

# TRUCKEE TAHOE AIRPORT (TRK) INSTRUMENT FLIGHT PROCEDURE (IFP) FEASIBILITY STUDY

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# ACRONYMS and ABBREVIATIONS

AC	Advisory Circular
AGL	Above Ground Level
AP	Auto Pilot
A-RNP	Advanced – Required Navigation Performance
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
AWOS	Automated Weather Observing System
CAT	Category
CG	Climb Gradient
CTAF	Common Traffic Advisory Frequency
DA	Decision Altitude
DER	Departure End of Runway
DME	Distance Measuring Equipment
DOF	Digital Obstacle File
DP	Departure Procedure
EFVS	Enhanced Flight Vision System
FAA	Federal Aviation Administration
FAC	Final Approach Course
FAF	Final Approach Fix
FAS	Final Approach Segment
FD	Flight Director
FMG	Mustang VOR
FPA	Flight Path Angle
FSDO	Flight Standards District Office
FT/ft	Feet
GA	General Aviation
GLS	Global Navigation Satellite System Landing System
GPS	Global Positioning System
HAA	Height Above Airport
HAR	Height Above Runway
HAT	Height Above Touchdown
HUD	Head-Up Display
IAF	Initial Approach Fix
IAP	Instrument Approach Procedure
ICA	Initial Climb Area
IFP	Instrument Flight Procedure
ILS	Instrument Landing System
IPDS	Instrument Procedure Design Software
LNAV	Lateral Navigation
LOA	Letter of Authorization
LP	Localizer Performance

LPV	Localizer Performance with Vertical Guidance
MAP	Missed Approach Point
MDA	Minimum Decent Altitude
MIRL	Medium Intensity Runway Light
MSL	Mean Sea Level
NAS	National Airspace System
NAVAID	Navigational Aid
NavSpec	Navigation Specification
NM/nm	Nautical Mile
NPIAS	National Plan of Integrated Airport Systems
OAA	Obstacle Accountability Area
ODP	Obstacle Departure Procedure
OpSpec	Operations Specification
PBN	Performance Based Navigation
REIL	Runway End Identifier Lights
RF	Radius to Fix
RNAV	Area Navigation
RNP	Required Navigation Performance
RNP – AR	Required Navigation Performance – Authorization Required
RWY	Runway
SID	Standard Instrument Departure
STD	Standard
SM	Statute Mile
SUA	Special Use Airspace
SVS	Synthetic Vision System
SWR	Squaw Valley VOR/DME
TACAN	Tactical Air Navigation System
TARGETS	Terminal Area Route Generation Evaluation and Traffic Simulation Software
TERPS	Terminal Instrument Procedures
VASI	Vertical Approach Slope Indicator
VDP	Visual Descent Point
VGSI	Vertical Glide Slope Indicator
VOR	Very High Frequency Omnidirectional Range
VORTAC	Very High Frequency Omnidirectional Range with TACAN
WAAS	Wide Area Augmentation System

# INSTRUMENT FLIGHT PROCEDURE (IFP) ASSESSMENT OVERVIEW

This feasibility study has been prepared to summarize the findings of the Instrument Flight Procedure Assessment at the Truckee-Tahoe Airport (TRK). The intent of this document is to provide significant insight into the factors affecting the capability of aircraft operators to safely and efficiently utilize current IFPs, analyze and offer any improvements that might be made to the existing system state, and finally to investigate the possibility of new and/or novel IFP concepts to better serve the surrounding community and Truckee-Tahoe's aviation stakeholders.

One of the key aspects of the study is assessing the airport's ability to accommodate operations by a wide array of aviation users, including higher performance aircraft, while remaining sensitive to the interests of nearby residential communities. In support of the review and development of IFP alternatives, this study of airspace and procedures encompasses a number of technical analyses, which include, but are not limited to, the following assessments:

- Airspace Assessment
- Runway and Navigational Aid (NAVAID) Assessment
- Operator Assessment
- Obstacle Evaluation and Deconfliction
- Existing Instrument Flight Procedure Assessment
- Feasibility Assessment of new and/or novel IFPs to include both instrument approach and departure procedures for runway 11 and 29

The flight procedure design improvements recommended through the course of this assessment considered general traffic patterns and preferences to avoid overflight of the communities surrounding TRK as directed by TTAD representatives. This report does not constitute any detailed analysis performed on the subject of noise abatement and does not represent an environmental assessment.

Any approach designs recommended in this assessment are considered to represent a prototype design made in compliance with 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 and community outreach.

# EXECUTIVE SUMMARY

Flight Tech Engineering has carefully considered the operating capabilities and navigation performance of both business and general aviation operators to determine the most viable instrument flight procedure solutions at TRK. The results of the feasibility study have determined that new PBN solutions can be implemented at the Truckee Tahoe Regional Airport. However, due to close-in mountainous terrain features, standard procedure design is not possible for most of the runways. Additionally, because of different aircraft equipage and the ongoing evolution from ground-based navigation to PBN, there is not a one size fits all public-use solution. Therefore, the new procedure concepts proposed here are tailored for aircraft equipped with advanced navigation systems, which are becoming more commonplace.

The most effective instrument approach procedure (IAP) to implement that utilizes standard FAA design criteria would be an Area Navigation (RNAV) approach with Required Navigation Performance – Authorization Required (RNP-AR). However, this Navigational Specification (NavSpec) requires advanced onboard navigation systems, performance monitoring, aircraft certifications, and special aircrew training. Because of the resultant costs, currently only commercial airlines have utilized RNP-AR and the Operator Assessment identified no operators at TRK capable of utilizing this solution.

Therefore, working within the navigational capabilities of the current business and General Aviation (GA) fleet, Flight Tech focused on exploring RNAV Global Positioning System (GPS) procedures to Runway 11/29 that do not require specialized RNP-AR solutions.

The first such solution was the development of an RNAV (GPS) procedure utilizing Localizer Performance with Vertical Guidance (LPV). While a basic LPV procedure was possible to runway 11, the standard vertical descent path through the mountainous terrain generated excessive descent angles far beyond allowable limits for the most common business jet categories. However, using a newly approved FAA methodology officially referred to as 'RNP to xLS' ('xLS' being a precision landing system such as an Instrument Landing System (ILS) or Localizer Performance with Vertical Guidance (LPV)), FTE was able to connect the initial and intermediate segments of the approach using RNP to an LPV final segment. Utilizing this method, Flight Tech created an RNP to LPV 'hybrid' procedure allowing for precision weather minimums to runway 11 of 310 feet Height Above Threshold (HAT) and 7/8-mile visibility. These new satellite-based procedures represent a profound improvement in IAP capabilities at TRK.

The second novel solution targets runway 29 and includes the use of RNAV (GPS) procedures with Lateral Navigation (LNAV) coupled to a guided visual segment. While these non-precision approach surfaces have a wider obstacle detection area and usually higher minimums, they can provide enhanced guided access to the runway.



# RUNWAY & NAVAID ASSESSMENT

## Purpose

The physical runway dimensions, lighting, and NAVAIDs are essential components to be considered when establishing instrument flight procedure capabilities at an airport. The Runway and NAVAID assessment identified the aeronautical assets which are currently available to support the existing instrument flight procedures and aircraft operations at TRK. This information was then used in addressing the feasibility of new IFP designs discussed later in the study.

## RUNWAY 11/29 & 2/20 PHYSICAL CHARACTERISTICS

Runway 11/29 is 7,001 feet by 100 feet of grooved asphalt in good condition, while 2/20 is a 4,654 foot by 75-foot asphalt runway in good condition with a 114-foot displaced threshold for runway 20. TRK Air Traffic Control Tower (ATCT) is operational between the hours of 0700 – 1900 (APR-MAY), 0700-2000 (JUN-SEP), and 0700-1800 (OCT-MAR), at all other times runway end identifier lights (REILs), medium intensity runway edge lights (MIRLs), and vertical approach slope indicator lights (VASI) are activated on the Common Traffic Advisory Frequency (CTAF) (120.575). Additionally, the airport incorporates an Automated Weather Observation System (AWOS-3PT) on frequency 118.0, lighted wind indication, and standard civilian rotating beacon.

RWY ID	True Bearing	Marking	Lighting	APPR Lighting	VGSI	TCH	TDZE
11	120°	NPA	MIRL, REIL	N/A	N/A	N/A	5,904.3'
29	300°	NPA	MIRL	N/A	N/A	N/A	5,900.8'
2	030°	NPA	MIRL	N/A	N/A	N/A	5,897.8'
20	210°	NPA	MIRL	N/A	VASI/3.5°/Left	25'	5,897.8'

Table 1: Runway 11/29 & 2/20 Physical Characteristics

## NAVAIDS

There are two pertinent off-field NAVAIDs located outside the airport area that have relevance to the instrument flight procedures at Truckee-Tahoe. The Mustang (FMG) Very High Frequency Omnidirectional Range/Tactical Air Navigation (VORTAC) is located 25.8 nautical miles northeast of MFR and is a combination of a Very High Frequency Omnidirectional Range (VOR)

beacon and a Tactical Air Navigation System (TACAN). Together these components provide directional guidance and distance measuring (DME) information. This NAVAID provides enroute transitions for aircraft arriving on the RNAV (GPS) RWY 11 and 29, as well as the TAHOE ONE RNAV Standard Instrument Departure (SID).

The Squaw Valley VOR/DME (SWR) is located 10.3 nautical miles southwest of the airport and provides directional guidance and distance information. This NAVAID is used as an enroute transition for the RNAV (GPS) RWY 11 instrument approach procedure and to define the TRUCK intersection in combination with FMG.

The FMG VORTAC is designed as a high altitude/high volume NAVAID meaning that it is intended to be used over the largest possible serviceable airspace that is not otherwise constrained by signal interference or terrain line of site. Because of surrounding terrain issues, Mustang's signal is unusable from radial 200° through 230° beyond 30 nautical miles below 13,000 feet MSL. The SWR VOR/DME is a low altitude/low volume NAVAID usable out to 40 nautical miles and up to 18,000 feet Above Ground Level (AGL). Both the FMG and SWR have a slaved magnetic variation of 16°E.

## Off-Field NAVAIDs

Identifier	Type	Supports	Distance	Bearing	Remarks
<b>SWR</b>	VOR/DME	Transition for RNAV (GPS) 11	10.3 nm	35.7°	OPERATIONAL RESTRICTED
<b>FMG</b>	VORTAC	Transition for RNAV(GPS) 11, 20 and TAHOE 1 and TRUCK 4 DPs	25.8 nm	240.7°	OPERATIONAL RESTRICTED VORTAC UNUSABLE 200°-230° BEYOND 30 NM BELOW 13,000'

Table 2: Off-Field NAVAIDs

# OPERATOR ASSESSMENT

## Purpose

The operator assessment determines the current operational capabilities of pilots and aircraft utilizing TRK's existing and potential future approaches. The analysis focused on which kinds of instrument procedures can be supported by installed technology on the aircraft, the approach types which are currently being trained, and aspects of sophisticated approaches which can either be accepted by an aircraft operator via Operational Specification (OpSpec) or Letter of Authorization (LOA) and/or potentially pass the FAA Procedure Review Board. This analysis highlights any significant technical limitations that must be considered for IFP enhancements.

## CURRENT OPERATIONS

Operations at Truckee–Tahoe represent a wide array of Part 91 general aviation traffic and Part 135 on-demand charter flights, including a Civil Air Patrol Squadron, an Experimental Aircraft Association Chapter (E.A.A. Chapter 1073) and a vibrant skydiving and soaring community. Much of the Part 91 operations for TRK are local in nature; however, a significant portion are transient flights typical for a resort destination in the West. These segments of aviation support the entire spectrum of avionics capabilities, from strictly VFR backcountry local owner/operators of small single engine piston aircraft to transient large cabin business/corporate class aircraft with advanced PBN avionics, including Synthetic Vision Systems (SVS), Enhanced Flight Vision Systems (EFVS), and Head-Up Displays (HUDs). The Part 135 on-demand charter component of Truckee-Tahoe's operations consists of a fleet of newer Cirrus and Pilatus aircraft supporting advanced PBN avionics, SVS, and EFVS systems.

Taken as a whole, this demographic of operators represents some of the fastest growing early adopters of advanced avionics in aviation. Currently this group broadly supports existing LPV/Wide Area Augmentation System (WAAS) Navigation Specifications (NavSpecs) and are frequently equipped with Garmin avionics. Unlike the legacy install base of large Part 121 Air Carriers, TRK's operators are uniquely positioned to take advantage of newer NavSpecs such as Advanced-Required Navigation Performance (A-RNP) approaches and their components. While many operators may face limitations currently, the vast majority of operators utilizing TRK are well positioned to take advantage of the trends in NavSpecs and avionics utilized in the upcoming section on novel IFP designs.

