Appendix B: Instrument Flight Procedure (IFP) Assessment Overview

This feasibility study, prepared by Flight Tech Engineering, LLC (Flight Tech), under guidance by Mead & Hunt, has been prepared to summarize the findings of the Instrument Flight Procedure (IFP) Assessment at the Truckee-Tahoe Airport (TRK or the Airport). This effort is in support of the runway alternatives proposed in the Master Plan Update – Runway Feasibility Study (MPU). The intent of this document is to provide significant insight into the factors affecting the capability of aircraft operators to safely and efficiently use new IFP concepts to better serve the surrounding community and TRK's aviation stakeholders. This report does not constitute any detailed analysis performed regarding noise abatement and does not represent an environmental assessment.

Any approach designs evaluated in this assessment are considered to represent a prototype design based on Federal Aviation Administration (FAA) Terminal Instrument Procedures (TERPS) and Performance Based Navigation (PBN) criteria. For any new or modified instrument approach procedures recommended by this study to take effect, a formal instrument procedure development process will need to be undertaken, including an environmental assessment with community outreach.

To evaluate proposed runway modifications and the effect on corresponding instrument flight procedures, Flight Tech uses the same design software as the FAA and the United States Air Force (USAF). This same software is used to evaluate protype instrument flight procedures for proposed runways not yet in existence. Since each aircraft flies a different profile based on their speed and performance, the procedure evaluation is performed on a three-dimensional trapezoidal area as opposed to a straight-line evaluation. This is reflected throughout the images for each new proposal outlined below. The flight procedures assessment images will depict the minimum and maximum lateral extents of the protected surface; however, the actual flight track of the aircraft tends to average towards the center of the surface.

Obstructions and Surface Penetrations

It is critical to understand and mitigate obstructions and surface penetrations which may impact aircraft operations. The FAA requires that visual and instrument approach paths be free from obstacles that pose a hazard to approaching and departing aircraft. These paths, often referred to as "surfaces", are three-dimensional trapezoid and polygon shaped areas that allow an aircraft to be contained within them, free from the threat of hitting or striking an object, tree, building, or structure while arriving or departing. The protection of these surfaces is a best management practice for airports of every size and required under the Code of Federal Regulation Section 14, Chapter I and outlined in Federal Grant Assurances for Airport Sponsors, (April 2022, Number 20, Hazard Removal and Mitigation.

TRK has undertaken long-term and continuous mitigation of obstructions – in this case, trees – located on and off Airport property. Actions performed in 2020, 2021, and 2022 included the removal and mitigation of trees located at the approach end of Runways 11 and 20. Additional work to remove trees on the north side of Runway 29 also took place. Prior to this, trees located to the distant east and south off airport property were removed, topped, and trimmed for surface protection.

Currently the Airport is evaluating obstructions located off airport property. This group of obstructions restricts certain instrument approach procedures for use at night. These obstructions further prohibit circling south of Runway 29 and east of Runway 02. It is recommended that the Airport continue to pursue removal of obstructions to the south as well as obstructions that exist within any of the visual or instrument surface areas pertinent to TRK.

Runway 16/34 Alternative

Flight Tech assessed the development of a new approach and departure for Alternative 1 in the Runway Feasibility Study. The new runway magnetic alignment was determined to be a heading of approximately 160 and 340 degrees. For purposes of air navigation, this is simplified to Runway 16/34.

Runway 16 Instrument Approach

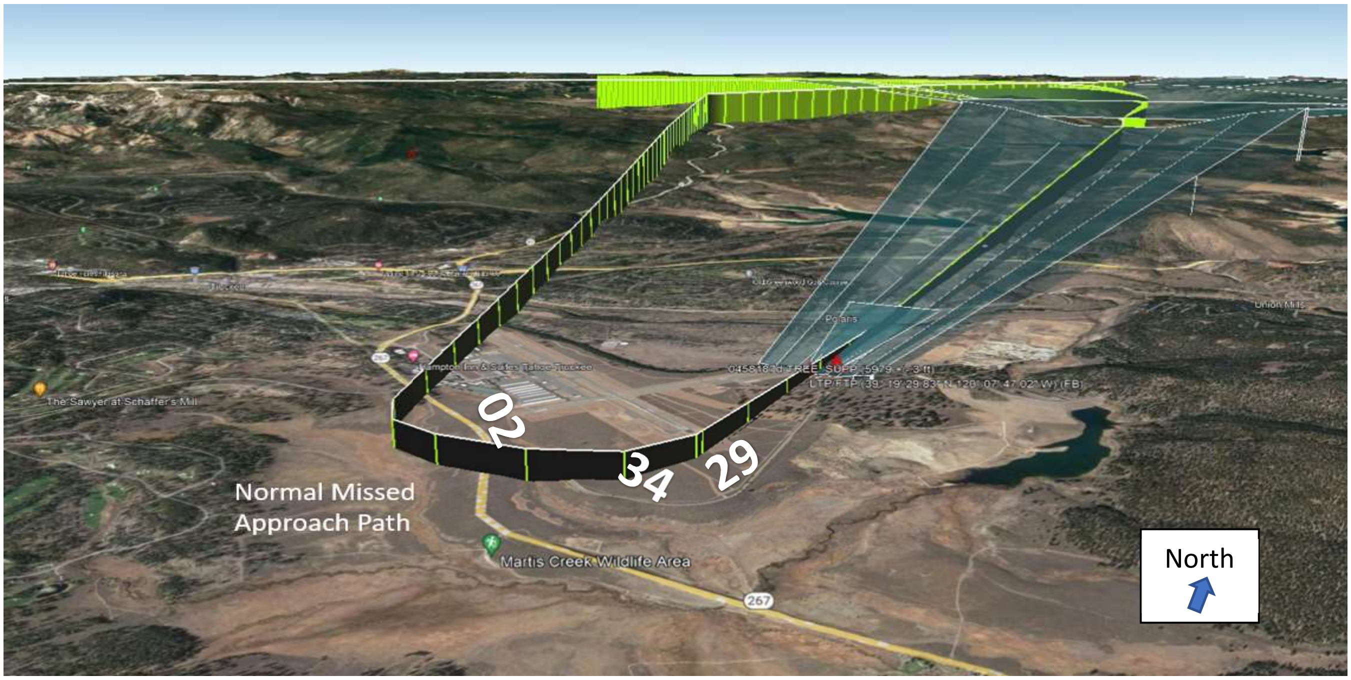
A straight-in satellite based (GPS) approach to Runway 16 was assessed. The proposed alignment of Runway 16/34 allows the final approach course to avoid the natural terrain features to the northeast of the airport which are advantageous for instrument procedure design. This alignment would enable an additional vertically guided approach at TRK from the enroute phase of flight to the runway. The approach supports Category A-C approach speeds and consists of area navigation (RNAV) approach with Localizer Performance (LP) with Vertical Guidance (LPV).

The guidance is supported by use of the FAA’s Wide Area Augmentation System (WAAS). The cloud ceiling and visibility requirements result in a Decision Altitude of 6,242 feet (360 feet Height Above landing threshold, and 1 Statute Mile Visibility). This Decision Height and Visibility are collectively referred to as *minima* and determine the overall quality of the IAP to guide the aircraft to the runway in poor weather with restricted visibility.

The missed approach requires limiting the speed during the first turn, between the enroute segment located north or Prosser Reservoir and the initial approach fix or waypoint aligning the aircraft on final approach to 185 knots, which is within FAA standard criteria. This helps provide adequate spacing between terrain to the south of the airport and the missed approach point. The missed approach point is the location at which the aircraft will discontinue the approach procedure, abandon an attempt to land, and fly through a protected airspace to initiate the same approach or circle in a hold pattern. This can result from being unable to see the runway, configuration issues with the aircraft, disruptions to flight performance, or hazards on the runway such as vehicles, aircraft, or personnel. This new runway configuration would also support non-precision lines of minima, or alternative heights and visibility requirements, such as WAAS LP or Lateral Navigation (LNAV) but would result in higher minima than the Localizer Performance with LPV approach which uses tighter obstacle containment surface requirements.

Figure B-1 depicts final and missed approach procedures with an LPV line of minima as part of the proposed RNAV (GPS) approach to Runway 16. A line of minima is a specified set of criteria that control the aircrafts final decent altitude, speed, and visibility approach criteria. A Line of Minima is unique to categories of aircraft based on speed, "A" being the slower aircraft and "D" being very fast aircraft that require higher approach speeds. The speed of the aircraft determines the radius of the turns it will make while maneuvering and thus control the area which requires protection from obstacles and terrain. "Higher Lines of Minima" mean the approach terminates higher above the ground and has more stringent visibility requirements.

