CRATER LAKE
KLAMATH
REGIONAL AIRPORT

Master Plan

February 2021

Mead&Hunt

Chapter 4

Improvement Alternatives

Chapter 4

Alternatives

INTRODUCTION

This chapter documents the evaluation of improvement alternatives and the preferred development plan for the Crater Lake – Klamath Regional Airport (LMT) to satisfy the facility requirements and recommendations described in **Chapter 3**. The purpose of the alternatives analysis is to recommend the size and location of future facility improvements to address Federal Aviation Administration (FAA) design standards and user demand. In some instances, only one design option is feasible. Where multiple design options are available, the alternatives are systematically evaluated to arrive at a preferred design recommendation. The preferred development concept is then carried forward to the Capital Improvement Plan (CIP) and Airport Layout Plan (ALP) discussed in subsequent chapters.

This Alternatives Chapter includes:

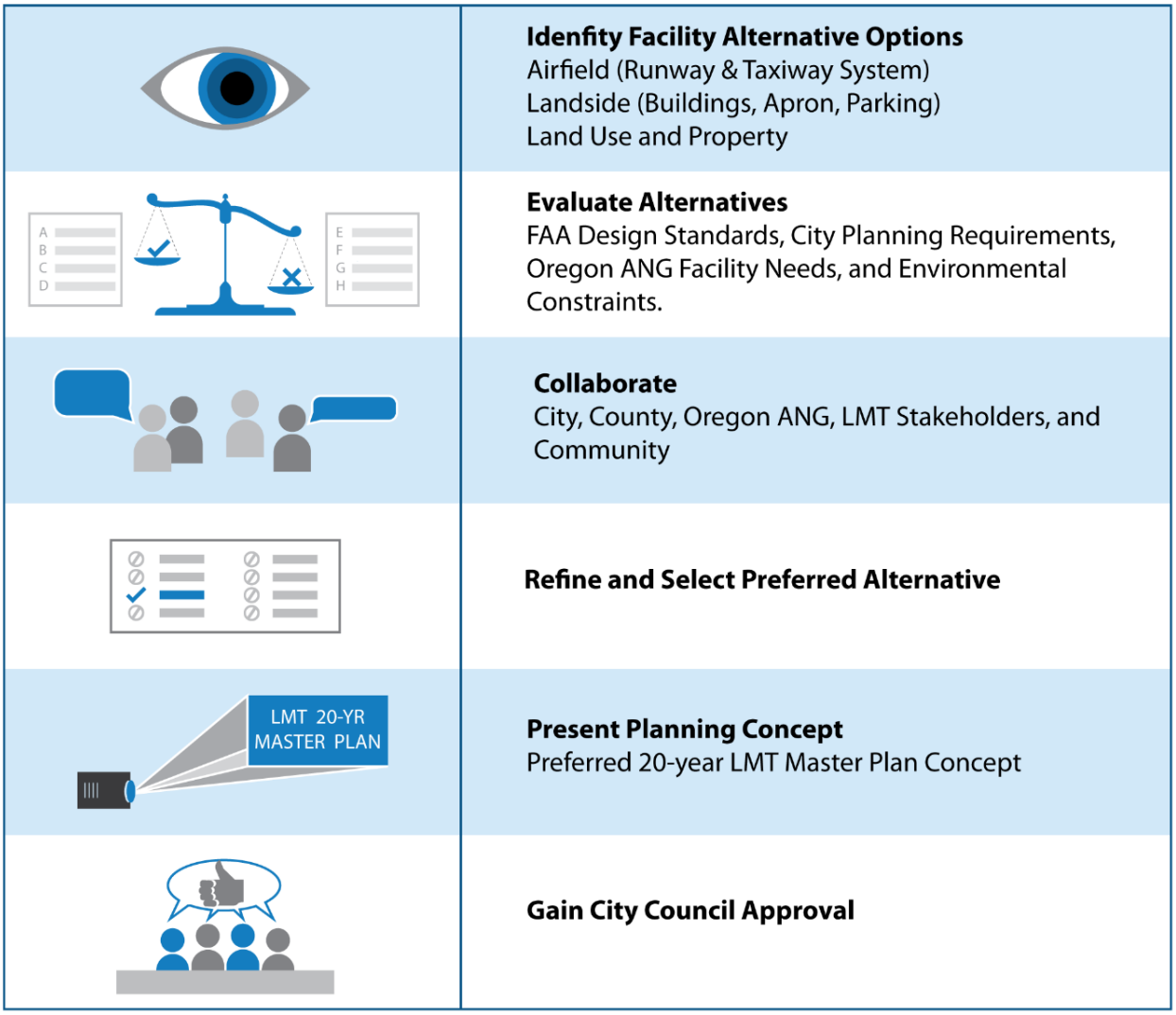
- Alternatives Approach
- Airfield System
  - Runway 14/32 Improvements
  - Runway 7/25 Improvements
  - Taxiway System
  - Runway 14 ILS
- Landside – Aeronautical
  - Airline Terminal
  - General Aviation Development
  - Administration and Operations Building
  - Aviation Tenants
- Landside – Non-Aeronautical
  - Airport Business Park
  - City Business Park
  - Airport Entrance Road.

ALTERNATIVES APPROACH

PROCESS

Figure 4-1 illustrates the process involved in developing, refining, and selecting the preferred facility improvement alternative. The process of defining and evaluating alternatives is iterative, beginning with a comprehensive range of unconstrained possibilities for facility improvements. These alternatives are then evaluated against screening criteria to assess operational, environmental, and financial constraints. Lastly, the alternatives are refined based on LMT strategic development goals, implementation feasibility, and collaboration with LMT stakeholders. The result of the alternatives analysis is selection of a preferred 20-year development plan for LMT that is carried forward to the CIP and ALP.

Figure 4-1 : Alternatives Process



Source: Mead & Hunt, Inc. 2020

SCREENING CRITERIA

The evaluation of alternatives is iterative and structured. Development of the facility alternatives are initially unconstrained; they are based on LMT user demand and FAA planning guidelines, without consideration of other LMT site factors or constraints. Screening criteria are then applied to provide a consistent analytical approach and technical basis for selection of a preferred design concept. The principal screening criteria used to evaluate the development alternatives and recommended facility improvements include:

- Operational Efficiency – Improvements in operational capabilities and performance
- Environmental Considerations – Sensitivities of the natural environment (e.g., flora and fauna, historical and cultural sites)
- Land Use Considerations – Land acquisition and land use compatibility factors
- Implementation Feasibility – Constructability, phasing, affordability, and implementation factors.

The factors considered for each screening criterion vary slightly to reflect the unique functional areas of LMT. **Figure 4-2** depicts the principal environmental and land use constraints considered in the evaluation of the improvement alternatives. On-airport facility constraints are also considered in the alternative analysis, but they are not specifically noted in **Figure 4-2**.

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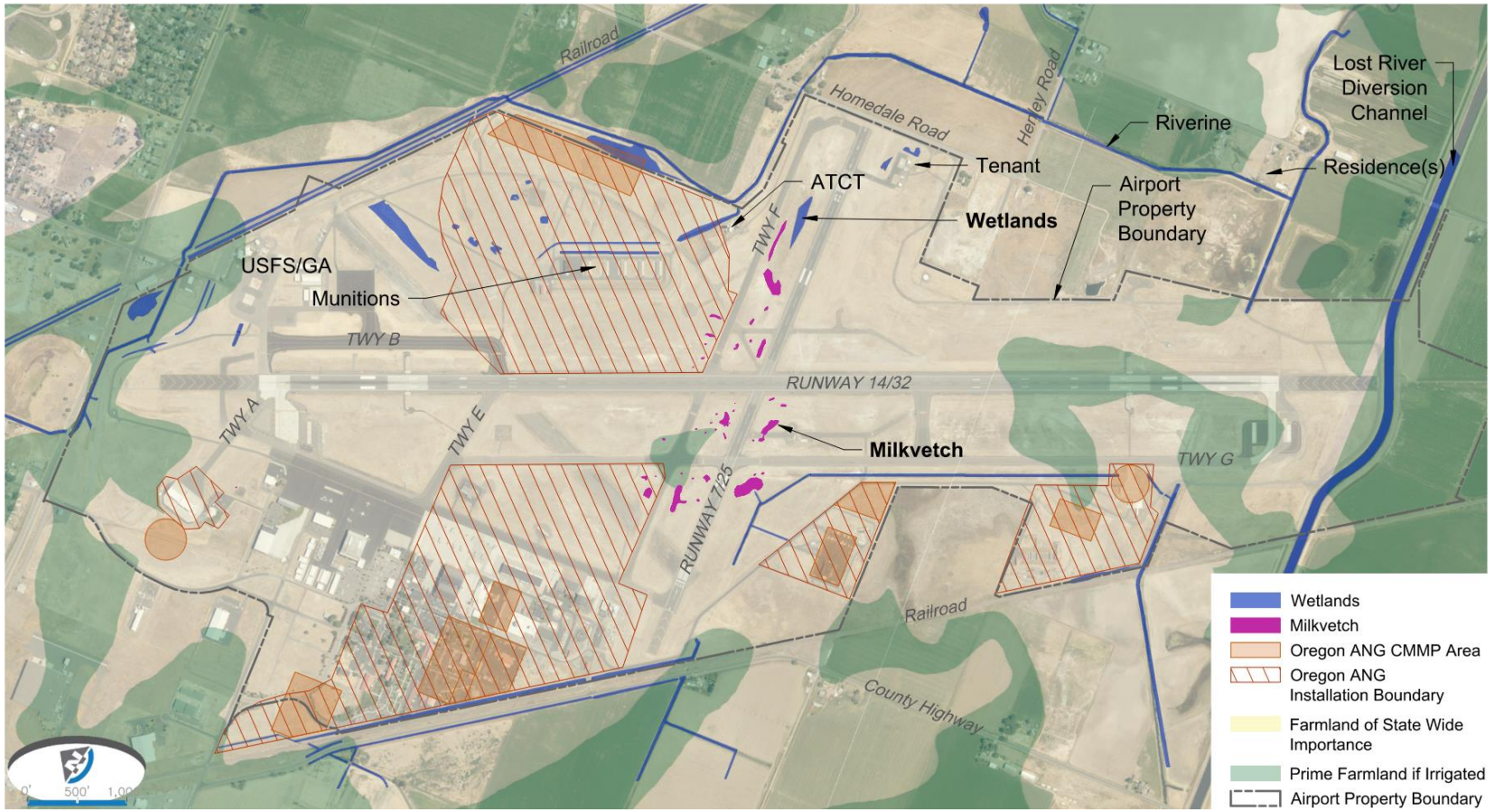
Figure 4-2 : Principle Environmental and Land Use Constraints



Sources: Prepared by Mead & Hunt, Inc. 2020

1. Wetlands: Wetland Permit Application Report, Wildlife Hazard Management Implementation Plan, W&H Pacific, 2006. Select wetlands and waterways filed under US Army Corps of Engineers Permit (NWP-2006-868) and Oregon Department of State Lands Permit (No. 37409) removed from mapped features.
2. Milkvetch: Rabe Consulting, 2019.
3. Oregon Air National Guard (ANG) Boundaries: Final Contaminated Media Management Plan (CMMP), Oregon National Guard, Kingsley Field, October 2017. CMMP establishes contamination cleanup measures for ground-disturbing activities in the specified areas.
4. Soils: US Department of Agriculture (USDA), 2020.

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LMT STRATEGIC DEVELOPMENT GOALS

While technical planning forms the basis for the evaluation of alternatives, selection of a preferred alternative is guided by the strategic development goals established for LMT by the City of Klamath Falls. The development goals recognize LMT's unique structure as a civilian airport with military operations through an Airport Joint Use Agreement (AJUA). The AJUA provides the mechanism for the Oregon Air National Guard (ANG) to reimburse the Airport for expenses associated with maintaining shared airport facilities including runway and taxiway system. The shared facilities necessitate a coordinated effort between LMT, the Oregon ANG, and the FAA for future facility improvements. As such, the evaluation of alternatives is guided by the following LMT strategic development goals:

- LMT facility improvements will be designed in accordance with FAA design standards while preserving operational efficiency for military missions and LMT users.
- Facility improvements initiated by the Oregon ANG or documented in its development plans (e.g., Oregon ANG Installation Development Plan) will be coordinated with the City and reflected on the LMT ALP where prudent.
- City investment in LMT facility improvements will be made pragmatically with a focus on safety and level of service enhancements.
- LMT facility improvements will consider and minimize impacts to the environment and community.
- LMT facility improvements will support LMT's regional role as an economic development generator (jobs, tourism, business development).

COORDINATION

LMT improvement alternatives are developed and refined based on input from the FAA, local government agencies (the City of Klamath Falls and the County of Klamath), LMT users (e.g., Oregon ANG, US Forest Service, and general aviation tenants), and the public. LMT stakeholder feedback helps shape this Master Plan into a document that reflects community goals and interests while meeting FAA design standards and Oregon ANG mission needs.

RUNWAY SYSTEM

Runway layout influences the development of other LMT facilities, such as the siting of taxiways, parking aprons, and buildings. The following section documents the recommended runway improvements based on the facility requirements and runway performance lengths documented in Chapter 3, *Facility Requirements*.

The following describes the existing facilities and future runway system facility recommendations from Chapter 3, *Facility Requirements*:

- **Runway 14/32 (Primary)**
  - Existing: 10,302' x 150' (D-III)
  - Future: 10,302' x 150' (D-IV)
- **Runway 7/25 (Crosswind)**
  - Existing: 5,258' x 100' (B-II)
  - Future: 5,000' x 75' (B-II)

RUNWAY 14/32 IMPROVEMENTS

No physical changes to the length or width of Runway 14/32 are recommended. The existing runway length of 10,302 feet accommodates the existing critical aircraft (F-15/Avro RJ-85/MD-87) and the future critical aircraft (DC-10-30 Series large tanker aircraft). The Runway 14/32 width is recommended to remain at 150 feet to meet the future FAA Runway Design Code (RDC) D-IV design standards and military criteria. Additional runway improvements to satisfy future FAA RDC D-IV and military standards include:

- Runway 14 Object Free Area Length: 1,000 Feet
- Runway Shoulders: 25 Feet Paved Per Side
- Runway Blast Pads: 200 Feet Long x 200 Feet Wide
- Runway Edge Lights: High Intensity LED (Based on FAA Funding and Avionics Integrity)
- Runway 14 and 32 in-pavement threshold lights installed within the width of the runway
- Runway 14 Instrument Approach (Oregon ANG Project): Precision (ILS, Medium Intensity Approach Light System with Runway Alignment Indicator Lights, not less than 3/4-mile visibility minimums)
- Runway 32 Light Aids: PAPI-4L.

Runway 14 Object Free Area Length Alternatives

The standard ROFA length of 1,000 feet beyond the runway end is limited on Runway 14 to approximately 715 feet by the location of the airfield perimeter roadway, perimeter fence, and Brett Way. Four alternatives are provided that would alleviate the nonstandard condition. **Table 4-1** summarizes the factors involved with the four alternatives.

Option A: Modification of Standards

LMT can submit a Modification of Standards (MOS) form to the FAA that will allow the existing conditions to remain. In order to approve an MOS, according to FAA Order 5300.1F, it must be justified by unusual local conditions and assurance that an acceptable level of safety will be provided. The unusual local conditions that exist at LMT include the presence of Brett Way, a two-lane public roadway located within the ROFA, and a sizeable drainage ditch located north of Brett Way that could be affected by the road relocation.

Option B: Use Declared Distances

Alternative B uses declared distances to reduce the runway length available for certain aspects of aircraft performance on takeoffs and landings. Declared distances can be used to achieve additional ROFA length and to effectively preserve usable runway length. Declared distances represent the maximum runway length an airport owner declares available and suitable for meeting takeoff, rejected takeoff, and landing distance performance requirements for turbine-powered aircraft. There are four declared distance categories:

- Takeoff Runway Available (TORA) – The runway length declared available and suitable for the ground run of an aircraft taking off.
- Takeoff Distance Available (TODA) – The TORA plus the length of any remaining runway or clearway beyond the far end of the TORA.
- Accelerate Stop Distance Available (ASDA) – The runway plus stopway length declared available and suitable for the acceleration and deceleration of an aircraft aborting a takeoff.
- Landing Distance Available (LDA) – The runway length declared available and suitable for landing an aircraft.

By reducing the published Runway 32 ASDA and LDA lengths by 285 feet, the distance equivalent from the Runway 14 threshold to the intersection of the ROFA and the perimeter road, the standard 1,000-foot ROFA length beyond Runway 14 is achieved. Some reconfiguration to the runway edge and end lights near the Runway 14 end and relocation of the distance-to-go signs would be needed to provide visual clues to pilots that the Runway 32 available takeoff and landing runway lengths are shorter than the physical end of the runway pavement. The Runway 32 lengths provided using declared distances are summarized below.

- TORA 10,302 feet
- TODA 10,302 feet
- ASDA 10,016 feet
- LDA 10,016 feet.

Option C: Shorten Runway 14/32

Instead of using declared distances to reduce certain aspects of the Runway 32 lengths to satisfy aircraft performance requirements, this alternative physically shortens the Runway 14/32 length by 285 feet. This is achieved by relocating the Runway 14 threshold 285 feet south, thus providing the standard 1,000-foot ROFA length beyond the runway end. This reduces the future Runway 14/32 length from 10,302 feet to 10,016 feet.

