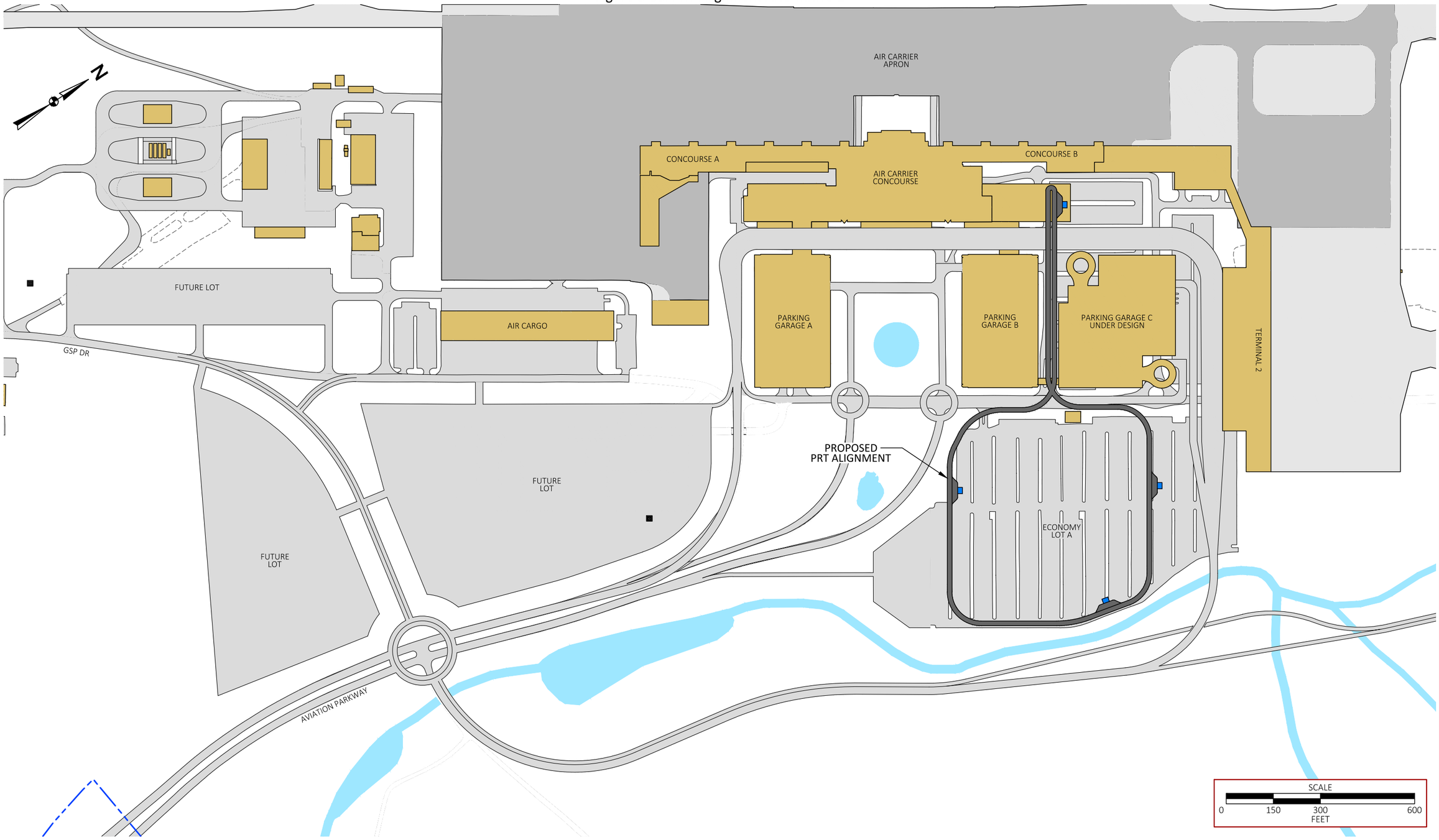

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Figure 6-84: PRT Alignment Alternative 2