Figure B-1: RNAV (GPS) Approach to Runway 16 with LPV Line of Minima

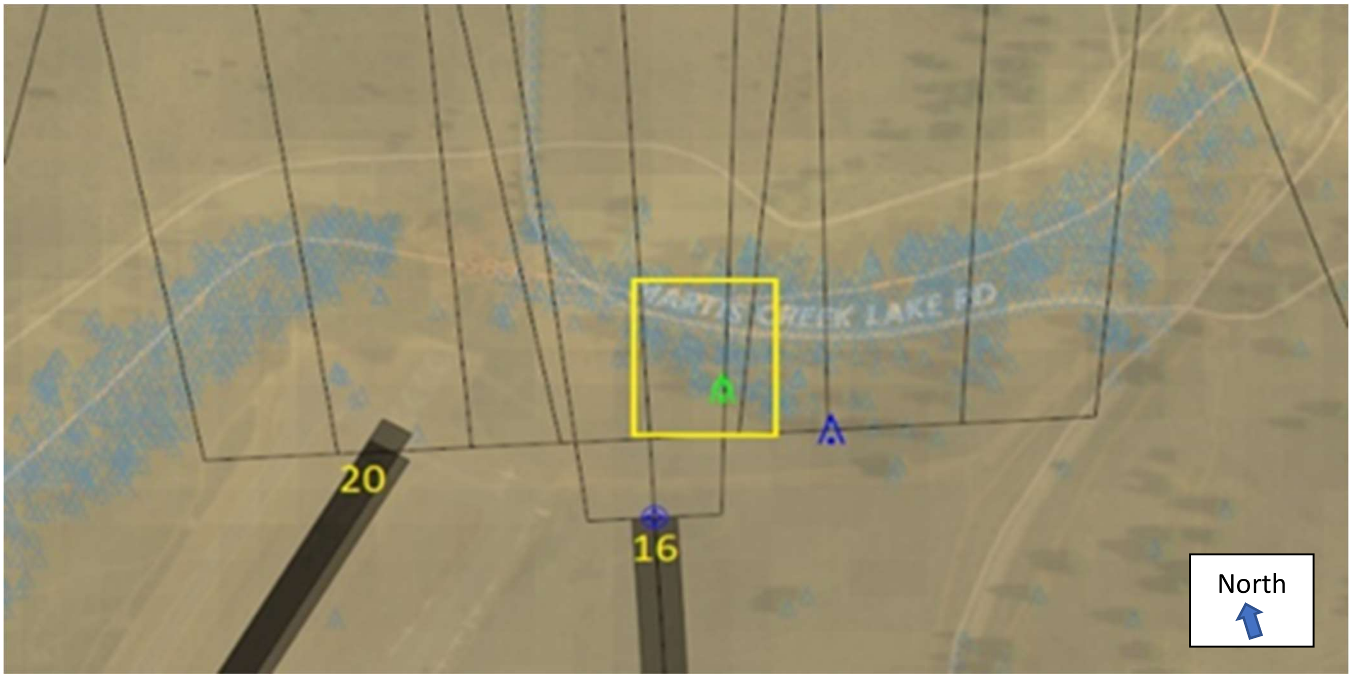


Source: Flight Tech Engineering, LLC

Runway 16 Obstacle Penetrations

Due to the location of the proposed new runway on airport property, numerous obstacle penetrations exist that would need to be cleared in support of the runway and procedure protection surfaces. A list of obstacles that are affecting Runway 16's visual protection surface is provided in **Table B-4** at the end of this document. **Figure B-2** presents Runway 16's visual surface obstacles.

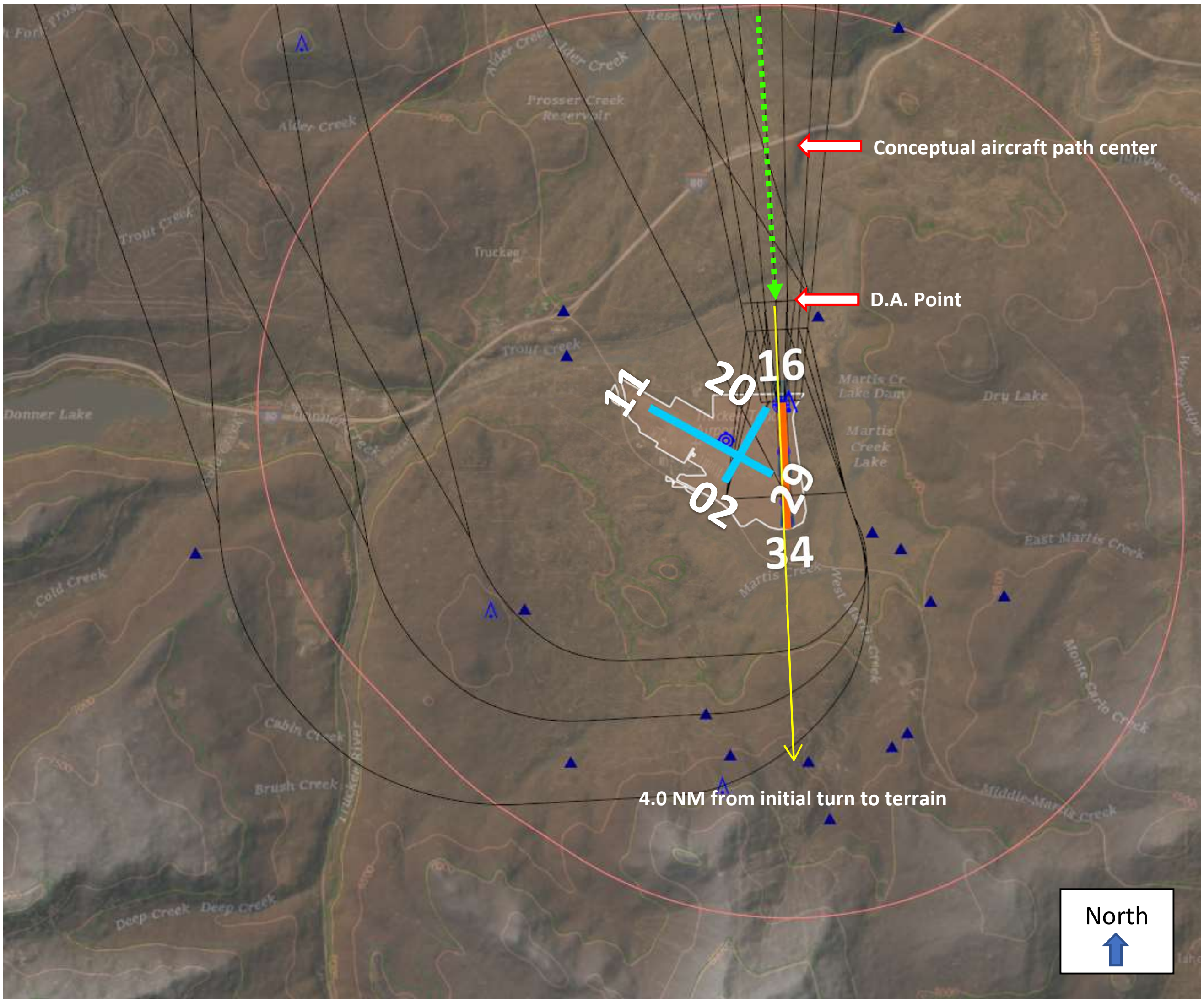
Figure B-2: Runway 16 Visual Surface Obstacles (20:1)



Source: Flight Tech Engineering, LLC

Figure B-3 depicts the TERPS surfaces and the RNAV (GPS) approach to Runway 16 with LPV lines of minima. In the graphic, the black lines indicate the maximum extent of the protection area, not the aircraft path. See **Figures B-1** and **B-4** for the projected centerline.

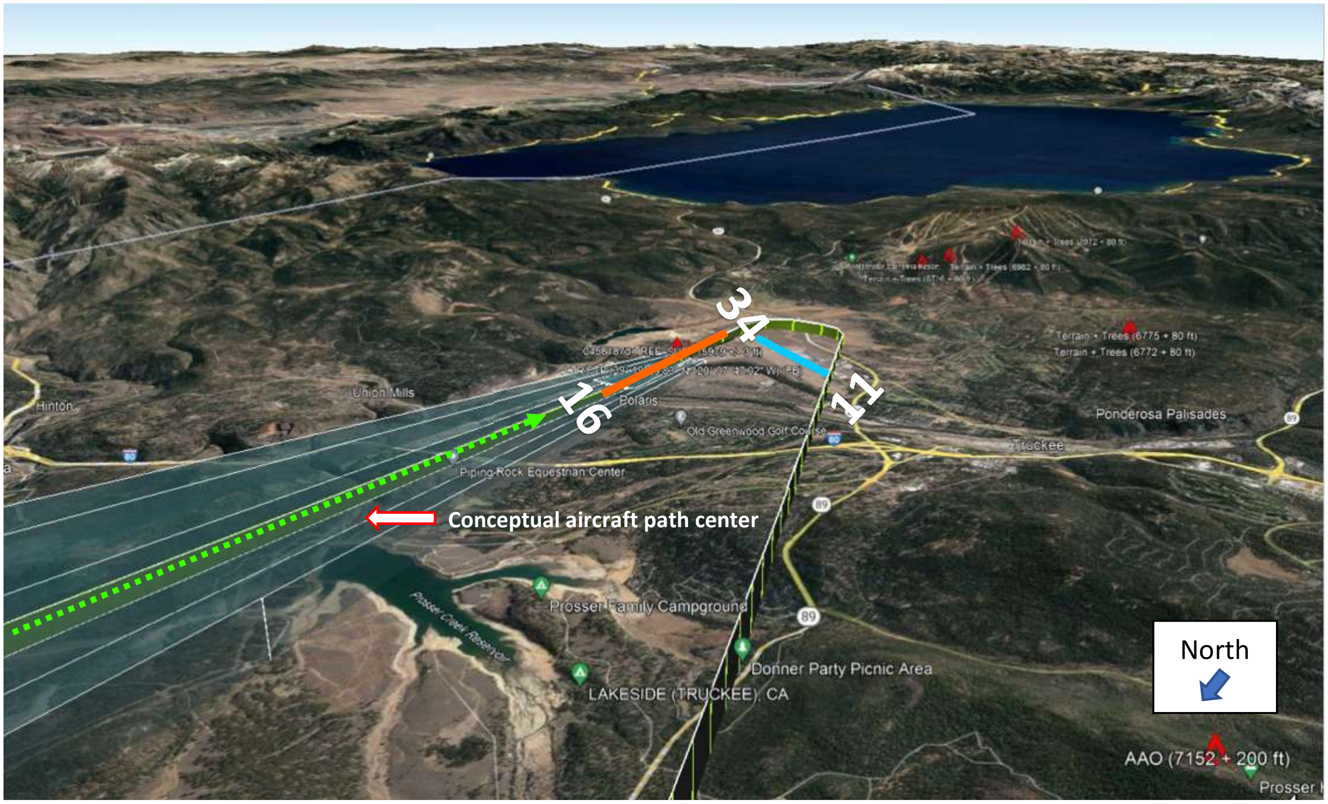
Figure B-3: RNAV (GPS) Approach to Runway 16 with LPV Lines of Minima



Source: Flight Tech Engineering, LLC
Note: Black lines represent TERPS evaluation surfaces, not aircraft flight path.

