CHAPTER 5: ALTERNATIVES ANALYSIS

Introduction

This chapter of the Airport Master Plan discusses airport development alternatives considered in the planning process for the Warren Municipal Airport (D37). The objective of this chapter is to clearly document the recommended airport development that meets the needs of airport users, as well as the strategic vision of the City of Warren.

Alternatives evaluated for this study are based on comparing existing conditions with facility requirements reviewed in detail in the previous chapters. Potential impacts of each alternative considered are discussed and used to help the airport select a preferred alternative(s) to be shown on the Airport Layout Plan. Alternatives outlined are split into the following functional facility areas:

- Airfield
- Terminal / Hangar Area

A Preferred Development Strategy based on the selected alternative(s) is summarized after the analysis. This preliminary plan provides a guideline for implementation based on identified needs and priorities. The recommended plan to implement the proposed development is outlined in **Chapter 6: Implementation**.

Evaluation Process

Steps

A wide range of alternatives is evaluated to determine the best solution for the airport to meet facility needs. In many cases the process is iterative to react to new information and input. FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans* identifies an alternatives analysis process to progressively screen alternatives to identify a recommended development plan. The process includes these steps:

1. **Identify** the functional airport elements that will be analyzed as primary and secondary elements. Include a "no action" alternative for comparative purposes.

2. **Evaluate** each alternative in an initial screening process to determine the ability for each to meet basic objectives. Criteria used to evaluate alternatives include operational performance, best planning tenets, environmental and fiscal factors. No weighting factors were used through the evaluation process because weighting factors by their nature create a bias and impedes the ability to truly consider the complexities of planning decisions.

3. **Select** preferred alternative(s) that best meet the needs of the airport based on the benefits and impacts. Preferred alternatives are combined into a single recommended alternative with refinements made as needed.

Review & Approval

The alternatives evaluation process is the most collaborative portion of the master plan study. The alternatives were reviewed and refined through meetings with agency representatives and the study's Master Plan Advisory Committee (MPAC). The preferred alternatives were presented to the City, airport

users, and for public review and comment at a public open house held on November 1, 2023. The draft plan was approved by the City of Warren on August 16, 2023.

Evaluation Criteria

Evaluation criteria is developed to determine the relative strength and weaknesses of the alternatives. FAA AC 150/5070-6B identifies criteria that would be examined in any alternatives evaluation. Using this guidance and local considerations, airport-specific criteria has been formulated. The alternative evaluation criteria utilized for this study is as follows:

OPERATIONAL PERFORMANCE

This factor evaluates how well the airport operates as a functional system. These include:

- **Capacity** to meet forecasted activity demands within and beyond the planning horizon
- **Capability** to meet FAA design standards to safely accommodate the critical design aircraft
- **Efficiency** to accommodate alternative elements as a combined airport system

BEST PLANNING TENETS AND OTHER FACTORS

This factor involves determining the relative strengths and weaknesses of the alternatives. The following tenants are typically reviewed:

- Conformance to industry best practices for safety and security
- Conforms to the intent of FAA design standards and other guidelines
- Provides for the highest and best on- and off-airport land use
- Allows for forecast growth and growth beyond the planning horizon
- Provides flexibility to react to unforeseen changes
- Conforms to the City of Warren's strategic vision
- Conforms to appropriate local, regional, and state transportation and other plans
- Technically feasible, constructible, and implementable
- Socially and politically feasible
- Satisfies airport user needs

ENVIRONMENTAL FACTORS

The potential effects of the alternatives upon the natural and built environment is an important consideration. These factors are evaluated early in the process to determine whether alternatives are likely trigger impacts to comply with the National Environmental Policy Act (NEPA), or if additional alternatives need to be considered.

FISCAL FACTORS

A fiscal analysis is necessary to determine if the alternative fits within the financial resources of the airport, as well as potential federal and state funding partners. Preparing rough planning-level development cost estimates is an effective way to compare alternatives. Evaluating the ability for the airport sponsor to finance each alternative is also important as it will provide an indication of the feasibility of proposed development. Fiscal factors to be reviewed in this study include

- Total Planning-Level Project Cost
- Ability to Receive State funding
- Ability to Fund Local Share

Airfield Development Alternatives

Needs Summary

The airfield is vital to the airport's core infrastructure for accommodating aircraft operations. The following section summarizes key airfield facility requirement findings:

- **Parallel Taxiway:** Full 35' wide parallel taxiway to meet design standards TDG-2A with medium intensity taxiway lighting to eliminate runway congestion by aircraft taxiing back.
- **Land Acquisition:** There is currently land needed to meet the runway safety standards, the MnDOT clear zones, and the parallel taxiway.
- **Certified Weather:** Install a certified Automated Weather Observation System (AWOS) for instrument approach procedures and medical aircraft operations.

Alternatives Evaluated

PARALLEL TAXIWAY

The airport does experience congestion and having to taxi back on the runway has raised safety concerns for its users. Two options were presented to the planning committee, a full parallel taxiway and a partial parallel taxiway.

Partial Parallel Taxiway

A partial parallel taxiway of 2,300 feet long and 35 feet wide was considered because this would require no land acquisition on the Runway 30 End.

Advantages:

- No land acquisition would be necessary.
- Would get the Runway 12 End turn-around out of the runway safety area.

Disadvantages:

- Aircraft would still have to us roughly 900 feet of the runway on the 30 End to taxiback.
- Would be a temporary solution.

Full Parallel Taxiway

The full taxiway would run parallel for the entire length of the runway at 3,199 feet long and 35 feet wide.

Advantages:

- Get aircraft off an active runway during busy times thus removing the likely hood of a close call.
- Would remove the turn-arounds in the runway safety area.

Disadvantages:

- Would require at least 2.10 acres of land acquisition.
- Crosses the turf runway.

LAND ACQUISTION

During this planning study the runway object free area (ROFA), runway protection zones (RPZs), MnDOT Clear Zones, and MnDOT Safety Zones were evaluated.