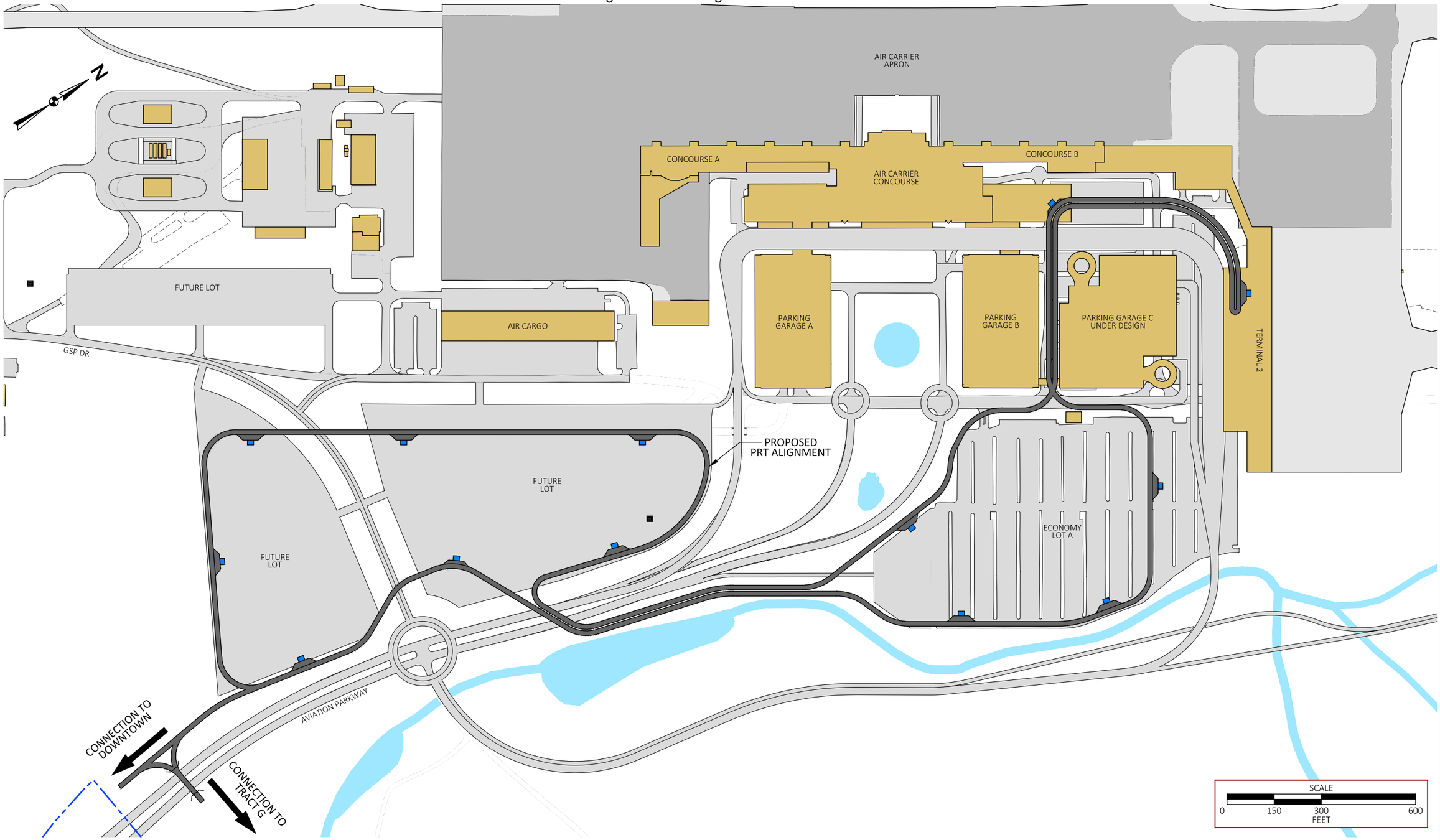

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Figure 6-85: PRT Alignment Alternative 3