Figure B-4 shows a view from north to south of the approach to TERPS surfaces and the RNAV (GPS) approach to Runway 16 with LPV lines of minima.

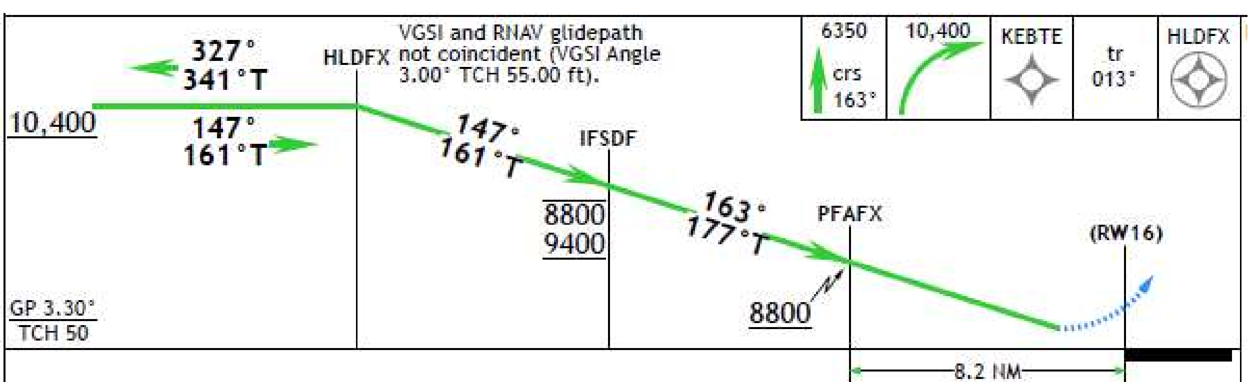
Figure B-4: RNAV (GPS) Approach to Runway 16 with LPV Line of Minima (Alternate View)



Source: Flight Tech Engineering, LLC

Figure B-5 presents the proposed approach minimums for Runway 16.

Figure B-5: Proposed Runway 16 Approach Minimums



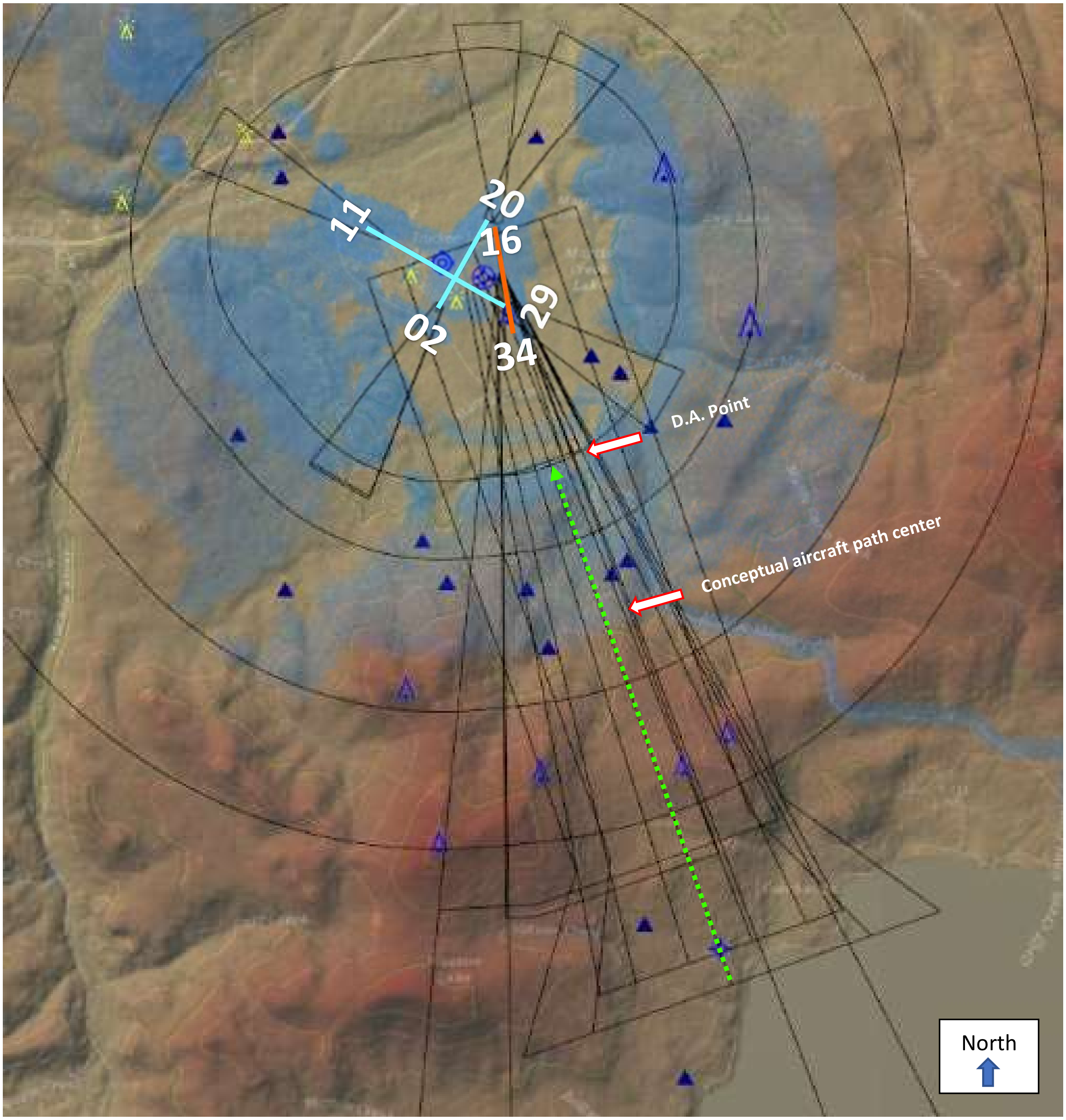
CATEGORY	A	B	C	D
LPV DA***		6237-1	355	

Source: Flight Tech Engineering, LLC

Runway 34 Instrument Approach

While the alignment of Runway 16/34 provides for an advantageous alignment for approaches from the north, the proximity of terrain directly south of the airport (Northstar) makes it challenging for implementation of standard instrument procedures. Flight Tech assessed an approach to Runway 34 and the resulting glidepath angles exceeded 11 degrees for straight-in aligned approaches. This is too steep for an aircraft to make a stabilized approach. A circling approach to Runway 34 could be developed, but the descent over mountainous terrain would not be favorable. A circling approach would have the aircraft terminate and then fly a circle around the airport, maneuvering visually while the aircraft selected a suitable runway for landing. The FAA does not support circling approaches and it is not recommended that TRK pursue a circling approach to this runway. **Figure B-6** depicts the approach path evaluation of Runway 34.