Option D: Relocate Perimeter Road, Fence, and Brett Way

This alternative relocates the airfield perimeter roadway, the perimeter fence, and Brett Way completely outside the ROFA, thus retaining the existing Runway 14/32 length of 10,302 feet.

Runway 14 ROFA Alternatives Analysis

Option A is the least expensive to implement (likely only requiring signage on the airfield perimeter roadway warning vehicles they are entering a ROFA and to be cautious within the area). Options B, C, and D improve the safety of the airfield environment at LMT by providing a standard Runway 14 ROFA length. Option B provides a standard ROFA length, but the use of declared distances might cause pilot confusion by having different runway lengths available to satisfy different aircraft performance requirements. Option B also requires some reconfiguration of runway edge and end lights near the Runway 14 end and the relocation of the distance -o-go signs. Option C reduces the Runway 14/32 length to 10,016 feet, which is insufficient to accommodate the future critical aircraft (DC-10-30). Options C and D are expensive alternatives involving road relocations, possible drainage ditch impacts, taxiway relocations, EOR Pad impacts, runway, taxiway, and threshold light relocations, signage relocation, and marking relocations.

Runway 14 ROFA Preferred Alternative

Option A is selected by the City and local stakeholders as the preferred short-term alternative, with Option D as the selected long-term alternative. Seeking and receiving an MOS in the short-term is more likely when large narrow body transport aircraft that have wingspans less than 118 feet (ADG III) are the critical aircraft. When heavy transport aircraft with wingspans greater than 118 feet (ADG IV) have sufficient operations to be the critical aircraft, then a long-term alternative of relocating the roads and fence is more likely to be the preferred option from the FAA.

Table 4-1 : Summary Evaluation of Runway 14 ROFA Alternatives

Summary Evaluation of Runway 14 ROFA Options				
Screening Criteria	**Option A - Modification of Standards**	**Option B - Declared Distances**	**Option C - Shorten Runway**	**Option D - Relocate Roads and Fence**
Operational Efficiency				
Runway 32 Length				
TORA	10,302'	10,302'	10,016'	10,302'
TODA	10,302'	10,302'	10,016'	10,302'
ASDA	10,302'	10,016'	10,016'	10,302'
LDA	10,302'	10,016'	10,016'	10,302'
Disruption of Airfield Operations	Low	Low	High	Medium
Relocation of Airfield Lighting	Low	Medium	High	Low
Taxiway Impacts	Low	Low	High	Low
EOR Impacts	Low	Low	High	Low
Environmental Consideration				
Drainage Ditch/Wetlands	No	No	No	Yes
Milkvetch	No	No	No	No
Farmland	No	No	No	Yes
Land Use Consideration				
Brett Way	No Relocation	No Relocation	No Relocation	Relocation
Perimeter Road	No Relocation	No Relocation	No Relocation	Relocation
Implementation				
Construction Difficulty (High, Medium, Low)	Low	Low	High	High
Financial	Low	Low	High	High
Phasing Complexity	Low	Low	High	Medium
Implementation Factors (EA and Permitting)	Low	Low	Medium	HIgh
FAA Acceptance	Low	Low	Medium	High
ALTERNATIVE EVALUATION				
Airport Ranking				
Meets Facility Requirements or Low Poterntial Impact				
Temporarily Does Not Meet Facility Requirements or Medium Potential Impact				
Does Not Meet Facility Requirements or High Potential Impact				

Source: Mead & Hunt, Inc. 2020

RUNWAY 7/25 IMPROVEMENTS

Chapter 3, *Facilities Requirements*, recommends a reduction in the length and width of the crosswind runway. The runway length analysis indicates that a minimum runway length of 5,000 feet is needed to meet the critical aircraft takeoff distance requirements for the King Air Series (King Air 300/1900). A runway width of 75 feet is recommended to meet FAA RDC B-II design standards.

The recommended runway layout provides a 5,000-foot length with no displaced thresholds. The Runway 7 end remains in its existing location and the Runway 25 end is relocated 245 feet west of its current position. The future Runway 25 end is located to provide the FAA-required RDC B-II Runway Safety Area (RSA) and Runway Object Free Area (ROFA) lengths as well as provide vertical clearance over the perimeter road and other nearby objects. The existing pavement west of the Runway 7 end will continue to be maintained as a blast pad to provide additional safety margin for civilian turbine-powered aircraft. The existing pavement east of the future Runway 25 end will be maintained as a blast pad.

Figure 4-3 shows the new runway configuration and the associated taxiway improvements to align the entrance taxiways with the new runway ends. Changes to the taxiway design are discussed in the Taxiway System section of this chapter.

Additional Runway 7/25 improvements include:

- Runway 7/25 length: 5,000 Feet
- Runway 7/25 width: 75 Feet
- Runway 7/25 Pavement Strength: 50,000 pounds DWG
- Runway Shoulders: 10 Feet Stabilized Per Side
- Runway 7 and 25 Blast Pads: 150 Feet Long and 95 Feet Wide
- Runway 7 Lighting Aids: Precision Approach Path Indicator (PAPI) and Runway End Identifier Lights (REIL)
- Runway Holding Positions: 200 Feet (from runway centerline; elevation adjustment not required)
- Runway Numbering: Runway 8 and 26 (change due to magnetic variation)
- Runway Marking: Visual (install markings to aid pilot and ATC awareness).

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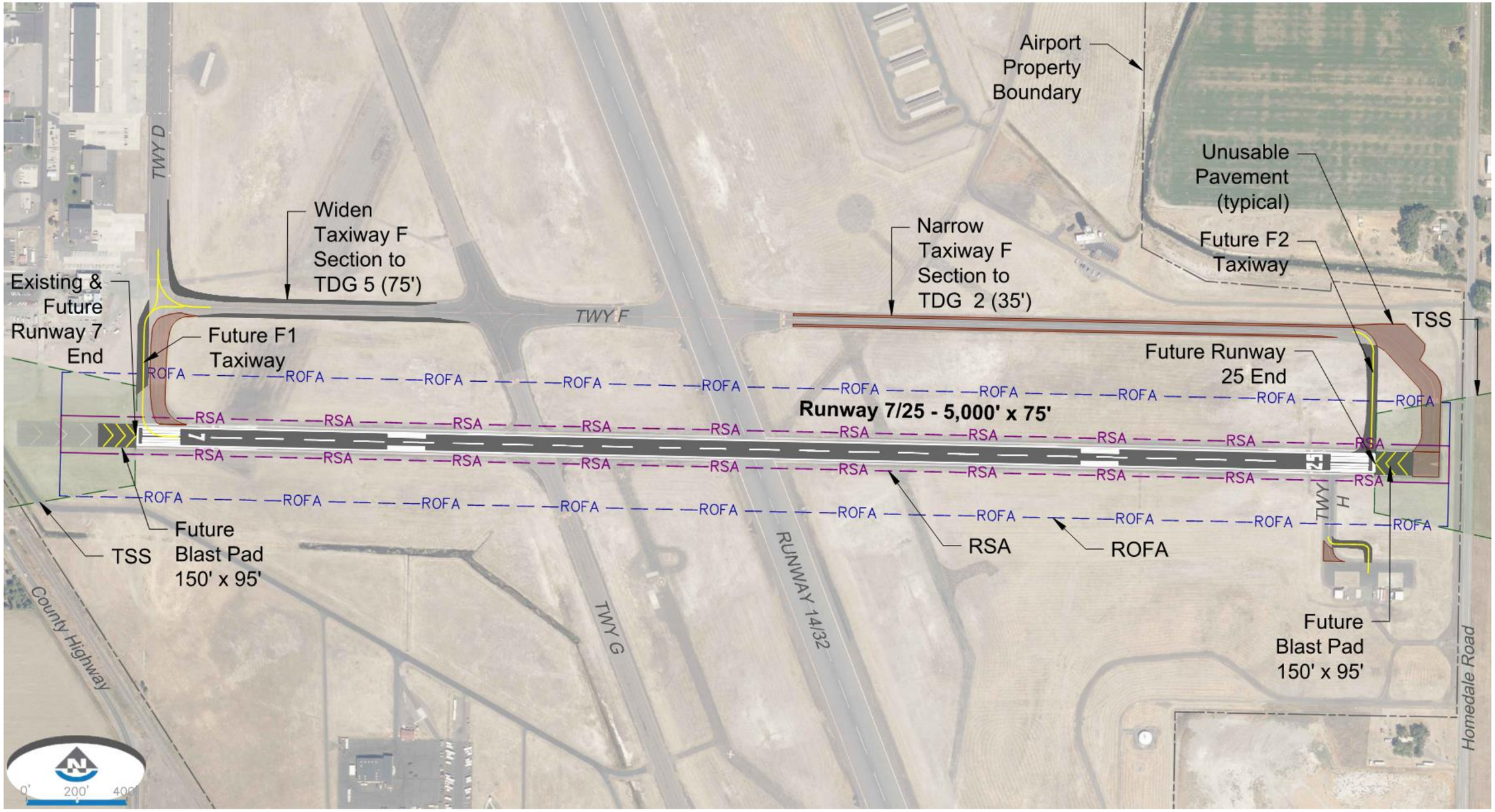
Figure 4-3 : **Runway 7/25 Preferred Alternative**



Source: Mead & Hunt, Inc. 2020

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TAXIWAY SYSTEM

The following section documents facility requirements for the taxiway system, including planned taxiway improvements based on forecast user demand, critical aircraft, and FAA design standards. The taxiway system is used to provide aircraft circulation between the runway and terminal area facilities. The portion of Taxiway D between the intersections of Taxiway E and Taxiway F is restricted to military use only and has been marked as a non-movement area taxilane adjacent to the military apron. To comply with FAA grant assurances, the Oregon ANG reimbursed the Airport and the FAA for grant funds previously used to maintain that section of Taxiway D.

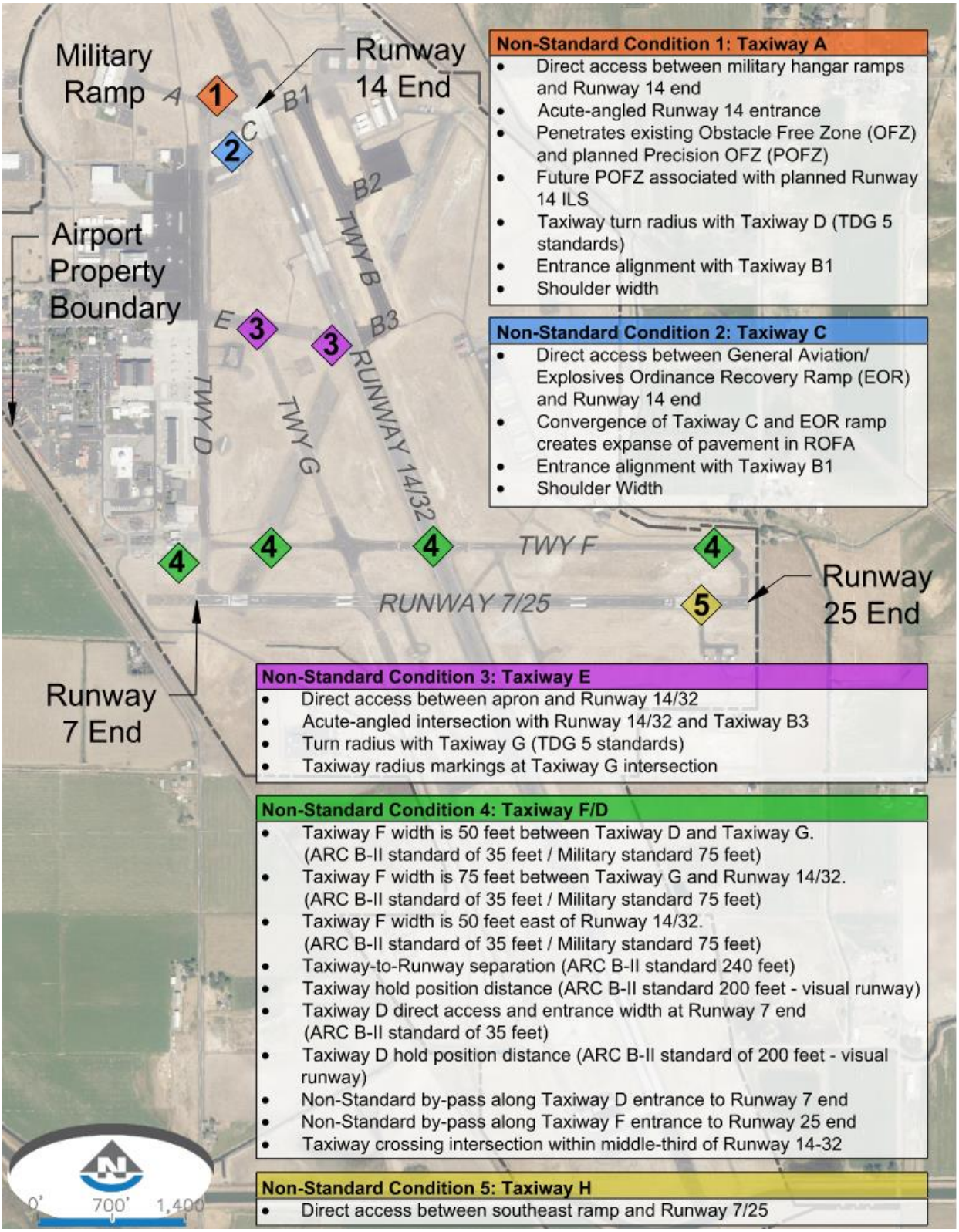
TAXIWAY DESIGN STANDARDS

Taxiway geometry standards are based on the critical aircraft, as determined by the Airplane Design Group (ADG) and Taxiway Design Group (TDG). The TDG is based on the aircraft Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) distance. The following are the taxiway design standards associated with each runway system based on the forecast critical aircraft:

- Runway 14/32 Taxiway System (DC-10-30 Critical Aircraft): **ADG IV, TDG 5**
- Runway 7/25 Taxiway System (King Air 300/1900D Critical Aircraft): **ADG II, TDG 2**

Figure 4-4 summarizes the areas of taxiway design noncompliance. The subsequent sections identify the improvements needed to address noncompliant design. Taxiway alternatives are provided where prudent.

Figure 4-4 : Taxiway Nonstandard Conditions



Source: Mead & Hunt, Inc. 2020

TAXIWAY IMPROVEMENTS

Recommended improvements to the taxiway system to address nonstandard conditions are described below and depicted in **Figure 4-5**. Alternatives are presented where prudent.

Taxiway A, C and New D1 Connector

A realignment of the taxiway connectors at the Runway 14 threshold is necessary to resolve nonstandard conditions for direct access from an apron, angled intersection with Runway 14/32, insufficient TDG 5 fillet radius, and insufficient separation for civilian aircraft from military aircraft in the Oregon ANG Explosives Ordinance Recovery (EOR) arming/de-arming positions.

Figure 4-6 shows the proposed taxiway realignment that closes Taxiway C and a portion of Taxiway A and provides a new perpendicular Taxiway D1 connector meeting TDG 5 design standards. The runway holding position line will be set 291 feet (elevation adjusted) from the Runway 14/32 centerline. To provide Oregon ANG aircraft on the EOR access to the Runway 14 threshold, a redesign of the EOR parking positions will be necessary. The EOR design concepts are discussed in the Oregon ANG Support Facilities section below.