On the Runway 30 End there is currently 2.10 acres for the ROFA that need to be purchased in fee as soon as the City of Warren is able. When the full parallel taxiway is constructed there will also need to be an additional 2.10 acres acquired in fee on the north side of the Runway 30 End for the parallel taxiway and to meet the taxiway safety areas. See **Figure 5-1**, the future airport property outline.

Currently, the City of Warren has some easements for the RPZs but some land within the RPZs are not under the necessary control. There is also MnDOT Clear Zone land that needs *"to be acquired and/or controlled"* under the MnDOT State Aviation System Plan released in 2022. The following table lays out the current easements in place for the RPZs and needed land control for the RPZs and clear zones.

Table 5-1 – RPZ and Clear Zone Acquisition (acres)

Runway End	12	30	4	22
Current RPZ Control	6.50	10.10	5.20	6.60
RPZ needing Control	1.60	2.90	1.40	1.20
Clear Zone to be Acquired/Controlled	Same as RPZ	16.50*	Same as RPZ	Same as RPZ
Total to be Acquired/Controlled	20.70			

*Source: KLJ Analysis. Notes: *Indicates land amount including the easement needed for the remaining RPZ control.*

In total there are roughly 25 acres that need to be acquired in fee or gain control as an easement. The possibility of trading land for parts of the current airport property that are not being used currently and will not be utilized for future development was also discussed. The recommended airport property to be traded includes the land along the far south and east edges of the airport property as long as they do not include any runway or taxiway safety areas.

The Warren Municipal Airport currently has exceeded the minimum standards of the MnDOT Safety Zones recommendation. Within these safety zones are certain restrictions and this enacts land uses in areas of airport influenced communities. When the ALP is completed, options for the minimum requirements will be presented which the City of Warren should follow.

CERTIFIED WEATHER

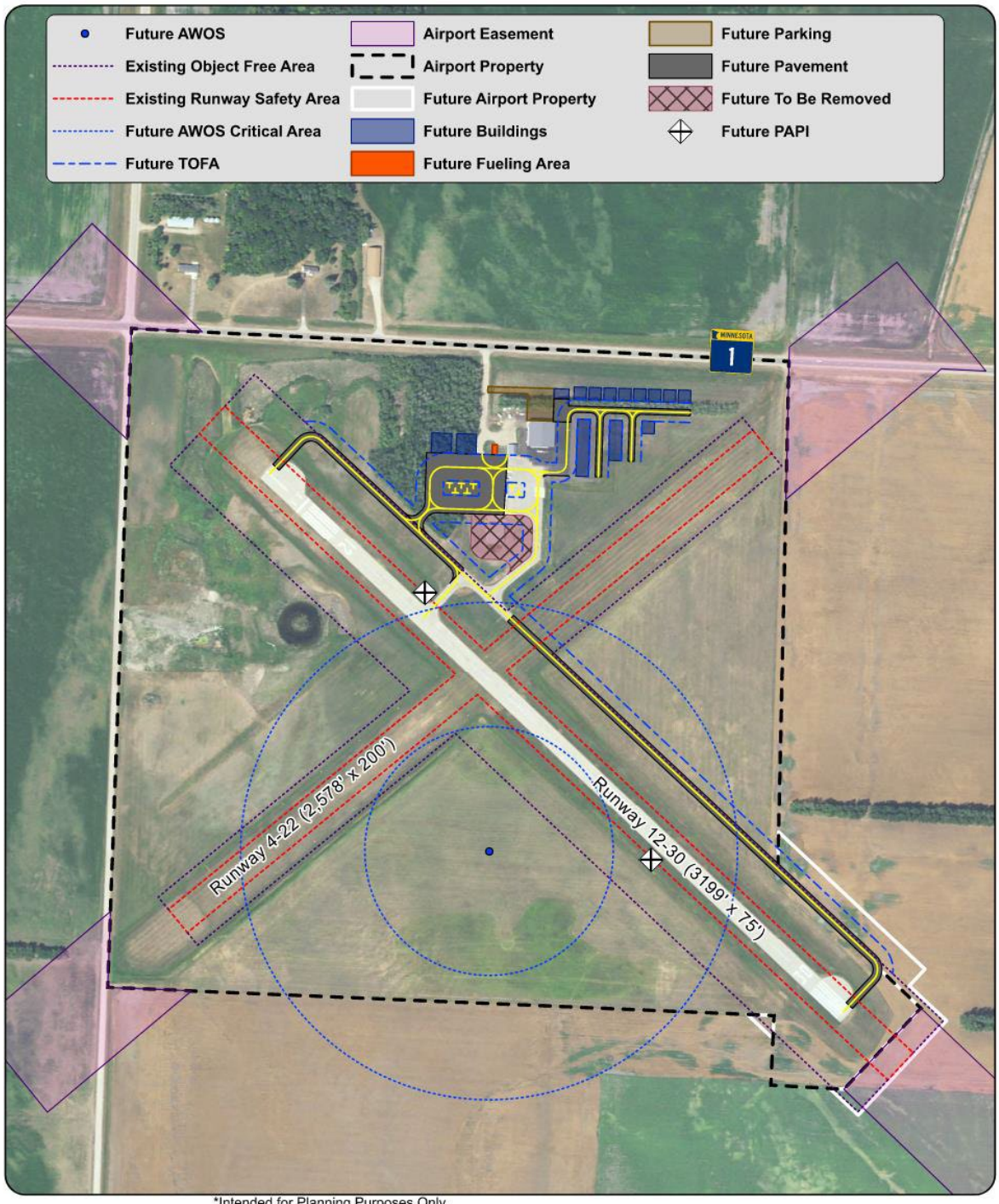
As stated in **Chapter 4**, it is recommended for an AWOS to be installed on the airfield. The AWOS is suggested to be installed in the long-term of this planning period or when medical centers in the area are planning to expand which can lead to more operations.

The AWOS will be planned to be installed south of the current windsock south of the runway intersection. See **Figure 5-1**.

Preferred Airfield Alternative

Figure 5-1 below shows the preferred airfield alternative working with the planning advisory committee, City of Warren, and State of Minnesota.