Figure B-6: Runway 34 Approach Path Evaluation



Source: Flight Tech Engineering, LLC

Runway 16 Departure

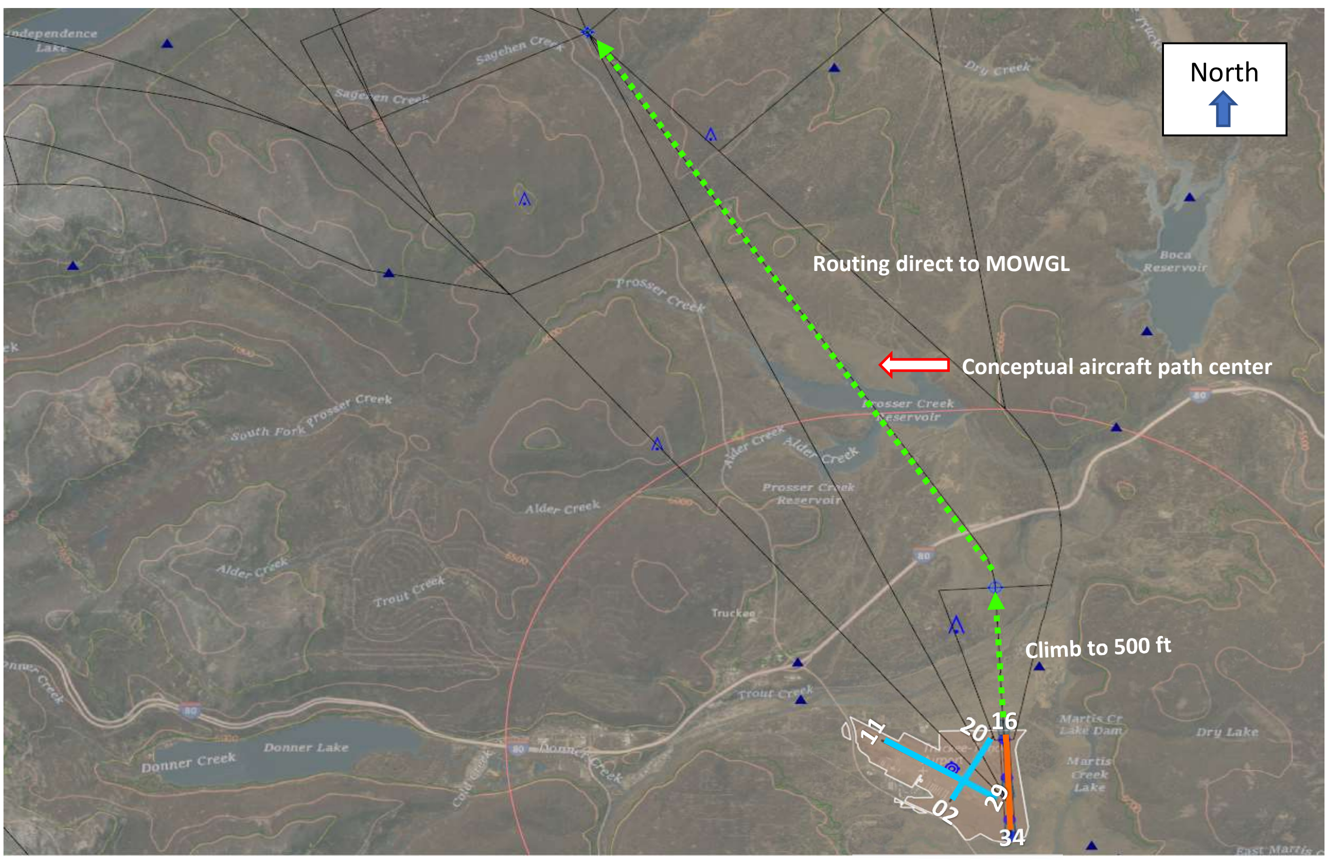
Similar to the Runway 34 Approach, terrain directly south of the airport prevents a standard instrument departure design to the South. TERPS design requires that an aircraft be given sufficient time to reach 500 feet AGL before turning. The ability to reach that altitude and complete the turn prior to reaching terrain - while allowing for the normal TERPS protection surfaces is not possible. A departure was assessed and resulted in excessive climb gradients that would not be attainable by most aircraft types.

Runway 34 Departure

A standard departure from Runway 34 was assessed. A departure procedure connects the aircraft to the enroute phase of flight and protects the aircraft in the initial climb out phase from the runway. This departure concepts connects to a similar enroute structure as the new MOWGL ONE RNAV SID, which becomes effective December 29, 2022, and serves departures from both existing Runways 29 and 02. The proposed new runway alignment is favorable for departures from Runway 34 due to lower terrain and avoidance of dense residential housing areas. The proposed Runway 34 departure procedure allows for a climb gradient of ~350 ft/nm, which is lower than what is offered by current public procedures. This means an aircraft will need to climb 350 feet for every mile it travels forward while following the path. A flight path routing that avoided dense housing communities near TRK was also possible. The combination of reduced climb gradient, standard TERPS design, and optimized routing over terrain and the community makes the Runway 34 departure procedure highly favorable for aircraft operations.

Figure B-7 presents the departure design surfaces for Runway 34.

Figure B-7: Runway 34 Departure Design Surfaces



Source: Flight Tech Engineering, LLC
Note: Black lines represent TERPS evaluation surfaces, not aircraft flight path.

Figure B-8 presents a satellite map overview of Runway 34 departures.

Figure B-8: Runway 34 Departures

Source: Flight Tech Engineering, LLC

Runway 20 Analysis

A flight procedure assessment was performed for Runway 20 to evaluate the effects of widening the runway and threshold length adjustment as proposed in the Master Plan Alternatives. A redesigned approach procedure to Runway 20 was built based on the proposed relocated runway threshold locations provided by the engineering consultant team. While there were changes to the physical location of the runway end and displaced threshold, they were minor enough that the resulting procedure design surface impacts were trivial. The new configuration shifts the runway centerline slightly closer to the terrain to the northeast of the airport; however, the use of a non-precision line of minima allows the final approach course to be offset. This offset design method mitigates these impacts. While the proposed runway configuration and alignment still precludes the development of a vertically guided approach, it can still support both GPS guided LNAV and an enhanced WAAS Localizer Performance (LP) lines of minima. This supports CAT A-C minima with a minimum Descent Altitude between 569 to 1,676 feet.

Runway 20 Visual Segment Evaluation

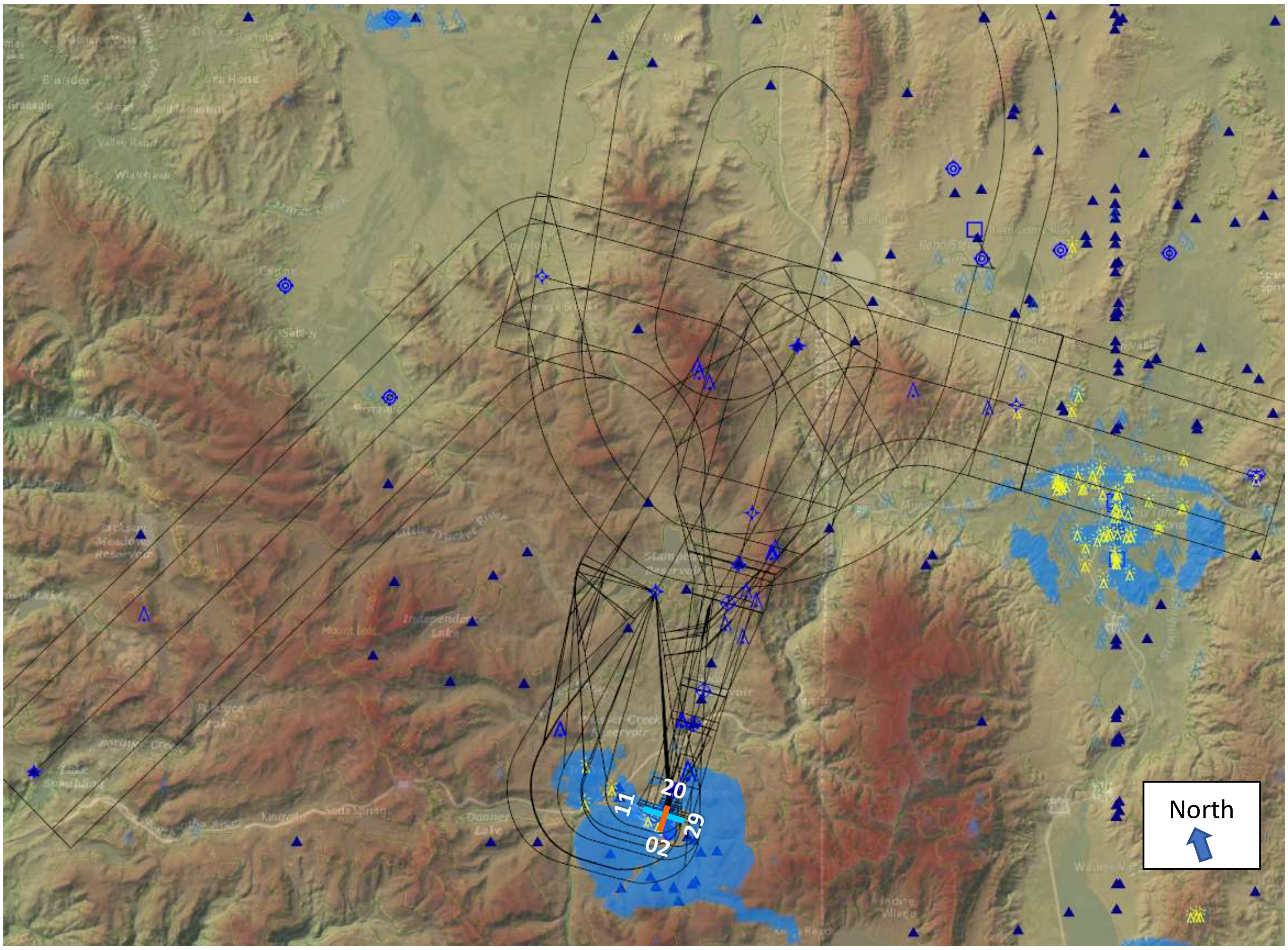
During the evaluation of the relocated Runway 20 procedure, it was found that obstacles penetrate the Runway 20 visual 20:1 surface. These will need to be mitigated prior to implementation to enable the procedure to be used during night conditions. Ongoing obstruction management at TRK is focused on mitigating these obstructions to Runway 20. **Table B-1** lists 20:1 surface penetrations for Runway 20. **Figure B-9** represents an overview of the Runway 20 TERPS design surfaces.

