

Runway Feasibility Study

Appendix A

Third Runway Preliminary Siting Analysis



Introduction

The alignment and location of the Third Runway were analyzed to provide maximum utility prior to evaluation in the full Runway Feasibility Study. This analysis confirmed whether Third Runway geometry is feasible while confirming the alignment to minimize airspace obstacles, maximize potential for Instrument Procedures (IP), and maximize runway length on TRK property. The alignment was refined from the original concept presented in the 2015 Airport Master Plan (AMP). This Appendix describes the refinement process. This process established the end points, length, and alignment for the Third Runway that was presented for further analysis of overflight and noise impacts in the Runway Feasibility Study.

The runway is referred to as the Third Runway throughout this Appendix since the alignment designations shown may be either 16/34 or 17/35 depending on magnetic declination.

Also, due to rising terrain south of the Truckee-Tahoe Airport (TRK), it was generally accepted that the Third Runway would function as a one-way-in and -out (contraflow) runway, with arrivals from the north and departures to the north. The south approaches would require a displaced threshold that would limit these operations to slower, piston aircraft, if needed. This condition is shown on all concepts below and was known and accepted by the project team during preliminary project planning.

Preliminary Concepts Considerations

The following are the major considerations for the Third Runway alignment and location.

- **Design Surfaces:** The Third Runway should attain standard design surfaces located on TRK property, especially the Runway Safety Area (RSA) and Runway Object Free Area (ROFA).
- **Geometry and Relation to Other Runways:** The Third Runway should minimize impact to existing runways and taxiways while conforming to Federal Aviation Administration (FAA) recommended geometry design.
- **Airport Property:** The Third Runway will be located on existing TRK property. The proposed alignment is limited by terrain drop-off to the north and Martis Dam Road, which is owned by the United States Army Corps of Engineers, to the south.

- **Instrument Approach Procedure Capability:** The Third Runway should maximize the potential for approach and departure instrument procedures (IPs). The general alignment of the Third Runway is believed to offer the fewest obstacles to an instrument approach to the south. Having an IP with low minimums may help encourage operations on the Third Runway and entice operations away from existing runways. Flight Tech Engineering (FTE) provided technical expertise in IPs and developed preliminary approaches for the concept runways. FTE's report is referenced in this Appendix and is presented in **Appendix B**.