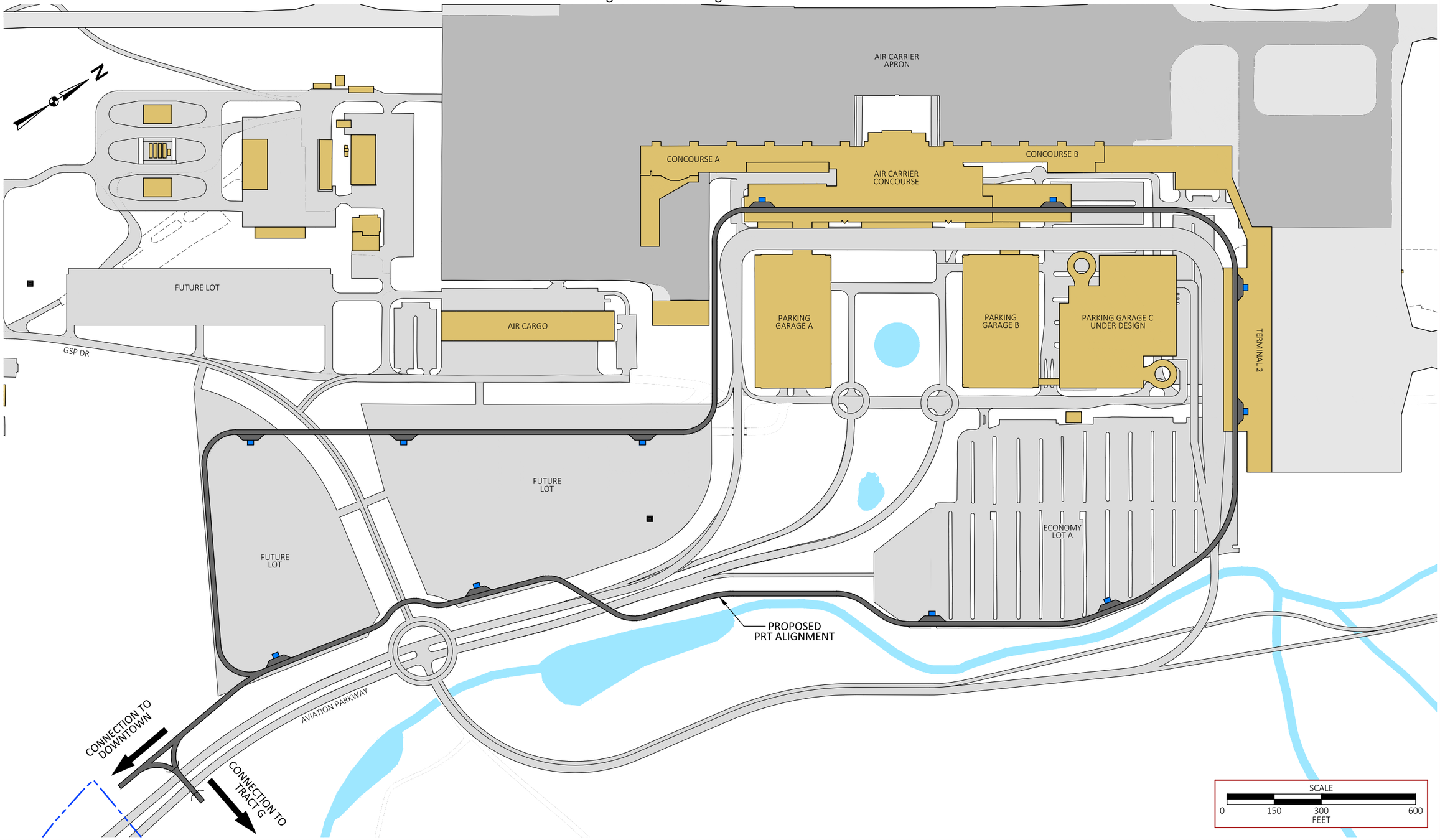

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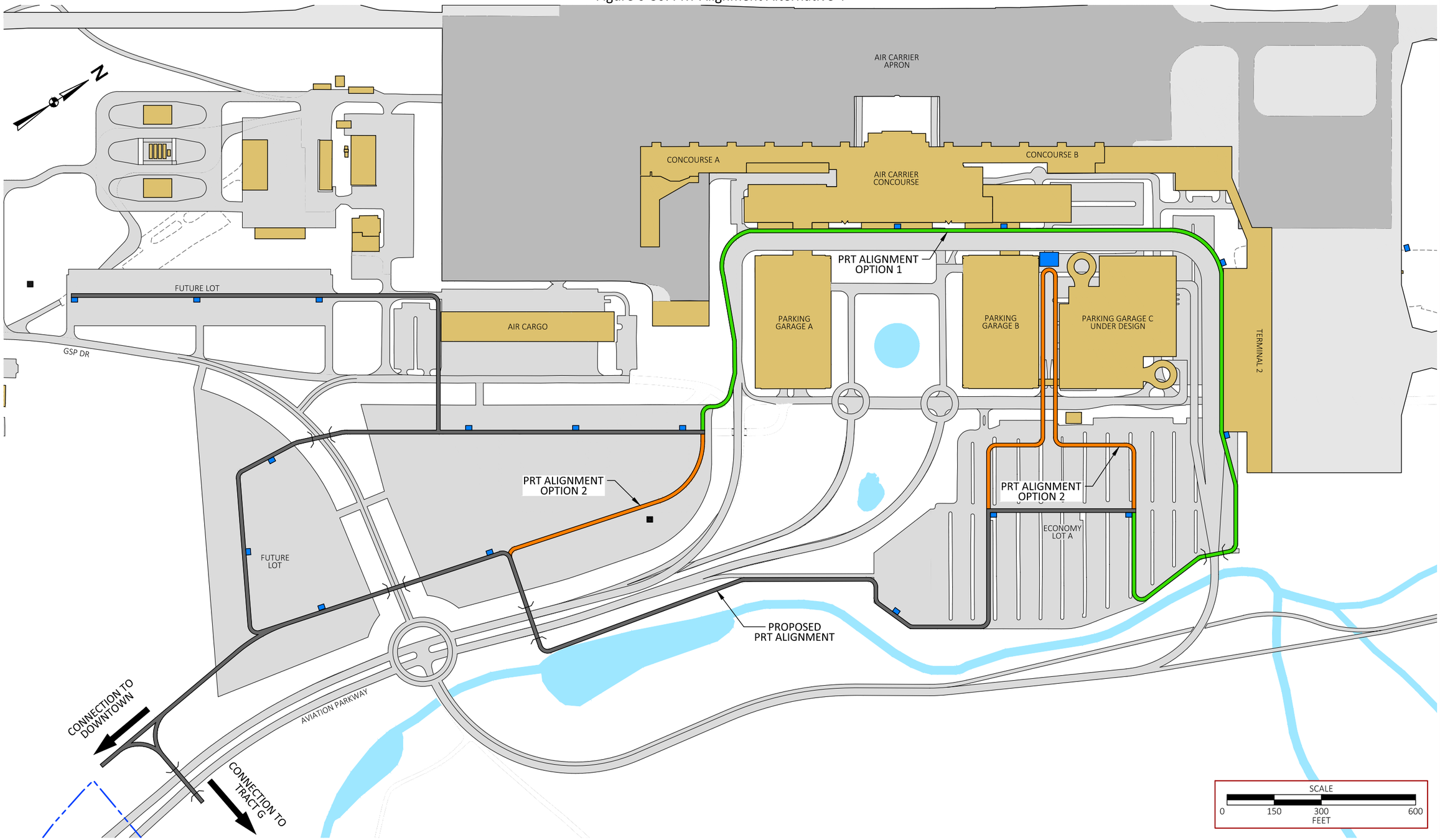
Figure 6-86: PRT Alignment Alternative 4



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Air Cargo Facility Alternatives

Of the air cargo development alternatives presented in Section 6.1.4, only the alternative with the greatest capacity was retained, as identified in **Table 6-17** and presented in **Figure 6-87**.