Table B-1: Runway 20 Visual Surface Penetrations

Description	Penetration	Effective MSL	MSL	Latitude	Longitude	Distance along RWY CL	Offset from RWY CL
TREE	17.93 ft	5926.15 ft	5926.15 ft	39° 19' 34.71 N"	120° 07' 49.31 W"	544 ft before	196 ft L
TREE_SUPP	6.87 ft	5918.25 ft	5918.25 ft	39° 19' 35.04 N"	120° 07' 48.42 W"	608 ft before	240 ft L
TREE_SUPP	6.71 ft	5910.58 ft	5910.58 ft	39° 19' 36.24 N"	120° 07' 54.92 W"	457 ft before	263 ft R
TREE	5.49 ft	5905.63 ft	5905.63 ft	39° 19' 35.37 N"	120° 07' 54.89 W"	383 ft before	217 ft R
TREE_SUPP	3.74 ft	5904.00 ft	5904.00 ft	39° 19' 35.37 N"	120° 07' 54.82 W"	385 ft before	212 ft R

Source: Flight Tech Engineering, LLC
Note: RWY CL = runway centerline

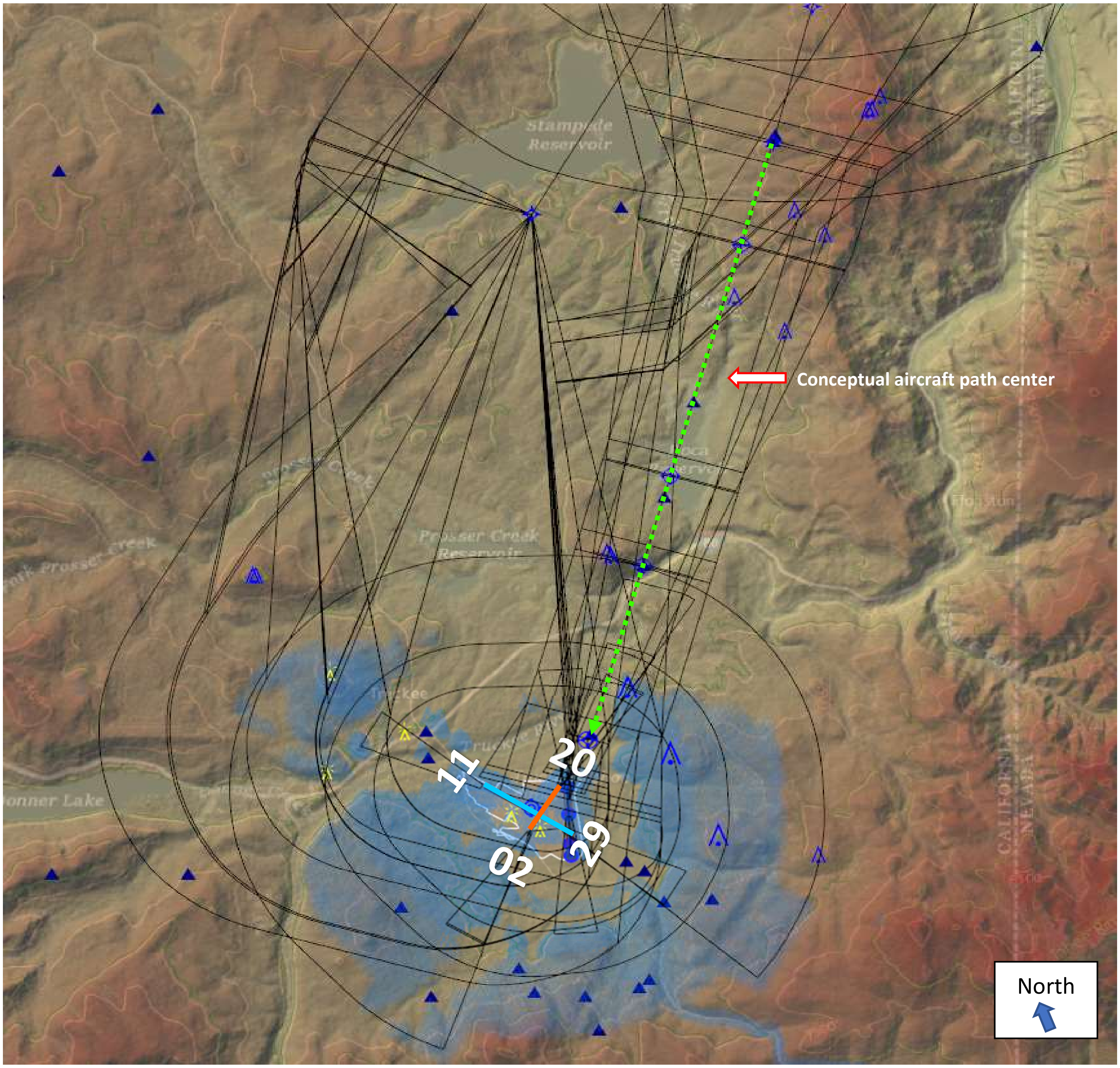
Figure B-9: Runway 20 TERPS Design Surfaces Overview



Source: Flight Tech Engineering, LLC
Note: Black lines represent TERPS evaluation surfaces, not aircraft flight path.

Figure B-10 represents the final and missed approach design surfaces for Runway 20.

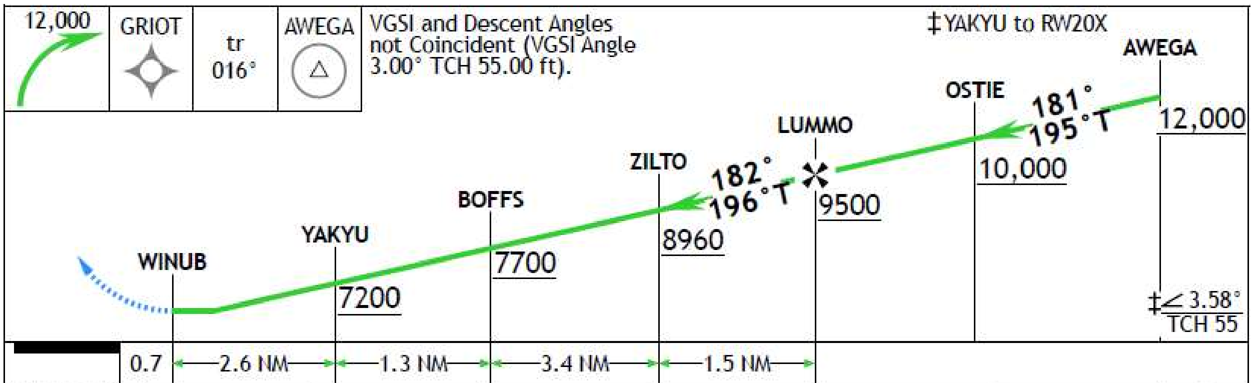
Figure B-10: Runway 20 FINAL and MISSED Approaches Design Surfaces



Source: Flight Tech Engineering, LLC
Note: Black lines represent TERPS evaluation surfaces, not aircraft flight path.

Figure B-11 presents the proposed approach minimums for Runway 20.

Figure B-11: Proposed Runway 20 Approach Minimums



CATEGORY	A	B	C	D
LP MDA***	6460-1 569		6460-1⅝ 569	NA
LP MDA	6600-1 709		6760-2½ 869	NA
LNAV MDA	7120-1¼ 1229	7120-1½ 1229	7120-3 1229	NA
C Circling	7120-1¼ 1216	7220-1½ 1316	7580-3 1676	NA

Source: Flight Tech Engineering, LLC

Runway 11 Analysis

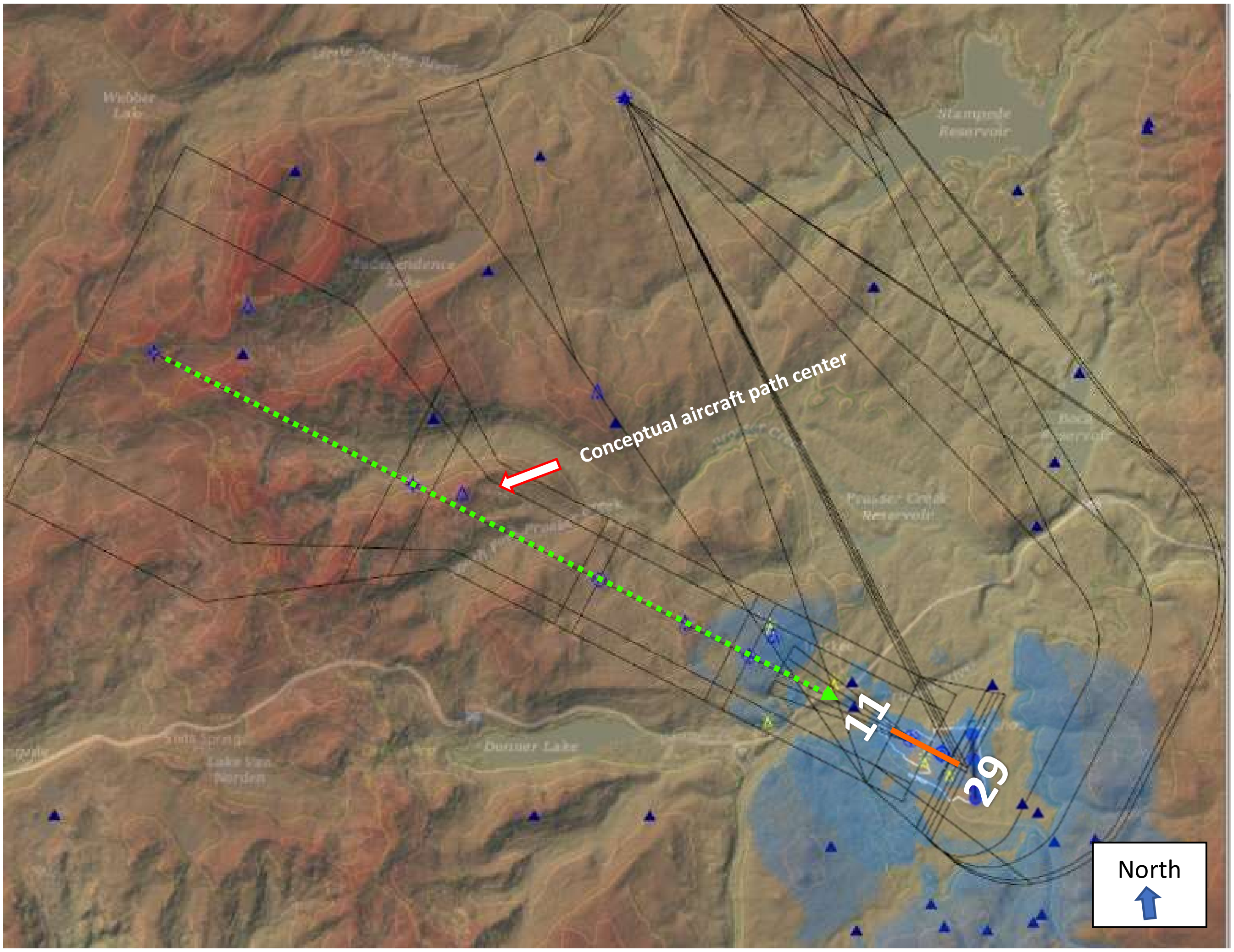
Runway 11 is currently designed for 7,001 feet of landing distance along the full length of the runway. Alternative 3 in the MPU proposes a displaced threshold of 1,000 feet. Conceptually, by design, this would keep the approaching aircraft higher over residential areas while on approach to Runway 11. An instrument procedures evaluation was performed to assess the results of displacing the Runway 11 threshold by 1,000 feet to the east.