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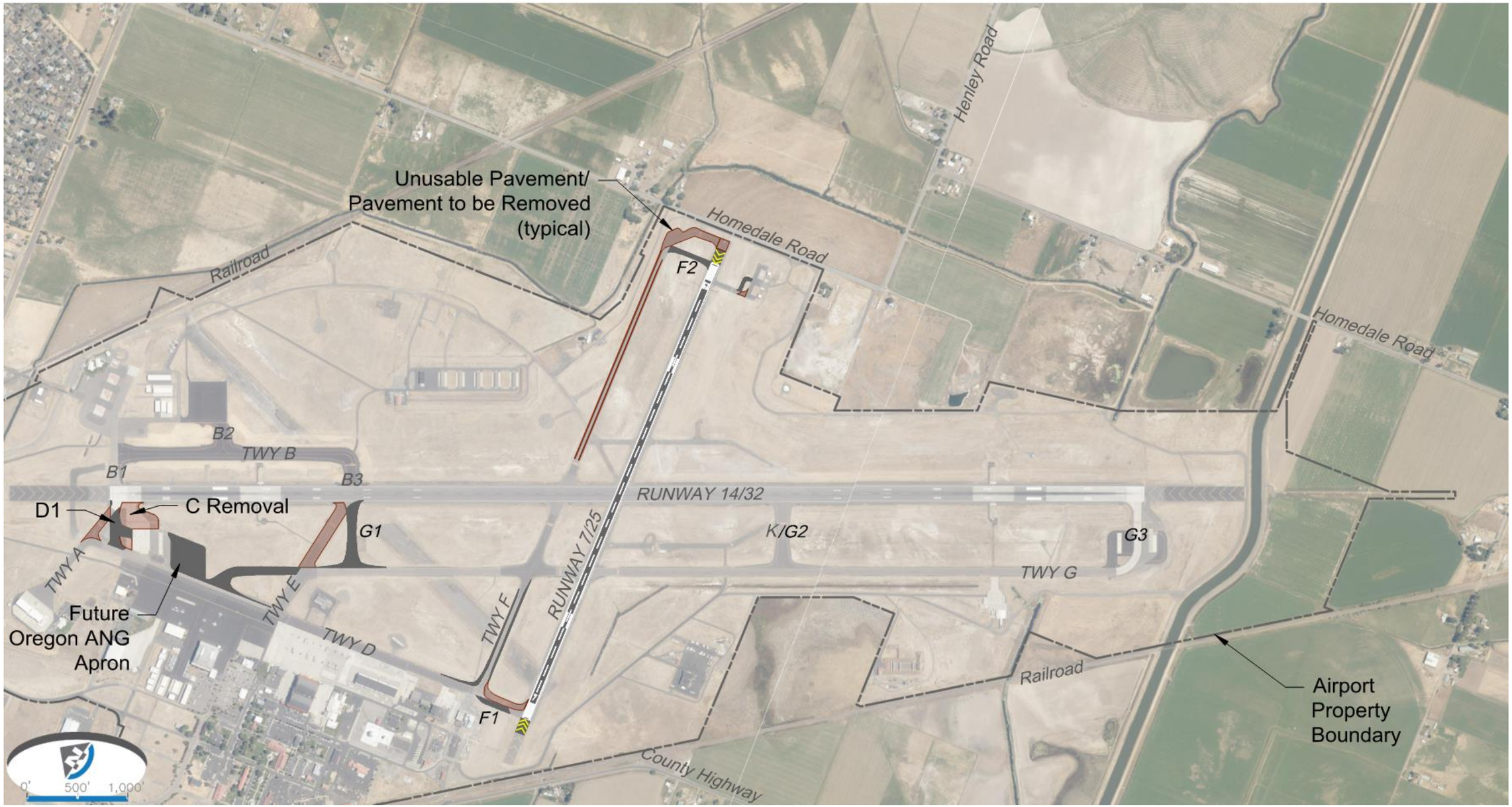
Figure 4-5 : **Preferred Alternatives Taxiway Layout**



Source: Mead & Hunt, Inc. 2020

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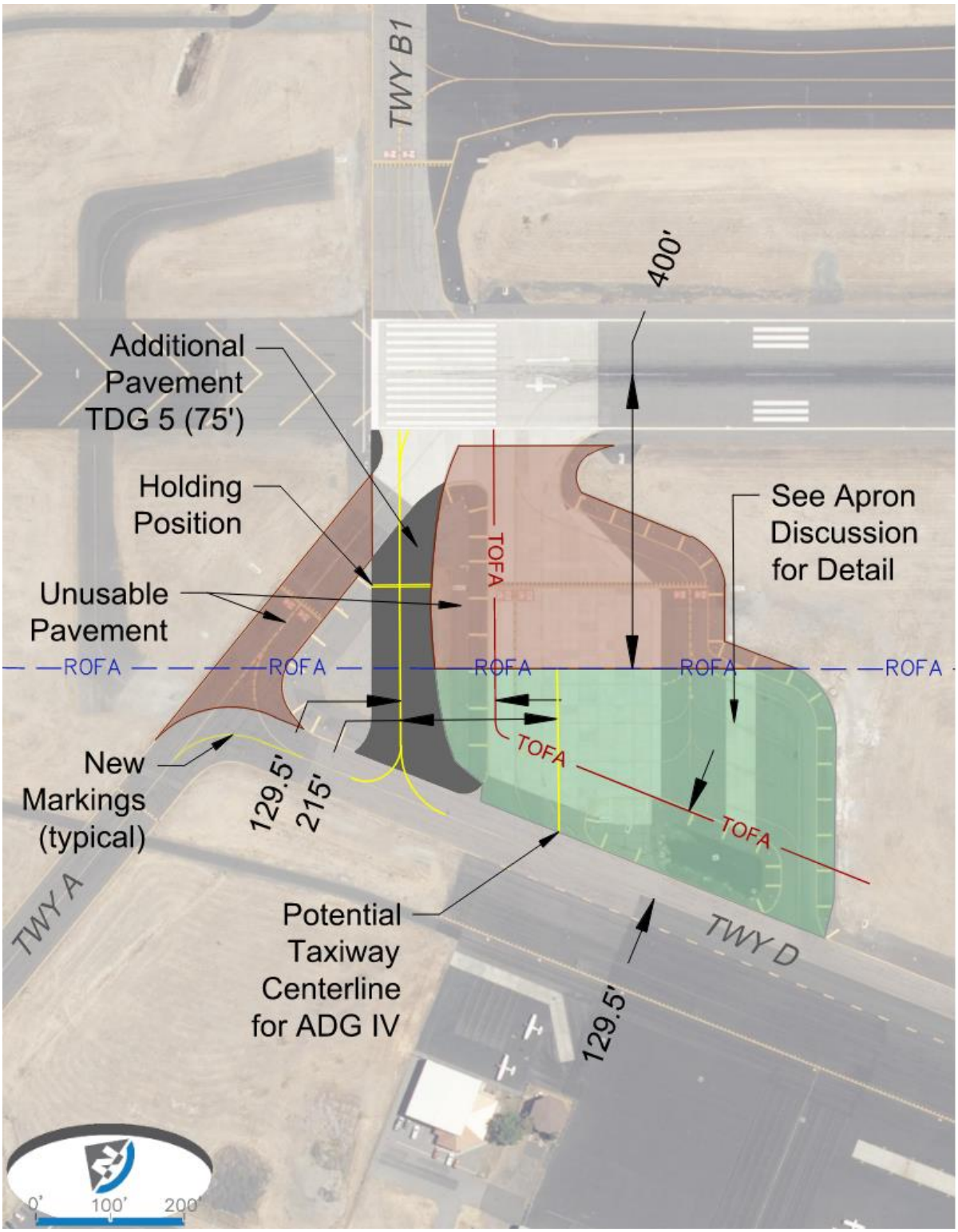
Figure 4-6 : Taxiway A & C Alternative



Source: Mead & Hunt, Inc. 2020

Taxiway E Alternatives and New G1 Connector

A realignment of Taxiway E is necessary to resolve nonstandard conditions for direct access from an apron, angled intersection with Runway 14/32, and insufficient TDG 5 pavement radius to turn onto Taxiway G. A portion of Taxiway E between Runway 14/32 and Taxiway G would be realigned to provide a perpendicular intersection with the runway. Two Taxiway E realignment alternatives are provided. **Table 4-2** summarizes the factors involved with the two Taxiway E alternatives and **Figure 4-7** presents the two realignment options.

Option A: Taxiway E (Taxiway B3 Intersection)

A new perpendicular Taxiway E connector would be aligned with the existing Taxiway B3 connector located east of Runway 14/32. This option minimizes taxiing times for aircraft from the eastside general aviation and US Forest Service aprons (northeast apron) that need to access Runway 32 for takeoffs.

Option B: Taxiway E (Taxiway G Intersection)

A new perpendicular Taxiway E connector would be aligned at the existing Taxiway G intersection. The new Taxiway E connector would be north of the Taxiway B3 and Runway 14/32 intersection and would force aircraft taxiing from the northeast apron onto the runway or to use Taxiway B1 to cross the Runway 14 threshold in order to access Runway 32 for takeoffs.

Taxiway E Alternatives Analysis

Both options locate the new Taxiway E connector outside the middle third of the runway where high-energy operations occur, thereby mitigating the risks associated with potential runway incursions. Option A provides direct access via Taxiway B3 to Taxiway G and the Runway 32 end, which reduces taxiing distances. Option A also helps to reduce traffic congestion at the Runway 14 end, which increases operational efficiencies. Option B forces aircraft to either back taxi on the runway to connect to Taxiway B3 or to cross at the Runway 14 end; neither of which improves safety or operational efficiencies.

Taxiway E Preferred Alternative

Option A is selected by the City, FAA, and local stakeholders as the preferred alternative. Aligning the new perpendicular taxiway connector (Taxiway G1) with the existing Taxiway B3 intersection provides direct access from the northeast apron to Taxiway G and reduces congestion at the Runway 14 end. The runway holding position line for the Taxiway G1 connector will be set 291 feet (elevation adjusted) from the Runway 14/32 centerline.

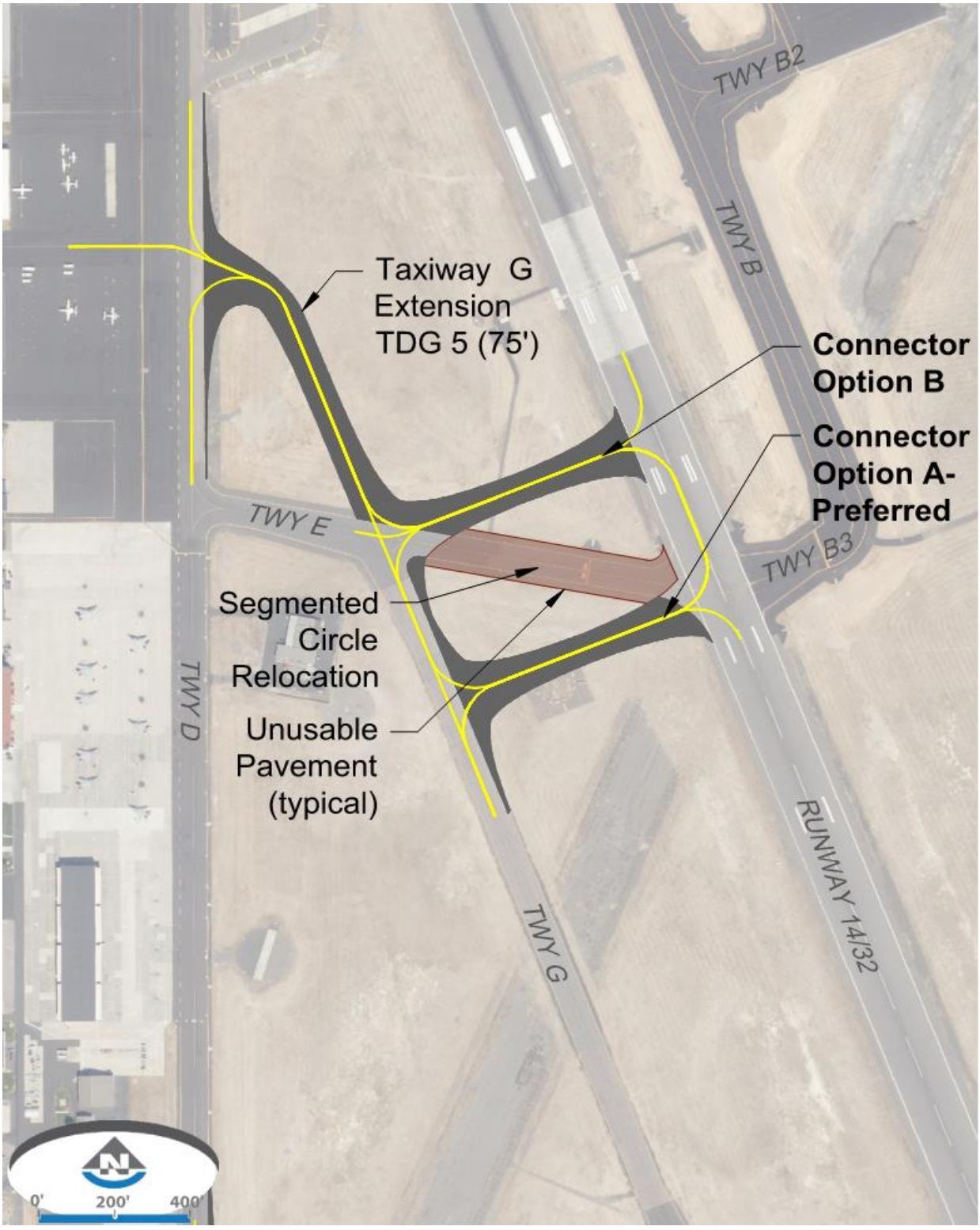
Table 4-2 : Summary Evaluation of Taxiway E Alternatives

Summary Evaluation of Taxiway E Alternatives		
Screening Criteria	**Option A (Twy B3 Intersection)**	**Option B (Twy G Intersection)**
Operational Efficiency		
Airfield Operability & Access	Improved	Yes, With Longer Taxi Times
Reduces Runway Crossings	No	Yes
Provides Alternate Taxi Routes	Yes	Yes - Longer
Reduces Aircraft Taxi Times	Yes	No
Increases Potential for Development	No	No
Expansion Capabilities	No	No
AC 150/5300-13A Deficiencies	Corrected	Corrected
Segmented Circle Relocation	Yes	No
Complies with Design Standards	Yes	Yes
Runway Crossing within High-Energy Zone	No	No
Environmental Considerations		
Impacts to Airport Property Use	None	None
Aviation Compatible Use	Yes	Yes
Critical Habitat/Endangered Species	No	No
Wetlands/Waterways Impacted	No	No
Impervious Surfaces	Increase	Increase
Land Use Considerations		
Property Acquisitions / Easements	None	None
Implementation		
Construction Difficulty (High, Medium, Low)	Low	Low
Phasing Complexity	Low	Low
Implementation Factors (EA, Permitting, Land Acquisition)	Temporary Closures	Temporary Closures
ALTERNATIVE EVALUATION		
Airport Ranking	1	2
DETERMINATION	**Advance**	**Not advanced**

Meets Facility Requirements
Temporarily Does Not Meet Facility Requirements
Does Not Meet Facility Requirements

Source: Mead & Hunt, Inc. 2020

Figure 4-7 : Taxiway E Alternatives



Source: Mead & Hunt, Inc. 2019

Taxiway G Extension

Taxiway G is not a full-length parallel taxiway. Extending Taxiway G to the north, however, would provide another connection to the apron edge taxiway (Taxiway D) that fronts the westside terminal and general aviation apron. This new Taxiway G connection would provide an alternate route to Taxiway E, which is heavily used by the Oregon ANG aircraft fleet and would help mitigate potential conflicts between civilian and military aircraft operations (see **Table 4-2** .

As discussed above, a new Taxiway G1 connector is proposed to replace the Taxiway E segment between Taxiway G and Runway 14/32. To maintain consistent taxiway naming conventions, Taxiway K will be renamed as Taxiway G2 and the entrance taxiway to Runway 32 will be renamed Taxiway G3.

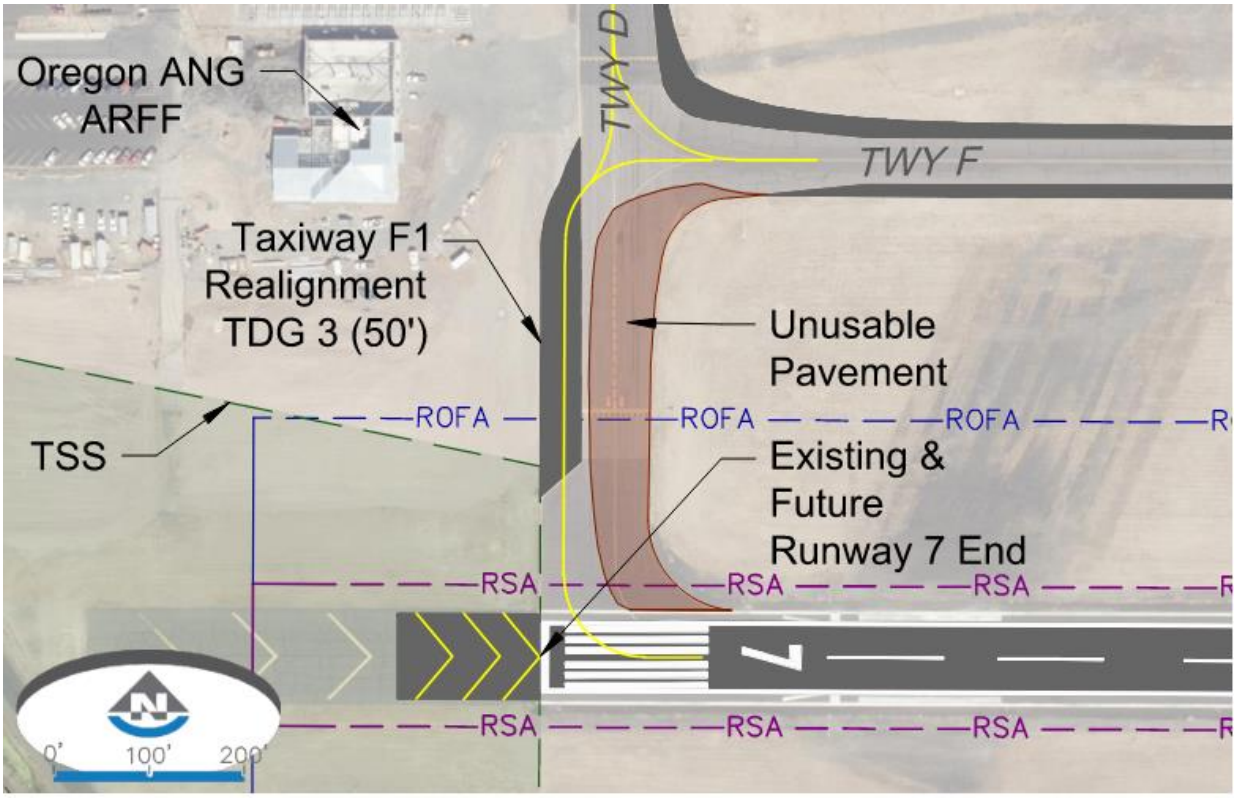
Taxiway F and New F1 and F2 Connectors

Taxiway F is the parallel taxiway serving crosswind Runway 7/25. The Runway 7/25 centerline to Taxiway F centerline separation of 525 feet exceeds the RDC B-II separation standard of 250 feet. Relocating Taxiway F closer to Runway 7/25 to meet the B-II separation standard would involve substantial reconstruction, impact taxiway connections, and potentially impact areas with endangered species of Milkvetch (requiring additional environmental reviews and mitigation efforts). A relocated Taxiway F also would not mitigate the runway incursion hazard of a runway crossing in the middle third of Runway 14/32 where high-energy impacts are most likely to occur. Therefore, to simplify the construction effort and mitigate impacts to sensitive areas, this alternative retains the existing separation distance. Other Taxiway F improvements include:

- The existing Taxiway F segment between Taxiway D and Runway 14/32 will be increased from 50 feet to 75 feet to accommodate the military standard for regular use by F-15s.
- The Taxiway F segment east of Runway 14/32 will be reduced from 50 feet to 35 feet to meet TDG 2 standards.
- Taxiway D at the Runway 7 threshold is reconfigured to provide a new Taxiway F1 connector properly aligned with the Runway 7 end. The new Taxiway F1 connector would normally be a TDG 2 standard width of 35 feet. However, when there is taxiway construction at the Taxiway G and Taxiway F intersection, the Oregon ANG F-15s will require an alternate route to taxi to reach Runway 32. Runway 7 can be used as an alternate connector to Taxiway G during the closure. Taxiway F1 will retain a TDG 3 pavement width of 50 feet to permit occasional F-15 access during construction periods. Runway holding positions would be marked 200 feet from the Runway 7/25 centerline. The nonstandard runup bypass area would be eliminated.
- Taxiway F2 connector would be relocated to align with the new Runway 25 end. Runway holding positions would be marked 200 feet from the Runway 7/25 centerline. The nonstandard runup bypass area would be eliminated.