# OBSTACLE EVALUATION AND DECONFLICTION

## Purpose

The purpose of geospatial deconfliction is to collect, review, compare, and create the most accurate aeronautical and geospatial picture of TRK and surrounding airspace to be used in assessing instrument flight procedure enhancements. This requires a collection of all published, as well as 3<sup>rd</sup> party sources, provided by various stakeholders who routinely work with instrument approaches at TRK. The act of deconfliction is central to this portion of the study as many public datasets frequently contain conflicting definitions about their size, position, currency, and accuracy. Out of date, or inaccurate information used in an instrument procedure design can lead to unsafe flight operations, but it can also lead to non-optimal approach and airport design considerations. Therefore, the goal of the assessment was to create both a “comprehensive” view of the necessary inputs to procedure design as well as point out any existing data deficiencies that TRK can improve to enhance future instrument approach procedure capabilities.

As part of the assessment, Fight Tech worked with the Airport's Airfield Engineering Consultant (Mead & Hunt) to determine the incorporate recent survey data that reflected the results of recent tree removal and provide additional obstacle reporting density in mountainous area. Obstacles in the FAA's Digital Obsatcle File (DOF) that conflicted with recently surveyed using Advisory Circular (AC) 150-5300/18B standards were deconflicted and updated accordingly. In total, FTE utilized 10,059 obstacle points from the established 2017 airport survey and 7,743 obstacles from the Supplemental obstacle survey performed in 2019.

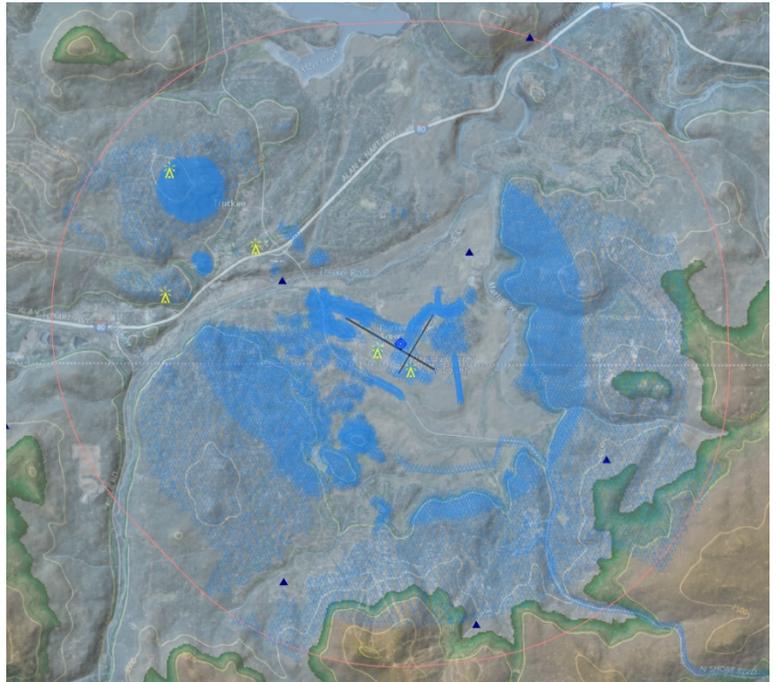


Figure 2: TRK Design Workspace - Obstacle Survey extent and density (in blue)

# CURRENT FLIGHT PROCEDURE ASSESSMENT

## Purpose

The purpose of the evaluation of current IFP capabilities is to recreate the existing procedures at TRK using the latest aeronautical and geospatial deconfliction information and examine the current published minimums against any potential improvements, or conflicts, that may exist. By determining the best possible combination of enhancements that can be made to the existing approaches, without fundamental changes in the design of the approach, a baseline will be established that enables future changes in instrument approaches, or new instrument approach procedures themselves, to be measured against.

This baseline of the existing straight-in and circling IAPs to Runways 11 and 20, as well as the TAHOE 1 RNAV SID and TRUCK 4 ODP utilizes the same Terminal Area Route Generation Evaluation and Traffic Simulation Software (TARGETS) design software and TERPS criteria used by the FAA. Beyond the aeronautical and geospatial information, each of the assessments described in the previous sections has informed this baseline, as well as the novel IFPs in the following section.

## DEPARTURE PROCEDURE ASSESSMENT

### TRUCK FOUR Departure

The TRUCK FOUR departure is a conventional navigation, Obstacle Departure Procedure (ODP) for use on Runway 2 & 29. Aircraft that utilize this ODP are expected to comply with standard departure procedures by climbing on runway heading to 400 feet Height Above Runway (HAR) before turning. Aircraft departing runway 2 will turn left to a heading of 275°. Aircraft departing runway 29 will turn right to a heading of 320°. All aircraft will join the SWR radial 002° northbound to TRUCK intersection. TRUCK intersection can be identified either by 16 DME from SWR or by the FMG 241° radial. TRUCK is an enroute waypoint with access to several airways but departing aircraft must hold as published at TRUCK until they have climbed to at least 11,500 ft. before proceeding on course. The departure ceilings and visibility are standard. Departure from runway 2 requires a climb gradient (CG) of 415 feet per nautical mile (NM) to 11,500 MSL. Departure from runway 29 requires a climb gradient of 500 feet per nautical mile to 11,500 MSL.

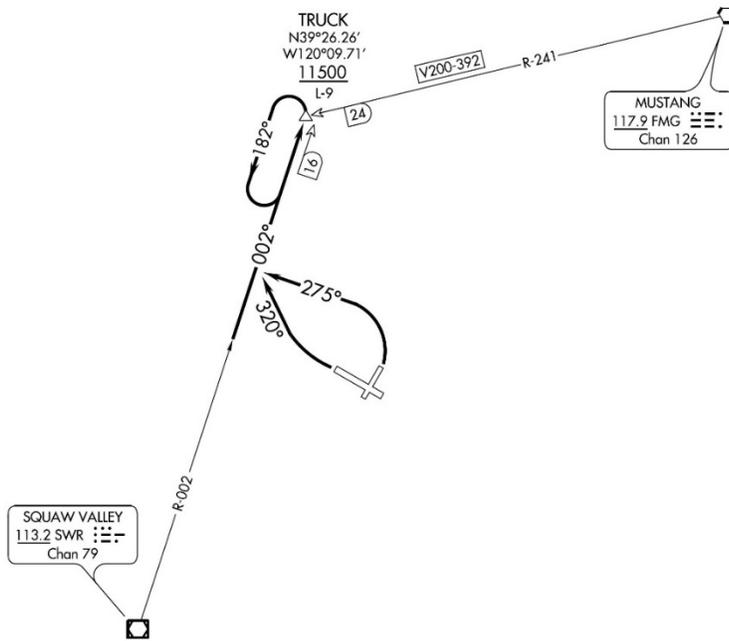


Figure 3: TRUCK FOUR DP Diagram

The following information is a summary of the key aspects about the TRUCK FOUR Departure from Runways 2 and 29.

**Navigation Method:** Conventional

**NAVAIDs Used:** SWR VOR/DME, FMG VORTAC

**Runway 2 CG:** 415' /nm to 6,000'

**Runway 29 CG:** 500' /nm to 6,000'

**Reason for CG:** Obstacle Driven

**Ceiling/Visibility Required:** Standard

**ICA Obstacles:** The Initial Climb Area (ICA) is a straight portion of the

departure segment which allows the aircraft to climb to a minimum height

of above 400' AGL above the runway

threshold before turning. Penetrating

obstacles in the extended ICA (to 3 statute miles (SM)) dictate the ceiling and visibility

requirements to allow aircraft to see and avoid obstructions.

obstacles in the extended ICA (to 3 statute miles (SM)) dictate the ceiling and visibility requirements to allow aircraft to see and avoid obstructions.

**Low Close-In Obstacle Evaluation (2015 Survey):**

- RWY 2, Trees beginning 2' from Departure End of Runway (DER), 288' left of centerline, up to 60' AGL (5939' MSL)
- RWY 2, Trees beginning 420' from DER, 312' right of centerline, up to 60' AGL (5939' MSL)
- RWY 29, Trees beginning 679' from DER, 507' left of centerline, up to 60' AGL (5997' MSL)
- RWY 29, Trees beginning 116' from DER, 412' right of centerline, up to 60' AGL (5997' MSL)

**TAHOE ONE Departure**

The TAHOE ONE departure is an RNAV SID procedure for use on runway 2 & 29. Aircraft that utilize this SID are expected to comply with standard departure procedures by climbing on runway heading to 500 feet Height Above Runway (6420' MSL) before turning. Aircraft departing runway 2 will turn left and proceed direct to PWWDR. Aircraft departing runway 29 will turn right and proceed direct to PWWDR. All aircraft then proceed to the TAHOE waypoint. Departing aircraft must hold as published at TAHOE until they have climbed to at least 12,000 feet before proceeding on course. Once above 12,000 feet, departing aircraft can either proceed east to FMG VOR or west to SIGNA intersection, or other heading as assigned by ATC. The departure ceilings and visibility are standard. Departure from runway 2 requires a climb gradient of 500 feet per nautical mile to 6,240 feet MSL, and then a minimum climb gradient

of 425' per nautical mile to 11,000 MSL. Departure from runway 29 requires a climb gradient of 500 feet per nautical mile to 10,200 MSL.

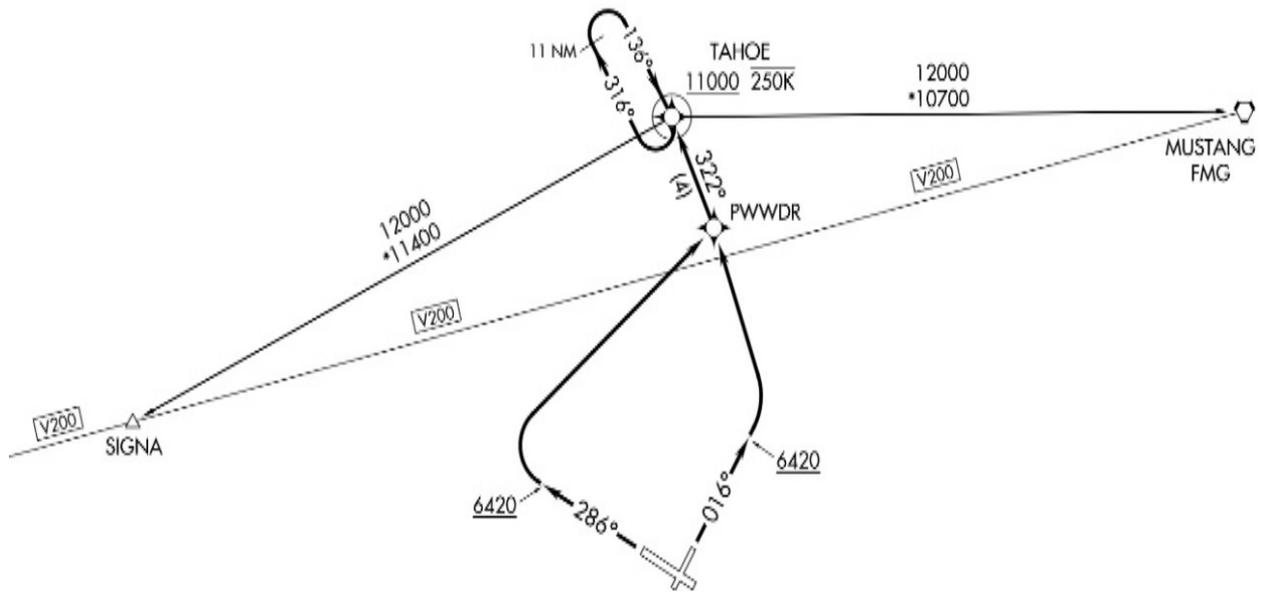


Figure 4: TAHOE ONE RNAV SID Plan View

The following information is a summary of the key aspects about the TAHOE ONE Departure from Runways 2 and 29.

**Navigation Method:** RNAV

**NAVAIDS Used:** FMG VORTAC

**Runway 2 CG:** 500'/nm to 6,420'

**Runway 29 CG:** 500'/nm to 10,200'

**Reason for CG:** Obstacle Driven

**Ceiling/Visibility Required:** Standard

**ICA Obstacles:** The ICA is a straight portion of the departure segment which allows the aircraft to climb to a minimum height of above 500' AGL above the runway threshold before turning. Penetrating obstacles in the extended ICA (to 3 SM) dictate the ceiling and visibility requirements to allow aircraft to see and avoid obstructions.