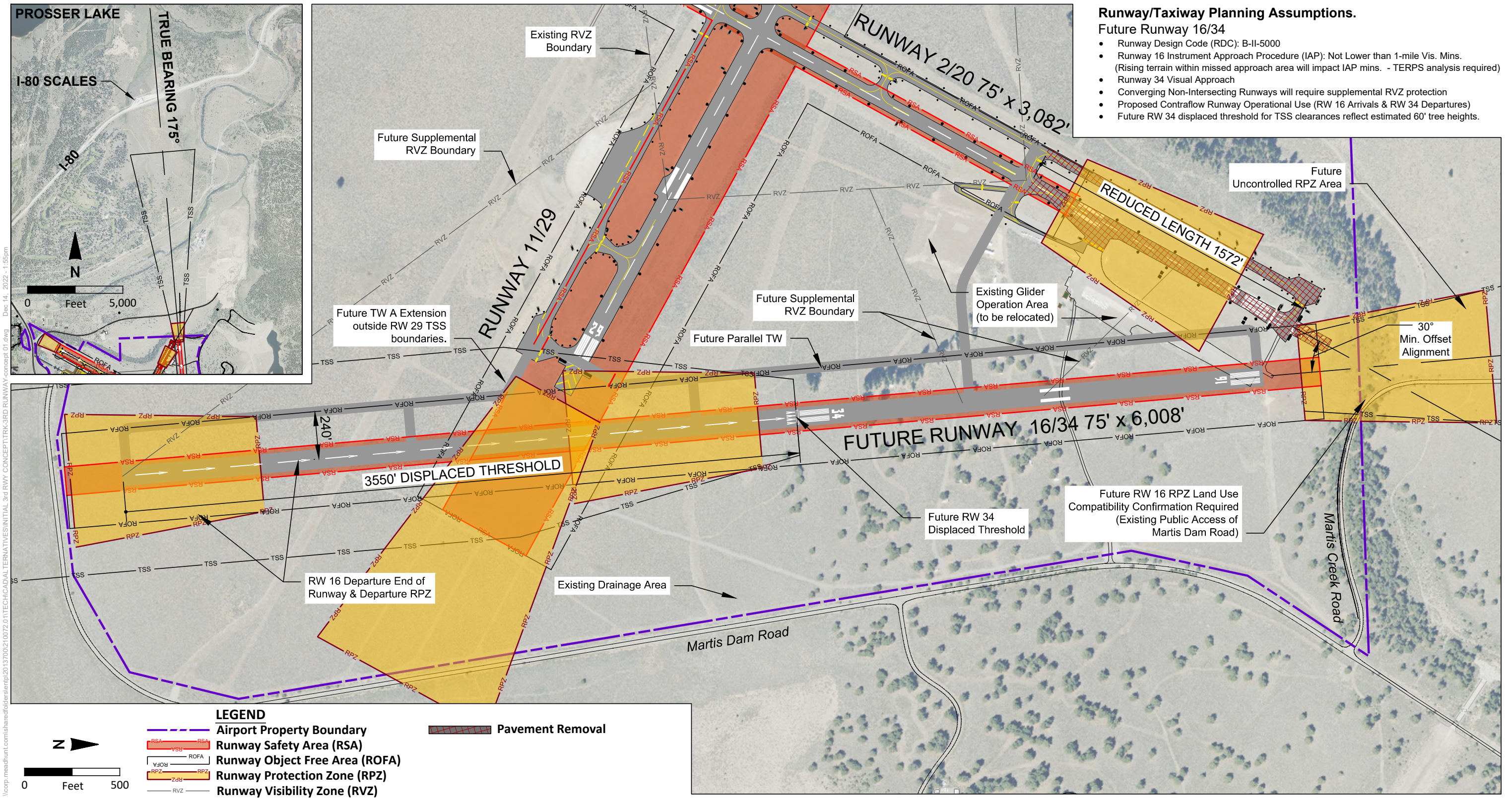
PRELIMINARY CONCEPT 1: ORIGINAL (2015 AMP) ALIGNMENT

The alignment proposed in the 2015 AMP is presented in **Figure A-1**, which lists general design components and potential issues. The primary concern is that the ends of Runway 20 and the Third Runway are coupled together. This design is nonstandard. To avoid this condition, the threshold for Runway 20 is shifted to the south 1,572 feet, effectively reducing Runway 02/20 to 3,082 feet. Because of the significant impact on Runway 02/20, this concept was eliminated from consideration and other alignments and designs were examined, as follow.