Figure 5-1 - Preferred Airfield Alternative



Terminal/Hangar Area Alternatives

NEEDS SUMMARY

The development concepts in the terminal/hangar area consider options for various infrastructure elements. **Figure 5-2** depicts the existing conditions of the airfield. The following key elements were considered in preparing the alternatives:

- **Based Aircraft Storage**: Currently there is approximately 25,100 square feet (SF) of aircraft storage facilities for the based tenants. It was recommended Group I T-Hangars be developed for near term needs while individual box hangars be determined later in the planning process. Storage will be developed as demand dictates using public or private funds.
- **Apron Expansion:** Total apron space is roughly 8,000 square yards (SY) with four tiedown spots. The apron must accommodate the required aircraft parking positions and maneuvering standards. Expansion of the apron was evaluated to meet the needs of Group II aircraft. Different apron layouts can be seen in the following alternatives.
- **Agriculture Spray Operator Area:** The based Air Tractor 802s being used for agricultural spray operations are currently housed in a 100’ x 100’ hangar on 2,800 SY of asphalt and an 80’ x 70’ hangar that is coming to the end of its useful life. An area dedicated to these types of aircraft with their own apron space and a minimum of at least one 80’ x 80’ hangar was evaluated and can be seen in the below alternatives.

Other Facilities

NEEDS SUMMARY

Included in the development concepts was a fuel farm and a dedicated building for snow removal equipment (SRE).

- **Fueling Facility:** A 6,000-gallon above ground AVGAS tank with a 24-hour credit card reader was evaluated. The placement of this facility was based on apron configuration, aircraft access, and limited a vehicle delivery tanker having to drive on the apron.
- **SRE Building:** A dedicated 40’ x 60’ storage building for SRE was evaluated in all alternatives. This building was shown to have direct apron access along with road side access for quick snow removal of airside and landside surfaces.
- **Vehicle Access and Parking:** The following alternatives have access roads and additional parking depicted depending on the alternative layout. This is to minimize vehicles driving on the apron and taxilanes.

Initial Alternatives Evaluated

The following was presented to the planning advisory committee for an initial round of alternative options.

NO BUILD

See **Figure 5-2 - Existing Terminal Area.**

Advantages: No cost

Disadvantages: No improvements would be made to meet existing needs or to accommodate future demand.

Figure 5-2 - Existing Terminal Area

ALTERNATIVE 1

See **Figure 5-3 - Alternative Option 1**. This offers:

- Apron: 3,600 SY of additional apron space reconfiguring the tiedown layout to offer seven spots total and lots of maneuvering room.
- Taxilanes: All for Group I aircraft running parallel to the new apron and north to south for new based aircraft storage.
- Based Storage: All Group I hangars including three, four, and six-unit T-hangars, three 40’ x 50’ and four 50’ x 50’ individual box hangars.
- Other Facilities: Fuel farm will be located on the north edge of the new apron and the SRE building north of the current hangar row.

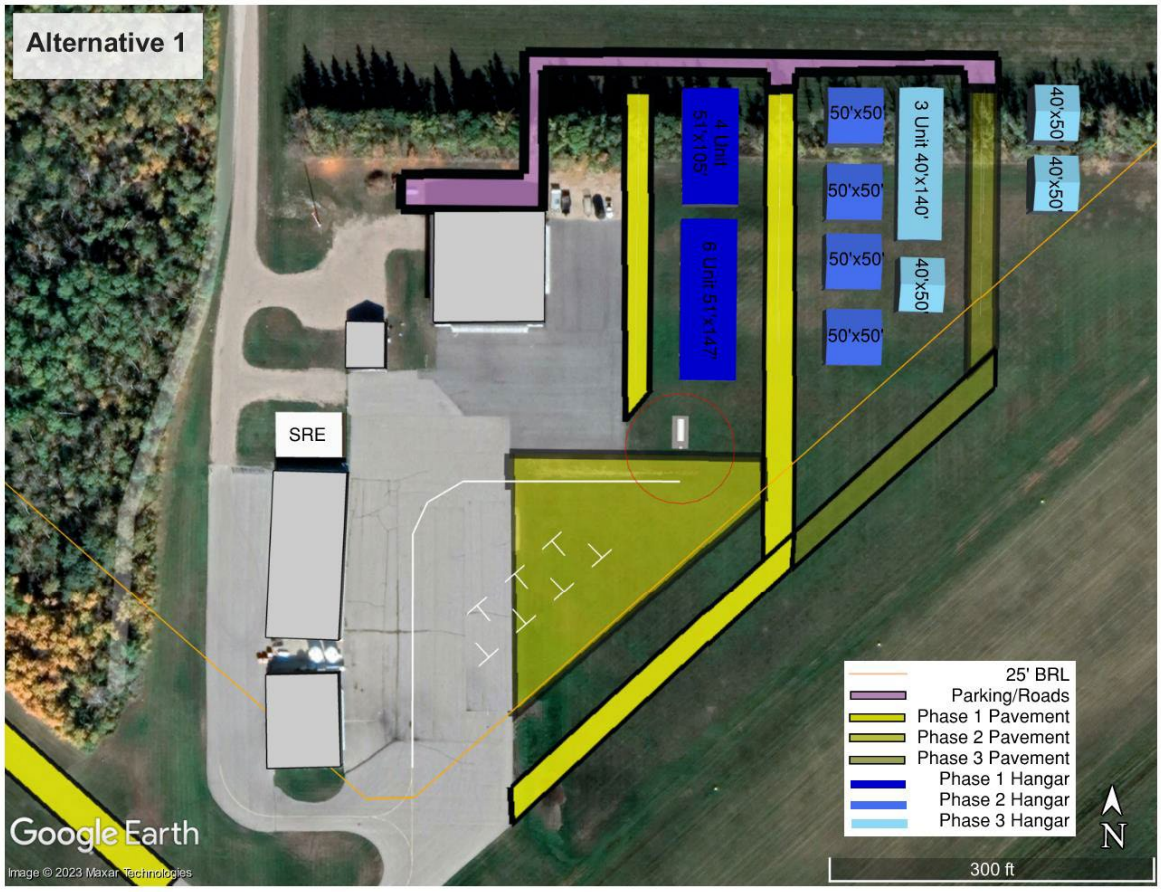
Advantages:

- No changes of current facilities.
- Offers a lot of maneuvering space around the apron and to the based hangars.