# INSTRUMENT APPROACH PROCEDURE ASSESSMENT

## Runway 11 RNAV (GPS)

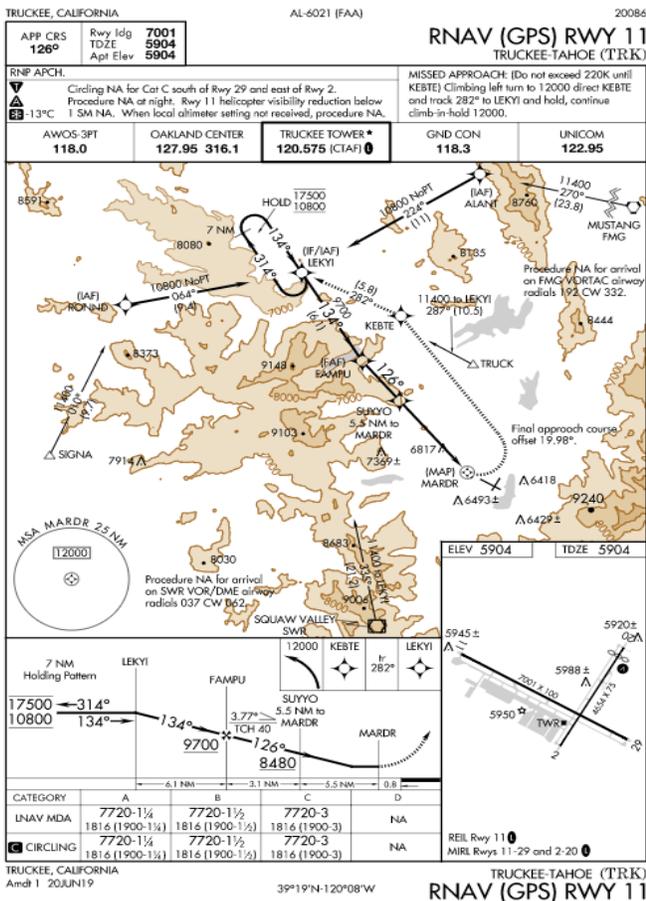


Figure 5: Current RNAV (GPS) 11 Approach

The RNAV (GPS) RWY 11 approach is oriented from the northwest and currently offers only LNAV (non-precision) minima. Three Initial Approach Fixes (IAFs) transition arriving aircraft into the terminal area and onto the approach. The RONND IAF collects traffic inbound from the southwest, ALANT from the east, and LEKYI from the north and south. High terrain in the final-approach segment, particularly the Alder hill area, is the main limiter to lower, more precise minimums on this approach. Indeed, the minimum descent altitudes for this approach are so high, that it is limited in its utility when ceilings and visibility are low. The final approach segment for this IAP has a 3.77° vertical descent angle from the Final Approach Fix to the Missed Approach Point at RWY 11. The procedure offers a circling option to the other runway ends at the airport. There is a prohibition against this approach being flown at night due to high terrain in the visual area (close to the runway). The standard minimum climb gradient (200'/NM) is all that is required on the Missed

Approach Procedure in order to fly the missed approach to the hold waypoint at LEKYI, which allows a climb-in-hold option to 12,000 ft., which is the proceed-on-course altitude.

The following are a list of key elements which define the current RNAV (GPS) RWY 11 instrument approach capabilities:

**Type:** PBN Non-Precision RNAV (GPS) based approaches up to CAT C approach speeds

**Best Minimums:** LNAV: 7,720 MSL (1816 HAT) & visibility 1¼ SM (CAT A) to 3 SM (CAT C)

**NAVAIDs Used:** GPS

**Last Revised:** Amendment 1 – 20JUN19

**Flight Inspection:** Satisfactory check with no comments

**Design Notes:**

- Standard missed approach climb gradient in effect
- Circling at night NA due to 20:1 obstacles
- Circling southeast of RWY 2 and southwest of RWY 29 NA
- Visual Descent Point (VDP) not established – 20:1 obstacles
- CAT D mins not established due to missed approach obstacles
- Lower minima allowed due to 220 knot speed restriction until KEBTE on missed approach.

RWY Ident	Procedure	Level of Service	Minimums	Primary NAVAID	Missed Approach Climb Gradient
11	RNAV (GPS)	LNAV	CAT A: 7720-1 <sup>1</sup> / <sub>4</sub> (1816') CAT B: 7720-1 <sup>1</sup> / <sub>2</sub> (1816') CAT C: 7720-3 (1816') CAT D: N/A	N/A	STD climb gradient
11	RNAV (GPS)	Circling	CAT A: 7720-1 <sup>1</sup> / <sub>4</sub> (1816') CAT B: 7720-1 <sup>1</sup> / <sub>2</sub> (1816') CAT C: 7720-3 (1816') CAT D: N/A	N/A	STD climb gradient

Table 3: Runway 11 Instrument Approach Procedure list.

# Runway 20 RNAV (GPS) Approach

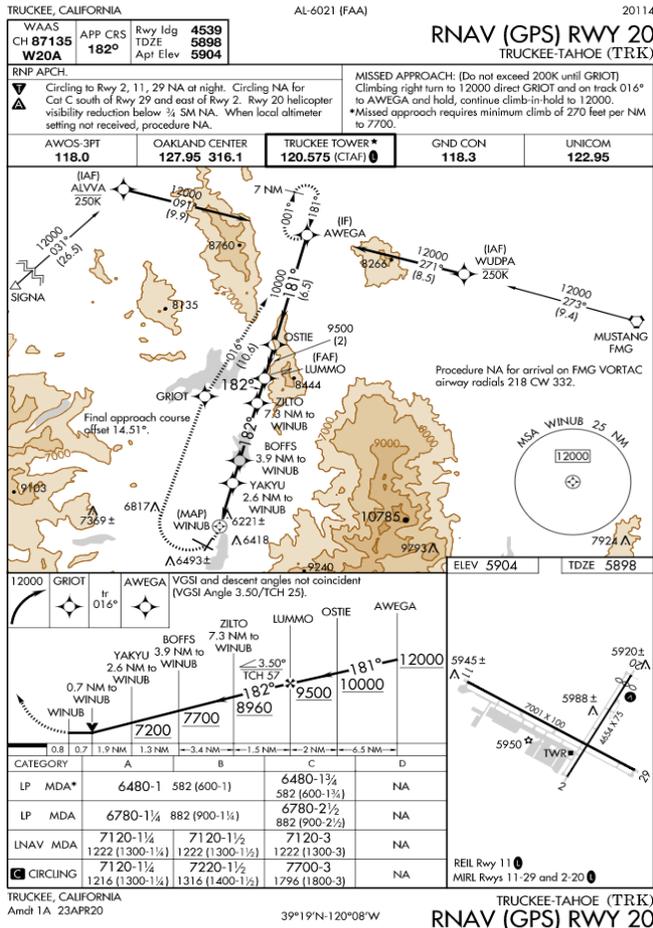


Figure 6: Current RWY 20 Approach

The RNAV (GPS) RWY 20 approach is oriented from the northeast and currently offers LP as well as LNAV and circling minima. Two IAFs transition arriving aircraft into the terminal area and onto the approach. The ALVVA IAF collects traffic inbound from the southwest, and WUDPA from the east. The final approach segment for this IAP has a 3.5° vertical descent angle from the Final Approach Fix to the Missed Approach Point. The procedure offers a circling option to the other runway ends at the airport, but there is a prohibition against circling to other runways at night due to obstacles in the visual area. The lowest minimums – 582' above the airport - require a 270'/NM climb gradient in the missed approach segment to 7,700 ft. With standard a standard climb gradient (200'/NM), the lowest minimums are 882' above the airport.

The missed approach is a right-turn course-reversal back to the AWEGA intermediate fix. The missed-approach climb gradient is a comparatively modest 270'/NM when using the lowest minimums – unusual for a mountain

airport. Once at AWEGA, a climb-in-hold option is available for departure from the area.

This approach offers the lowest minimums of any instrument approach into Truckee. However, the approach ends at the "short" runway (~4500 ft), which while suitable for all piston-powered, most turboprop, and small business jet aircraft, it is too short for many faster, swept-wing turbojet airplanes. Should those faster airplanes attempt to use the RNAV(GPS) RWY 20 approach, they would be forced to perform a circling maneuver to the long runway. Current industry best-practices suggest that larger, faster, less maneuverable aircraft should not attempt to circle to land in poor weather or low visibility, but should instead use "straight-in" approaches aligned with the runway of intended landing whenever possible. This industry realization regarding the discouragement of low-altitude maneuvering has been responsible for a noticeable reduction in aircraft accidents during the landing phase of flight.

The following are a list of key elements which define the current RNAV (GPS) RW20 instrument approach capabilities:

**Type:** PBN Non-Precision RNAV (GPS) based approaches up to CAT C approach speeds.

**Best Minimums:** LP: 6,480' MSL (582' HAT) & visibility 1SM (CAT A) to 1<sup>3</sup>/<sub>4</sub>SM (CAT C)

**NAVAIDs Used:** GPS

**Last Revised:** Amendment 1A – 23APR2020

**Flight Inspection:** Satisfactory check with no comments

**Design Notes:**

- The lowest approach minimums require a 270'/NM climb gradient to 7,700 ft.
- Circling to other runways at night NA due to 20:1 obstacles
- CAT C aircraft prohibited from circling southeast of RWY 2 and southwest of RWY 29
- VDP established
- Final Approach Course (FAC) and RW20 centerline offset by 14.51 degrees
- FAC crosses RWY 20 centerline 5,000 ft. from threshold
- FAC Flight Path Angle (FPA) not coincident with VASI
- CAT D mins not established due to missed-approach obstacles
- Lower minima allowed due to 200 knot speed restriction until GROIT on missed approach.

RWY Ident	Procedure	Level of Service	Minimums	Primary NAVAID	Missed Approach Climb Gradient
20	RNAV (GPS)	LP	<u>W/ CG 270'/NM to 7700:</u> CAT A-B: 6480-1 (582') CAT C: 6480-1 <sup>3</sup> / <sub>4</sub> (582') CAT D: N/A  <u>Standard MA CG:</u> CAT A-B: 6780-1 <sup>1</sup> / <sub>4</sub> (882') CAT C: 6780-2 <sup>1</sup> / <sub>2</sub> (882') CAT D: N/A	N/A	270 feet per nautical mile to 7,700'  STD CG line of minima
20	RNAV (GPS)	LNAV	CAT A: 7120-1 <sup>1</sup> / <sub>4</sub> (1222') CAT B: 7120-1 <sup>1</sup> / <sub>2</sub> (1222') CAT C: 7120-3 (1222') CAT D: N/A	N/A	STD climb gradient
20	RNAV (GPS)	Circling	CAT A: 7120-1 <sup>1</sup> / <sub>4</sub> (1216') CAT B: 7220-1 <sup>1</sup> / <sub>2</sub> (1316') CAT C: 7700-3 (1796') CAT D: N/A	N/A	STD climb gradient

Table 4: Runway 20 Instrument Approach Procedure list

## RNAV (GPS)-A Approach

The RNAV (GPS)-A approach is oriented from the west and offers only circling minimums. The single IAF starts at SIGNA and is best set up for arriving aircraft from the west. The final approach segment for this IAP, like all circling-only approaches does not have a published descent angle. However, the altitude constraints between the FAF and the Missed Approach Point (MAP) suggest a 3.3-degree descent in order to take most advantageous use of the minimum-descent altitude afforded. The procedure is not designed for a specific runway, but the final approach and MAP set it up for a manageable right turn to runway 11. However, the altitude



Figure 7: RNAV (GPS)-A Visual Circling path

loss from the FAF to the RWY 11 threshold – 3,200 ft. – requires a 7.5-degree descent angle which is not consistent with industry best practice of a stabilized approach. Therefore, some type of circling maneuver will be required before lining up on one of the four available runway ends. The notes caution against circling south of the airport, specifically east of RWY 2 and south of RWY 29, due to high terrain.

For example an airplane desiring to land on RWY 29 from this approach would, with the airport in sight, circle north then east of the airport in a right-hand turn in order to line up on runway 29 (green dashed line in the figure). Due to the chart notes prohibiting circling south of the airport, the airplane must not break off early and circle west of the airport for a left turn to runway 29 (orange dashed line passing through the no-circling area).

Circling is prohibited at night, and therefore this approach is not available at night.

The missed approach is a left-turn to the north, ending up at the LEKYI fix. The missed-approach climb gradient is a standard 200'/NM – unusually shallow for a mountain airport. Once at LEKYI, a climb-in-hold option is available for departure from the area.