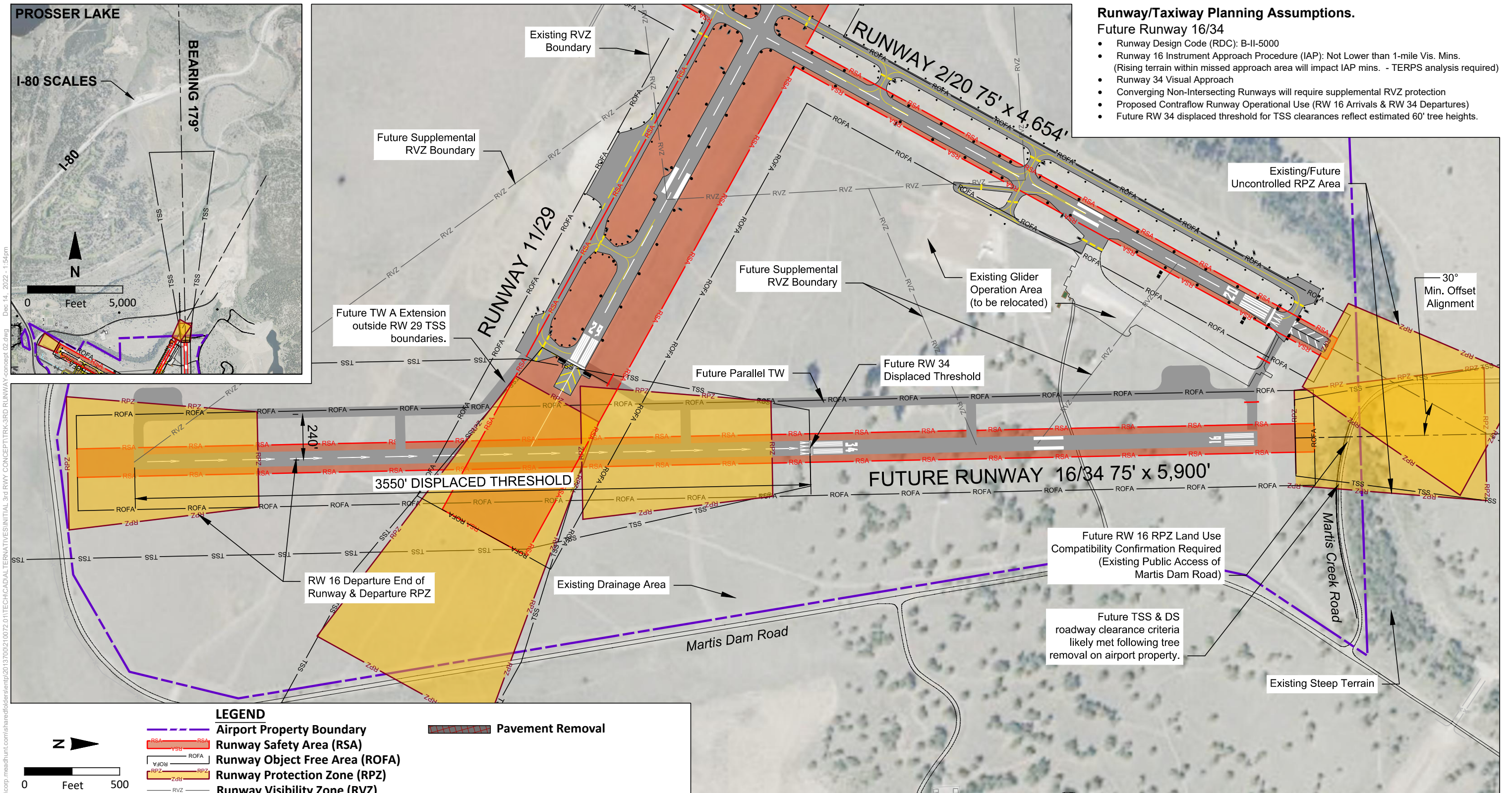
PRELIMINARY CONCEPT 2: ORIGINAL ALIGNMENT, SHIFTED EAST

To avoid the coupling with the Runway 20 approach end, the Third Runway was shifted to the east. This provides adequate separation between the two thresholds on the north end while providing the minimum 30-degree angle difference between converging runways. This is shown in **Figure A-2** with callouts for general design components and potential issues. Concept 2 reduces the total Third Runway length to 5,900 feet to achieve standard RSA and ROFA on TRK property.

This alignment was evaluated for instrument approach capabilities for arrivals from the north and departures to the north.