Runway 11 Displaced Threshold Assessment Results

Vertically guided approaches using standard design criteria did not benefit from any substantial changes by displacing the runway threshold 1,000 feet to the southeast. This is caused by high terrain beginning 2.5 nautical miles northwest of the airport and continuing to rise towards the mountain range to the west. The vertical descent path would still require a glidepath angle between 4.14-4.51 degrees depending on the amount of obstacle mitigation or design waivers used to clear terrain in the final approach segment of the approach. This would limit the approach to aircraft operating within CAT A or B approach speeds. Other issues with the design include connecting the intermediate segment to the final approach segment which require extending the final to a distance of 8.5 nautical miles and raising the glidepath angle to 4.60 degrees to clear distant terrain. While this could be accomplished as a circling approach using lateral only guidance, it could not be designed as a straight in line of minima due to the excessive descent angles.

Figure B-12 demonstrates the Runway 11 procedure evaluation.

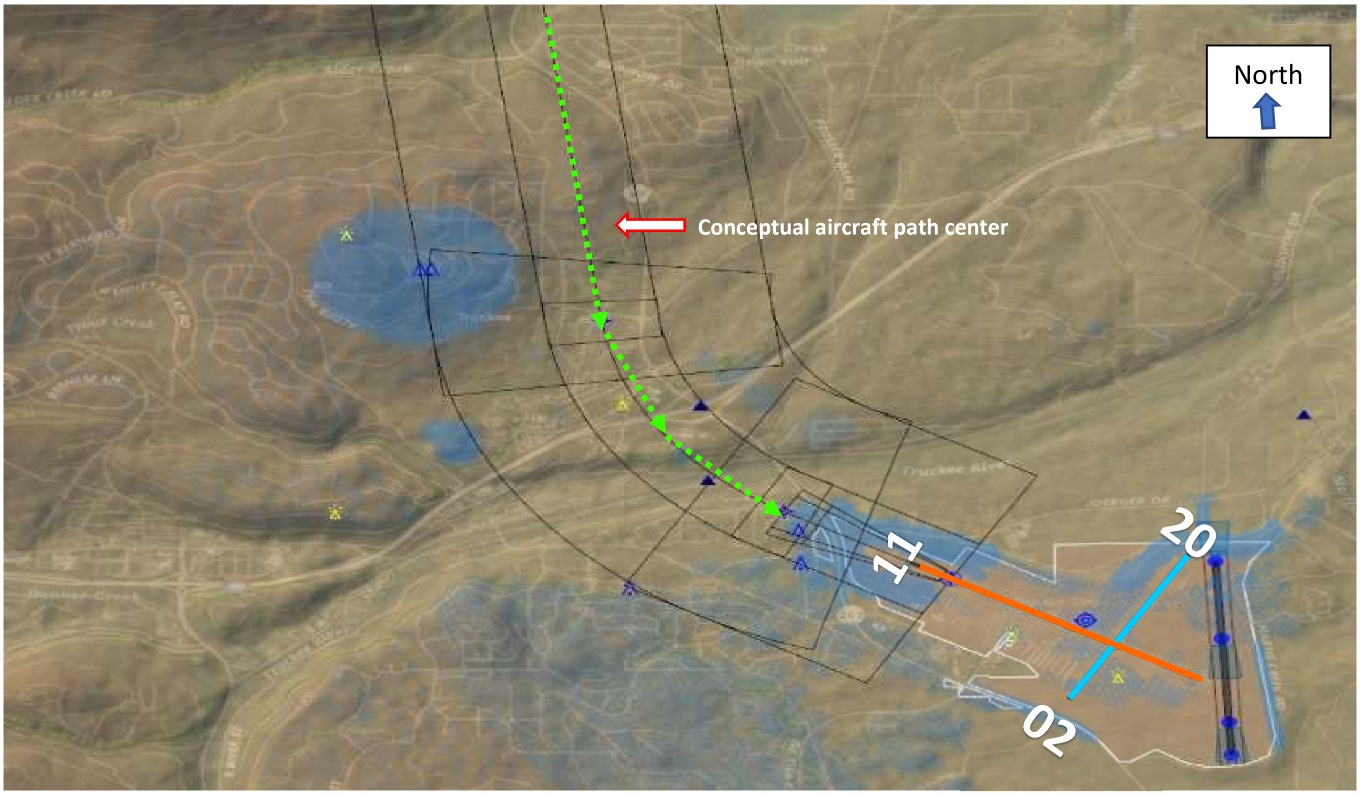
Figure B-12: Runway 11 Procedure Evaluation



Source: Flight Tech Engineering, LLC
Note: Black lines represent TERPS evaluation surfaces, not aircraft flight path.

The only procedures benefiting from the Runway 11 threshold displacement were RNP-AR approaches, which require an advanced level of equipage and special authorization. The displacement allows for a longer straight segment and shallower glidepath prior to rollout; however, it would not benefit many of the current operators at TRK as most are not equipped for RNP-AR. The design for advanced RNP procedures is shown in **Figure B-13**.

Figure B-13: Advanced Required Navigation Performance – RNP Design



Source: Flight Tech Engineering, LLC
Note: Black lines represent TERPS evaluation surfaces, not aircraft flight path.

Runway 11 Visual Segment Obstacles

The approach is clear of 20:1 Visual Surface penetrations and therefore would be eligible for nighttime operations. No obstacle mitigation is required based on the current Airport Geographic Information System (AGIS) data.

Flight Procedure Development Process

Instrument Flight Procedures (IFP) consisting of approaches and departures can be developed publicly (by the FAA) or privately (by the airport sponsor or an operator). For airports that are designated as public use, the procedures can be funded and developed by the FAA. To develop procedures for use at public use airports, procedures must be designed to the standard set of FAA rules and flyable by a wide range of aircraft. If the procedure does not qualify for standard design, the IFP may be developed privately as a Special procedure by the FAA, or an FAA authorized third-party procedure designer.

This process normally takes the FAA about two to five years to implement or one to two years if performed by a third-party procedure designer. A new AGIS Obstacle survey supporting a vertically guided approach will need to be performed as a precursor to moving forward with new instrument procedures. **Table B-2** introduces the development process for the design of instrument approach procedures.

Table B-2: Instrument Approach Procedure Design

IAP Type	Developer	Funding	Timeframe	AGIS Survey Required?	Other Requirements
Public	FAA	FAA, if airport is open for public use	2-5 years	Yes	Developed using standard set of FAA design rules and flyable by variety of aircraft
Private	Airport Sponsor, non-FAA service provider or Operator	FAA, if airport is open for public use	1-2 years	Yes	Developed using standard set of FAA design rules and flyable by variety of aircraft
Private Special	Airport Sponsor, non-FAA service provider or Operator	Airport Sponsor or Operator	1-2 years	Yes	Developed using special criteria, special authorization required

Source: Flight Tech and Mead & Hunt

Instrument Procedure ROM Cost

If the procedures qualify for FAA development and are made available for public use, the cost is free. For privately developed public procedures or private special procedures the cost varies widely. The major project elements are listed below in **Table B-3** with Rough Order of Magnitude (ROM) cost estimates.

Table B-3: Instrument Approach Procedure Design

Option	Phase	Time	Cost
A1, B1, & C1	Initial Design	1 year	$15K-$45K
A1, B1, & C1-2	Conceptual (Notional) Design	6 months	$15K-$45K
B2, C1-2	Flight Procedure Evaluation	1 month	$30K-$55K
B2, C1-2	FAA Submission	6 months	$15k-18K
B2, C1-2	Community Outreach/Environmental Review	6 months	$10K-$15K
B2, C1-2	FAA Revision and Coordination	1-2 years	$15K-$45K
C1-2, B2	Final Publication and Special Procedure Program Implementation	6 months	$25K-$35K Annually Recurring

Implementation Options

Option A

1. Submit the procedures to the Instrument Flight Procedure Information Gateway for assessment and development by the FAA (only applicable to airports/runways deemed open for public use).
2. If the FAA determines there are no special design criteria requirements, and has ability to commit resources, the procedures will be added to the backlog and will be published within three to five years.
3. An updated Airport Layout Plan (ALP) and AGIS survey must be completed.
4. For this option, the cost of development and maintenance is funded by the FAA.