Table 6-17: Retained and Refined Air Cargo Facility Alternatives

Focus	Initial Alternatives	Refinement	Figure
Air Cargo Expansion	Air Cargo Alternative 3	Optimized taxiway bridge to work with existing terrain / Expanded existing north cargo apron to the east	**Figure 6-87**

Source: McFarland Johnson, 2018

General Aviation Facility Alternatives

Of the GA development alternatives presented in Section 6.1.5, only the alternative providing ADG III setbacks throughout the GA development area was retained and refined as presented in **Table 6-18**. This alternative will provide considerable flexibility in the ability of GSP to service the needs of a variety of aircraft types across its GA campus.

As the national GA fleet shifts away from piston driven aircraft and more towards jet aircraft and GSP continues to communicate the appeal of the Airport to the business aviation community, it is prudent to plan for an expanded GA development area capable of supporting a variety of large business jet aircraft.

Table 6-18: Retained and Refined General Aviation Facility Alternatives

Focus	Initial Alternatives	Refinement	Figure
ADG III Design	GA Development Area Alt. 1	Optimized to better integrate with air cargo expansion area as well as the proposed crossfield taxiway.	**Figure 6-88**

Source: McFarland Johnson, 2018

Figure 6-88 presents the refined GA development area alternative.

Figure 6-87: Refined Air Cargo Alternative 3

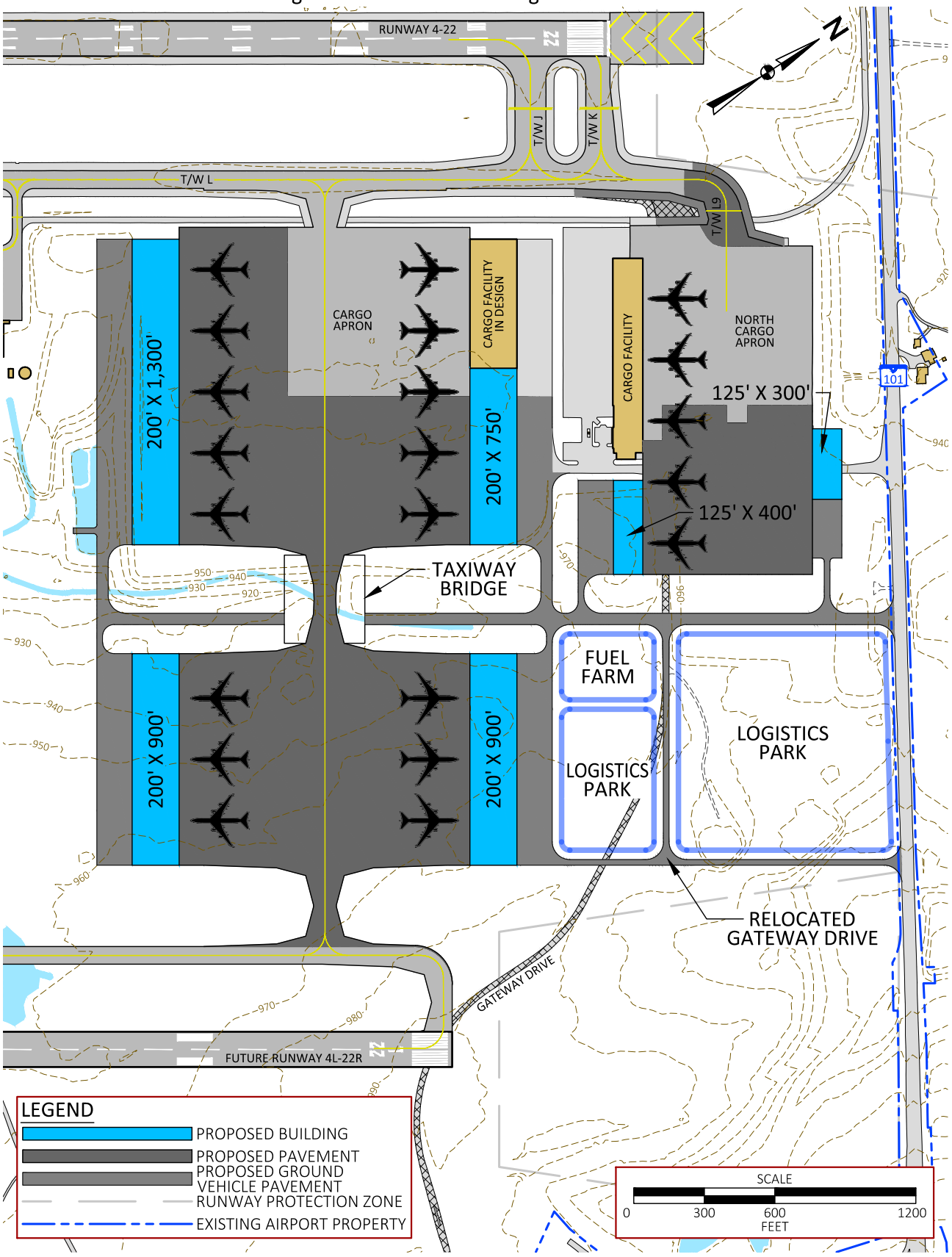

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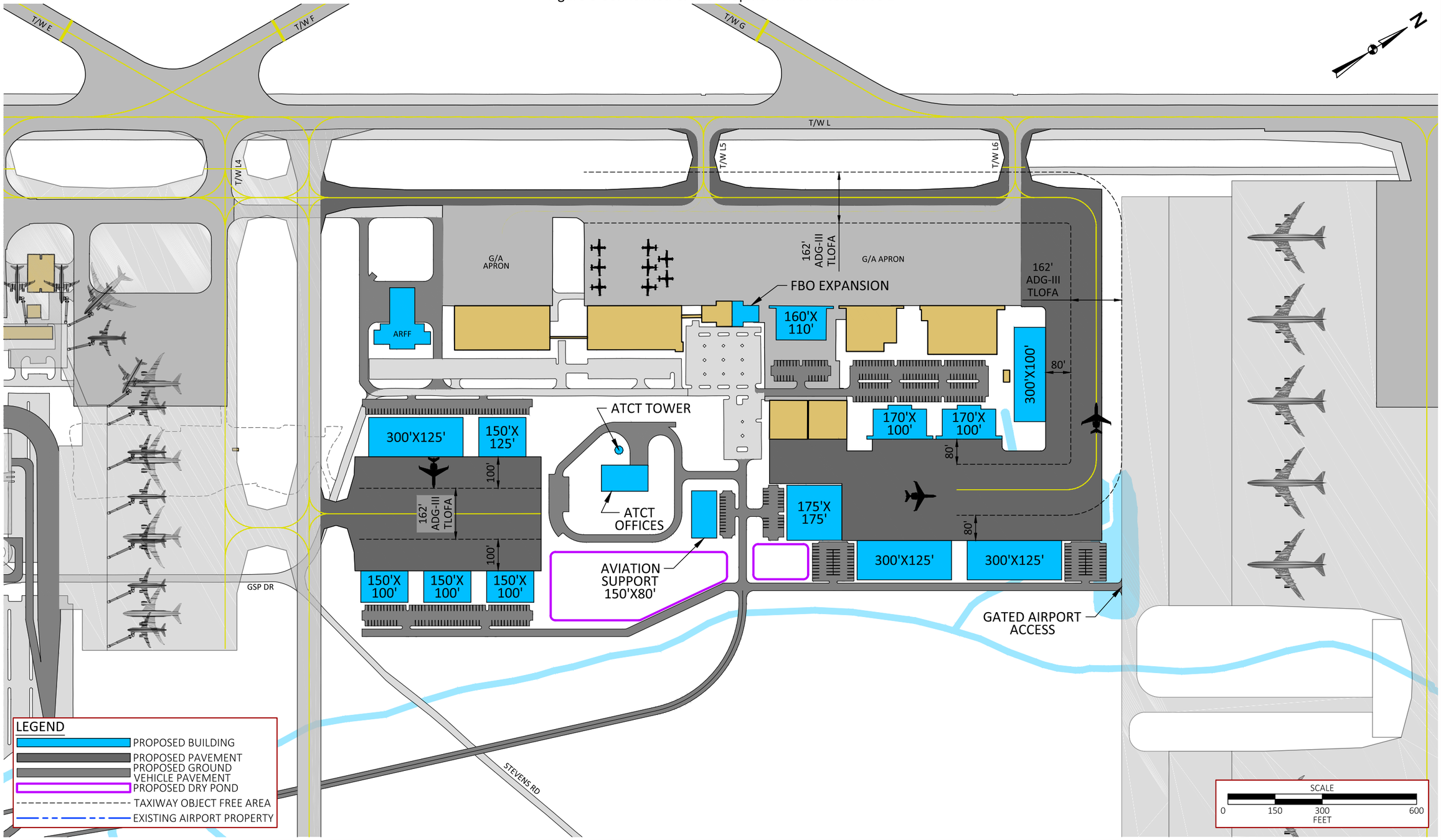
Figure 6-88: Refined GA Development Area Alternative 1



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Other Aviation Development Properties

West Side Aviation Development

Although westside properties are long-term in nature, significant opportunity exists to provide for aviation uses in this area. Table 6-19 presents the retained westside development alternative and discusses its refinement.

Table 6-19: Retained and Refined Westside Aviation Alternatives