Figure A-1: Third Runway Concept 1


Original (2015 AMP) Alignment
Truckee Tahoe Airport

Figure A-2: Third Runway Concept 2


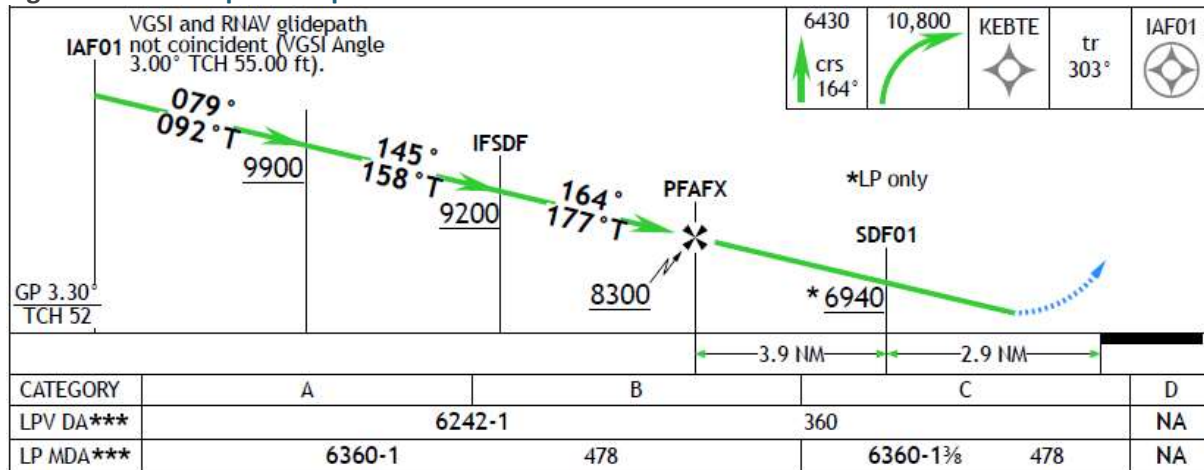
Original Alignment, Shifted East
Truckee Tahoe Airport

Concept 2 Instrument Procedure Capabilities

The Concept 2 alignment offers a Localizer Performance (LP) approach with improvements over current runway capabilities. However, the best approach alignment has a three-degree offset from the runway centerline to avoid terrain north of the Third Runway (Boca Hill) and for air traffic deconfliction from Reno-Tahoe International Airport (RNO). Because of the terrain to the north, this offset must be included to the Concept 2 alignment, which prevents the approach from having vertical guidance as a Localizer Performance with Vertical Guidance (LPV) approach. As the name indicates, an LPV approach offers vertical guidance while an LP approach does not. **Figure A-3** shows the conceptual Sample Procedure Minima to the Concept 2 north end LP approach.

In addition, this alignment offers a departure procedure to the north with a climb gradient of 340 feet per nautical mile, to 7,200 feet above mean sea level (MSL). This rate would provide the lowest climb gradient at TRK.