Figures 4-8 and **4-9** present the preferred Taxiway F layout and modifications.

Figure 4-8 : Taxiways F and F1 Design

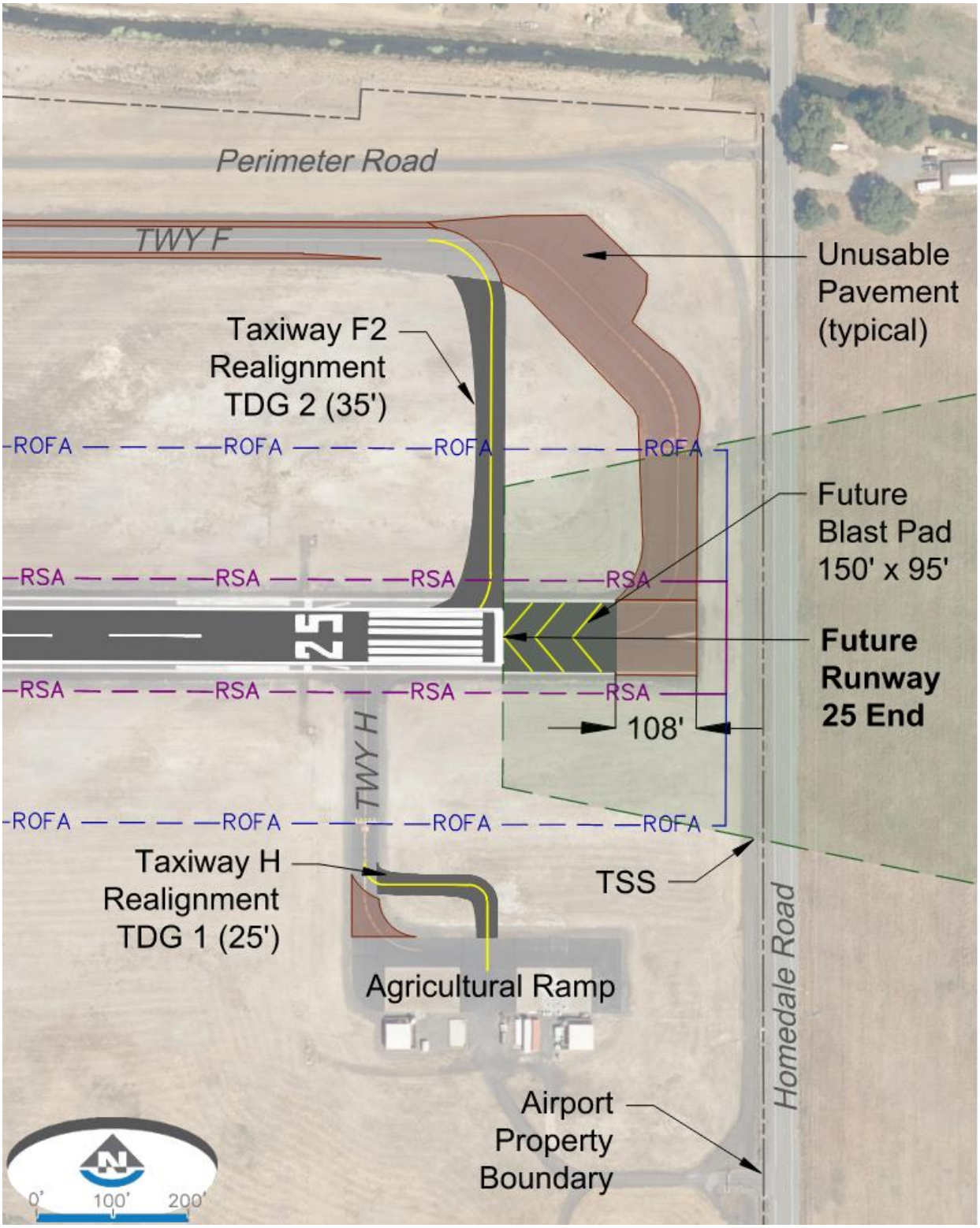


Source: Mead & Hunt, Inc. 2020

Taxiway H

Currently, Taxiway H has direct access from the Agricultural Spray apron to Runway 7/25. A realignment of Taxiway H is needed to mitigate pilot confusion and minimize runway incursions. **Figure 4-9** provides details of the recommended Taxiway H connector at the Runway 25 end.

Figure 4-9 : Taxiways F, F2, and H Design



Source: Mead & Hunt, Inc. 2020

NAVIGATIONAL AIDS (NAVAIDS)

The following section outlines improvements for navigational aids at LMT based on the recommendations provided in Chapter 3, *Facility Requirements*. No changes are planned to the following existing facilities: VHF Omnidirectional Range/Tactical Aircraft Control (VORTAC), Automated Surface Observation Station (ASOS), and Airport Rotating Beacon.

RUNWAY 14 INSTRUMENT LANDING SYSTEM (ILS) ALTERNATIVES

The following section documents findings from a FAA feasibility study conducted in August 2019 and revised in January 2020 for locating an Instrument Landing System (ILS) on Runway 14. The Runway 14 ILS project was initiated by the Oregon ANG to provide instrument approach capability for F-15s landing from the north. Military procedures and policies require both primary and backup instrument systems for aircraft operations. Since F-15s are not equipped with satellite-based navigation systems such as Global Positioning System (GPS), instrument approaches based on a GPS are not eligible as a primary or backup instrument system. With the two existing Very High Frequency Omnidirectional Range Station with Distance Measuring Equipment (VOR/DME) instrument approaches to LMT candidates for cancellation, the Oregon ANG requires another non-GPS based instrument approach capability to insure continued access to Runway 14 under Instrument Flight Rules (IFR) weather conditions. The F-15s use the Ultra High Frequency (UHF) version of the civilian approaches utilizing the Tactical Air Navigation (TACAN) unit co-located with the VOR/DME. This Master Plan assumes that the Runway 14 ILS will not have visibility minimums of less than ¾ mile. An ILS system is composed of two primary antenna sites: 1) the Glideslope (GS) antenna that provides descent path guidance; and 2) the Localizer (LOC) antenna that provides course guidance down the extended runway centerline.

Glideslope Antenna Placement

A GS antenna can be located on either side of a runway, but the optimal siting is the side that offers the least possibility of signal reflection from buildings, powerlines, vehicles, aircraft, terrain, and other objects. The GS antenna must be located beyond the RSA and ROFA, which at LMT is a minimum of 250 feet and 400 feet, respectively, from the runway centerline. The GS antenna requires a smoothly graded critical area clear of objects and high growth vegetation. It also requires an equipment shelter, which is typically located near the antenna but outside the GS antenna critical area.

The FAA feasibility study identifies three possible locations for the placement of the GS antenna. **Figure 4-10** shows the location of the GS antenna and the associated critical area associated with Options A, B, and C.

Option A (East - Near)

Option A sites the GS antenna 955 feet south of the Runway 14 threshold and 262 feet east of the runway centerline. At this location, the GS antenna and equipment shelter are outside the Runway 14 RSA but is within the ROFA.

One of two large drainage ditches located on either side of the perimeter road near the US Forest Service ramp is in the north end of the GS antenna critical area. To implement Option A, the approximate 3-foot diameter culvert inside the ditch would need to be extended for the full length of the ditch, backfilled, and graded to meet GS critical area slope standards.

Option B (East - Far)

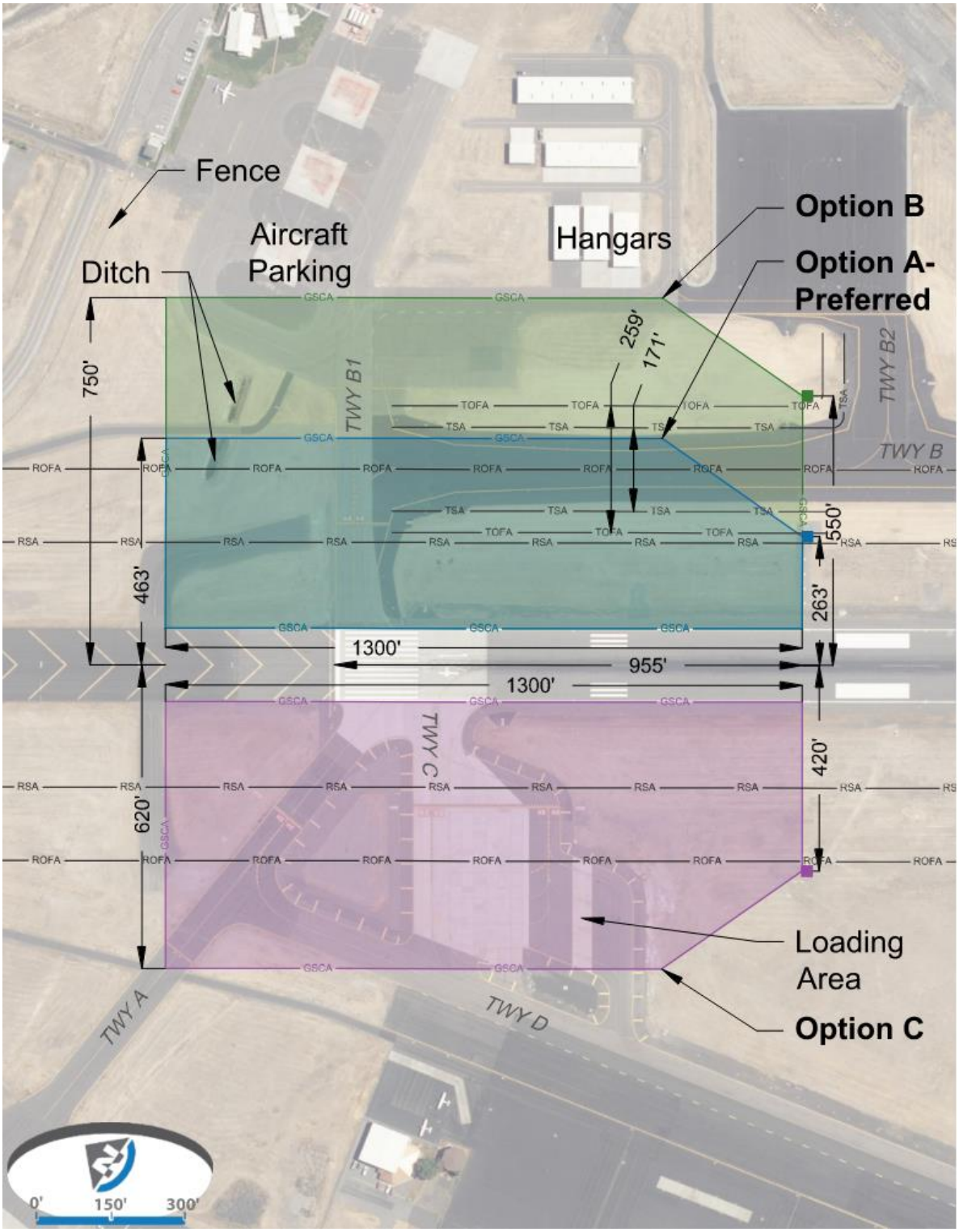
Option B sites the GS antenna 955 feet south of the Runway 14 threshold and 550 feet east of the runway centerline, between Taxiway B and the eastside apron. At this location, the GS antenna is beyond both the RSA and ROFA.

The GS antenna critical area conflicts with the US Forest Service firebase where planes park seasonally. The critical area also includes both drainage ditches near the perimeter road and US Forest Service parking apron. The LMT perimeter fence to the north, although outside the critical area, is near the GS antenna and would need to be modeled to determine signal interference. Distant terrain 5,000 feet beyond the Runway 14 end is more pronounced at the Option B location. This could be an issue for the GS antenna signal propagation and distortion. To implement Option B, the site would need to address critical area grading requirements, fence proximity, nearby buildings, existing ditches, and parked aircraft interference.

Option C (West)

Option C locates the GS antenna 955 feet south of the Runway 14 threshold and 420 feet west of the runway centerline. At this location, the GS antenna is beyond both the RSA and ROFA. The Option C GS antenna critical area encompasses the Explosive Ordinance Recovery (EOR) arming/de-arming ramp. The USAF/ANG uses this area to load and unload F-15 aircraft with munitions prior to and after training mission sorties. The EOR area has flat grading without obstacles, obstructions, fences, or open drainage ditches, which is ideal for GS antenna signal quality. However, aircraft taxiing on the adjacent taxiways or the F-15s parked on the EOR ramp would create signal interference. Therefore, use of the ILS on Runway 14 would prevent F-15s from using the EOR ramp while approaches are being conducted. Alternatively, F-15s in the critical area would preclude aircraft from using the Runway 14 ILS while arming and disarming occurs on the EOR ramp, further limiting the utilization of the ILS. DoD requirements dictate that arm/de-arm pads be located adjacent to runway thresholds.

Figure 4-10 : GS Antenna Options A, B, and C



Source: Mead & Hunt, Inc. 2020

Glide Slope Antenna Alternatives Analysis

Table 4-3 provides a summary of the factors effecting the location of the ILS GS antenna. Operational efficiency, environmental considerations, land acquisition requirements, and implementation challenges are noted.

Option A locates the GS antenna within the Runway 14/32 ROFA. Although not ideal, Table 6-1 in FAA Advisory Circular (AC) 150/5300-13A allows a GS antenna within the ROFA due to a physical constraint and should be evaluated on a case-by-case basis. Mounting the antenna on frangible connectors might be required to satisfy FAA ROFA standards. Option A also requires capping one of the large ditches near the US Forest Service apron. Compared to Option B, however, the clearing and grading needs are less extensive given the smaller size of the GS antenna critical area with Option A.

Option B presents several significant challenges. Foremost, is the potential signal degradation that would result from high terrain located about 5,000 miles to the north. If the intended benefit of reduced visibility and ceiling minimums to allow F-15 operations during IFR weather conditions cannot be met, then there is no benefit to the Runway 14 ILS project. The GS antenna critical area requirements also would reduce the utility of the US Forest Service apron. Lastly, given the size of the GS antenna critical area, substantial grading and the capping of two ditches would be needed.

Option C poses significant operational challenges for the Oregon ANG. Siting the GS antenna on the west side of Runway 14/32 would either: 1) deny use of the EOR site when aircraft are flying the Runway 14 ILS approach, or 2) deny use of the instrument approach procedure when F-15s are parked on the EOR ramp. The Runway 14 ILS is a military-initiated project intended to improve military training missions by providing non-GPS based instrument approach capabilities to Runway 14. However, if the Runway 14 ILS project jeopardizes another critical military facility (i.e., EOR site), then there is reduced benefit to installing an ILS on Runway 14. As such, Option C is deemed least desirable by the City, Oregon ANG, and local stakeholders.