The following are a list of key elements which define the current RNAV (GPS)-A instrument approach capabilities:

**Type:** PBN Non-Precision RNAV (GPS) based approaches up to CAT C approach speeds

**Best Minimums:** 7,500' MSL (1,596' HAA) & visibility 1<sup>1</sup>/<sub>4</sub>SM (CAT A-B) to 7,700' MSL (1,796' HAA) 3SM (CAT C)

**NAVAIDs Used:** GPS

**Last Revised:** Original – 20JUN2019

**Flight Inspection:** Satisfactory check with no comments

**Design Notes:**

- The lowest approach minimums are obtained with standard climb-gradient in the missed-approach
- CAT C aircraft prohibited from circling southeast of RW 02 and southwest of RWY 29
- Procedure is prohibited at night due to 20:1 penetrations
- FAC is somewhat aligned with RWY 11 but would require a prohibitive descent rate to be flown without significant maneuvering
- CAT D mins not established due to missed-approach obstacles
- Lower minima allowed due to 200 knot speed restriction until KEBTE on missed approach

RWY Ident	Procedure	Level of Service	Minimums	Primary NAVAID	Missed Approach Climb Gradient
N/A	RNAV (GPS)	Circling	CAT A: 7500-1 <sup>1</sup> / <sub>4</sub> (1596') CAT B: 7500-1 <sup>1</sup> / <sub>2</sub> (1596') CAT C: 7700-3 (1796') CAT N: N/A	N/A	STD CG line of minima

Table 5: Circling Instrument Approach Procedure list

# FEASIBILITY ASSESSMENT OF NEW INSTRUMENT FLIGHT PROCEDURES

## DESIGN OVERVIEW

As was initially described in the Executive Summary, several novel design concepts were explored once the baseline procedure set was established in the prior Assessment section. Using the results of the Operator Assessment conducted for TRK, the prototype IFPs in this section are tailored to the actual operator demographics at Truckee-Tahoe. While the specific procedures set forth in this section are currently prototypes, they represent actual solutions that can be implemented at TRK should the TTAD decide to move forward with implementation after the conclusion of this feasibility study.

## NEW DEPARTURE PROCEDURE ASSESSMENT

The TRUCKEE ONE (RNAV) departure procedure for runway 11 and 29 incorporates standard NavSpec design with an option for an additional RNP-1 equipment requirement applied to the runway 11 DP that would reduce the TERPS containment areas in order to lower the required CG. Each flight path has been specifically crafted to minimize traffic in noise sensitive residential areas near the airport.

### Runway 11 Departure

Terrain immediately to the east of the departure end of runway (approx. 2.3 NM) requires a prompt turn to prevent an excessive climb gradient. The procedure climbs direct to the first waypoint located 1.25 NM from the runway end. Then turns left to the Northwest.

- Design utilizes RNAV waypoints.
- As an RNAV-1 DP, the required climb gradient is 775 ft/NM to 9,300'.
- As an RNP-1 DP, the required climb gradient falls to 675 ft/NM to 7,200'.

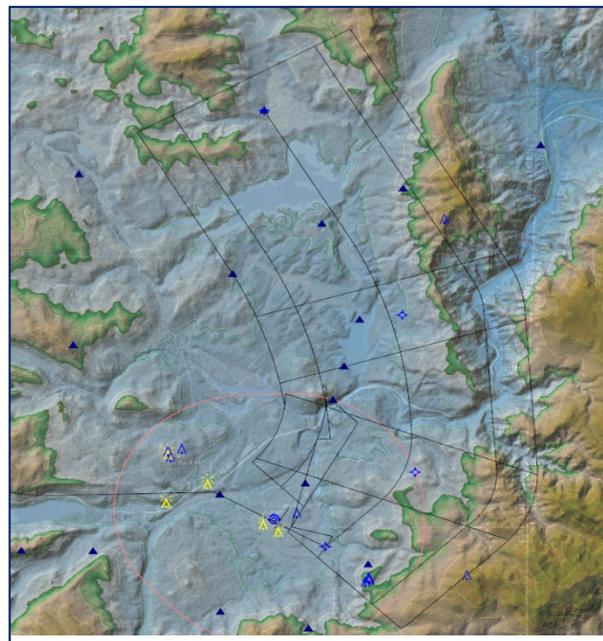


Figure 8: RWY 11 Departure Path

The use of Required Navigation Performance (RNP-1) allows for the reduction of secondary obstacle containment areas. The secondary area is the outer 1NM extension depicted in the departure surface depicted above. The reduction of this surface prevents additional terrain pickup which drives the Climb Gradient from 675 ft/nm to 775 ft/nm. The standard FAA limit for Climb Gradients is

500 ft/nm however, higher than standard CGs can be approved via special waivers or exceptions and is common at airports located in the mountains.

### Runway 29 Departure

The RWY 29 procedure makes use of Interstate 80 in avoiding terrain issues as well as noise sensitive residential areas. The proposed Departure Procedure climbs to a waypoint located 1.0 NM from the runway end and begins a left turn to the west towards Donner Lake. The design utilizes standard RNAV-1 criteria allowing for a turn above 400 ft. AGL and includes secondary obstacle capture areas.

Design Notes:

- Design utilizes RNAV waypoints.
- As an RNAV-1 DP, the required climb gradient is 475 ft/NM to 10,200'.

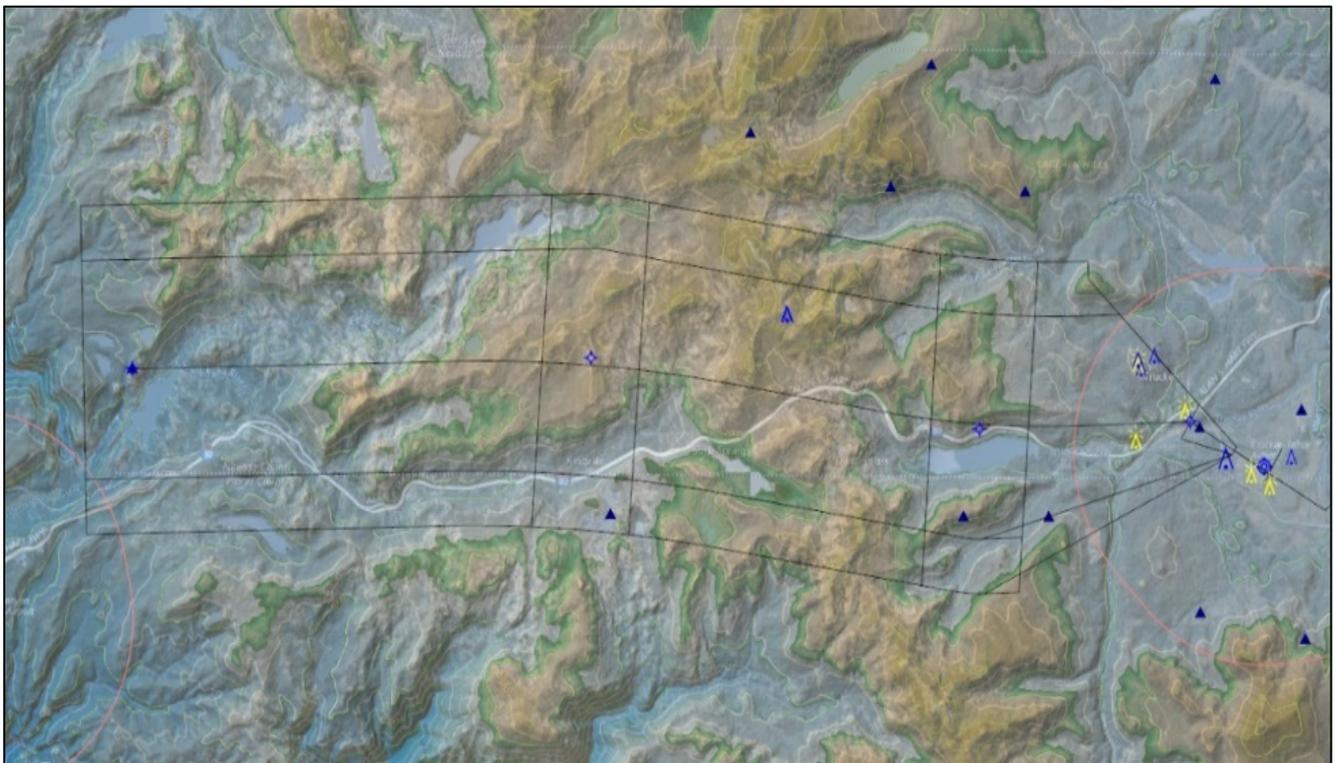


Figure 9: RWY 29 Departure Procedure Path.

TRUCKEE ONE DEPARTURE (RNAV)



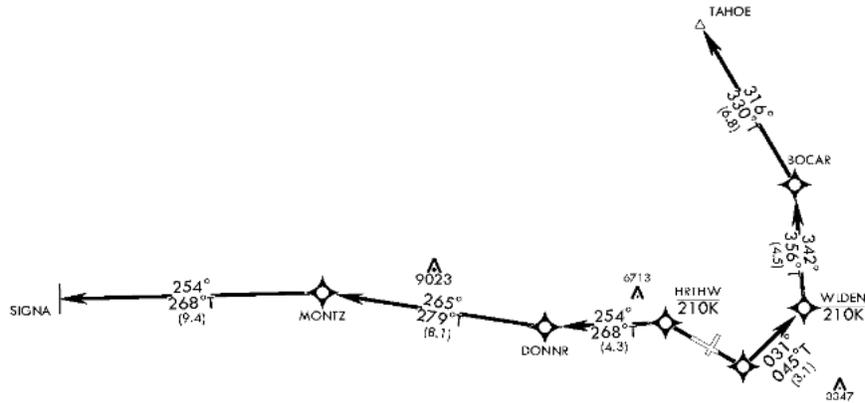
TRUCKEE-TAHOE (KTRK)

TRUCKEE, CALIFORNIA

Rwy	Knots	60	90	120	150	180	240	300
RW11 (a)	V/V(fpm)	775	1163	1550	1937	2325	3000	3875
RW29 (b)	V/V(fpm)	475	713	950	1188	1425	1900	2375

Minimum Climb Rate  
 (a) to 9300  
 (b) to 10,200

GPS Required  
 RNAV-1



**PROTOTYPE**  
 NOT FOR NAVIGATION



DEPARTURE ROUTE DESCRIPTION

**TAKEOFF RWY 11:** Climb direct MARTIS, then track 031 to WLDEN, then track 342 to BOCAR, then track 316 to TAHOE

**TAKEOFF RWY 29:** Climb direct HRTHW, then track 254 to DONNR, then track 265 to MONTZ, then track 254 to SIGNA

TAKE-OFF MINIMUMS

RWY 11, Standard with minimum climb of 775 ft./NM to 9300 ft.  
 RWY 29, Standard with minimum climb of 475 ft./NM to 10200 ft.

TRUCKEE ONE DEPARTURE (RNAV)

TERPS

TRUCKEE, CALIFORNIA  
 TRUCKEE-TAHOE (KTRK)

Figure 10: RWY 11/29 - Combined Departure Procedure Paths

Note: Unless both procedures end at a common point, two separate departure procedures will be required. For illustration purposes, both runway transitions have been combined on a single chart.

## NEW APPROACH PROCEDURE ASSESSMENT

The new approach assessment was focused on runway 11/29 based on the scope of the project and recognizing runway 20 is already served by a WAAS based approach. Runway 11/29 is also the preferred runway of choice for larger aircraft types due to its length. This study focused on navigation methods that provide for stabilized approaches to the airport as opposed to unguided (circling only) methods.

### Runway 11 Hybrid RNP to LPV Solution

The FAA has recently published criteria (Order 8260.58A) allowing for the joining of an ILS, Ground Based Landing Systems (GLS), or LPV final segment to an RNP-1 or RNP 0.30 initial and intermediate segment (RNP to xLS). Due to its recent addition and requirements for additional avionics equipment and certification, this navigation technique has not been widely implemented within the National Airspace System (NAS) and is mostly utilized by Helicopters and Special Fixed Wing Approaches (Eagle, CO & Hailey, ID). Based on feedback from the Operator Assessment, RNP capabilities utilizing a design half width of 0.30 nm was possible in the intermediate and initial segments.



Figure 11: Obstacle Accountability Area (OAA) Lateral Dimensions

In the United States, the use of A-RNP requires the avionics to be capable of Radius-to-Fix (RF) legs, Scalability to 1.0 or 0.3, and parallel offsets. In addition, the use of RNP 0.30 requires the aircraft to be flown using Autopilot (AP) and Flight Director (FD).

With these limitations in mind, the proposed IAP connects an RNP 0.30 Intermediate segment to a WAAS vertically guided Final Approach Segment (FAS). The key element for the design was to ensure that both the intermediate and final segments avoided the highest portions of the mountainous terrain to the northwest of the runway.

The missed approach segment was built utilizing standard RNAV-1 criteria starting at the LPV Decision Altitude (DA) and requires a 200-knot speed restriction. The missed approach path takes advantage of a slight clearing in the terrain as it begins a left-hand turn from the DA to the north for holding thus allowing for a low climb gradient requirement. The pairing of these navigation modes allowed for successful connection of all procedure segments using standard obstacle clearance margins. This resulted in vastly improved minimums of 310 feet HAT and 7/8 SM visibility.