Disadvantages:

- Need new pavement for immediate building of hangars.
- Reconfiguration of current tiedown location.

Figure 5-3 - Alternative Option 1



ALTERNATIVE 2

See **Figure 5-4 - Alternative Option 2.**

- Apron: New 3,000 SY of apron to the east of the current apron for nine new tiedown locations. 4,200 SY of apron to the west of the current apron for agriculture spray operations.
- Taxilanes: All new taxilanes on the east to based storage are for Group I aircraft while the taxilane for the spray operations area is for Group II aircraft.
- Based Storage: Group I hangars to the east includes a four-unit T-hangar, eight 40’ x 40’ and 40’ x 50’ individual box hangars. An 80’ x 80’ hangar is planned for the sprayer operations on the west apron.
- Other Facilities: Fuel facility will be next to the spray operations hangar on the west apron and the SRE building is placed north of the current hangar row.

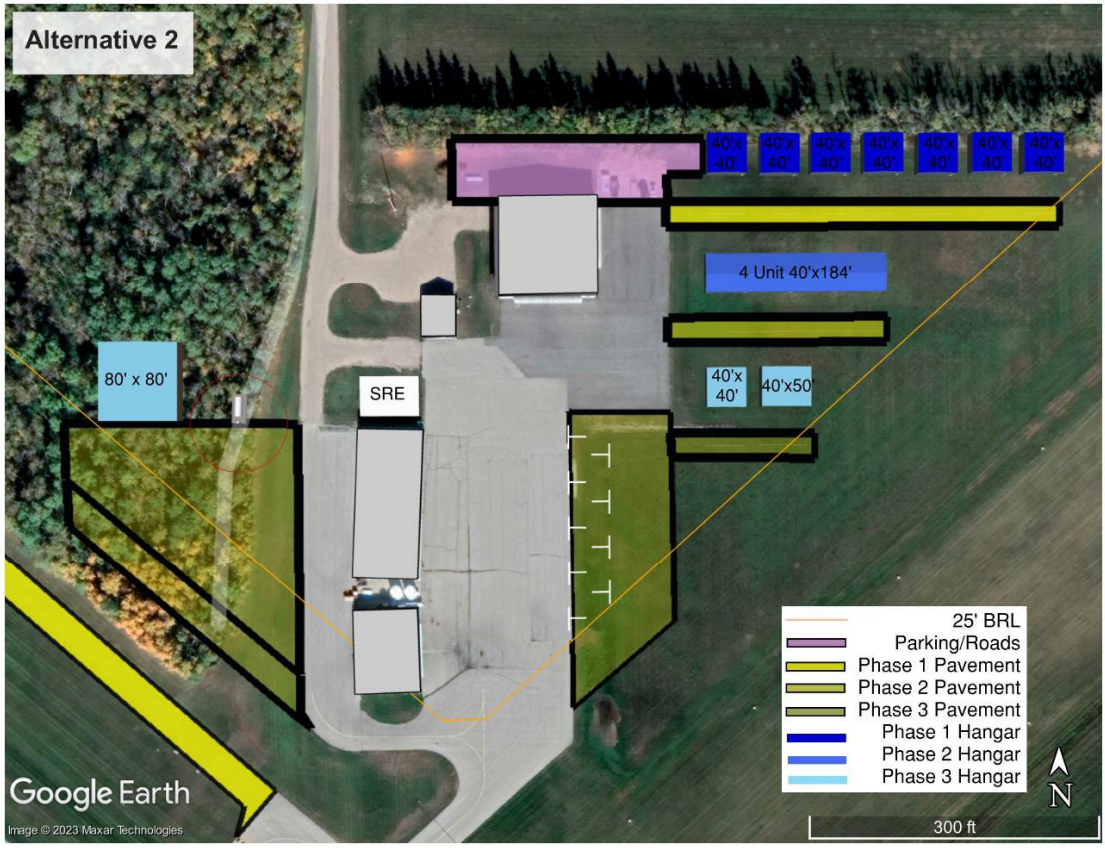
Advantages:

- No changes of current facilities.
- Separates the agricultural spray operations from other airfield tenants.

Disadvantages:

- Fuel is far for aircraft based on the east side of the terminal area.
- Needs new pavement for the immediate building of hangars

Figure 5-4 - Alternative Option 2



ALTERNATIVE 3

See **Figure 5-5 - Alternative Option 3.**

- Apron: 4,400 SY of apron surrounding the west side of the current west taxilane with four tiedown spots and 600 SY in the corner of the current and north apron for the fuel farm.
- Taxilanes: Group I taxiway parallel to Runway 4-22 then breaking into two taxilanes heading north to based aircraft storage. Additional Group II taxilane extending to the north on the current north apron.
- Based Storage: Group I storage hangars include two eight-unit T-Hangars, two four-unit T-Hangars, five 40'x 40' and three 40' x 50' individual box hangars. There is an 80' x 80' hangar located directly to the north of the current 100' x 100' hangar facing east.
- Other Facilities: Fuel facility will be on the 600 SY apron in the corner of the current and north apron. The SRE building will be next to the current terminal building along the north edge of the new expended apron.