Focus	Initial Alternatives	Refinement	Figure
MRO/Air Cargo Development Opportunities	West Side Aviation Area Alt. 2	Identified aviation support areas / Identified aviation fuel farm / Optimized building sizes and parking based on storm water considerations	Figure 6-89

Source: McFarland Johnson, 2018

Figure 6-89 presented the retained westside development area alternative.

Southside Aviation Development

The southside aviation development alternative presented in Figure 6-59 was retained but not refined for further consideration. Cursory engineering analysis identified that only the ingress/egress route presented in the alternative would meet grade requirements. Alternatives to raise the site elevation to runway grade were not explored.

Support Facility Requirements

Elements of each of the support facility development alternatives presented in Section 6.1.7 were utilized in development of the preferred support facility development presented in Figure 6-90 which presents the preferred fuel farm and maintenance apron expansion. After full refinement of alternatives, a new location for a GRE was identified adjacent to the proposed taxilane for the southside aviation development area. This reflects the preference of airport stakeholders while meeting facility requirements.

6.2.3. Non-Aviation Land Use Considerations

The Airport's Master Land Use Plan completed in 2013 identifies a variety of Airport lands not intended to be reserved for aviation use purposes. These properties were recommended for such uses as retail, hospitality, industrial, light industrial, service, and flexible uses. These properties were identified for such non-aviation activities because they are non-contiguous with airfield properties, not at grade with the airfield, and/or are not anticipated to be required to support future aviation demand.

Utilizing the 2013 Master Land Use Plan as a starting point, Figure 6-91 depicts an updated map of non-aviation use properties at GSP compatible with the future development goals previously identified and the existing Airport property boundary.