Table 4-3 : Summary Evaluation of Runway I4 ILS GS Antenna Location Alternatives

Summary Evaluation of Runway 14 ILS GS Location Alternatives			
Screening Criteria	**Option A - East side (Nearest)**	**Option B - East side (Far)**	**Option C - West Side**
Operational Efficiency			
Antenna in ROFA	Yes - OK with Frangible Mounts	No	No
Antenna in TOFA	Yes - OK with Frangible Mounts	Yes - OK with Frangible Mounts	No
Ditch in Critical Area	Yes - OK with Capping	Yes - OK with Capping	No
Taxiway Complexity in Critical Area	Yes - Low	Yes - Medium	Yes - High
Apron/Hangar in Critical Area	No	Yes - USFS Non-Movement Area	No
OANG EOR Apron in Critical Area	No	No	Yes
EOR Interference When Aircraft Present	No	No	Yes
Critical Area Grading	Small area, Precise criteria	Large area - Moderate criteria	No
Terrain Interference with Signal	No	Yes	No
Runway 14 PAPI	Requires Relocation	Requires Relocation	No Relocation
Runway 14 MALSF to MALSR	Requires Replacement	Requires Replacement	Requires Replacement
Environmental Considerations			
Wetland/Retention Pond Displacement	Yes- For MALSR	Yes- For MALSR	Yes- For MALSR
Land Use Consideration			
Land Acquisition - Easement	Yes- For MALSR	Yes- For MALSR	Yes- For MALSR
Implementation			
FAA AIP Eligibility / Grants	No FAA Funding - OANG Project	No FAA Funding - OANG Project	No FAA Funding - OANG Project
Implementation Factors (EA, Permitting, Land Acquisition)	Possible for MALSR	Possible for MALSR	Possible for MALSR
ALTERNATIVE EVALUATION			
Airport Ranking	1	2	3
DETERMINATION	**Preferred Alternative**	**Not advanced**	**Not advanced**
Meets Facility Requirements			
Temporarily Does Not Meet Facility Requirements			
Does Not Meet Facility Requirements			

Source: Mead & Hunt, Inc. 2020

Glide Slope Antenna Preferred Alternative

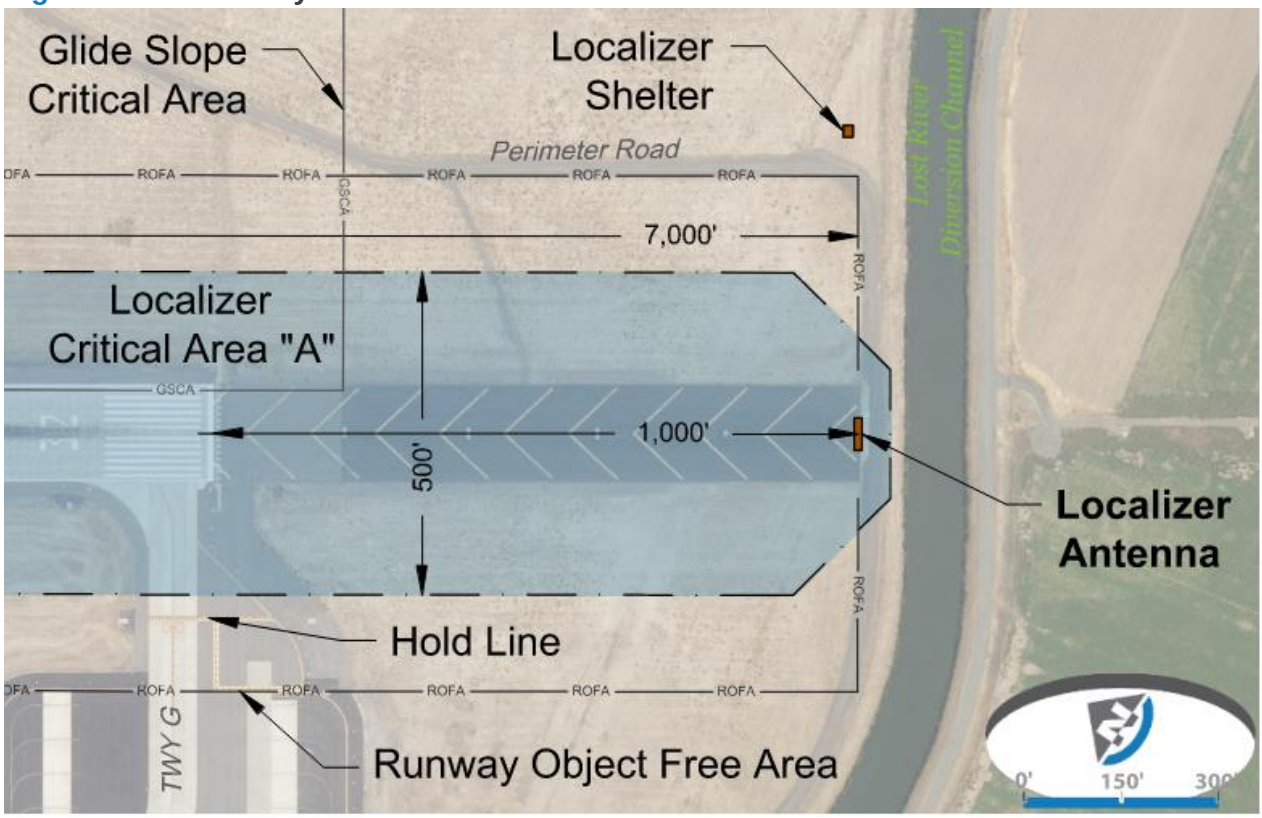
Based on the assessment described above, Option A is the preferred location for the GS antenna as it has the fewest impacts on or interference with existing facilities. It also has the lowest impact to aircraft operations on Taxiway B, the US Forest Service ramp, and the Oregon ANG EOR ramp.

Localizer Antenna Placement

The ideal siting location for the LOC is along the extended runway centerline beyond the RSA and ROFA. According to the ILS feasibility study, the proposed location for the LOC antenna is 1,000 feet south of the Runway 32 end at the edge of the RSA. Due to an existing ditch at this location, the LOC antenna would require a platform structure for mounting the equipment. This location would require the continued practice of ATCT personnel controlling vehicular traffic on the perimeter road into and out of the critical area. Additionally, there are three light stanchions associated with the existing Runway 32 Medium Intensity Approach Light System with Runway Alignment Indicator Lights (MALSR) currently located in this area. An approximate 20-foot relocation of the light stanchions either to the north or south might be required for proper LOC antenna function.

The LOC shelter that houses the electronics, power, and control system for the LOC antenna is 1,000-feet south of Runway 32 threshold and offset by 420 feet east of the runway centerline. This location places the LOC shelter outside of the ROFA and Runway 32 ILS GS antenna critical area. **Figure 4-11** presents the proposed LOC antenna location and the position relative to the drainage ditch.

Figure 4-11 : Runway 14 Localizer Antenna



Source: Mead & Hunt, Inc. 2020

Runway 14 Approach Light System

The existing Runway 14 Medium Intensity Approach Light System with Sequenced Flashing Lights (MALSF) is nearing its useful life span. The FAA has approved decommissioning the MALSR pending any catastrophic failures or inability to maintain and restore the light system since the flush mounted lights are no longer manufactured nor supported by manufacturers. To fully incorporate the proposed Runway 14 ILS, the MALSF would require replacement by a new MALSR light system. Due to the extended length of the MALSR relative to the MALSF, additional property north of Highway 140 would need to be acquired.

Runway 32 VASI to PAPI

Runway 32 is currently equipped with a four-box Visual Approach Slope Indicator (VASI) on the west side of the runway. It is recommended that the VASI be replaced with a Precision Approach Path Indicator (PAPI) that provides an enhanced visual glideslope reference.

LANDSIDE – AERONAUTICAL FACILITIES

The following section describes the recommended improvements to landside facilities at LMT. Landside facilities located on-airport are used to support aircraft parking and storage, on-airport businesses, and airport administration, operations, and maintenance.

LANDSIDE ALTERNATIVES COMMON ELEMENTS

After LMT staff and stakeholders reviewed Chapter 3, *Facility Requirements,* they found the facilities listed below to be sufficient for existing and forecasted demands. No changes or alternatives were evaluated for these facilities. Should demands change during the planning period, landside development can be accommodated within designated areas reserved for future growth. Project development that replaces or repurposes buildings and facilities that have reached the end of their expected service life can be completed when service demands make those changes financially feasible.

The facilities listed below are sufficient through the planning period.

- Passenger Terminal Apron
- Passenger Terminal Building Automobile Parking
- Deicing Apron Containment System
- General Aviation (GA) Automobile Parking
- US Forest Service Apron
- Agricultural Spray Facilities
- Air Traffic Control Tower
- Passenger Terminal Rental Car Facilities

Landside Facilities that do have recommended changes and will be evaluated further in this section include the following:

- Terminal Building Repurposing
- Westside Hangar and Apron Area
- Eastside Hangar and Apron Area
- Oregon ANG Support Facilities
- Airport Administration and Maintenance Facilities
- Perimeter Security Fencing and Gates enclosing entire Airport Operations Area
- Airport Entrance Road – Realignment.

TERMINAL BUILDING REPURPOSING

While there are no recommendations for changing the existing passenger terminal building's size or location, there is a possibility for repurposing the facility. While not currently being used for commercial airline service, the space could be used by private or public entities to conduct business. With access to the flight apron, the building space could be used for other flight services such as charters, aircraft leasing, or aircraft sales. Repurposing of the facility is not within the scope of this Master Plan and would be on an as needed basis. Should commercial air service resume at LMT, an evaluation is recommended for the floor plan layout to include updated Transportation Security Administration (TSA) office space and screening area needs and passenger holding areas capable of meeting expected passenger traffic needs.

GENERAL AVIATION DEVELOPMENT

General aviation development at LMT includes 116,300 square feet (4.4 acres) of general aviation/corporate hangar space and 76,300 square feet (1.8 acres) of hangar space for a full-service Fixed Base Operator (FBO) or Specialized Aviation Service Operation (SASO) providing a single service. The general aviation apron totals 781,500 square feet with 62 marked tie-down parking positions for fixed-wing aircraft.

The following section describes the layout of future general aviation development within LMT's two building areas: Westside Building Area and Eastside Building Area. The proposed layout of future development in the westside building area is shown in **Figure 4-12** and in the eastside building area in **Figure 4-13**.

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Figure 4-12 : Westside Development Options

Source: Mead & Hunt, Inc. 2020
Note: Fixed Base Operator (FBO), Flight School (FS), General Aviation (GA), Specialized Aviation Service Operation (SASO); Forecast Hangars- facilities needed to meet 20-year forecast– and Contingent Hangars as demand requirements.

Figure 4-13 : Eastside Development Options

Source: Mead & Hunt, Inc. 2020

FBO Hangar Building and Facilities

Existing FBO facilities are located immediately north of the airline terminal area and include two large commercial hangars (Buildings #4 and #8) and an aircraft parking apron. In response to user demand, the following facility improvements are planned:

- Renovate/expand FBO hangar for GA patrons (Building #4-B). The existing FBO/General Aviation terminal building space is 1,800 square feet and is attached to the FBO maintenance hangar. A larger dedicated space or structure between 3,000 and 4,500 square feet is recommended as either an attached structure to the FBO hangar or stand-alone building near the existing Flight School hangar. The building amenities, including office and retail space, pilot lounge, and 24-hour restroom access, would be dictated by level of service, minimum standards, and cost factors.
- Build a new, large hangar (±35,000-square-foot building) for FBO/SASO common or maintenance hangar. A site west of Building #8-A has ample space to accommodate a large 38,000-square-foot common hangar as well as a large 16,000-square-foot box hangar. Access to the site, however, is dependent upon crossing an existing leasehold for Building #8-A, as well as closing a segment of Altamont Drive. Another site on the northeast apron also provides space for a large common hangar (>35,000 square feet).
- Install 100LL Avgas self-serve fuel storage/dispensing system. A 100LL Avgas self-serve fuel storage/dispensing system can be accommodated on the main apron directly east of the existing FBO hangar. This fuel location provides convenient access to fuel services from Taxiway D, which facilitates aircraft turn times. Although this fuel location would displace existing tie-down spaces for transient aircraft and parking areas for current fuel trucks, there is sufficient space on the existing northwest apron near the existing flight school to accommodate the displaced spaces.
- Provide additional aircraft parking/tie-down area(s) on the northwest apron near the existing flight school.

General Aviation Hangars

Approximately 80 to 90 percent of LMT's based aircraft are stored in hangars with the remainder parked on the tie-down apron. Nearly 60 percent of the hangars are individual T-hangars/Box hangars comprising 116,300 square feet and the rest are common hangars storing multiple aircraft comprising 76,300 square feet. Hangar ground leases are controlled by LMT under individual tenant leases and agreements allowing for private hangar ownership or rental arrangements. Hangars must be developed consistent with LMT Minimum Standards and City building/fire codes.

The following list identifies general hangar siting considerations:

- Hangars should be developed in a linear, modular manner. Hangar locations should be centralized or grouped by type, function, and aircraft size categories (piston, turboprop, jets, rotor) to promote efficient airfield and landside access. Hangars should be constructed along existing flight lines as much as possible to minimize costs associated with expanded paved areas, drainage, utilities, auto parking, and secured access.
- Hangar orientation should consider weather conditions and provide adequate drainage with minimal slope differential.
- Hangars must be constructed beyond the runway and taxiway safety areas, object free areas, and NAVAID critical areas. Hangars must remain beyond visibility line of sights and regulated by height to prevent encroachment of airspace surfaces.
- Hangars should be separated to meet, at a minimum, FAA taxilane object free area distances while providing enough access, maneuvering, and apron space for the expected class of aircraft.

Small Hangars (Box/T-Hangars)

All future based aircraft are anticipated to be stored in hangars. The forecasted need is for 2 to 8 additional new hangars for individual aircraft owners (total 20,000 square feet). These hangars can be accommodated in either the westside or eastside building areas with the preference based on LMT and tenant needs.

The eastside building area offers ample space to accommodate the hangar forecast needs within the existing building constraints of the US Forest Service leasehold to the north and Oregon ANG munitions buffer to the south. The new hangars would include infill development along existing taxilanes or an expansion of the building area with new taxilanes to the east.

The westside building area also provides space for small box or T-hangar development west of the existing general aviation hangar area. However, hangar expansion to the west is constrained by the following circumstances:

- Separation between the existing hangar buildings restrict use of the new hangar area to aircraft in the FAA Airplane Design Group I (ADG I, wingspan < 49 feet).
- Conversion of nonaeronautical land in the Airport Business Park and relocation of the LMT Administrative Building would be required to accommodate these new hangars.
- Closure of Fairchild Avenue would be required.
- A connecting taxilane would be needed along the current Fairchild Avenue alignment to provide alternate routes of taxi between the long rows of hangars.

Since the westside development option includes greater implementation complexities, the westside hangar expansion is shown in **Figure 4-12** as contingent development.

Also shown in **Figure 4-12** is the option to replace several existing portable hangars north of FBO building #4-A to allow construction of box or T-hangars. A site on the northeast apron is provided for the relocation and consolidation of portable hangars, if warranted.

Large Hangars (Executive/Corporate/FBO/SASO/Business Aircraft Owners)

Chapter 3, *Facility Requirements*, indicates a forecast need for 2 to 3 additional large hangars (total 61,500 square feet) for use as executive or corporate hangars or FBO/SASO common and aircraft maintenance hangars. These large hangars are intended to accommodate aircraft in ADG II (wingspan < 79 feet) and III (wingspan < 118 feet) categories. These types of hangars can be accommodated in both the westside and eastside building areas and built based on demand.

The eastside building area offers a site for a large hangar of 55,000 square feet with office space immediately east of the general aviation apron. This site offers convenient access to Runway 14/32 via Taxiway B.

On the westside building area, a site east of Building #8-A could be redeveloped to accommodate a large hangar of 11,000 square feet. Although this site requires removal of an existing T-hangar, it offers direct access to Taxiway D to facilitate use by large general aviation and corporate aircraft and space for an expanded apron for additional aircraft parking.

Additional sites for large hangars on the westside and eastside building areas are identified in **Figure 4-12** and **Figure 4-13** as contingent development.

General Aviation Apron

The general aviation apron is in the westside building area. The existing apron area is not designated by tenant user nor is it distinguished for fixed wing or helicopter aircraft types. Providing dedicated space for specific users and activities will improve operational efficiencies during peak-periods (summer). It is recommended that the taxilanes and aircraft parking spaces be developed to meet ADG II dimensional standards with a pavement strength up to 30,000 pounds for piston, turboprop, and helicopter aircraft and 60,000 to 90,000 pounds for business jets based on intended use.

Several facility improvements proposed in the terminal, FBO, and air cargo areas will displace general aviation facilities to other areas of the westside aircraft apron. Given this spatial relationship between aviation activities on the apron, the proposed improvements to the westside aircraft apron (including non-general aviation improvements) are summarized below:

- Dedicated parking space for aircraft deicing is proposed east of the terminal building and west of Taxiway D.
- Dedicated space for a 100LL Avgas fuel storage/dispensing system is proposed on the main apron in front of the FBO Building (#4-A).
- Dedicated space for air cargo users (total 5,000 square feet) is proposed east of the cargo hangar.

- Dedicated space for large aircraft parking is proposed east of the cargo hangar fronting Taxiway D.
- Dedicated space for helicopter parking is proposed at the north end of the apron fronting Taxiway D.
- 6 additional parking/tie-down spaces is proposed to meet forecasted demand.

Apron expansion is also necessary to support future hangar development. **Figure 4-12** depicts three apron expansion areas in the westside building area:

- A new aircraft parking apron is proposed north of the existing flight school and is intended to support flight training operations. A self-serve fuel facility for the flight training school would be located on the north edge of the new apron.
- If a large hangar is constructed east of Building #8-A, expanding the existing apron to provide access to the new hangar would be needed. Additional paved areas would be available for aircraft parking.
- If hangar development is proposed west of Building #8-A, a new parking apron would be required to provide hangar access.