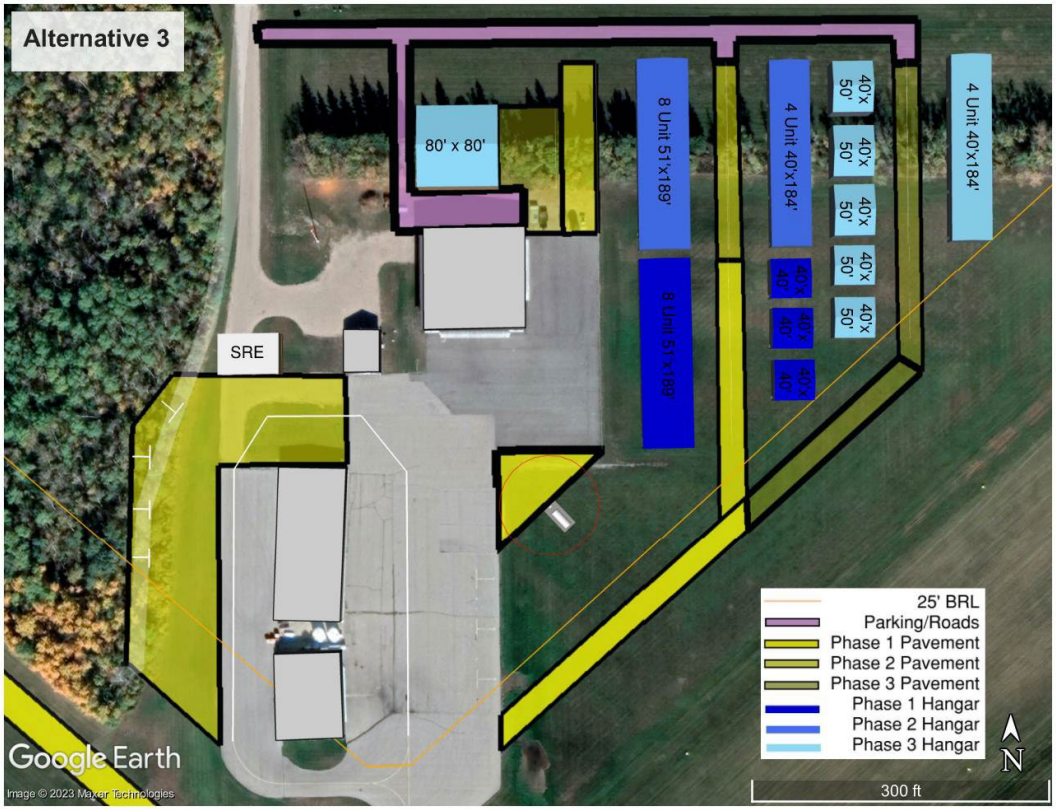
Advantages:

- No changes of current facilities.
- Extends the agricultural spray operations in the current location.

Disadvantages:

- Tiedown locations are not ideal in relation to the terminal building.
- Extra unused pavement because of the building restriction line.

Figure 5-5 - Alternative Option 3



ALTERNATIVE 4

See **Figure 5-6 - Alternative Option 4.**

- Apron: 3,200 SY of pavement added west of the current apron. Once the current T-hangar row and individual south box hangar have reached the end of their useful life that area will be leveled for the new 10 tiedown spots.
- Taxilanes: Three new Group I taxilanes will run parallel to the planned runway taxiway on the far west side taxilane with a direct access to the Runway 12-30 parallel taxiway.
- Based Storage: The three planned west taxilanes will include a six unit T-hangar and three 40’ x 50’ individual box hangars. The east apron expansion will house an 80’ x 80’ and 100’ x 100’ box hangars facing west.
- Other Facilities: The fueling facility will be located next to the new 80’ x 80’ hangar on the southeast corner of the apron expansion. The SRE building will be on the far north edge of pavement between the current and new 100’ x 100’ hangars.

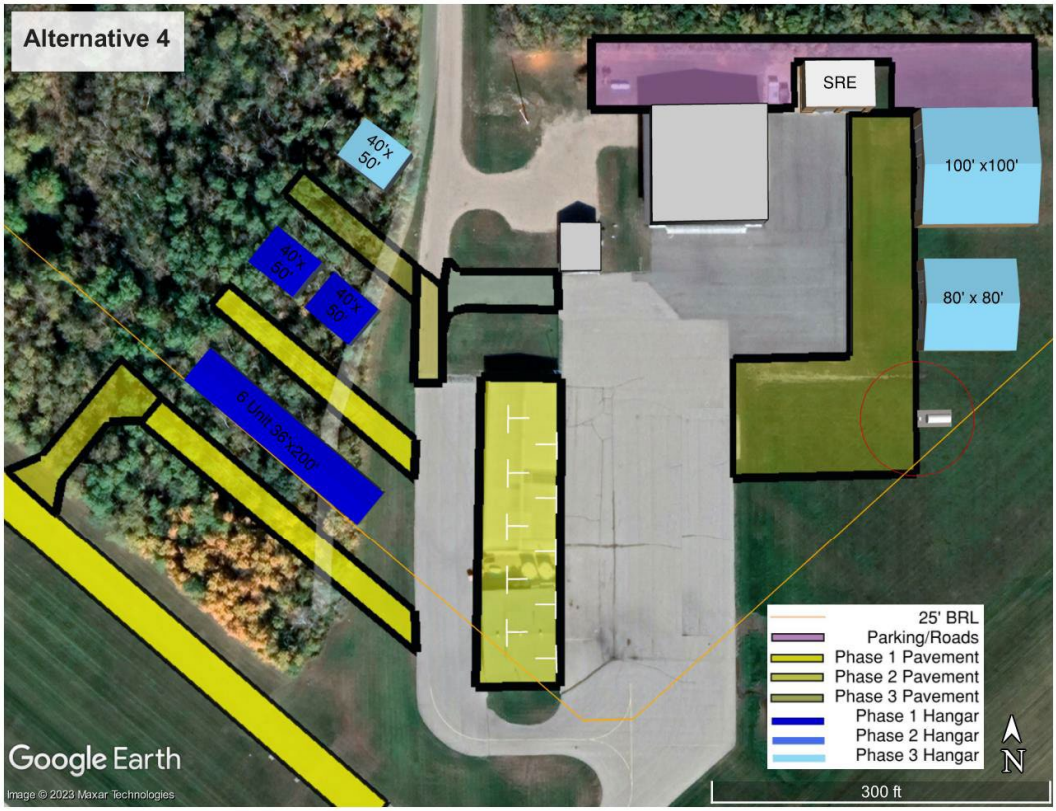
Advantages:

- Separates the agricultural spray operations area from other airfield tenants.
- Offers a lot of maneuvering space around the apron and tiedown locations.