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Figure 6-89: Refined West Side Aviation Area Alternative 2

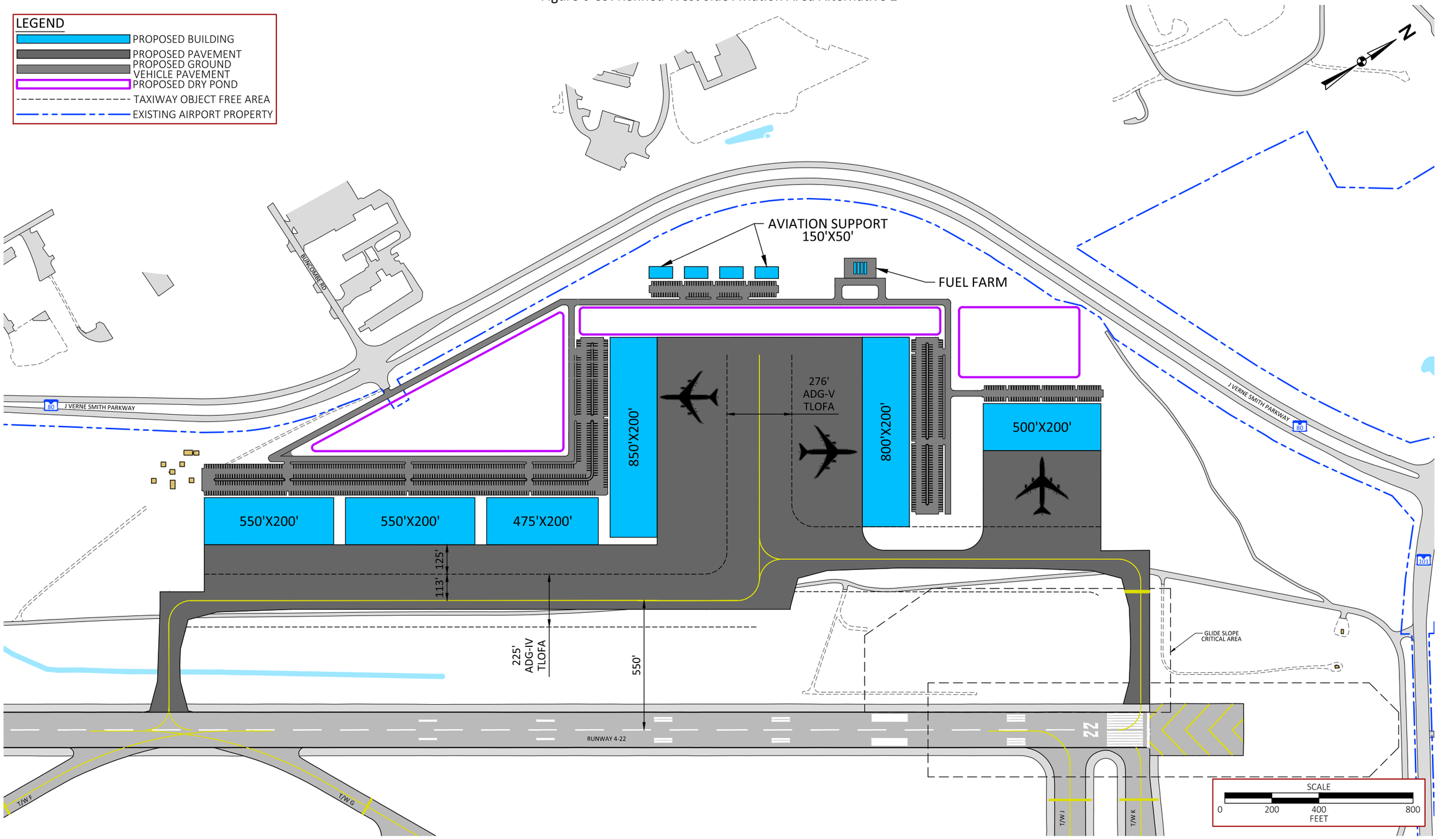

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Figure 6-90: Preferred Support Facility Development and GRE Considerations