Figure 4-13 shows apron expansion in the eastside building area to provide access to a large hangar (contingent development). The apron expansion areas are also anticipated to accommodate some of the tie-down spaces displaced by the proposed improvements to the main aircraft apron discussed above (e.g., fuel island).

Flight Training Facilities

Chapter 3, *Facility Requirements,* recommends the development of a hangar and flight training building comparable to the existing 12,000-square-foot building. Locating the second facility close to the current location was deemed important for shared purpose and common operational characteristics. The existing general aviation hangar and apron area directly to the north of the existing flight school has a dedicated location set aside for future development. A self-serve fuel facility would be on the northern edge of the apron directly north of the flight school serving the flight training facility. Development of this area is dependent upon future tenant and flight training demand as well as financial feasibility.

US Forest Service Facilities

The US Forest Service, with facilities located on the eastside building area, has not identified facility improvements for their leased area, buildings, aircraft parking, or support facilities. However, future changes to the US Forest Service mission at LMT may trigger facility improvements and modification to the lease area. As such, systems installations for retardant tanks and fuel storage are shown as additions to the existing general aviation aircraft parking apron. These facilities are sited to provide wingtip clearance for the DC-10-30 maneuvering on the apron.

AIRPORT ADMINISTRATION AND OPERATIONS FACILITIES

LMT Administration and Operations Building

The existing Airport Administration building is located on the corner of Airport Way and Arnold Avenue. The existing size of the airport administration building is inadequate for current uses, such as public meetings and staff office space, and it is reaching the end of its expected service life. The current Airport Operations/Maintenance facility is located on Airport Way, in the southwest corner of the passenger terminal parking lot. Operations and maintenance personnel do not have direct access to the airside, resulting in less efficient operations and slower response times to events on the airfield. The current maintenance building also does not have sufficient floorspace to house the snow removal equipment or garage door clearance to enable moving equipment in and out of the building. Exposure to the elements reduces equipment life span and increases maintenance costs. Maintenance buildings to house equipment are eligible for FAA AIP grant funding.

Chapter 3, *Facility Requirements,* recommends replacing and combining the Airport Administration building with the Airport Operations and Maintenance building to gain administrative and operational efficiencies. Two alternatives are provided that combine these Airport functions in a single 6,500-square foot Airport Operations/Maintenance Building (AOB). Between 2,500 and 3,000 square feet would be used for administration offices and meeting rooms, and the rest of the building would be used for Airport operations and maintenance. **Figure 4-12** above shows the location for AOB 1 and AOB 2 in the westside building area.

AOB Alternative Analysis

Several benefits are gained by combining the two primary airport administration and operations buildings into one facility. Staff communication, coordination, and effectiveness are improved by having all staff in the same building. Benefits for equipment maintenance and expected lifetime of service duration are improved by housing equipment indoors and out of the elements, thus reducing the need for equipment replacement or repairs. Equipment servicing and upkeep can be conducted indoors, improving staff working conditions, comfort, and efficiencies. A new facility will also have benefits of more efficient construction to improve heating, ventilation, and air conditioning (HVAC) systems that reduce the energy consumption required.

Siting the proposed AOB was based on the following criteria:

- Remaining within the primary west side GA hangar and passenger terminal area;
- Minimizing impacts to existing tenant lease spaces; and
- Not restricting existing aircraft access to hangars.

The two proposed locations meet these requirements. The primary operational need for the AOB is to have both public access to the administration side of the facility and, if possible, have direct access to the airside operations area for operations and maintenance personnel in order to improve staff efficiencies and reduce response times to events on the airfield.

AOB Option A (North)

AOB Option A is located on the west side of the FBO parking lot. This location displaces vehicle parking spaces for FBO and hangar tenants; however, the area is underutilized, and additional parking is available closer to the FBO. The location is still outside the existing airside fence, but it does not require maintenance equipment and snow removal vehicles to drive on public roads before entering the airport operations area.

To improve airside access without having to pass through a security gate, a realignment of the operations area perimeter fence is proposed. The public would have access to the building from the street side but would be prevented from accessing the aprons directly. The operations and maintenance staff would have direct access to the apron. The fence alignment would still allow fuel trucks to deliver to the nearby FBO fuel storage tanks and would provide public access to the FBO parking lot via Airport Way.

Advantages of AOB Option A include:

- Using underutilized space in the parking lot near the FBO
- Providing direct access to the airport operations area.

Disadvantages of AOB Option A include:

- Displacing some vehicle parking for FBO and hangar tenants
- Needing to realign the fence to encompass the back portion of the AOB area to enable direct access to the airport operations area by Airport personnel.

AOB Option B (South)

AOB Option B is located 200 feet to the west of the existing Operations/Maintenance facility. The site would displace underutilized passenger terminal overflow parking. The site is large enough to accommodate the airport administration offices and house the maintenance and snow removal equipment in one facility. Access to the airport operations area would be via Fairchild Avenue and through the access gate near the GA hangar area.

Advantages of Option B include:

- Using underutilized parking space in the overflow parking lot
- Not impacting any current lease holds.

Disadvantages of Option B include:

- Not improving access to airside facilities
- Eliminating parking spaces in the overflow lot used for the terminal
- Needing to realign Airport Way to accommodate the new building footprint.

AOB Preferred Alternative

After review by the City, the preferred alternative is AOB Option A because it can provide direct access to the airport operating area while providing public access to the administration offices.

Perimeter Security Fencing and Gates

Chapter 3, *Facility Requirements*, identifies that enclosing the entire Airport Operations Area (AOA) is necessary in order to comply with the 2014 Wildlife Hazard Management Plan. Perimeter fence is installed except for a section along the southern AOA, north of the Lost River Diversion Channel. Fencing standard for a general aviation airport is a 6-foot tall chain link fence with three strands of barbed wire on the top for a total height of 8 feet.

OREGON ANG SUPPORT FACILITIES

This Master Plan considers the facilities identified by the Oregon ANG to meet future mission needs. The runway concepts discussed below considers FAA design standards as well as military standards defined in the US Department of Defense (DoD) Unified Facilities Criteria (UFC) and Air National Guard Handbook (ANGH) for shared-use facilities. Since the Oregon ANG projects are not eligible under the FAA AIP grant program, the funding for the projects would come from the Oregon ANG and DoD.

New Additional Runway

To amplify safety factors, military standard practices prefer having two runways capable of accommodating F-15 operations. With a single runway available at LMT for use by F-15 aircraft, any incident that closes Runway 14/32 would cause F-15s out on training sorties to divert to Rogue Valley International Airport in Medford, Oregon. Circumstances such as these create significant operational, safety, and financial burdens for the Oregon ANG.

The Oregon ANG's 2005 Installation Development Plan (IDP) includes a proposal to extend the crosswind runway 3,000 feet to the east for a total length of 8,000 feet. The proposal also includes designing the runway to meet military Class B runway standards and installing a cable arresting system at each end of Runway 7/25.

As documented in Chapter 3, *Facilities Requirements*, several significant constraints (e.g., railroads, terrain, school) preclude extension of the crosswind runway to 8,000 feet and cannot therefore be used as a secondary runway for F-15s. Several locations for an additional runway were assessed to recognize the Oregon ANG's desire to amplify safety factors, improve operational efficiencies, and augment future mission capabilities by providing an alternate runway in the event that the primary runway is closed for an emergency.

Both military and FAA design standards have been considered for the new additional runway layout. For runways serving F-15s, military standards require the runway to have a length and width of 8,000 feet and 150 feet, respectively, and include 1,000-foot long overruns at each runway end. The US Military guidance for runway classification and specifications are found in Attachment B at the end of this chapter. LMT is not designated as a joint-use facility, so, according to Department of Defense (DoD) criteria, the runway design must comply with FAA design standards.

The purpose and need for an additional runway is not based on the forecasted operational capacity of the existing runway; it is based on the Oregon ANG operational mission characteristics and gaining efficiencies for launching and recovering large numbers of aircraft in a short period during training scenarios that may be needed in the future. Such a need is not expected to occur during this Master Plan's planning period of 20 years; as such, a preferred design option is not selected. Rather, the additional runway evaluations described below were conducted to determine the space allocation requirements and to gain a general assessment of impacts to facilities and environmental resources to determine project feasibility. The ultimate layout of an additional runway will be determined by the City, Oregon ANG, and DoD at a future date. While the additional runway concepts consider FAA design standards, the project would not be funded by the FAA because LMT operations do not justify an additional runway. The Oregon ANG and DoD would be the primary funding source.

The runway concepts described below consider the design factors listed below.

Design Factors

Runway Classification

- FAA Runway Design Standard (RDC): D-III
- Military Runway Design Standard (UFC 3-260-01): Class B (8,000' x 150')

Runway Design

- Runway Dimensions: 8,000' x 150' with paved shoulders (Military Class B Aircraft)
- Paved Overrun: 1,000' beyond each runway end
- Runway Equipment: edge lighting and arresting gear installation
- Approach Capabilities: Visual
- Taxiway System: Connectors, Partial-Parallel, Full-Parallel
- Pavement Strength: ±150,000 Pounds DWG

On-Airport Site Factors

- Airport civilian and military facilities impact – both existing and planned
- Conformity with existing airfield configuration and geometry
- Military munitions proximity
- VORTAC proximity
- Air Traffic Control Tower (ATCT) proximity
- Automated Weather Observing Station (AWOS) proximity
- Airport Tenants (agricultural spray facilities)
- Irrigation Ditches
- Environmental Factors (noise, impact on residential land, wetlands, Applegate's Milkvetch).

Off-Airport Site Factors

- Public Roadway (realignment and/or closure)
- Air Traffic and Airspace Pattern
- Land Uses (residential, farm and business acquisition and/or relocation)
- Utilities (relocation)
  - Electrical Transmission Lines
  - Sewer Systems
- Drainage/Irrigation Ditches
- Wetlands
- Land Use Compatibility:
  - Military standards (UFC/ANGH guidance)
  - Civilian standards (FAA guidance)
  - City/County Ordinances (Height, Safety Zones, Noise)
- Environmental and Permitting
- Funding of Site Development and Airfield Infrastructure
- Constructability

Additional Runway Concepts

Several locations for an additional runway were considered by the City, County, Oregon ANG, and FAA. As indicated in Chapter 3, *Facility Requirements*, a parallel runway on the east side of primary Runway 14/32 is recommended. **Figure 4-14** shows three parallel runway configurations for Runway 14L/32R that are 8,000 feet long and 150 feet wide with 1,000-foot long overruns at each runway end.

The three parallel runway configurations considered include:

- Option A (1,000-Foot Separation)
- Option B (2,075-Foot Separation)
- Option C (2,500-Foot Separation)

Table 4-1 summarizes the factors considered in reviewing the three additional runway concepts. The factors are grouped by operational efficiencies, environmental considerations, land use considerations, and implementation feasibility. The color coding (green, orange, red) indicates the level of effort required to satisfy facility requirements.

The purpose and need for an additional runway is not based on the forecasted operational capacity of the existing runway; it is based on the Oregon ANG operational mission characteristics and gaining efficiencies for launching and recovering large numbers of fighter aircraft in a short period during training scenarios that may be needed in the future. Such a need is expected to occur beyond the current planning period of 20 years. The additional runway evaluations were conducted to determine the space required and to gain a general assessment of impacts to facilities and environmental resources to determine project feasibility. While the additional runway concepts considered FAA design standards, the project would not be funded by the FAA because LMT operations do not justify an additional runway. The Oregon ANG and DoD would be the primary funding source.

Table 4-4 : Summary Evaluation of Additional Runway Concepts

Summary Evaluation of Additional Runway Options			
Screening Criteria	**Option A - 1,000' Offset**	**Option B - 2,075' Offset**	**Option C - 2,500' Offset**
Operational Efficiency			
Runway length 8,000' x 150' Military Class B Standard	8,000' x 150'	8,000' x 150'	8,000' x 150'
Runway Overrun	1,000' Each End	1,000' Each End	1,000' Each End
RPZ Easement / Property Acquistion	Yes	Yes	Yes
VOR-TAC	Relocation Required	Relocation Required	Relocation Required
Runway 25 PAPI	Relocation Required	Relocation Required	No Disruption
Munitions Storage Depot	Relocation/Displacement	Relocation/Displacement	No Relocation
AG Sparyers Hangars and Apron	No Relocation	Relocation/Displacement	Relocation/Displacement
Northwest Apron	Loss of Use within RPZ	No Relocation	No Relocation
ATCT	Relocation/Displacement	Relocation/Displacement	Relocation/Displacement
Environmental Consideration			
Wetland	Yes	Yes	Yes
Milkvetch	Yes	Yes	Not Known
Farmland	Yes	Yes	Yes
Land Use Consideration			
Homedale Road	No Relocation	Relocation/Displacement	Relocation/Displacement
Henley Road	No Relocation	Relocation/Displacement	Relocation/Displacement
Private Residence	No Relocation	Relocation/Displacement	Relocation/Displacement
Farmland	No Relocation	Relocation/Displacement	Relocation/Displacement
Railroad	No Relocation	Relocation/Displacement	Relocation/Displacement
Retention Pond	Relocation/Displacement	Relocation/Displacement	No Relocation
Schools	No	No	Yes
Drainage/Irrigation	No	Yes	Yes
Lost River Diversion Channel	Yes	Yes	Yes
Implementation			
Construction Difficulty (High, Medium, Low)	Medium	High	Very High
Financial	Not AIP Eligible	Not AIP Eligible	Not AIP Eligible
Phasing Complexity	High	High	High
Implementation Factors (EA, Permitting, Land Acquisition)	Medium	High	High
Runway 7/25	Disrupted During Construction	Disrupted During Construction	Disrupted During Construction
ALTERNATIVE EVALUATION			
Airport Ranking	2	1	3

Meets Facility Requirements
Temporarily Does Not Meet Facility Requirements
Does Not Meet Facility Requirements

Source: Mead & Hunt, Inc. 2020

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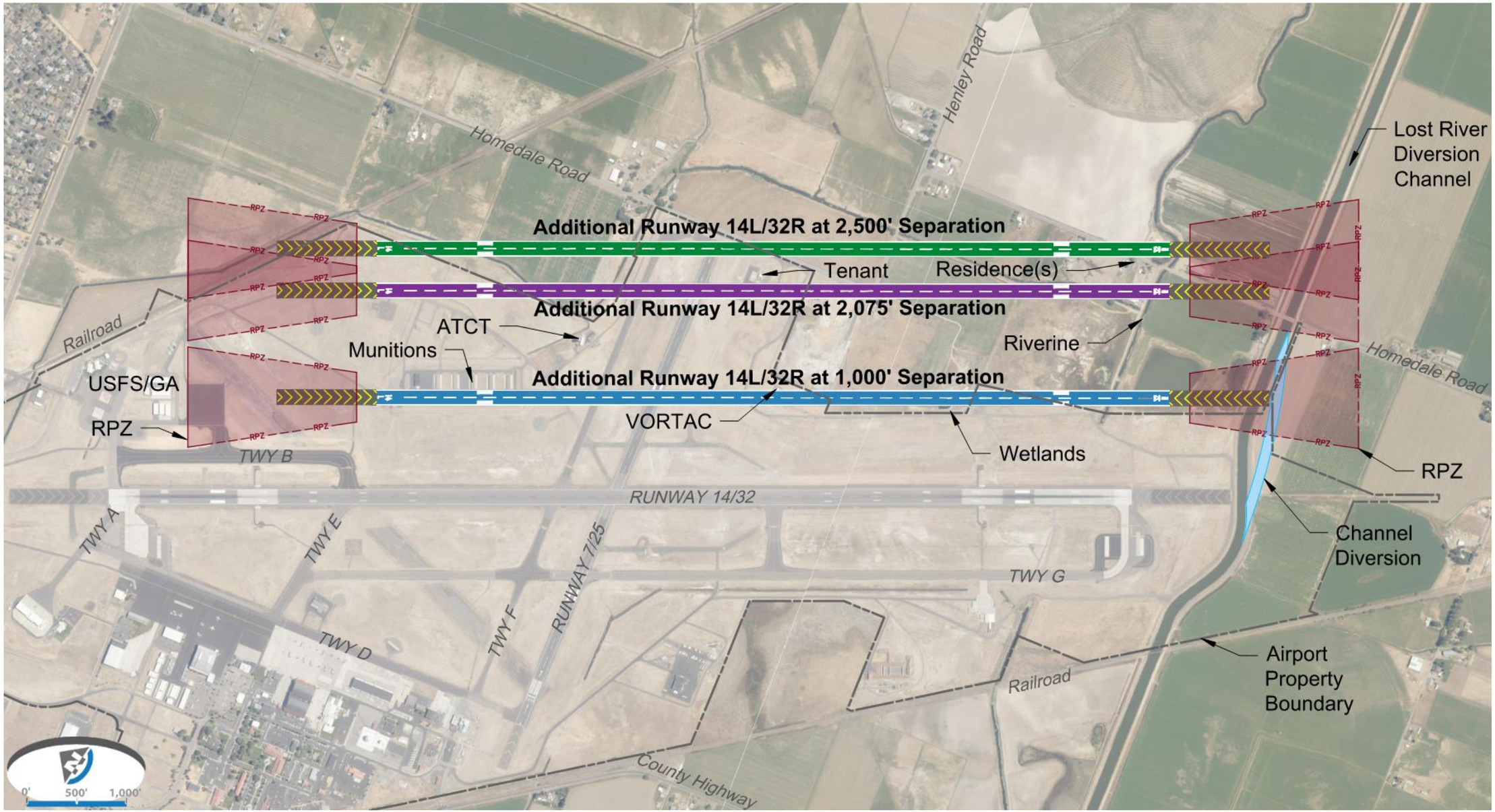
Figure 4-14 : Additional Runway Concepts



Source: Mead & Hunt, Inc. 2020

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Option A: Additional Runway (1,000-Foot Separation)

The 1,000-foot runway-to-runway separation reflects FAA design standards. This runway separation allows for simultaneous VFR operations only. Option A provides a partial parallel taxiway 400 feet from the runway centerline, which aligns the new parallel taxiway with the existing Taxiway B segment at the end of Runway 14.