Disadvantages:

- Fuel facility on opposite side of the airfield for some based tenants.
- Removes some current facilities.

Figure 5-6 - Alternative Option 4



Final Alternatives Evaluated

ALTERNATIVE 1 VERSION 2

This option took elements from Alternative Option 1 and Alternative Option 3 and was adjusted based on feedback from the planning advisory committee. See **Figure 5-7 - Alternative Option 1 Version 2**.

- Apron: 1,800 SY of pavement to the west of the current terminal, squaring off the current apron. Once the current T-hangar row and south box hangar have reached the end of their useful life, that area will be developed for 10 tiedown spots.
- Taxilanes: A Group I taxilane will extend to the east from the middle of the current apron, then lead parallel with Runway 4-22 and then two taxilanes will run north for the hangar storage. Another taxilane will lead north from the north edge of the current apron.
- Based Storage: There will be two six-unit T-hangar rows and a three-unit T-hangar row. This Includes four 50’ x 50’ and four 40’ x 50’ individual box hangars. Two 80’ x 80’ hangars will go on the new west apron facing east and one 80’ x 80’ will go directly north of the current 100’ x 100’.
- Other Facilities: The fuel farm and SRE building will go west of the current terminal building on the north edge of the new west apron.

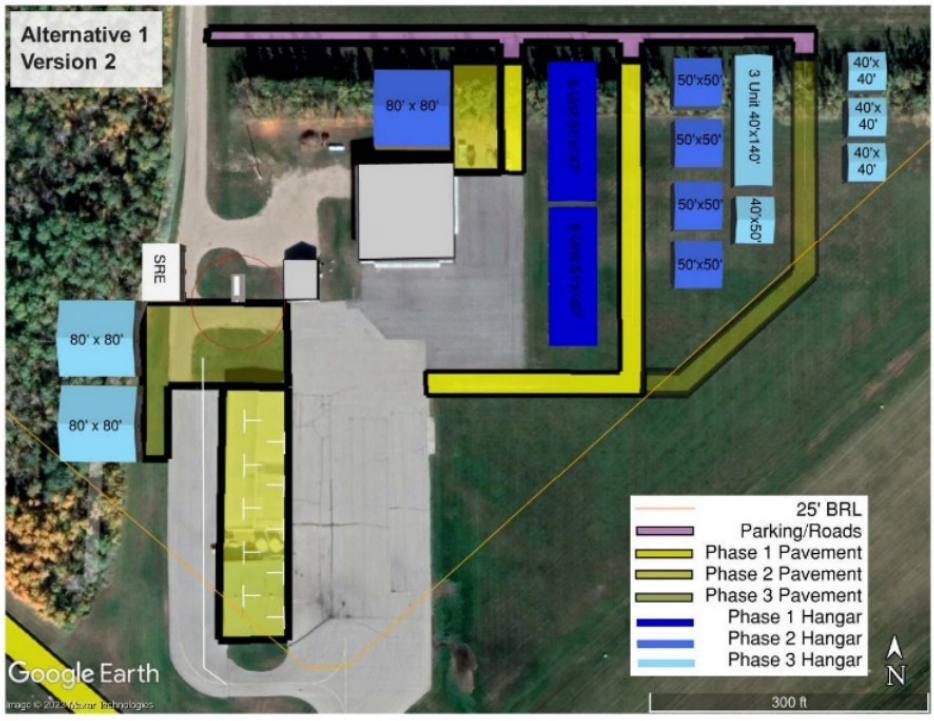
Advantages:

- Lots of room for agricultural sprayer operations.
- One row of six-unit T-hangar available for immediate build without other elements being added.

Disadvantages:

- Fuel facility on opposite side of airfield as some based tenants.
- Removes some current facilities.

Figure 5-7 - Alternative 1 Version 2



ALTERNATIVE 2 VERSION 2

This option was adjusted from Alternative Option 1. See **Figure 5-8 - Alternative Option 2 Version 2**.

- Apron: An additional 3,400 SY of pavement will be added to the east of the current apron area reconfiguring the current tiedown spots to include six total spots and a 2,100 SY apron will be added to the west side.
- Taxilanes: Three Group I taxilanes will run to the east of the current apron and new east apron that will house aircraft storage. A Group II taxiway connector from the Runway 12-30 parallel taxiway will be for the new west apron area.
- Based Storage: Eight 40’ x 40’ and a 40’ x 50’ individual box hangar, and one row of a four-unit T-hangar along the three east taxilanes. Two 80’ x 80’ hangars will be placed on the planned west apron facing south for agricultural spray operations.
- Other Facilities: The fuel facility will be placed directly south of the current terminal and that part of the apron will be removed to control aircraft parking. The SRE building will be on the far north edge of the current apron next to the current 100’ x 100’ hangar.