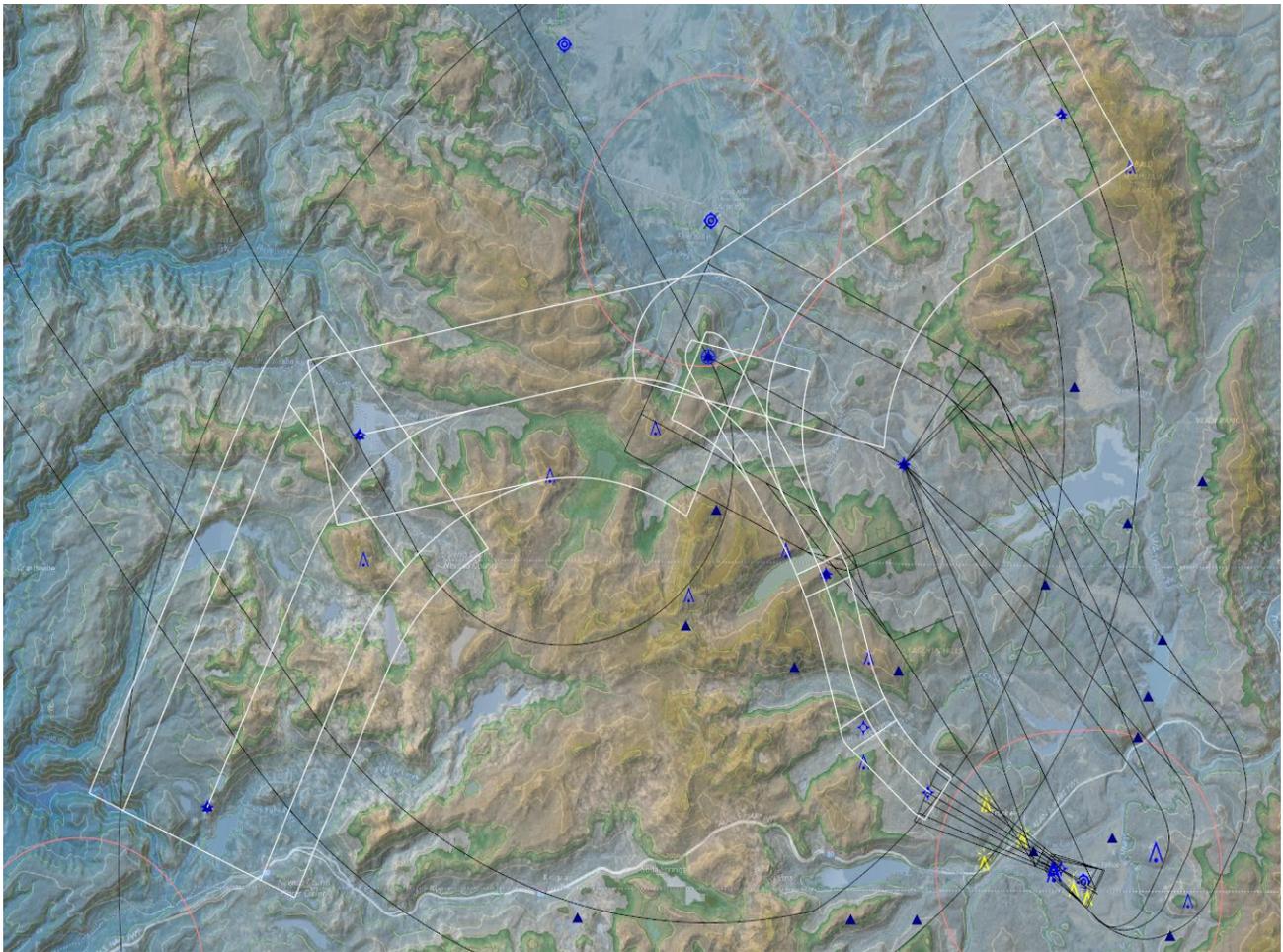


Figure 12: RWY 11 RNP to LPV Approach. White lines are RNP 0.30 surface.

TRUCKEE, CALIFORNIA



20257  
RNAV (GPS) RWY 11

SBAS Chan <b>12345</b> W11A	APCH CRS <b>103°</b>	Rwy Ldg TDZE <b>6999</b> 5904	Arpt Elev <b>5901</b>
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(TYPE PROTOTYPE)

TRUCKEE-TAHOE (KTRK)

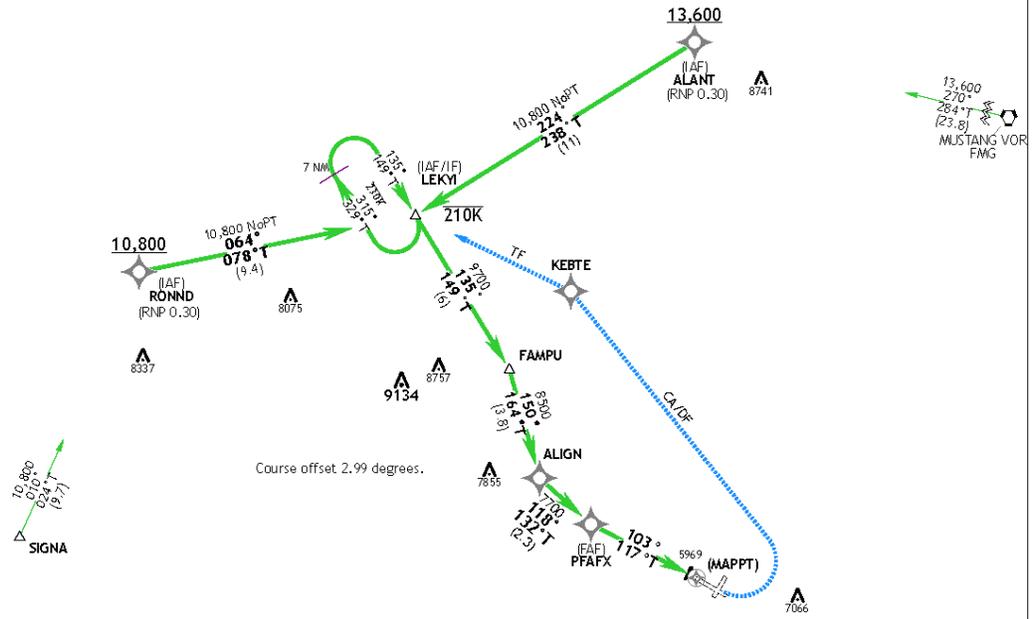
Visibility Reduction by Helicopters NA.

↑ MISSED APPROACH: (Do not exceed 200 KIAS until initial turn completion.) Climb to 6400 then climbing left turn to 12000 direct KEBTE, track 282 to LEKYI and hold, continue climb-in-hold to 12000. \*\*\*Missed Approach requires a minimum climb of 389 ft per NM to 7300 ft.

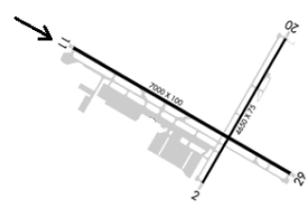
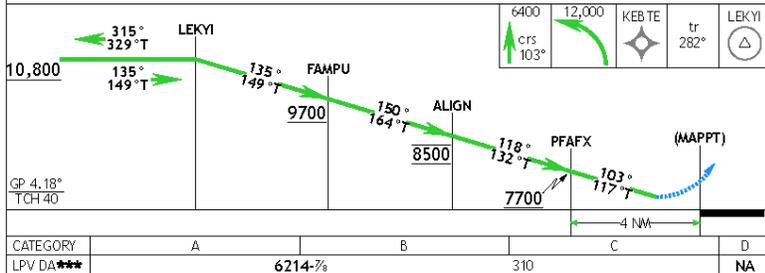
A-RNP-GPS APCH  
MIN RNP 0.30

↑ CAUTION: Missed Approach  
Minimum Climb Rate to 7300

Knots	60	90	120	150	180	240	300
V/V (fpm)	389	584	778	973	1167	1556	1945



**PROTOTYPE**  
NOT FOR NAVIGATION



CATEGORY	A	B	C	D
LPV DA ***	6214-70		310	NA

TRUCKEE, CALIFORNIA

39°19'N - 120°08'W

TRUCKEE-TAHOE (KTRK)

Orig TERPS

RNAV (GPS) RWY 11

Figure 13: RWY 11 xLS to LPV Approach Concept

## Runway 29 RNAV (GPS) Guided Visual Solutions

The two proposed solutions for runway 29 utilize a design feature known as “Fly Visual” to provide guidance beyond the Minimum Descent Altitude (MDA) to the MAP. One of the benefits of this design methodology is that positive course guidance is provided to the flight crew during the “Fly Visual” segment. Upon reaching the Fly Visual segment, the pilot must have the required flight visibility prescribed in the approach and proceed to the airport maintaining visual contact with the ground while remaining clear of clouds. Altitude on the visual flight path is at the discretion of the pilot; however, obstacle clearance is the sole responsibility of the pilot after descent is initiated below the MDA. While turns beyond the Final Approach segment are not widely used with the NAS, public RNAV examples exist at John F. Kennedy International Airport (KJFK RWY 13L) and Palm Beach International Airport (KPBI RWY 28R).

### RWY 29 Option #1– TAHOE FLY VISUAL RWY 29 Approach

- RNAV (GPS) RWY 29 provides LNAV non-precision lateral guidance.
- Because of terrain and obstacle penetrations in the FAS, a turn and Fly Visual segment is utilized from FSDF1 to the airport.
- This is a ‘clean sheet’ design encompassing special routing for the Initial, Intermediate, and Missed Approach segments.
- Provides positive lateral guidance to the runway during the visual segment.
- Requires standard Missed Approach CG.

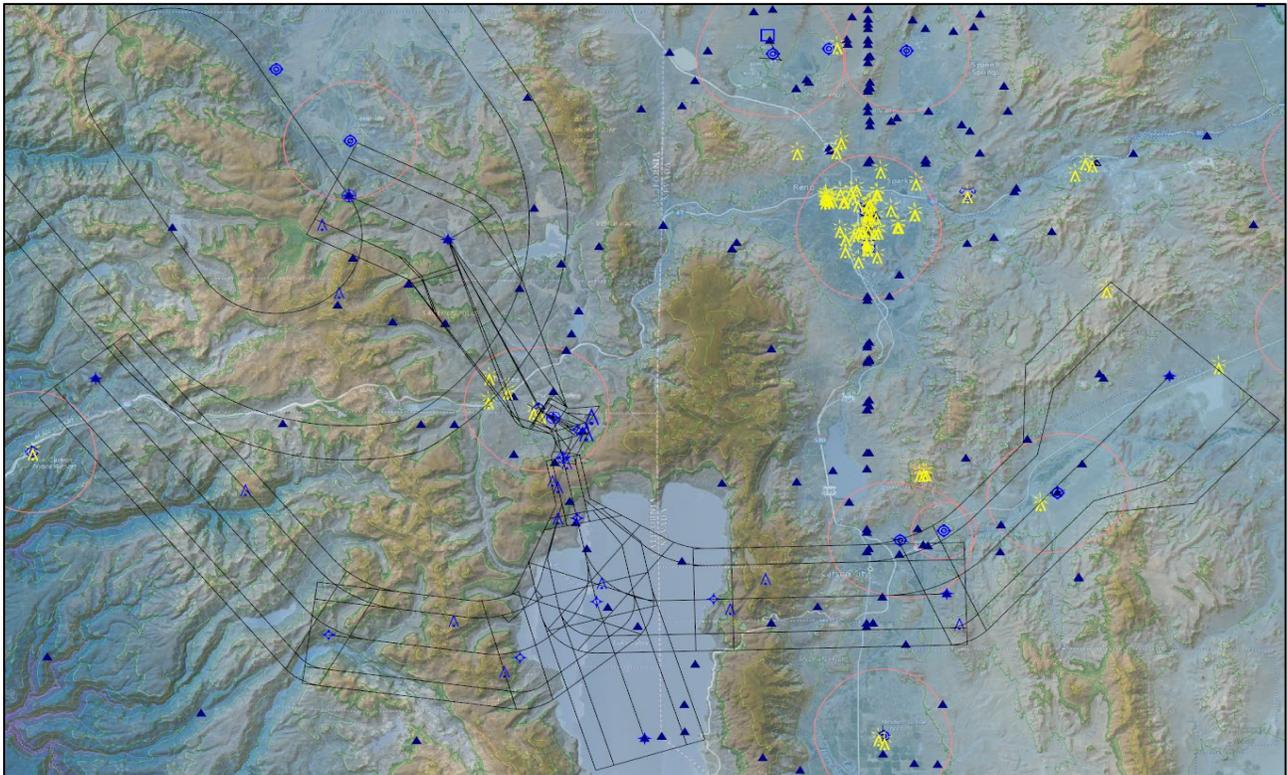


Figure 14: RWY 29: TAHOE Fly Visual Concept #1

TRUCKEE, CALIFORNIA



**RNAV (GPS) RWY 29**

20257

APCH CRS	Rwy Idg	6999
286°	TDZE	5899
	Arpt Elev	5901

(P | E | PKU | U | Y | P | E)