The location and length of the runway, with paved overruns and Runway Protection Zones (RPZs), will have impacts to facilities on and off airport. Option A impacts the following existing facilities:

- The northern edge of the RPZ covers the existing US Forest Service apron adjacent to Taxiway B, which prevents future development of general aviation facilities south of the existing T-hangars in order to reserve this area for future RPZ and runway overrun.
- The Oregon ANG munitions storage depot site would require relocation.
- The existing ATCT and VORTAC would require relocation.
- The agricultural spray tenant hangars and apron would require relocation. Future apron and hangar layouts would accommodate this move.
- Existing wetlands and drainage canals would be affected.
- The Lost River Diversion channel at the south end would require realignment to accommodate the new 1,000-foot overrun/stop way.
- Land acquisition or avigation easements would be needed at the south end where the runway overrun and RPZ extend beyond Airport property lines.

Option A remains primarily on the existing Airport, but the RSA, ROFA, RPZ, and airspace considerations would have off-airport impacts to properties south of LMT. The amount of land acquisition, the number of residences displaced, and the extent of relocating railroads, roads, and waterways make this the least challenging concept to implement. However, Option A restricts the ability to expand aeronautical development near the US Forest Service and general aviation apron located northeast of Runway 14/32.

Option B: Additional Runway (2,075-Foot Separation)

The runway-to-runway separation distance of 2,075 feet reflects DoD airfield design standards for allowing a parallel taxiway between two runways. This runway separation also allows for future instrument approach capability but would not permit conducting simultaneous instrument operations to both runways. Therefore, there is no operational gain for the Oregon ANG at this separation distance.

Option B enables expansion of the US Forest Service and general aviation apron located east of Runway 14/32. In terms of off-Airport impacts, Option B involves greater displacements and more land acquisition due to the additional offset distance. The existing on- and off-Airport factors impacted by this option are listed below.

- Northern edge of the RPZ covers an area that includes a roadway, drainage canal, and railroad, which could all be considered incompatible land uses and might require displacements to be clear.
- The Oregon ANG weapons storage depot site would require relocation.
- The existing ATCT would require relocation – no alternate site has been determined.
- The existing VORTAC would require relocation to accommodate a parallel taxiway – no alternate site has been determined.
- Ag sprayer tenant hangars and apron would require relocation – additional hangar development for future GA would accommodate this relocation.
- Existing wetlands and drainage canals would be displaced.
- Waterway canal at south end would require shift to be clear of overrun/stop way and RPZ.
- A roadway bridge over canal would require relocation along with a shift in the roadway alignment.

When compared to Option A, the additional amount of land acquisition, the number of residences displaced, and the extent of relocating railroads, roads, and waterways make this option the second most challenging concept to implement.

Option C: Additional Runway (2,500-Foot Separation)

Option C provides a runway-to-runway separation of 2,500 feet based on DoD design standards for simultaneous instrument approach to one runway and instrument condition departure on the other runway. There are similar impacts to existing on- and off-airport facilities as found in Option B; however, most of the runway system would be outside the existing LMT property and would require the relocation of 10-12 residences, several roadways, and the greatest linear feet of relocation for canals. Cloud cover and visibility below VFR (1,000 feet and 3 miles) occur an average of 4.1 percent of the year based on National Oceanic and Atmospheric Administration records of weather observations at LMT. Based on that percentage, IFR conditions occur an average of 15 days a year at LMT. This option would provide minimal gain to Airport capacity and operational efficiencies.

The off-airport siting and orientation would require the greatest amount of land acquisition of all the options discussed. Option C also causes the most residences to be displaced, and the extent of relocating railroads, roads, and waterways make this option the most difficult concept to implement.

Runway 14 ILS

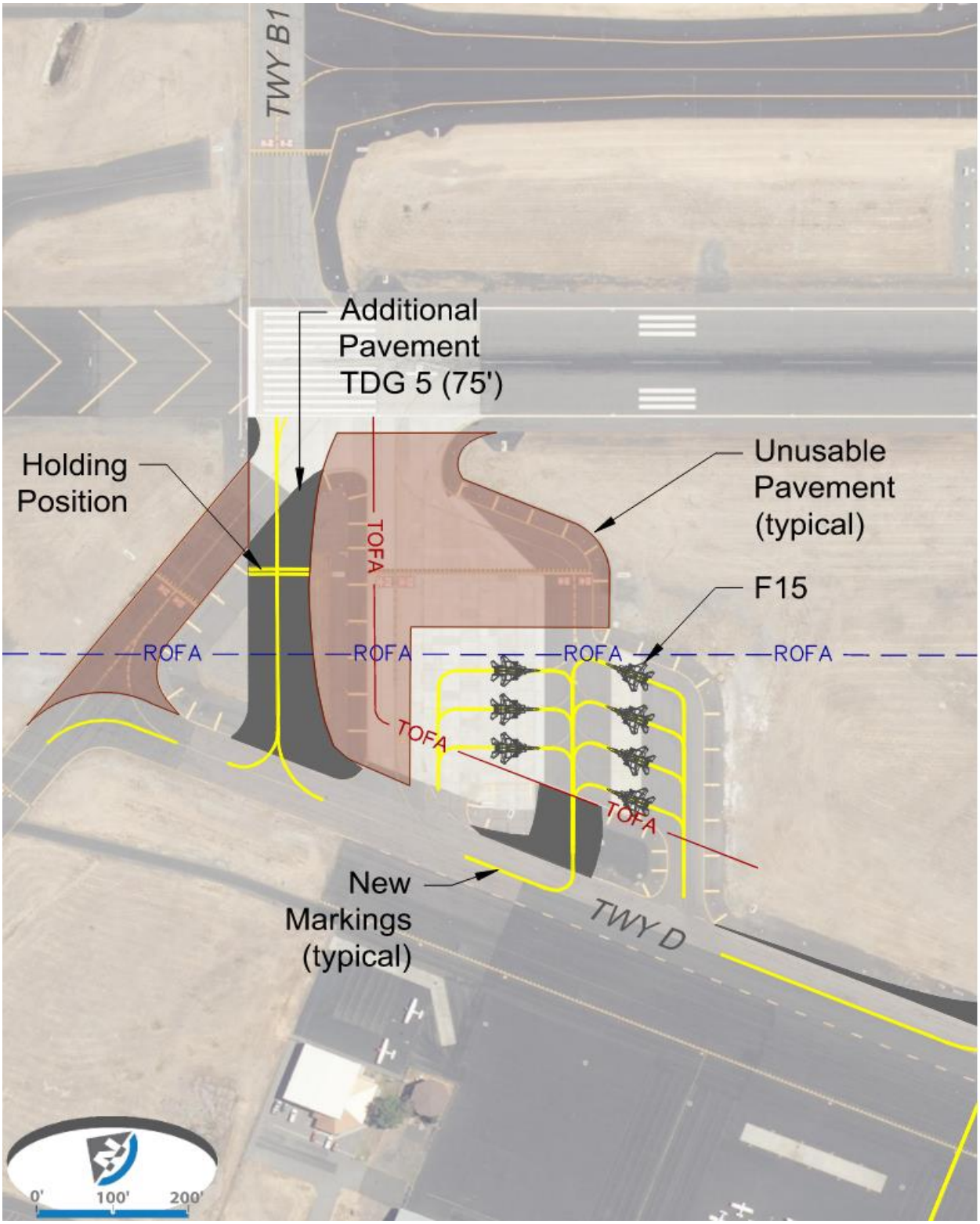
As discussed above, the Oregon ANG is proposing a new ILS system for Runway 14 to provide additional capability for operations during instrument weather conditions. It is anticipated that the ILS would be available for use by civilian aircraft, but its primary purpose is to enhance Oregon ANG instrument weather capabilities. The details of this proposal are discussed above in the instrument approach and NAVAIDs section. The ILS would not be funded by FAA as it is not required under FAA criteria.

Explosive Ordinance Recovery (EOR) Ramp Concepts

The realignment of Taxiway A and C into a single new Taxiway D1 connector to the Runway 14 threshold creates a runway access challenge for the Oregon ANG F-15s using the northern EOR ramp adjacent to Taxiway D. The existing access point to the runway from the EOR ramp does not meet taxiway separation standards. A realignment of the markings and parking spaces on the EOR ramp will be needed in order to provide direct access to Taxiway D1 to allow the F-15s to enter the runway environment. **Figures 4-15** through **4-17** show three potential layout options for the realignment of the EOR ramp. **Figure 4-17** includes a potential future expansion of the EOR ramp to include a total of 12 parking spaces and represents the preferred alternative.

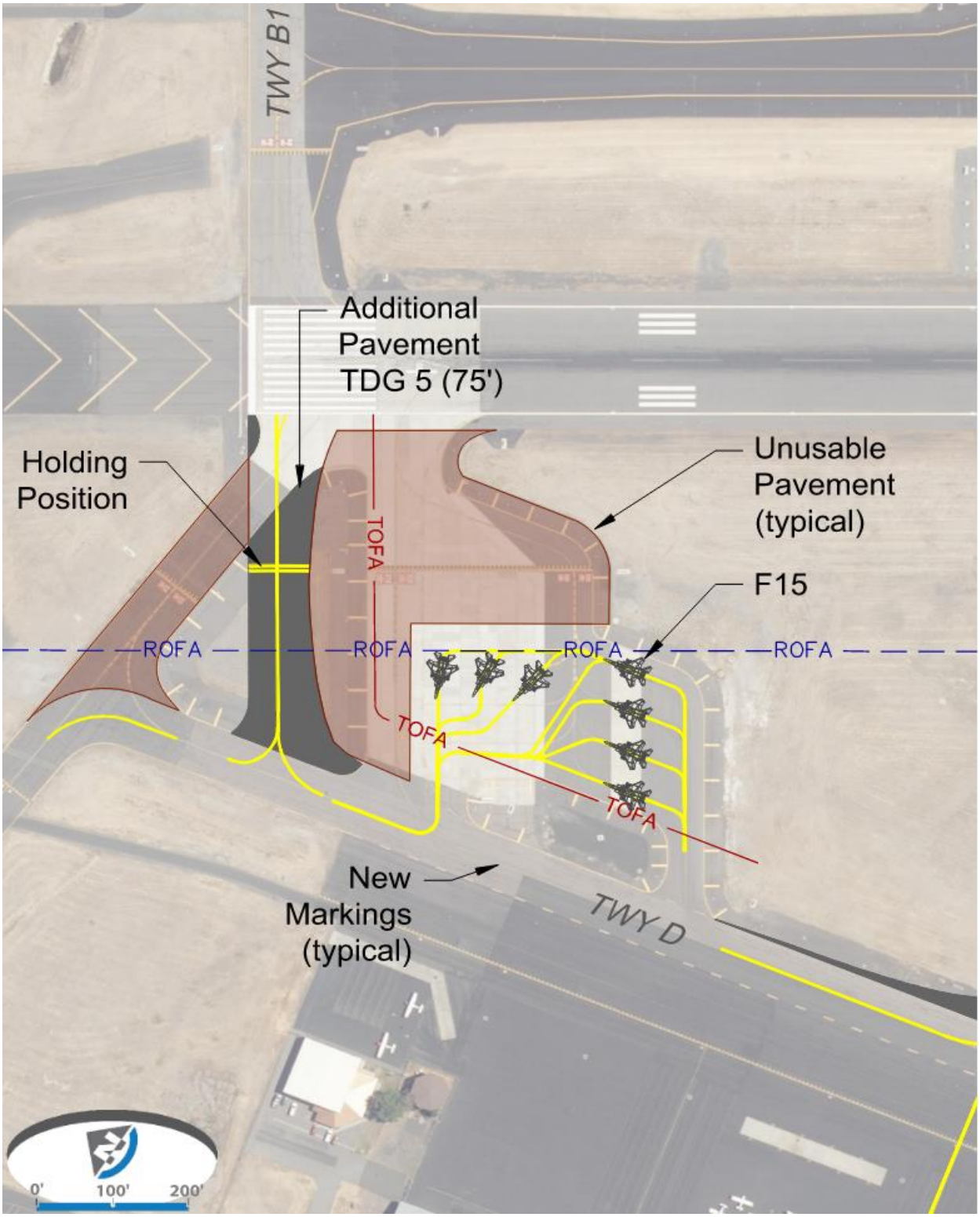
An additional challenge for the location of the EOR ramp is the proposed Runway 14 ILS system, which has an option for the siting of the GS antenna on the west side of Runway 14. Placement of the GS antenna on the westside would limit access to the EOR ramp while instrument approaches are being conducted. And likewise, F-15s parked on the EOR ramp would be inside the GS antenna critical area and would preclude other aircraft from using the Runway 14 ILS approach. In either case, locating the GS antenna on the west side has negative impacts to the operational efficiencies and capabilities of the intended Oregon ANG mission. Retaining the EOR ramp in its current location with a GS antenna on the west side would require additional coordination with the local ATCT and regional radar approach control to continue EOR operations during instrument weather conditions.

Figure 4-15 : Oregon ANG EOR Concept A



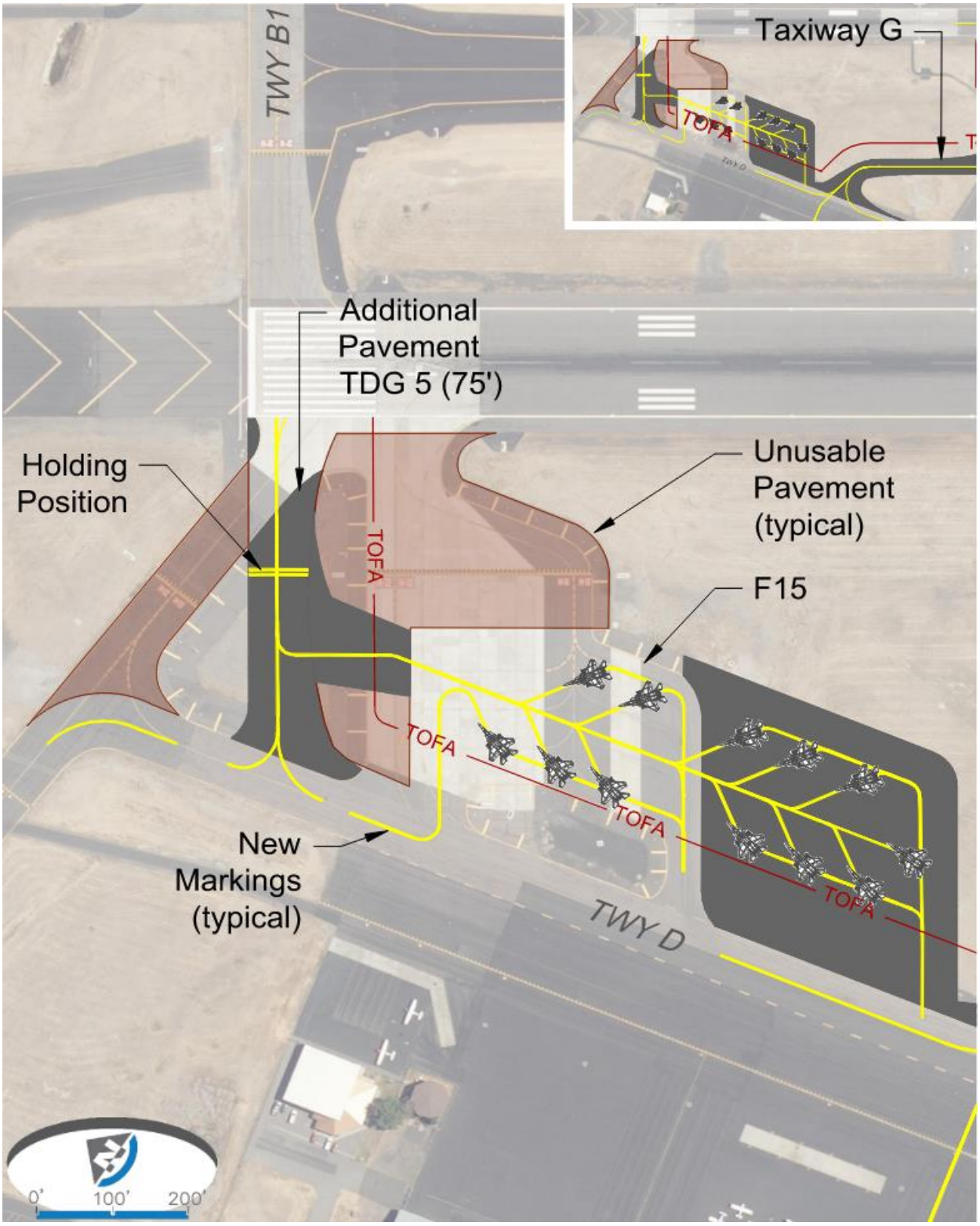
Source: Mead & Hunt, Inc. 2020

Figure 4-16 : Oregon ANG EOR Concept B



Source: Mead & Hunt, Inc. 2020

Figure 4-17 : Oregon ANG EOR Concept C (Preferred)



Source: Mead & Hunt, Inc. 2020

Building 400 Annex

The Building 400 Annex is located at the west end of Taxiway A, to the north of the west side GA apron and hangar area.