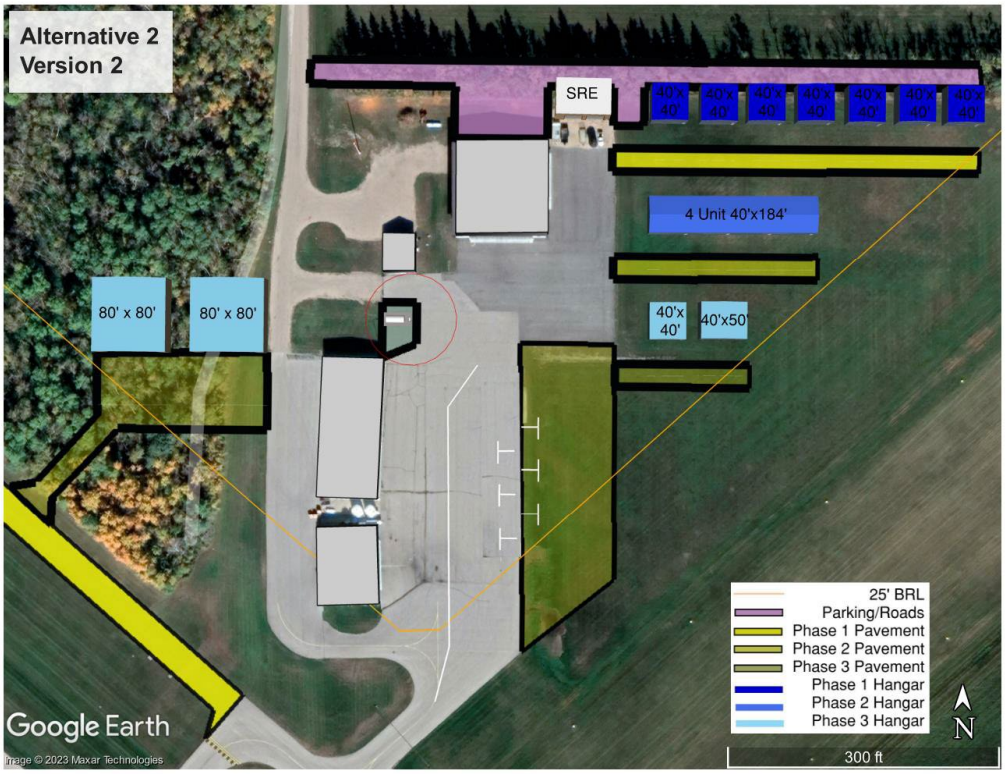
Advantages:

- Minimal changes of current facilities.
- Fuel facility is centrally located.

Disadvantages:

- Pavement will need to be added before building based storage facilities.
- Little maneuvering room around the terminal and fuel facility.

Figure 5-8 - Alternative 2 Version 2



ALTERNATIVE 4 VERSION 2

This option was adjusted from Alternative Option 4. See **Figure 5-9 - Alternative Option 4 Version 2**.

- Apron: 2,900 SY of pavement will extend the north apron to the east. At the end of their useful life, the current T-hangar row and south individual box hangar will be developed for seven tiedown spots.
- Taxilanes: Two Group I taxilanes will extend to the west and run parallel to the Runway 12-30 parallel taxiway with a connect for the far south taxilane and parallel taxiway.
- Based Storage: There will be one six-unit T-hangar row and two four-unit T-hangar rows with four 40’ x 50’ and three 40’ x 40’ individual box hangars along the west taxilanes. A 100’ x 100’ and 80’ x 80’ hangar will be placed on the new east apron facing south for agricultural spray operations.
- Other Facilities: The fuel facility will be placed on the north edge of the new tiedown area and the SRE building will go directly west of the fueling facility.

Advantages:

- Centrally located fuel facility for easy access for all airport users.
- Separates agricultural sprayer operations from other based tenants.

Disadvantages:

- Taxiing to some hangar locations can take longer than desired.
- Potential for heavy traffic on the west taxilanes.

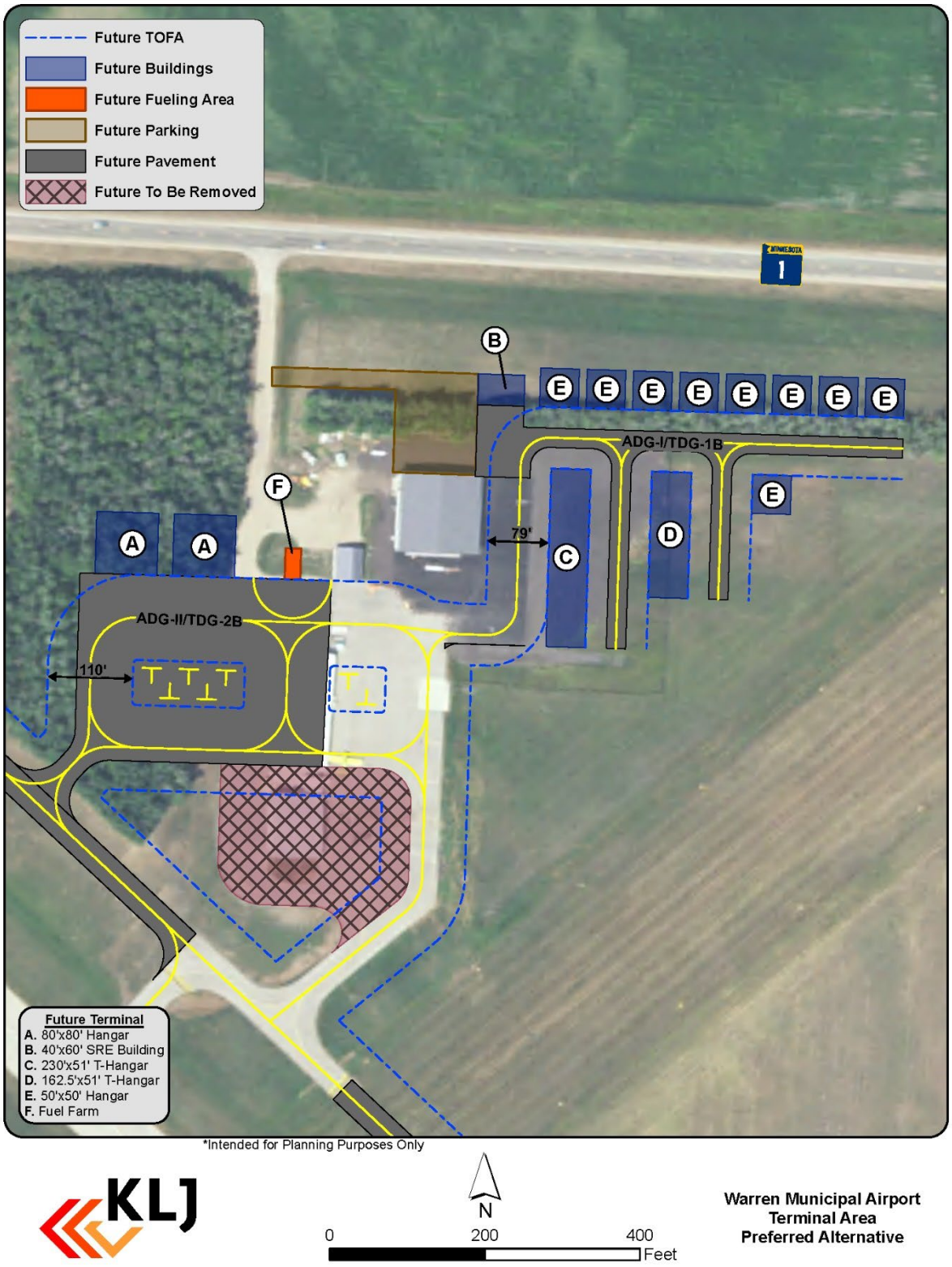
Figure 5-9 - Alternative 4 Version 2

Preferred Terminal Alternative

After evaluating the last three alternatives the final decision was made, see **Figure 5-10 - Preferred Terminal Alternative.** This alternative combines elements of previous Alternative 1 Version 2 and Alternative 2 Version 2.