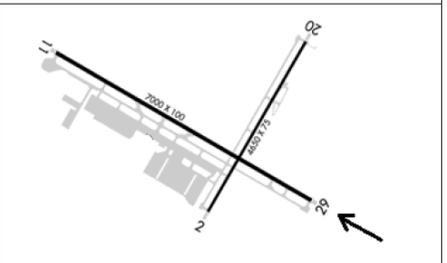
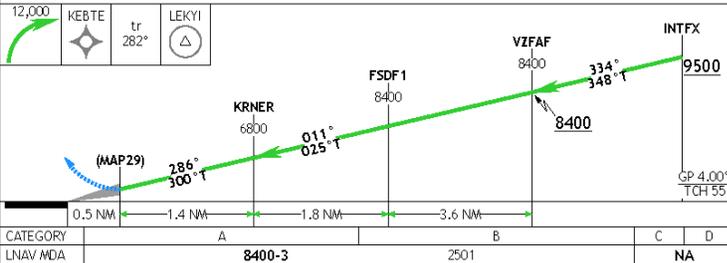
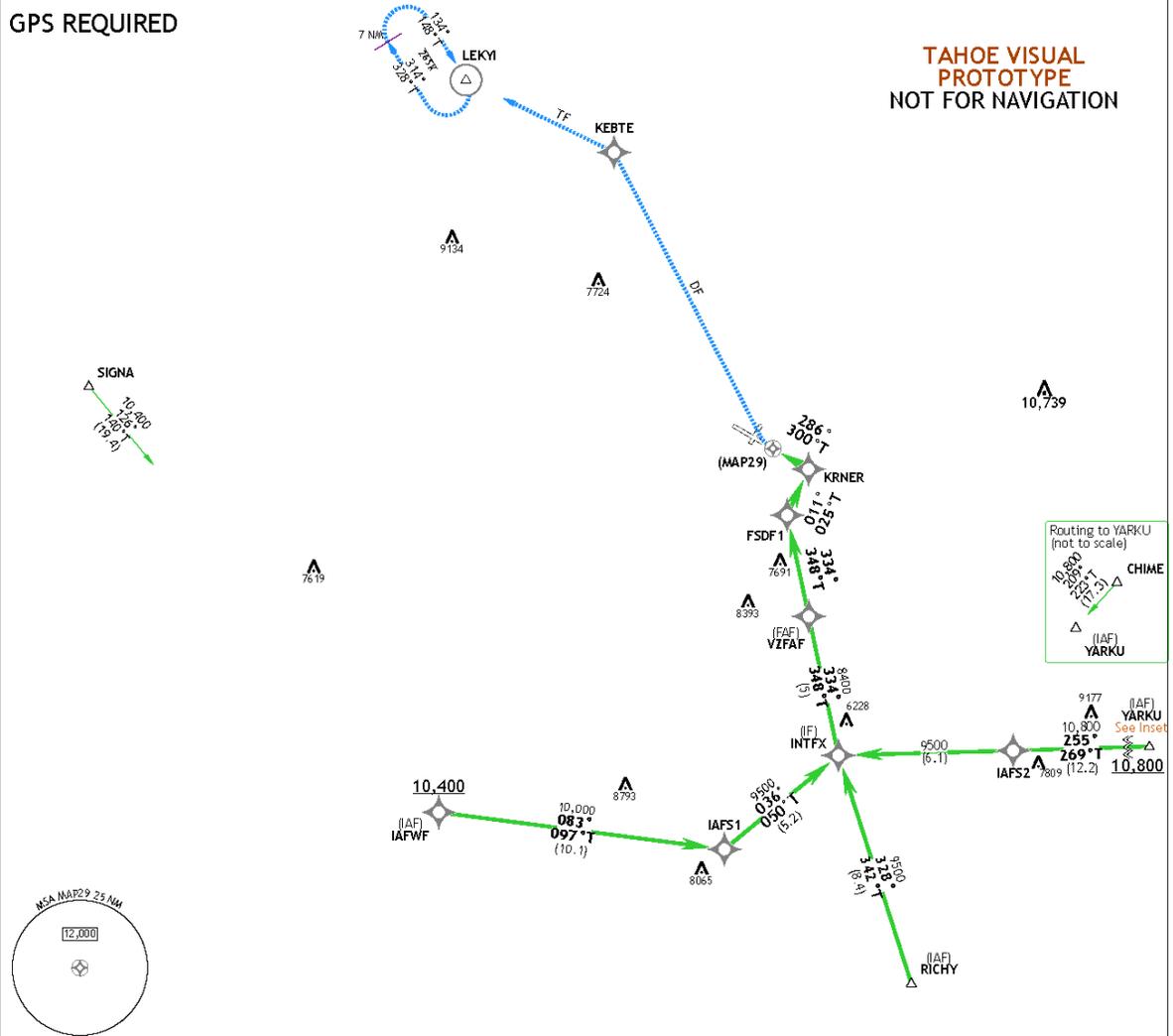
TRUCKEE-TAHOE (KTRK)

TAHOE VISUAL CONCEPT. Procedure NA at night. Fly Visual from FSDF1 to Runway 29.

MISSED APPROACH: Climb to 6400 then climbing right turn to 12000 direct KEBTE, track 282 to LEKYI and hold, continue climb-in-hold to 12000.

**RNP APCH**  
**GPS REQUIRED**

**TAHOE VISUAL PROTOTYPE**  
**NOT FOR NAVIGATION**



CATEGORY	A		B		C	D
LNAV MDA	8400-3		2501		NA	

TRUCKEE, CALIFORNIA

39°19'N - 120°08'W

TRUCKEE-TAHOE (KTRK)

Orig TERP-S

**RNAV (GPS) RWY 29**

Export Date: 13 Sep 2020 22:59:55

Figure 15: Approach Chart Prototype for RWY 29 Option #1



TRUCKEE, CALIFORNIA



RNAV (GPS) RWY 29 20258

APCH CRS 283°	Rwy Ldg TDZE 6999 5899	Appt Elev 5901
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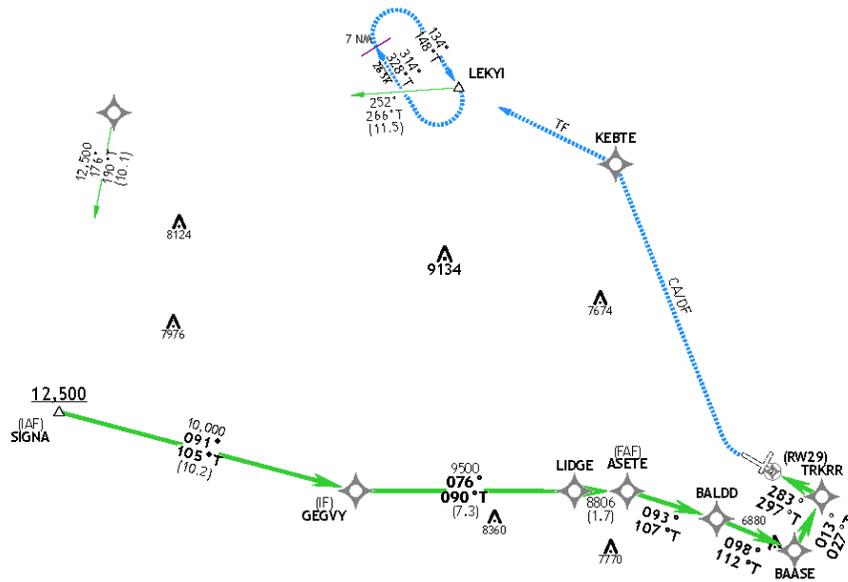
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TRUCKEE-TAHOE (KTRK)

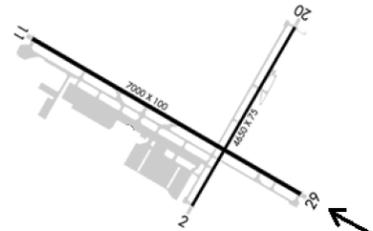
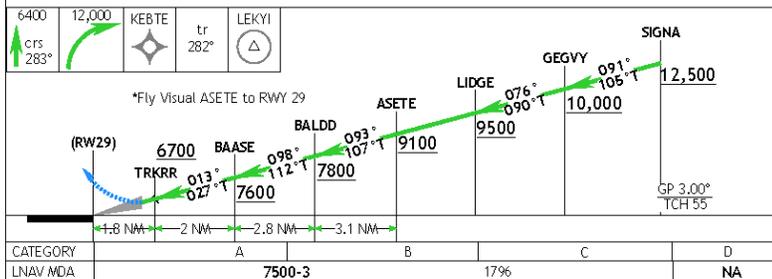
▼ DONNER VISUAL CONCEPT. Procedure NA at night. Fly Visual from ASETE to Runway 29.

MISSED APPROACH: Climb to 6400 then climbing right turn to 12000 direct KEBTE, track 282 to LEKYI and hold, continue climb-in-hold to 12000.

**RNP APCH**  
**GPS REQUIRED**



**DONNER VISUAL  
PROTOTYPE  
NOT FOR NAVIGATION**



TRUCKEE, CALIFORNIA  
Orig TERPS

39° 19'N - 120° 08'W

TRUCKEE-TAHOE (KTRK)

**RNAV (RNP) RWY 29**

Figure 17: Prototype Approach Chart for RWY 29 Option #2 - Donner Lake Visual

## Approach Concept Notes and Recommendations:

The three specialized approach solutions developed by FTE - a Hybrid xLS to LPV approach and two LNAV with Fly Visual segment approaches - are both highly customized solutions. It is possible the FAA could develop a RNP-AR public approach using a final segment RNP value below 0.30, but based on operator equipment feedback, the number of operators who would be able to utilize such a procedure would be low. Therefore, the RNP-AR concepts were not explored as part of this feasibility process.

The Hybrid RNP to LPV solution utilizes design criteria waivers that would require it be built within the special procedure category. Special IAPs are also developed using FAA TERPS/RNAV guidance but are not available to the general public without authorization (via an OpSpec or LOA). The FAA authorizes only certain individual pilots and/or organizations to use special IAPs and may require additional crew training and/or aircraft equipment or performance.

The RWY 29 RNAV procedure concepts utilizing 'Fly Visual' segments could theoretically be implemented by the FAA utilizing previous precedence established by the public KJFK/KPBI procedures. However, this represents additional procedures they would have to add to their backlog during a time period where the goal is to reduce the overall procedure catalog instead of increasing it. Also, some older navigation systems have are not compatible with turns beyond the FAF which may limit the number of users who can fly the procedure. These limitations will theoretically be reduced over time as aircraft equipment continues to evolve and improve.

For procedures that fall within the 'Special Procedure' category, these are not usually developed or funded by the FAA unless they serve a major airport within the NAS and provide both a GA and airline benefit. As a result, there are unique requirements and multiple pathways forward in implementing for the procedures the FAA is not available to implement. In the next section are the two alternatives typically used in this situation.

## Implementation Options

**Option A:** Submit procedures to Instrument flight procedure gateway for assessment by the FAA. If the FAA determines they don't fall within the special category, determines a public use case, and has ability to commit resources, the procedures will be added to the backlog and will be published within 3-5 years.

**Option B:** A qualified private operator can utilize the conceptual designs provided within this report and then develop, implement, and flight validate the procedure with their own resources and at their expense. Once implemented, the procedure is proprietary to that operator and is usually not shared. If the operator decides to no longer serve TRK, the special approach cannot be easily transferred. Only a few operators have their own in-house procedure development staff, validation, and maintenance divisions (i.e. Alaska, Delta,

NetJets, etc.). Alternatively, the operator can hire a third-party procedure developer to implement the procedure on their behalf, subject to their budget constraints.

**Option C:** The airport can sponsor a special approach procedure for use by multiple operators. This allows for the procedure to be assigned to multiple users and helps spread out the cost of development and maintenance. An FAA approved third-party procedure designer (such as FTE) can design, flight validate, implement, and maintain the approach during the period of use. The procedures are still private, but they can be flown by individual operators once they have requested approval from their local Flight Standards District Office (FSDO) or added to their OpSpec.

### Third Party Procedure 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 runs 8-12 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 LOAs with the FAA to accomplish each step described above as well as maintain the procedures after certification.