Figure A-3: Concept 2 Sample Procedure Minima



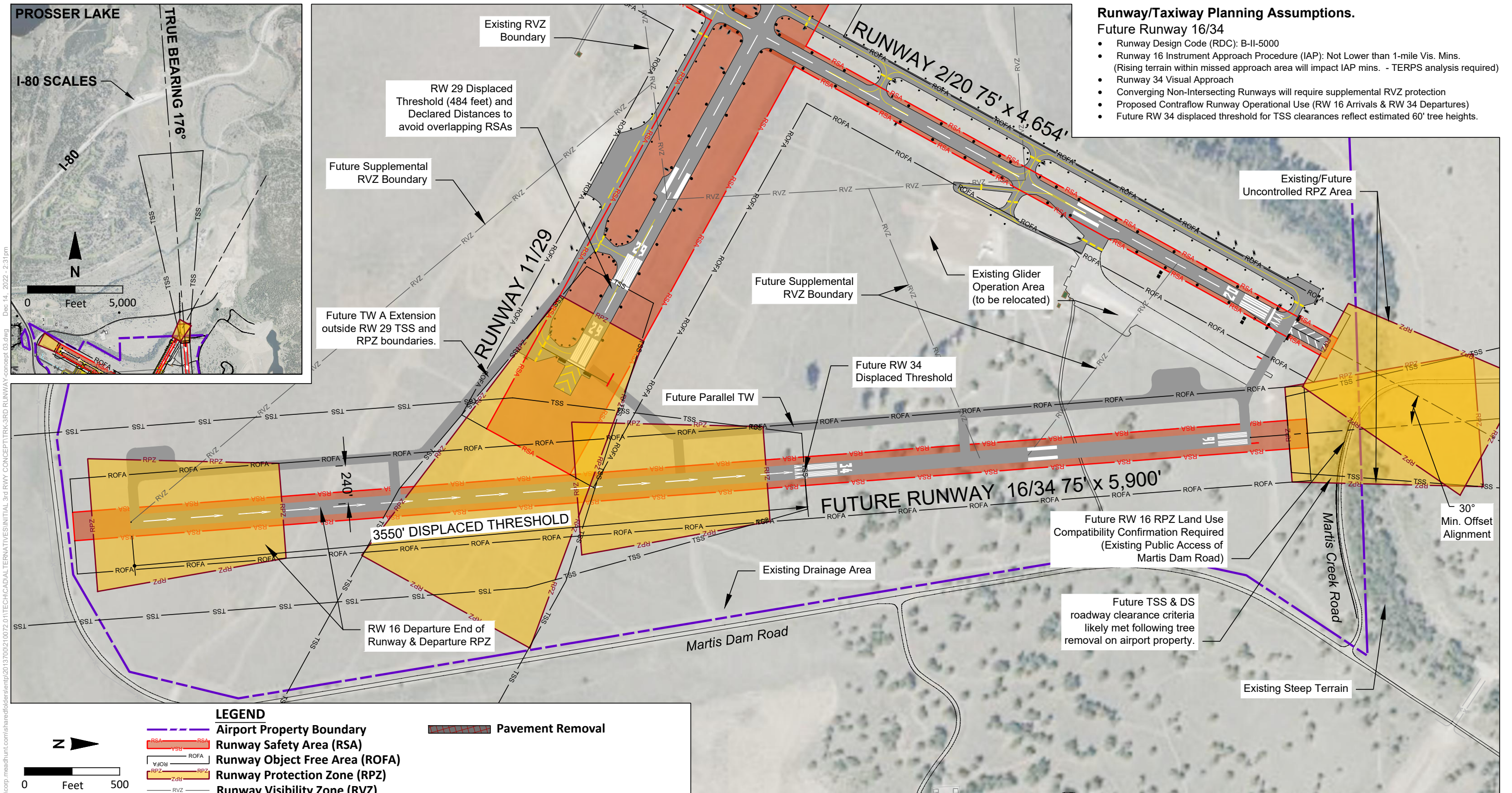
Source: Flight Tech Engineering

PRELIMINARY CONCEPT 3: ROTATED ALIGNMENT

After IP analysis on Preliminary Concept 2 was presented to TRK staff and the Truckee Tahoe Airport District (TTAD) Ad Hoc committee, FTE proposed that, by rotating the Third Runway counterclockwise a few degrees, there may be opportunity for better IP approach minima with a non-offset approach. Concept 3 is shown in **Figure A-4** with callouts for general design components and potential issues. This alignment retains the north runway end and rotates Concept 3 a few degrees counterclockwise.

While developing this concept, the FAA issued clarified guidance on intersecting RSAs. This requires the RSAs for Runway 11/29 and the Third Runway to not intersect or overlap. To avoid an overlapping configuration, a displaced threshold and declared distances are incorporated on Runway 29. This reduces the length of Runway 11 to 6,516 feet and the landing distance on Runway 29 to 6,516 feet.

Figure A-4: Third Runway Concept 3



- Runway/Taxiway Planning Assumptions.**
- Future Runway 16/34**
- Runway Design Code (RDC): B-II-5000
 - Runway 16 Instrument Approach Procedure (IAP): Not Lower than 1-mile Vis. Mins. (Rising terrain within missed approach area will impact IAP mins. - TERPS analysis required)
 - Runway 34 Visual Approach
 - Converging Non-Intersecting Runways will require supplemental RVZ protection
 - Proposed Contraflow Runway Operational Use (RW 16 Arrivals & RW 34 Departures)
 - Future RW 34 displaced threshold for TSS clearances reflect estimated 60' tree heights.