- Apron: To the west of the terminal and west of the current apron, 6,400 SY of pavement will be added. At the end of its useful life the current T-hangar row will be leveled and paved for apron development. The south individual box hangar and the south 4,800 SY of the current apron will be removed at the end of its useful life. Once the apron is completed it will have a total of seven tiedown spots.
- Taxilanes: An east Group I taxilane will be added along the north edge of the current north apron which will have three taxilanes branching off leading to the south. A Group II taxiway will connect the new apron and the Runway 12-30 parallel taxiway. The current 35’ wide taxiway from the Runway 12-30 and the current apron will continue to be utilized through the planning period, and when the south part of the apron gets removed it will connect to the apron area utilizing the east side of the current apron.
- Based Storage: Seven 50’ x 50 individual box hangar will face south along the new north taxiway. A 10-unit T-hangar can be installed right away if desired along the east edge of the north apron. An eight-unit T-hangar row will face east and west along two of the south taxilanes and another 50’ x 50 individual box hangar will face west along the second taxilane leading south. Two 80’ x 80’ hangars will face south along the north edge of the new apron for agricultural spray operations.
- Other Facilities: The fuel facility will be located directly west of the terminal building along the north edge of the new apron. The SRE building will be west of the new north hangar row and northeast of the current 100’ x 100’ hangar.

Figure 5-10 - Preferred Terminal Alternative



Summary

The recommended development identified in this chapter includes the following:

- ROFA Land Acquisition: Acquire in fee or trade roughly around 2.10 acres of land for the Runway 30 End for the Runway Object Free Area (ROFA). This runway does not meet the necessary standards until this land is under the City of Warren's control for the airport and should be done immediately.
- Land Control: The City of Warren needs to obtain land control in fee acquisition or as an easement for roughly 21 acres for the remaining areas of the RPZs and MnDOT clear zones that are not currently controlled. This should be done in the short-term (0-5 years).
- Parallel Taxiway: Construct the full 3,199' long by 35' wide parallel taxiway for Runway 12-30. This will also remove the turnaround area currently on each runway end out of the Runway Safety Area (RSA). This will require a land acquisition or land trade of roughly another 2.10 acres. This amount of land includes all safety zones for the new taxiway. Construction and land purchases should be taking place in the short-term (0-5 years) along with construction.
- AWOS: Install a certified Automated Weather Observation Station (AWOS) south of the current runway intersection for there is already electricity in that area for the lighted windcone. This is for mid- to long-term development of the airfield (6-20 years) or if medical operations increase.
- Precision Approach Path Indicators: Install two box precision approach path indicators (PAPIs) for both current Runway Ends 12 and 30 in the mid- to long-term (6-20 Years).
- Storage T-Hangars: The city should develop the 230' x 51' 10-unit T-hangar in the short-term (0-5 years) and the 162.5' x 51' eight-unit T-hangar short- to mid-term (0-10 years)
- Taxilanes: Construct one 500' long by 25' wide far north taxilane to house individual box hangars which will be developed in three stages. The first stage, starting at the current north apron heading east will be roughly 200' long in to be developed in the short- to mid-term (0-10 years). The second part will be roughly 130' long to be constructed in the mid- to long-term (6-20 years). The final section at 170' long should be planned to be constructed in the long-term (11-20 years) or for ultimate development (21+ years).
  As that north taxilane is being developed two other taxilanes leading to the south should be developed; the first one is roughly 260' long by 25' wide and will go on the east side of the 10-unit T-hangar row which should be constructed in the short- to mid-term (0-10 years). The second taxilane is roughly 220' long by 25' wide and will be to the east of the eight-unit T-hangar row and should be constructed in the mid- to long-term (6-20 years).
- Individual Storage Hangars: 50' x 50' individual storage/base hangars will be developed as demand dictates.
- Apron Expansion: Expand the current apron to the north and west by roughly 6,400 SY. This will include an 85' long by 35' wide taxiway connector from the new apron to the planned parallel taxiway. Five tiedown spots will be reconfigured in the new apron area with Group II taxilanes. This is planned for long-term or the ultimate development (11-20+ years).
- Fuel Facility: An above ground 6,000-gallon AVGAS tank with a 24-hour credit card reader is planned to be installed west of the current terminal on the new north apron edge. This is planned for instillation in the long-term to ultimate planning period (11-20+ years) once the apron expansion is constructed.

- SRE Building: Construct a 40’ x 60’ indoor storage building for SRE and maintenance equipment located east of the current 100’ x 100’ with appropriate separation distance from the future taxilane that will be located south of the building.
- Removal of Hangars: The current T-hangar row and south box hangar are older structures and will be removed once they are at the end of their useful life which should be in the long-term (11-20 years). Once the T-hangar row is removed it is planned to be paved for the apron completion that will house taxilanes and two additional tiedown spots. This will be roughly 1,200 SY of additional apron.
- Current Apron Removal: The south half of the current apron is planned to be removed at the end of its useful life and after the new apron area is constructed. The current taxiway connection from Runway 12-30 will remain and part of the south apron area will remain to continue the current taxiway connection to the new configured apron area. This is planned to happen for ultimate development (20+ years) because the pavement is in good condition.