The **Instrument Flight Procedure (IFP) Information Gateway** is a communication tool the FAA uses to disseminate information about proposed changes to flight procedures to solicit comments from civil aviation organizations, affected military and civil air traffic control facilities, and airport owners and sponsors.

Option B

1. If the desire is for the procedures to be made available publicly and need to be implemented on an accelerated timeline, a non-FAA service provider can design and implement the procedure publicly on behalf of the airport.
2. In this scenario the Airport is responsible for the cost of development and maintenance of the procedures.
3. The timeline for development is normally one and a half to two years; however, it is still subject to the FAA process.
4. The procedures will be made available for public use and therefore must meet standard design requirements.

Operations Specifications (OpSpec) are the rules, operating criteria, and behavior that each aircraft owner/operator adopts. OpSepc usually refers to the official rules published in company handbooks, electronic flight bags, manuals, or chart supplements over and above any regulatory requirements, that an owner/operator consigns to by policy that enhances safety, operational efficiency, or passenger experience.

Option C

1. The Airport can sponsor a special approach procedure for use by specific or multiple operators. This is useful when specialized design criteria is required to accommodate non-standard conditions.
2. An FAA authorized third-party procedure designer can design, flight validate, implement, and maintain the instrument procedures during the period of use. The procedures are still in the special category, but they can be flown by individual operators once they have requested approval from their local Flight Standards District Office (FSDO) or have added them to their individual OpSpec.

Ongoing Flight Procedure Development
From 2020, TRK has undertaken an effort to develop both public and private special flight procedures. In fall 2022, Flight Evaluation was conducted on all notional flight procedures. TRK is currently evaluating the viability of each flight procedure. Once a determination on the efficacy of each procedure to enhance safety or reduce community environmental impact is made, the final procedures will be submitted to the FAA for consideration. At that time, it is anticipated that the TRK consultant team will engage all stakeholders in the final outreach process while pending approval from the FAA is gained.

Non-FAA developed Approval Process

Even though Special procedures are developed by a non-FAA service provider, they go through the same FAA coordination and quality assurance process as a standard public IFP. The timeline between start and finish typically lasts eight to 14 months. The development and implementation process would begin with finalizing the procedure encoding, initiation of coordination meetings with Oakland Air Route Traffic Control Center (ARTCC), waiver approval meetings with FAA Flight Standards, all of which culminates with flight validation in a properly equipped aircraft. Third-party developers hold the necessary letters of agreement with the FAA to accomplish each step described above as well as maintain the procedures after certification. This non-FAA developed Approval Process is complicated and the development of the exact steps and cost are not within the scope of this document. This narrative along with the tables and options listed above are designed to give the reader an understanding of the process and not a final roadmap for procedures development.

AGIS Survey Updates

AGIS survey updates are required when significant changes to the airport obstacle or runway environment have occurred. Except for the Runway 11 threshold displacement alternative, the new Runway 16/34 and 02/20 alternatives will require an update to the AGIS Obstacle and Runway Survey. The AGIS update will allow for accurate designs of future instrument flight procedures and airport planning considerations. **Table B-4** presents the 20:1 visual segment penetrations of the Runway 16 IAP.

Table B-4: 20:1 Visual Segment Penetrations for Runway 16 Approach

Description	Penetration	MSL	Latitude	Longitude	Distance along RWY CL	Offset from RWY CL
TREE	79.66 ft	5967.58 ft	39° 19' 33.07 N"	120° 07' 45.08 W"	318 ft before	170 ft L
TREE_SUPP	79.66 ft	5967.58 ft	39° 19' 33.07 N"	120° 07' 45.08 W"	318 ft before	170 ft L
TREE_SUPP	68.98 ft	5956.95 ft	39° 19' 33.04 N"	120° 07' 45.88 W"	319 ft before	107 ft L
TREE_SUPP	68.70 ft	5956.95 ft	39° 19' 33.11 N"	120° 07' 45.49 W"	325 ft before	139 ft L
TREE_SUPP	64.62 ft	5952.80 ft	39° 19' 33.14 N"	120° 07' 44.50 W"	323 ft before	217 ft L
TREE_SUPP	58.16 ft	5947.02 ft	39° 19' 33.27 N"	120° 07' 44.56 W"	337 ft before	213 ft L
TREE_SUPP	54.34 ft	5948.31 ft	39° 19' 34.26 N"	120° 07' 45.02 W"	439 ft before	182 ft L
TREE_SUPP	53.80 ft	5947.23 ft	39° 19' 34.17 N"	120° 07' 44.72 W"	428 ft before	205 ft L
TREE_SUPP	51.08 ft	5945.42 ft	39° 19' 34.32 N"	120° 07' 45.41 W"	447 ft before	152 ft L
TREE_SUPP	49.91 ft	5939.17 ft	39° 19' 33.33 N"	120° 07' 45.03 W"	345 ft before	176 ft L
TREE_SUPP	48.47 ft	5938.01 ft	39° 19' 33.35 N"	120° 07' 45.82 W"	351 ft before	113 ft L
TREE_SUPP	47.60 ft	5943.06 ft	39° 19' 34.51 N"	120° 07' 46.23 W"	469 ft before	88 ft L
TREE	47.60 ft	5943.06 ft	39° 19' 34.51 N"	120° 07' 46.23 W"	469 ft before	88 ft L
TREE_SUPP	46.94 ft	5939.28 ft	39° 19' 33.93 N"	120° 07' 45.22 W"	407 ft before	164 ft L
TREE_SUPP	46.67 ft	5939.28 ft	39° 19' 34.01 N"	120° 07' 44.73 W"	412 ft before	203 ft L
TREE_SUPP	46.51 ft	5938.56 ft	39° 19' 33.88 N"	120° 07' 45.13 W"	401 ft before	171 ft L
TREE_SUPP	46.40 ft	5936.40 ft	39° 19' 33.44 N"	120° 07' 45.84 W"	360 ft before	113 ft L
TREE_SUPP	45.70 ft	5938.92 ft	39° 19' 34.14 N"	120° 07' 44.38 W"	424 ft before	231 ft L
TREE_SUPP	43.31 ft	5935.85 ft	39° 19' 33.98 N"	120° 07' 45.00 W"	411 ft before	182 ft L
TREE_SUPP	42.72 ft	5935.12 ft	39° 19' 33.96 N"	120° 07' 44.90 W"	408 ft before	189 ft L
TREE_SUPP	42.68 ft	5935.01 ft	39° 19' 33.85 N"	120° 07' 47.08 W"	407 ft before	18 ft L
TREE_SUPP	42.56 ft	5936.40 ft	39° 19' 34.20 N"	120° 07' 45.92 W"	437 ft before	111 ft L
TREE_SUPP	42.24 ft	5934.04 ft	39° 19' 33.83 N"	120° 07' 45.04 W"	396 ft before	178 ft L
TREE_SUPP	41.45 ft	5938.38 ft	39° 19' 34.86 N"	120° 07' 44.88 W"	499 ft before	196 ft L
TREE_SUPP	40.45 ft	5933.16 ft	39° 19' 33.99 N"	120° 07' 45.73 W"	414 ft before	124 ft L
TREE_SUPP	40.41 ft	5933.85 ft	39° 19' 34.13 N"	120° 07' 45.74 W"	429 ft before	124 ft L
TREE_SUPP	39.90 ft	5931.08 ft	39° 19' 33.68 N"	120° 07' 45.76 W"	384 ft before	120 ft L
TREE_SUPP	39.86 ft	5932.24 ft	39° 19' 33.91 N"	120° 07' 45.96 W"	408 ft before	106 ft L
TREE_SUPP	38.59 ft	5929.35 ft	39° 19' 33.64 N"	120° 07' 44.71 W"	375 ft before	202 ft L
TREE_SUPP	38.45 ft	5932.01 ft	39° 19' 34.14 N"	120° 07' 46.09 W"	431 ft before	97 ft L
TREE_SUPP	38.38 ft	5929.35 ft	39° 19' 33.68 N"	120° 07' 44.69 W"	379 ft before	204 ft L
TREE_SUPP	37.74 ft	5929.35 ft	39° 19' 33.81 N"	120° 07' 44.65 W"	392 ft before	208 ft L
TREE_SUPP	36.25 ft	5930.39 ft	39° 19' 34.25 N"	120° 07' 46.15 W"	443 ft before	93 ft L
TREE_SUPP	35.46 ft	5930.16 ft	39° 19' 34.32 N"	120° 07' 47.14 W"	454 ft before	15 ft L
TREE_SUPP	33.98 ft	5930.62 ft	39° 19' 34.67 N"	120° 07' 47.79 W"	493 ft before	34 ft R
TREE_SUPP	33.71 ft	5928.77 ft	39° 19' 34.36 N"	120° 07' 47.77 W"	461 ft before	33 ft R
TREE_SUPP	33.55 ft	5930.92 ft	39° 19' 34.94 N"	120° 07' 44.93 W"	507 ft before	192 ft L
TREE_SUPP	33.32 ft	5926.46 ft	39° 19' 34.02 N"	120° 07' 46.99 W"	423 ft before	26 ft L
TREE_SUPP	33.25 ft	5930.92 ft	39° 19' 35.01 N"	120° 07' 44.69 W"	513 ft before	212 ft L
TREE_SUPP	32.73 ft	5921.61 ft	39° 19' 33.23 N"	120° 07' 45.53 W"	338 ft before	136 ft L
TREE_SUPP	31.73 ft	5929.36 ft	39° 19' 35.01 N"	120° 07' 44.51 W"	513 ft before	226 ft L
TREE_SUPP	31.19 ft	5926.46 ft	39° 19' 34.42 N"	120° 07' 47.36 W"	465 ft before	1 ft R
TREE_SUPP	30.04 ft	5924.24 ft	39° 19' 34.26 N"	120° 07' 46.05 W"	444 ft before	101 ft L
TREE_SUPP	30.01 ft	5925.77 ft	39° 19' 34.52 N"	120° 07' 47.33 W"	475 ft before	2 ft L
TREE_SUPP	29.71 ft	5925.08 ft	39° 19' 34.46 N"	120° 07' 46.94 W"	467 ft before	32 ft L
TREE_SUPP	29.64 ft	5928.43 ft	39° 19' 35.21 N"	120° 07' 45.29 W"	536 ft before	165 ft L
TREE_SUPP	29.37 ft	5930.31 ft	39° 19' 35.67 N"	120° 07' 44.45 W"	579 ft before	235 ft L
TREE_SUPP	29.37 ft	5930.31 ft	39° 19' 35.67 N"	120° 07' 44.45 W"	579 ft before	235 ft L
TREE	29.37 ft	5930.31 ft	39° 19' 35.67 N"	120° 07' 44.45 W"	579 ft before	235 ft L