LEGEND

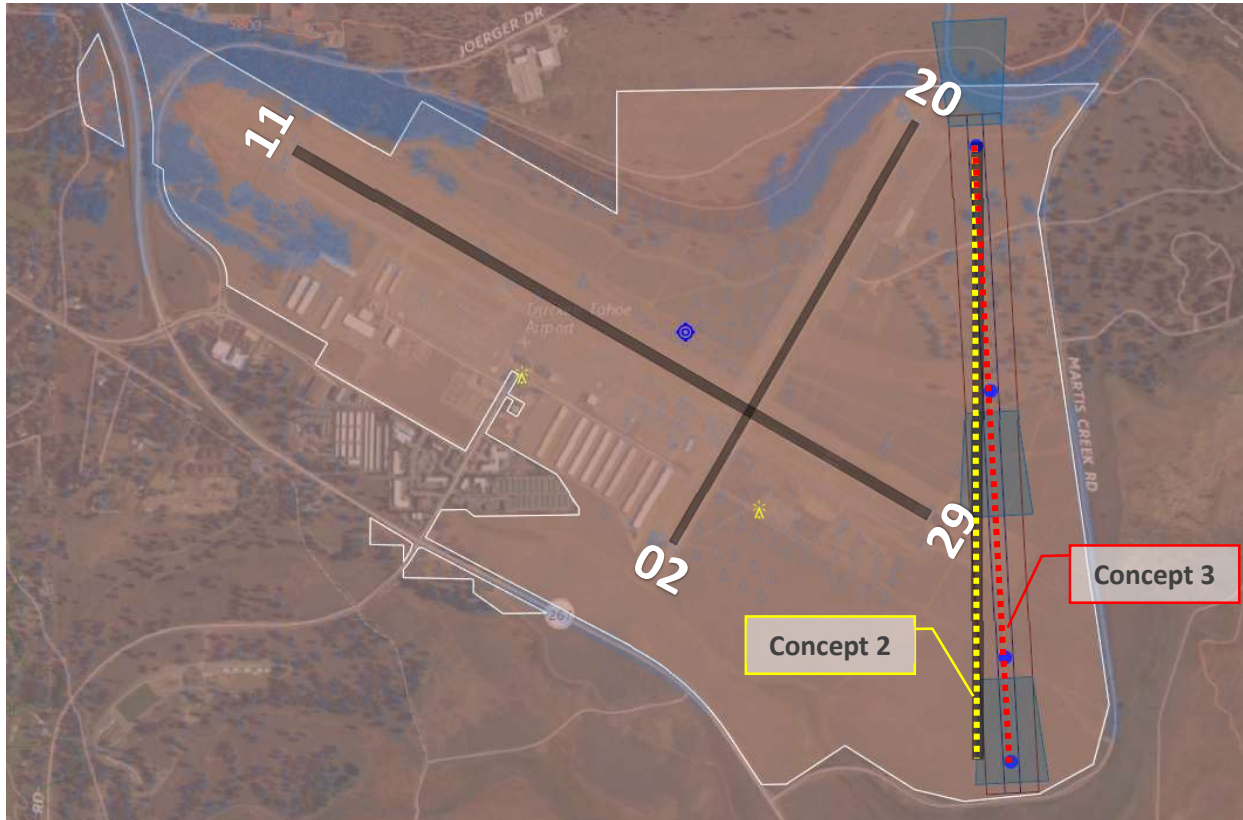
- Airport Property Boundary
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Protection Zone (RPZ)
- Runway Visibility Zone (RVZ)
- Pavement Removal

Rotated Alignment
Truckee Tahoe Airport

Concept 3 Instrument Procedure Capabilities

The Concept 3 alignment was developed after evaluating Concept 2 and rotating this a few degrees counterclockwise while maintaining runway length on TRK property. With rotation, the north end of the runway is able to accommodate a straight-in LPV approach. The rotation also reduces the climb gradient for Runway 02 IP departures. This rotation is shown in **Figure A-5** below.