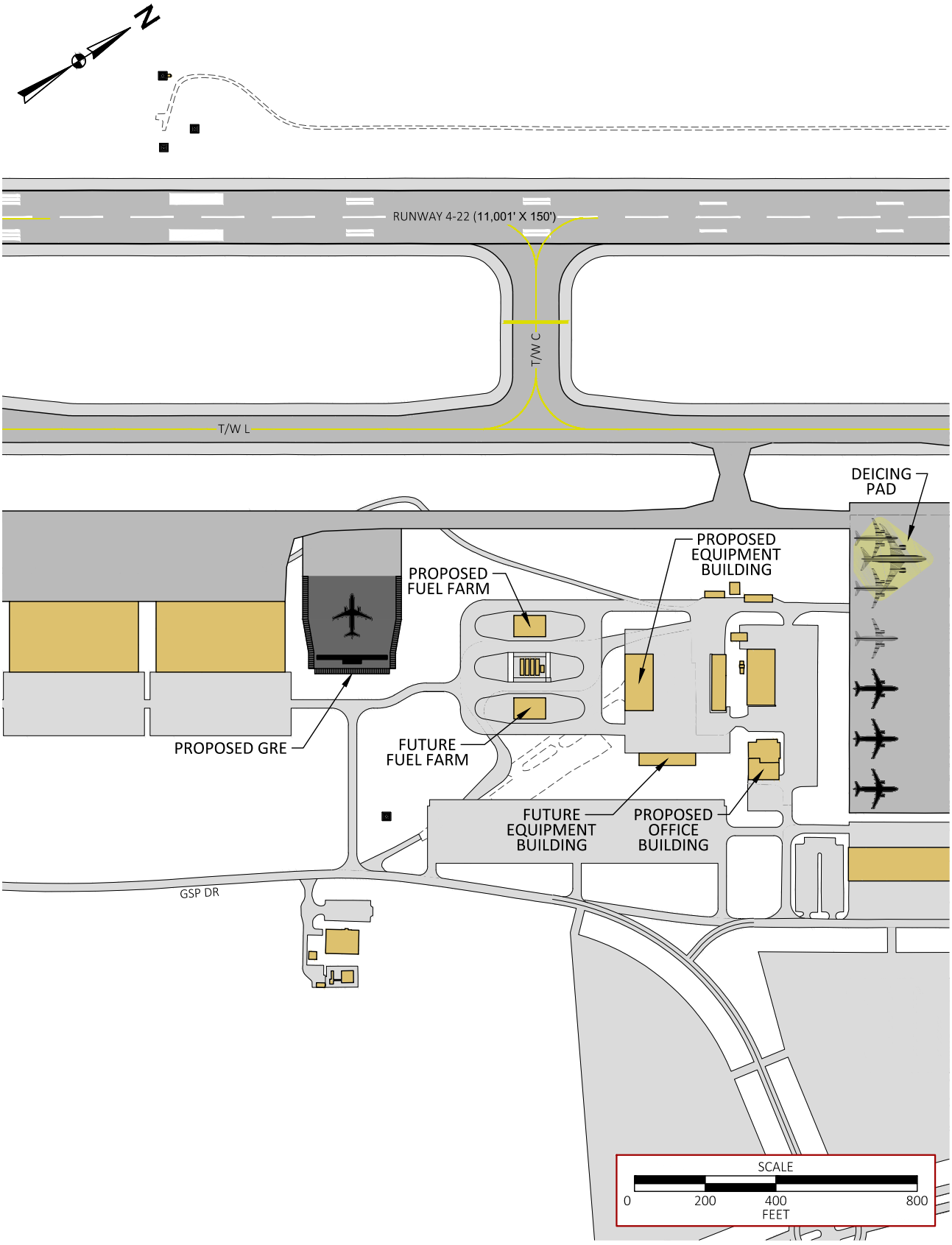

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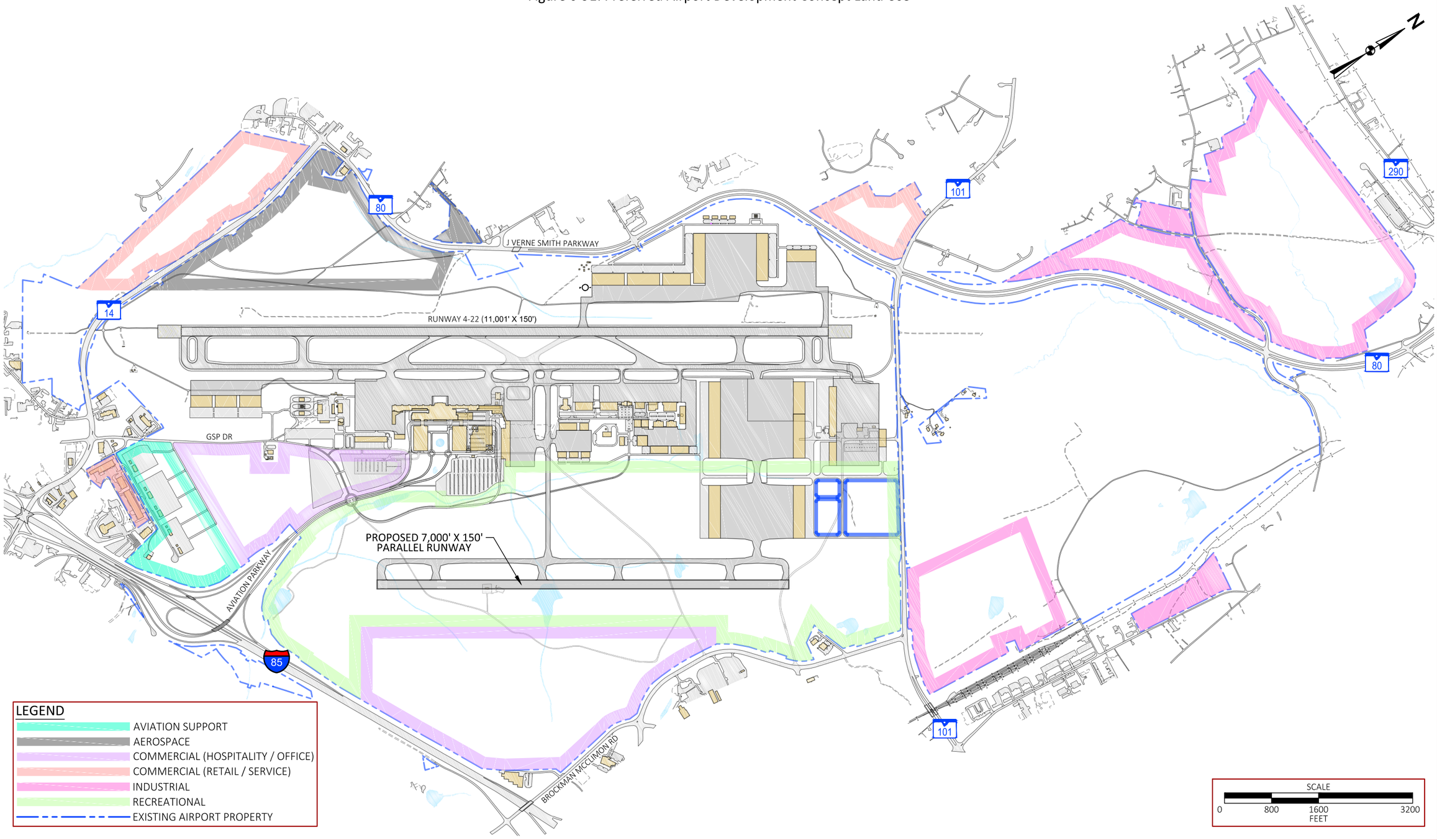
Figure 6-91: Preferred Airport Development Concept Land Use