Source: Flight Tech Engineering, LLC
Note: RWY CL = runway centerline

Table B-4: 20:1 Visual Segment Penetrations for Runway 16 Approach (Continued)

Description	Penetration	MSL	Latitude	Longitude	Distance along RWY CL	Offset from RWY CL
TREE_SUPP	29.11 ft	5921.38 ft	39° 19' 33.89 N"	120° 07' 45.82 W"	405 ft before	117 ft L
TREE	28.98 ft	5926.15 ft	39° 19' 34.71 N"	120° 07' 49.31 W"	503 ft before	152 ft R
TREE_SUPP	28.78 ft	5917.68 ft	39° 19' 33.23 N"	120° 07' 45.70 W"	338 ft before	123 ft L
TREE_SUPP	28.54 ft	5926.26 ft	39° 19' 35.01 N"	120° 07' 45.01 W"	514 ft before	186 ft L
TREE_SUPP	27.10 ft	5927.22 ft	39° 19' 35.51 N"	120° 07' 44.49 W"	563 ft before	230 ft L
TREE_SUPP	26.39 ft	5922.30 ft	39° 19' 34.53 N"	120° 07' 47.71 W"	478 ft before	28 ft R
TREE_SUPP	25.70 ft	5921.84 ft	39° 19' 34.62 N"	120° 07' 46.82 W"	483 ft before	42 ft L
TREE_SUPP	25.64 ft	5917.25 ft	39° 19' 33.82 N"	120° 07' 44.42 W"	392 ft before	226 ft L
TREE_SUPP	24.65 ft	5919.43 ft	39° 19' 34.34 N"	120° 07' 46.92 W"	456 ft before	33 ft L
TREE_SUPP	24.61 ft	5923.29 ft	39° 19' 35.20 N"	120° 07' 44.83 W"	534 ft before	202 ft L
TREE_SUPP	22.81 ft	5921.69 ft	39° 19' 35.20 N"	120° 07' 45.86 W"	538 ft before	121 ft L
TREE_SUPP	22.66 ft	5916.99 ft	39° 19' 34.25 N"	120° 07' 46.91 W"	447 ft before	33 ft L
TREE_SUPP	21.01 ft	5919.42 ft	39° 19' 35.14 N"	120° 07' 45.03 W"	528 ft before	186 ft L
TREE_SUPP	20.08 ft	5911.45 ft	39° 19' 33.70 N"	120° 07' 46.17 W"	387 ft before	88 ft L
TREE_SUPP	19.64 ft	5918.25 ft	39° 19' 35.04 N"	120° 07' 48.42 W"	532 ft before	81 ft R
TREE_SUPP	19.46 ft	5915.84 ft	39° 19' 34.65 N"	120° 07' 47.22 W"	487 ft before	11 ft L
TREE_SUPP	19.04 ft	5918.26 ft	39° 19' 35.26 N"	120° 07' 45.97 W"	544 ft before	113 ft L
TREE_SUPP	18.85 ft	5916.97 ft	39° 19' 35.04 N"	120° 07' 46.09 W"	522 ft before	102 ft L
TREE_SUPP	18.40 ft	5917.19 ft	39° 19' 35.18 N"	120° 07' 46.04 W"	536 ft before	107 ft L
TREE_SUPP	17.50 ft	5914.14 ft	39° 19' 34.81 N"	120° 07' 44.61 W"	493 ft before	217 ft L
TREE_SUPP	16.99 ft	5916.64 ft	39° 19' 35.39 N"	120° 07' 44.90 W"	553 ft before	197 ft L
TREE_SUPP	16.79 ft	5910.52 ft	39° 19' 34.15 N"	120° 07' 46.58 W"	435 ft before	59 ft L
TREE_SUPP	16.52 ft	5915.05 ft	39° 19' 35.11 N"	120° 07' 46.45 W"	531 ft before	74 ft L
TREE_SUPP	16.48 ft	5916.94 ft	39° 19' 35.55 N"	120° 07' 44.94 W"	569 ft before	195 ft L
TREE_SUPP	14.50 ft	5911.22 ft	39° 19' 34.70 N"	120° 07' 47.43 W"	494 ft before	5 ft R
TREE_SUPP	13.95 ft	5916.94 ft	39° 19' 36.04 N"	120° 07' 45.22 W"	620 ft before	176 ft L
TREE_SUPP	13.26 ft	5906.36 ft	39° 19' 34.04 N"	120° 07' 46.26 W"	422 ft before	83 ft L
TREE_SUPP	12.44 ft	5904.29 ft	39° 19' 33.78 N"	120° 07' 46.45 W"	397 ft before	67 ft L
TREE_SUPP	11.73 ft	5909.69 ft	39° 19' 35.00 N"	120° 07' 46.26 W"	519 ft before	89 ft L
TREE_SUPP	11.33 ft	5911.40 ft	39° 19' 35.38 N"	120° 07' 47.25 W"	561 ft before	13 ft L
TREE_SUPP	10.27 ft	5909.48 ft	39° 19' 35.24 N"	120° 07' 46.47 W"	544 ft before	73 ft L
TREE_SUPP	10.10 ft	5910.12 ft	39° 19' 35.39 N"	120° 07' 46.78 W"	560 ft before	50 ft L
TREE_SUPP	9.59 ft	5909.19 ft	39° 19' 35.22 N"	120° 07' 48.79 W"	552 ft before	109 ft R
TREE_SUPP	9.13 ft	5909.26 ft	39° 19' 35.38 N"	120° 07' 47.45 W"	563 ft before	3 ft R
TREE_SUPP	8.25 ft	5909.08 ft	39° 19' 35.62 N"	120° 07' 45.16 W"	577 ft before	178 ft L
TREE_SUPP	8.11 ft	5906.23 ft	39° 19' 34.94 N"	120° 07' 48.37 W"	522 ft before	77 ft R
TREE_SUPP	7.81 ft	5907.43 ft	39° 19' 35.17 N"	120° 07' 49.94 W"	552 ft before	199 ft R
TREE_SUPP	6.85 ft	5903.17 ft	39° 19' 34.64 N"	120° 07' 47.07 W"	487 ft before	23 ft L
TREE_SUPP	5.34 ft	5904.55 ft	39° 19' 35.23 N"	120° 07' 46.73 W"	544 ft before	52 ft L
TREE_SUPP	4.99 ft	5905.45 ft	39° 19' 35.54 N"	120° 07' 45.26 W"	569 ft before	170 ft L
TREE_SUPP	3.55 ft	5905.41 ft	39° 19' 35.72 N"	120° 07' 47.56 W"	597 ft before	10 ft R
TREE_SUPP	3.49 ft	5904.54 ft	39° 19' 35.65 N"	120° 07' 45.43 W"	581 ft before	157 ft L
TREE_SUPP	3.35 ft	5900.91 ft	39° 19' 34.94 N"	120° 07' 45.90 W"	511 ft before	117 ft L
TREE_SUPP	2.84 ft	5904.54 ft	39° 19' 35.79 N"	120° 07' 45.08 W"	594 ft before	186 ft L
TREE_SUPP	2.12 ft	5903.64 ft	39° 19' 35.75 N"	120° 07' 45.24 W"	590 ft before	173 ft L
TREE_SUPP	1.51 ft	5900.91 ft	39° 19' 35.25 N"	120° 07' 47.12 W"	548 ft before	22 ft L
TREE_SUPP	0.26 ft	5900.69 ft	39° 19' 35.46 N"	120° 07' 47.00 W"	569 ft before	33 ft L
Terrain	0.02 ft	5882.55 ft	39° 19' 32.00 N"	120° 07' 45.00 W"	211 ft before	171 ft L

Source: Flight Tech Engineering, LLC
Note: RWY CL = runway centerline