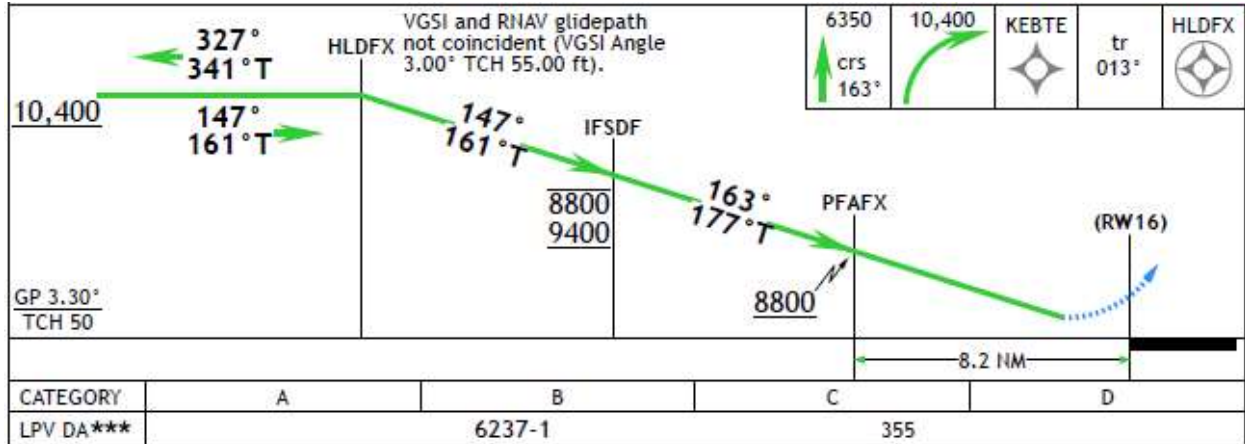
Figure A-5: Concept 3 Rotation from Concept 2



Source: Flight Tech Engineering

Figure A-6 shows the conceptual Sample Procedure Minima to the Concept 3 north end approach with a straight-in LPV approach. This is optimized for the best flight path alignment. With this rotation, the runway designation for the new alignment changes to 16/34 to match magnetic bearings. This alignment also offers a departure procedure to the north with a climb gradient of 300 feet per nautical mile, to 6,400 feet MSL. This rate would provide a lower climb gradient than Concept 2 and the lowest at TRK.