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6.3. SELECTED AIRPORT DEVELOPMENT PLAN

The individual preferred and refined development alternatives for each functional area of GSP property considered in the preceding sections collectively represent the Airport's long-term vision for the physical development of its property. Figure 6-92 presents this long-term development vision for GSP.

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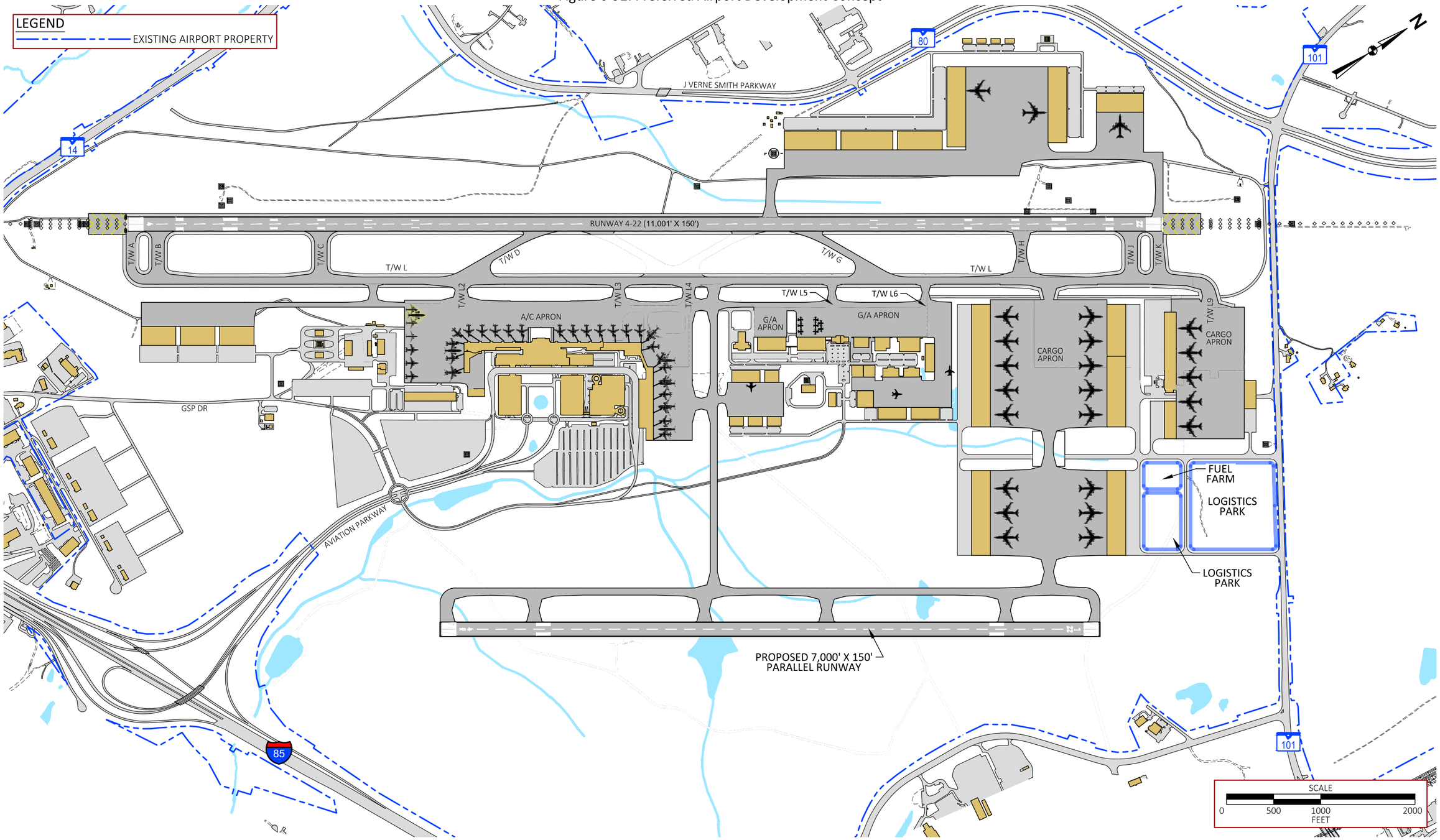
Figure 6-92: Preferred Airport Development Concept



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