The areas reserved for future expansion of apron, hangars, and support facilities are shown in **Figure 4-18**. The Oregon ANG lease areas have been reserved for future use to support the expected growth in aircraft supporting the aggressor role for Oregon ANG training missions. An additional hangar and a blast fence (to protect areas to the south of the apron from jet blast) are shown on the extended parking apron. There are known Milkvetch sites in the proposed development area, so any projects will require updated Milkvetch surveys and environmental reviews before proceeding.

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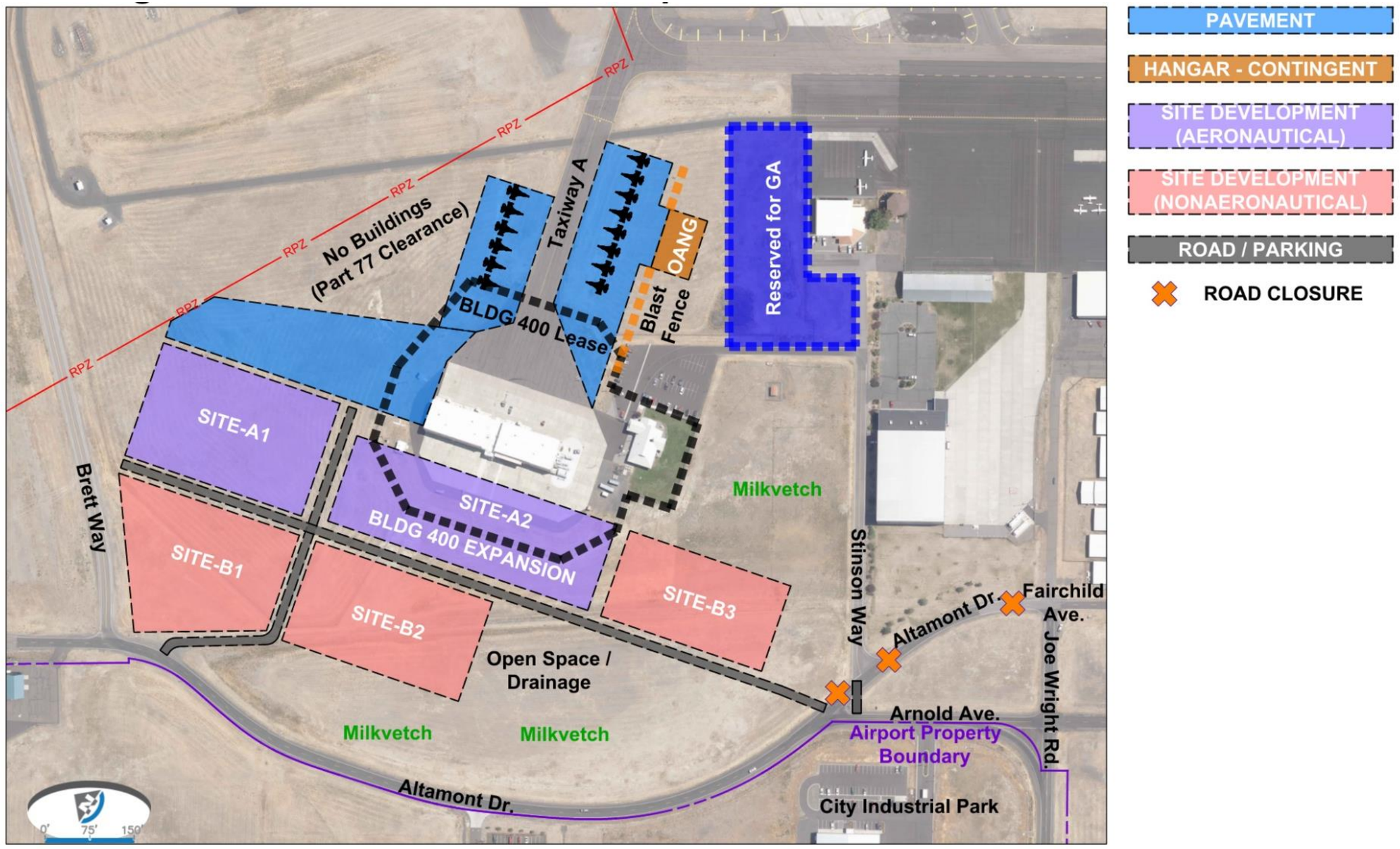
Figure 4-18 : Building 400 Annex Development



Source: Mead & Hunt, Inc. 2020

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Capital Improvement Projects

Figure 4-19 identifies capital improvement projects programmed by the Oregon ANG for the next five years (2020-2025). These projects are proposed within the Oregon ANG leasehold and include the following:

- Building 127 Addition: Includes a 4,750 square foot addition to the current multi-use facility to house the support services such as deployment processing, physical fitness training and testing, honor guard and office space.
- Running Track: A new 400-meter rubberized running track will be located west of Building 127.
- Building 210 Addition: Includes a 5,000 square foot addition to the backside of the existing communications facility in order to co-locate all the communications functions that are housed in various facilities around the base.
- Building 243 Operations Patio: A 30-foot by 60-foot concrete covered patio will replace the existing concrete patio on the south side of the building.
- Delta Barns: Includes a 4-bay, 8-parking-spot aircraft shelter with High Expansion Foam (HEF) fire suppression system and wet pipe sprinkler systems and will be located in the infield right area east of Taxiway D.
- Defense Logistics Agency (DLA) Compound: Existing complex will replace/expand facilities and will include the following: aboveground fuel storage tanks, pump house with a control room, product recovery tank, petroleum, oil, and lubricants (POL) operations building with a laboratory, refueling vehicle parking, truck loading and unloading points, motor gas storage tank, diesel storage tank, and supporting facilities.

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Figure 4-19 : Oregon ANG Capital Improvement Projects (2020-2025)

Source: Oregon ANG 2020
Notes: Defense Logistics Agency (DLA); Petroleum, Oil, and Lubricants (POL)

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LANDSIDE – NON-AERONAUTICAL FACILITIES

NON-AERONAUTICAL DEVELOPMENT OF AIRPORT PROPERTY

The following section describes the future landside facilities, which are on-airport areas outside of the airfield and are used to develop on-airport businesses. In conjunction with Airport-owned properties there is a large business park development owned by the City to the north of Airport development area.

AIRPORT BUSINESS PARK

Approximately 14.8 acres of LMT property is currently reserved for non-aeronautical development. This area is designated as the Airport Business Park and is located west of Arnold Avenue. Access roads have not been put in place and layouts are dependent upon the facility needs of prospective leaseholders. Utilities and other supporting infrastructure are stubbed in for connection to facilities when built. As discussed above, approximately 4 acres of the easterly portion of the Airport Business Park is needed for aeronautical development to meet forecasted GA hangar demand. As shown in **Figure 4-20,** approximately 10.8 acres of land would remain for the Airport Business Park**.**

Figure 4-20 : Airport Business Park

Source: Mead & Hunt, Inc. 2020

CITY INDUSTRIAL PARK

The City of Klamath Falls has a City Industrial Park located immediately north of the Airport Business Park. The City Industrial Park encompasses approximately 61 acres and is bound by Southside Expressway (Highway 140) to the north, Altamont Drive to the east, Joe Wright Road to the south, and Washburn to the west. The City owns 34.8 acres of land within the Industrial Parkland, which is available for lease or purchase by private entities. As described below, a new access road providing more direct access to LMT is proposed to go through the City Industrial Park.

AIRPORT ENTRANCE ROAD – REALIGNMENT

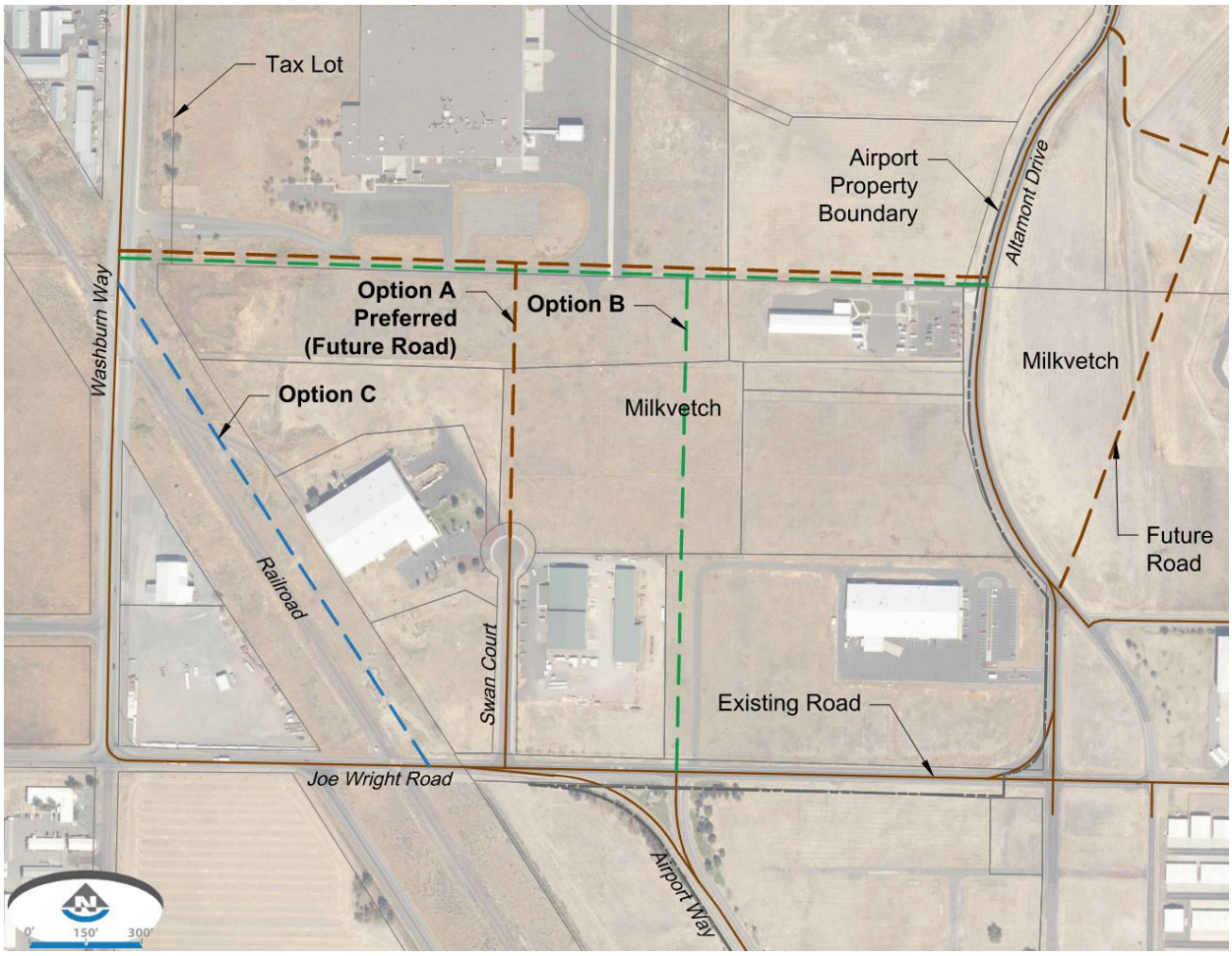
The primary entrance road to the terminal requires crossing the railroad line twice west of the airport on Washburn Way and Joe Wright Road. For pubic and emergency response purposes, a new entrance road access route is recommended to bypass the railroad tracks and connect directly with Washburn Way. **Figure 4-21** presents three potential alignments.

- Option A provides a new west/east road segment from Washburn Way to Altamont Drive. The north/south road segment would connect to Joe Wright Road via Swan Court.
- Option B is similar to Option A, but the new north/south road segment would connect at the intersection of Joe Wright Road and Airport Way. This alignment provides the most direct route to the LMT terminal.
- Option C reflects the future Washburn Way realignment included in the City of Klamath Falls Urban Area Transportation System Plan (TSP) Update (April 2012).

Option A is considered by the City to be the least problematic due to an existing tie-in for the surface street at Swan Court. Although Option B provides the most direct route to the LMT terminal, the protected species of Milkvetch may be present along the proposed north/south road segment and could require environmental mitigation efforts. The Option C alignment, which would parallel the railroad tracks, would be within existing railroad easements and would require coordination with the Union Pacific Railroad. Option A is deemed by the City to be the most feasible and preferred option.

The City's TSP also shows realignment plans for portions of Brett Way to connect with Homedale Road west of LMT. Brett Way and Summers Lane are used to access the eastside hangars and US Forest Service facilities. **Figure 4-22** shows the existing and future road system in the immediate vicinity of LMT.

Figure 4-21 : Airport Entrance Road Realignment



Source: Mead & Hunt, Inc. 2020

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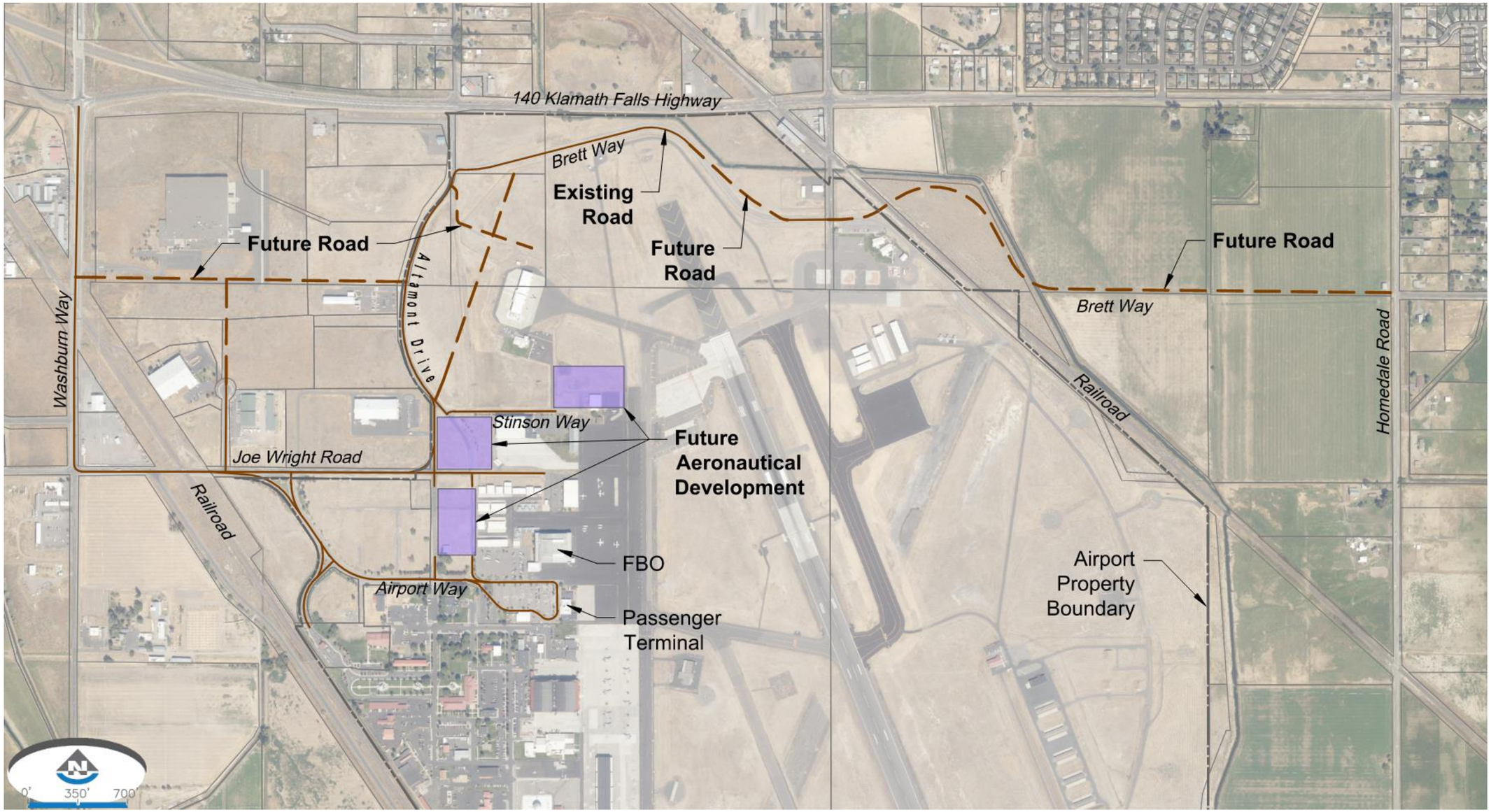
Figure 4-22 : LMT Road System



Source: Mead & Hunt, Inc. 2020

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