Figure A-6: Concept 3 Sample Procedure Minima



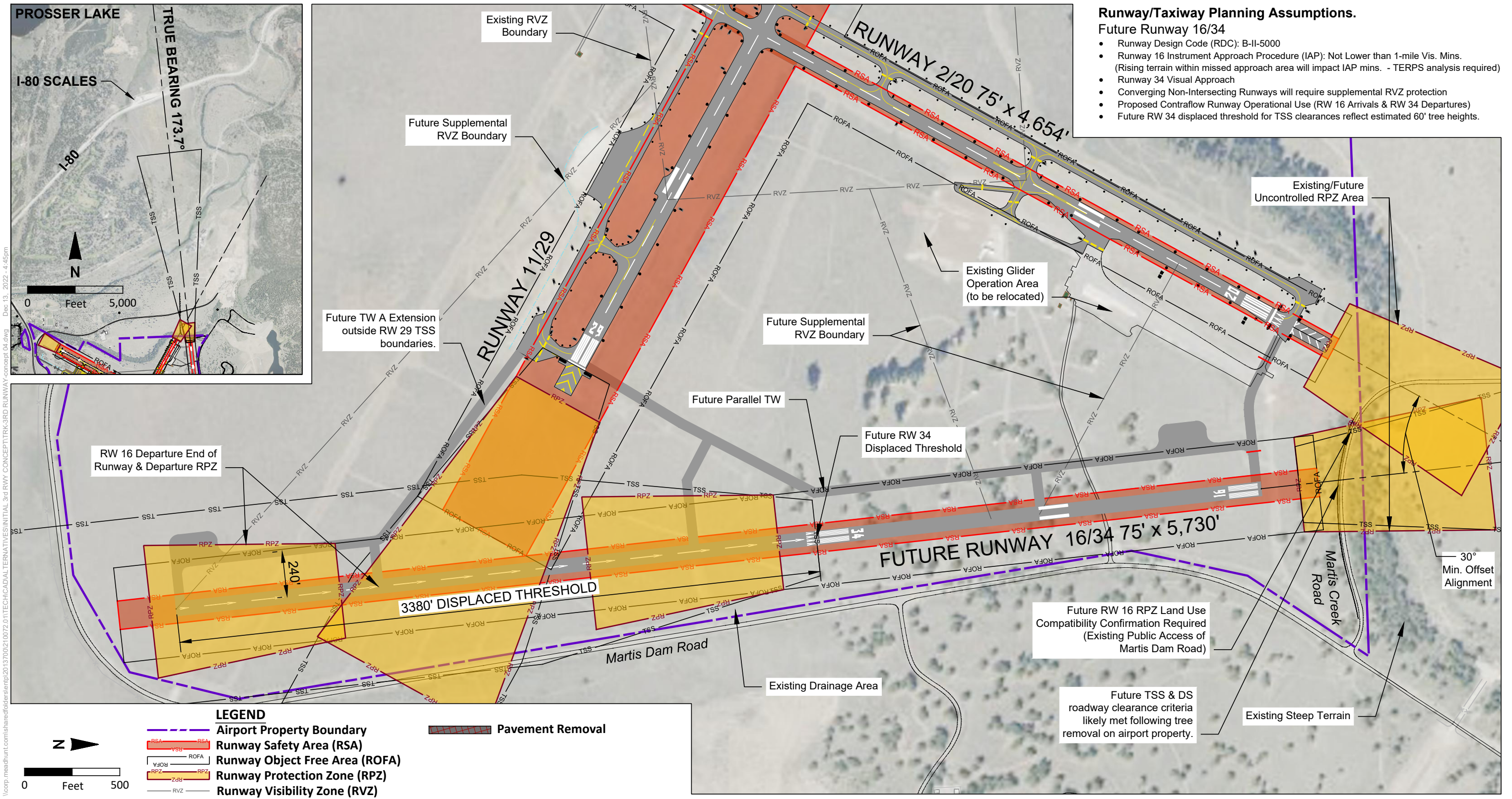
Source: Flight Tech Engineering

PRELIMINARY CONCEPT 4: SHIFTED EAST WITH ROTATED ALIGNMENT

Preliminary Concept 4 is shown in Figure A-7. This alignment was developed as the FAA RSA standard for intersecting runways was being revised. This alignment shifts the Third Runway to the east, parallel to Concept 3, to avoid RSA intersections and the need for declared distances on Runway 11/29 as needed for Concept 3. However, this has two adverse effects: this reduces the Third Runway length to 5,730 feet and may reduce the capability for an LPV/non-offset approach from the north.

It was jointly decided among the Master Plan Team, TTAD Ad Hoc, and TRK management that evaluating Concept 4 for IP capabilities would not be considered at this time for two significant reasons. First, FTE indicated that by shifting the alignment to the east, this will likely bring Boca Hill back into the approach envelope thereby requiring an offset approach and losing the ability to accommodate an LPV approach. This was an assumption without formal analysis. Second, this formal IP analysis would delay the Feasibility Study, which was not in the interest of the team and TTAD at the time.

Figure A-7: Third Runway Concept 4



Shifted East with Rotated Alignment
Truckee Tahoe Airport

Third Runway Siting Analysis Conclusion

Concept 3 will be brought forward for analysis in the Runway Feasibility Study. After discussion with the Ad Hoc committee, it was agreed that Concept 3 offers the best IP capabilities and keeps the Third Runway and critical design surfaces on TRK property. Concept 3 is 5,900 feet long and able to accommodate most turboprop and jet aircraft that regularly operate at TRK under calm wind and low-density altitude conditions. This alignment incorporates declared distances to meet design standards and is likely to be used as a one-way runway with arrivals from and departures to the north. Concept 3 will be analyzed in the Runway Feasibility Study for noise and overflight impacts and other criteria and evaluated against other alternatives in this Study. To complete this analysis, Concept 3 will be vetted with pilots and operators to determine use patterns.

Based on magnetic declination, Concept 3 is designated Runway 16/34 and will be referred to as this in the Runway Feasibility Study.

Concept 4, while reducing Third Runway length and with unknown IP capabilities, does offer standard RSAs and maintains the full length of Runway 11/29 without declared distances. If the Runway Feasibility Study concludes that Concept 3 significantly reduces impacts and meets the goals stated, then reevaluating the Concept 4 alignment for IP capabilities may be advantageous if needed to avoid impacts to Runway 11/29. This path was discussed with TRK staff and the TTAD Ad Hoc committee prior to moving forward with Concept 3 in the Feasibility Study. Concept 4 noise and overflight impacts would likely not be significantly different than Concept 3, if an LPV approach would be attained on Concept 4.