Figure 2: TRK Design Workspace - Obstacle Survey extent and density (in blue)

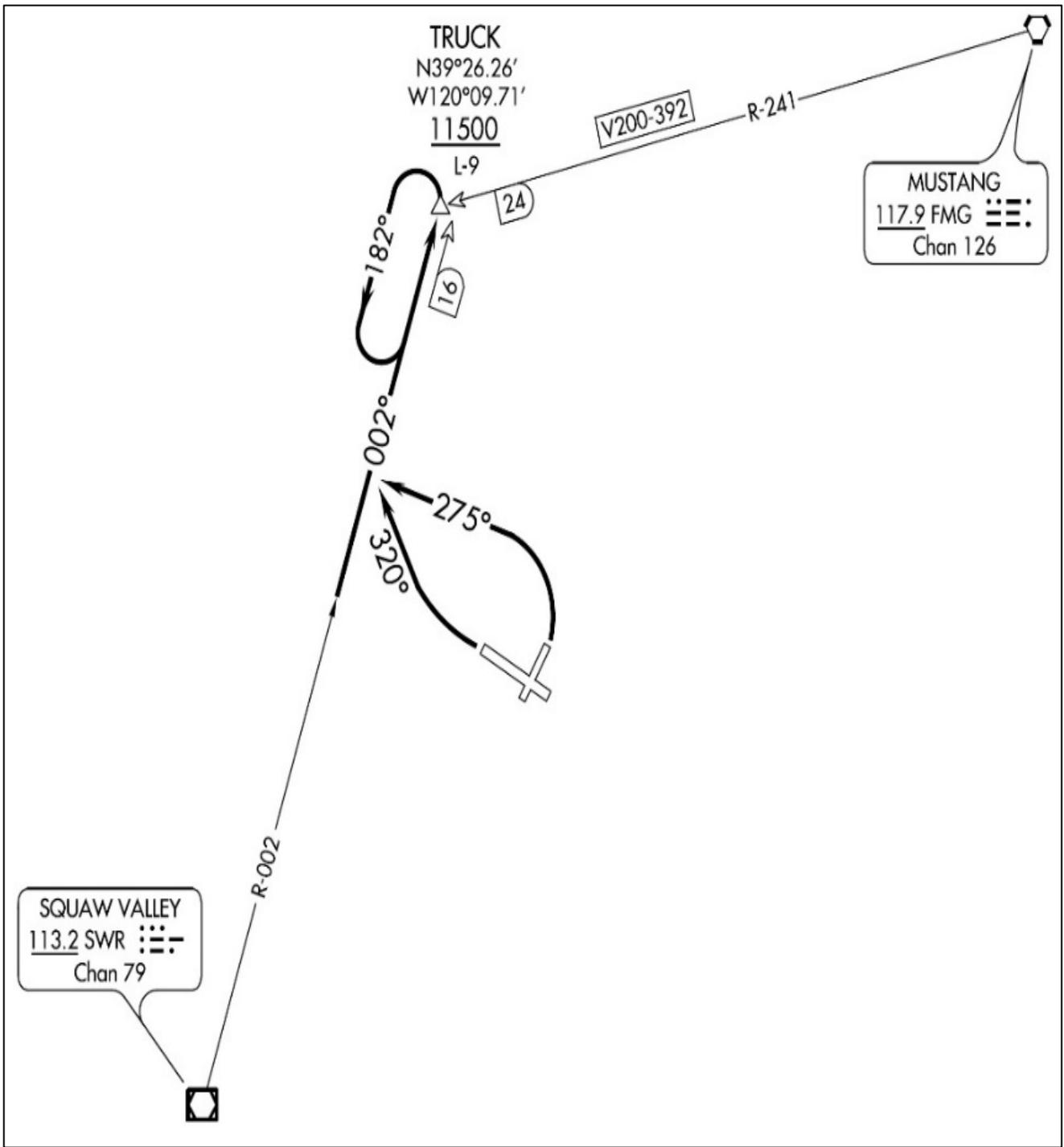


Figure 3: TRUCK FOUR DP Diagram

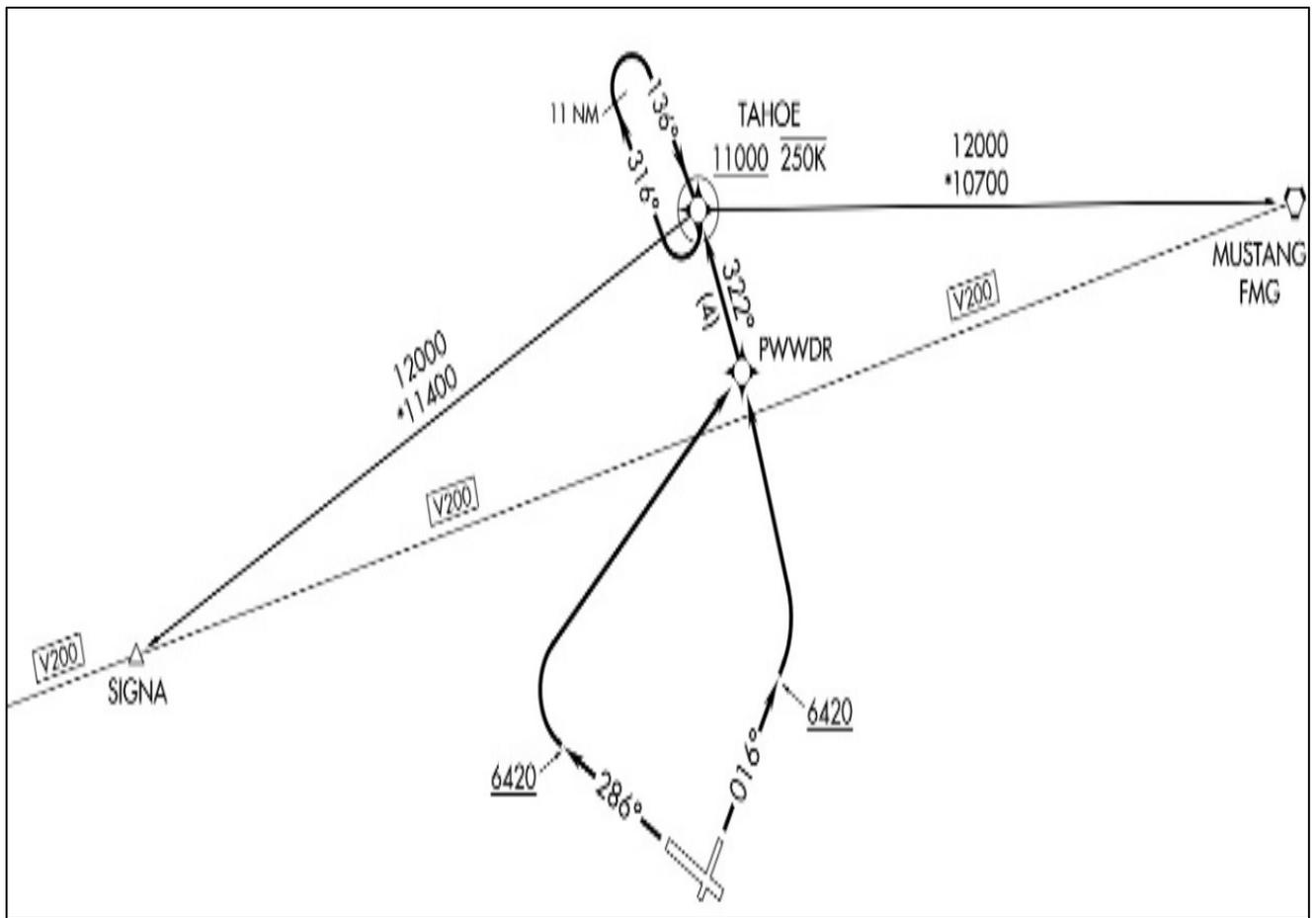


Figure 4: TAHOE ONE RNAV SID Plan View

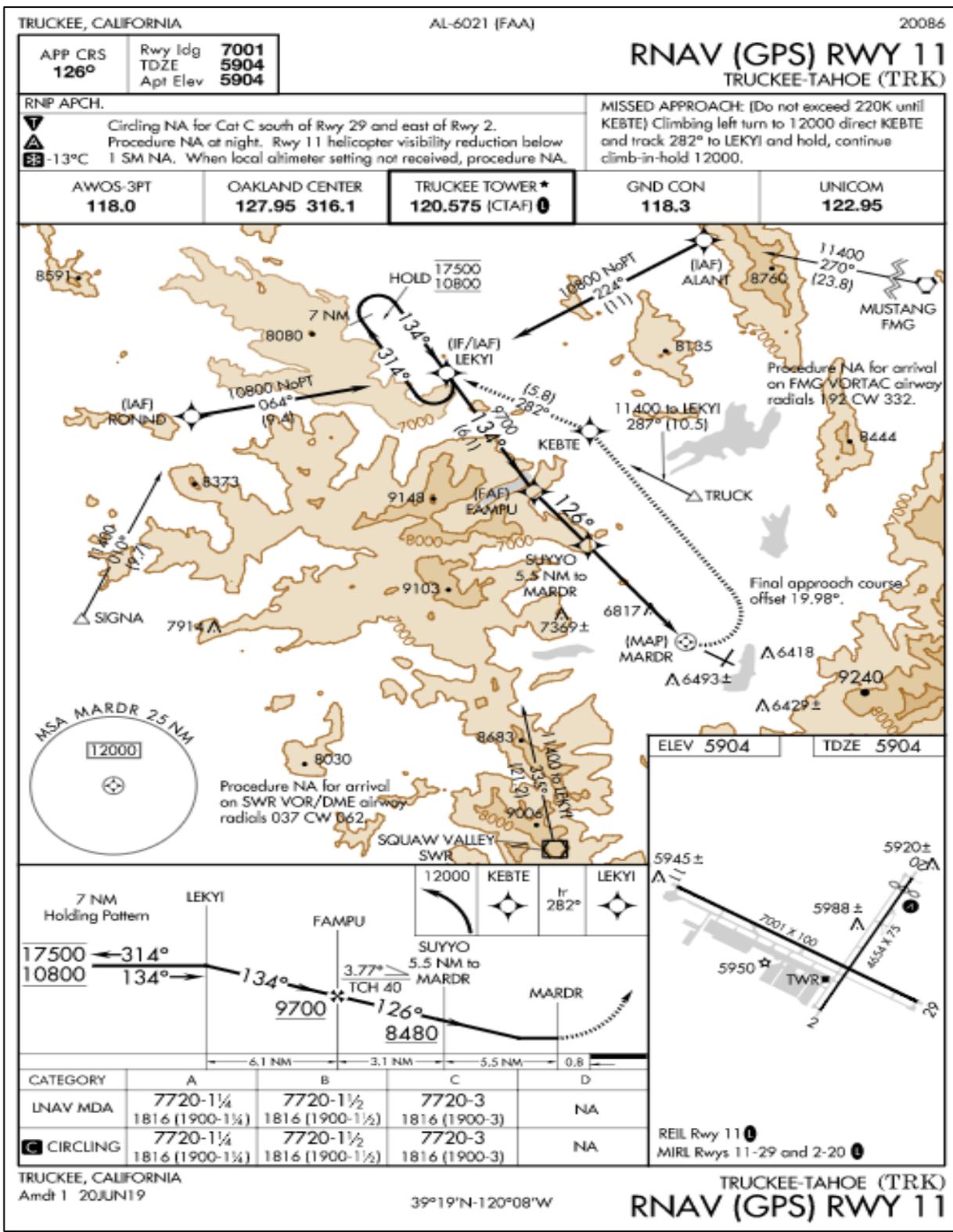


Figure 5: Current RNAV (GPS) 11 Approach

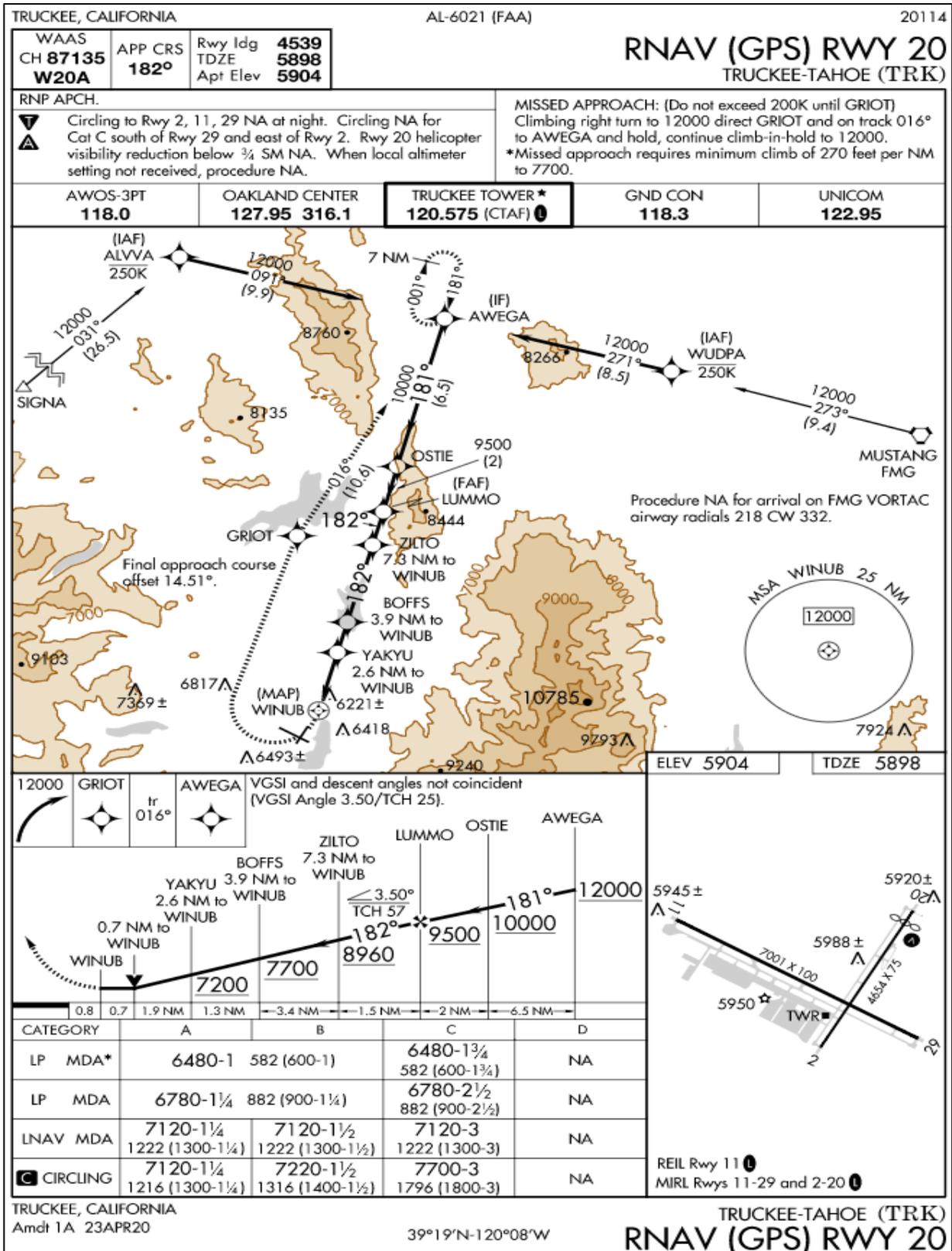


Figure 6: Current RWY 20 Approach

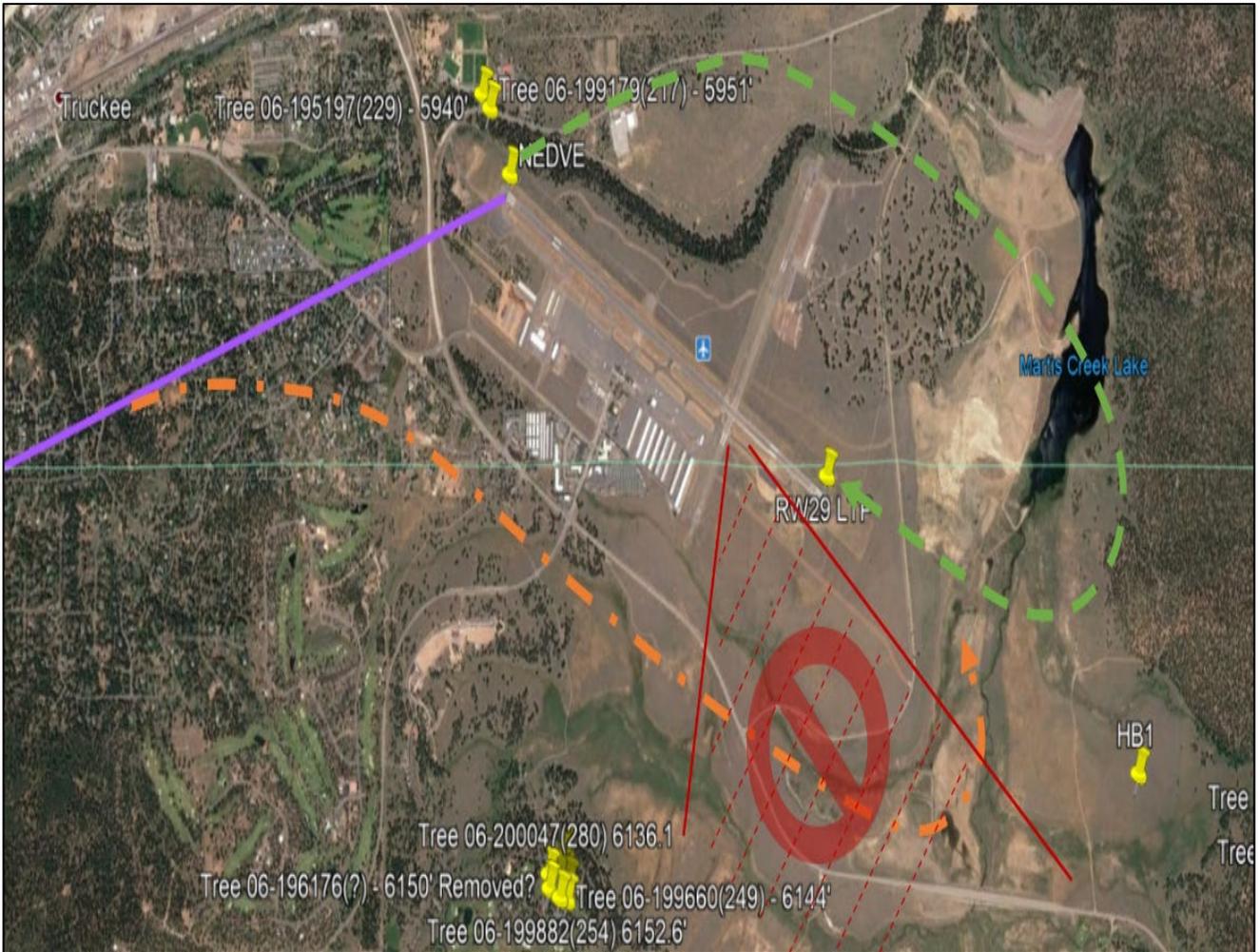


Figure 7: RNAV (GPS)-A Visual Circling path

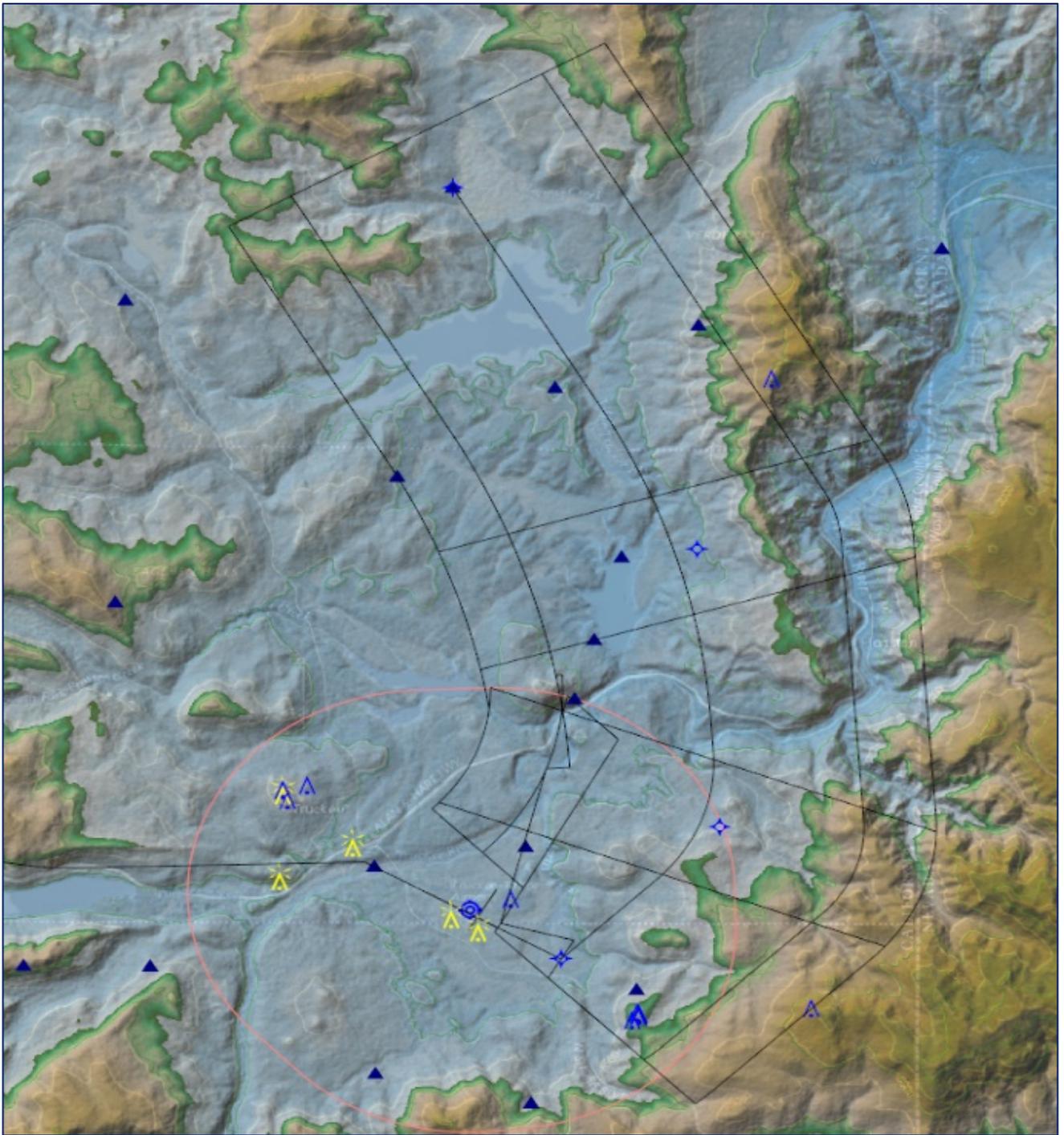


Figure 8: RWY 11 Departure Path



*Figure 9: RWY 29 Departure Procedure Path*

20257

**TRUCKEE ONE DEPARTURE (RNAV)**



TRUCKEE-TAHOE (KTRK)

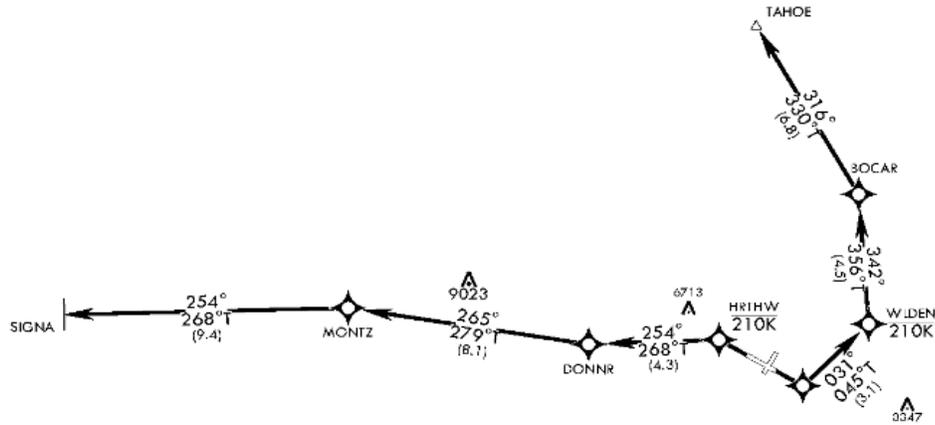
TRUCKEE, CALIFORNIA

Rwy	Knots	60	90	120	150	180	240	300
RW11 (A)	V/V(ftpm)	775	1163	1550	1937	2325	3100	3875
RW29 (B)	V/V(ftpm)	475	713	950	1188	1425	1900	2375

Minimum Climb Rate  
 (A) to 9300  
 (B) to 10,200

GPS Required

RNAV-1



**PROTOTYPE**  
 NOT FOR NAVIGATION



DEPARTURE ROUTE DESCRIPTION

**TAKEOFF RWY 11:** Climb direct MARTIS, then track 031 to WLDEN, then track 342 to BOCAR, then track 316 to TAHOE

**TAKEOFF RWY 29:** Climb direct HRTHW, then track 254 to DONNR, then track 265 to MONTZ, then track 254 to SIGNA

TAKE-OFF MINIMUMS

RWY 11, Standard with minimum climb of 775 ft/NM to 9300 ft.  
 RWY 29, Standard with minimum climb of 475 ft/NM to 10200 ft.

**TRUCKEE ONE DEPARTURE (RNAV)**

TERPS

TRUCKEE, CALIFORNIA  
 TRUCKEE-TAHOE (KTRK)

Figure 10: RWY 11/29 - Combined Departure Procedure Paths

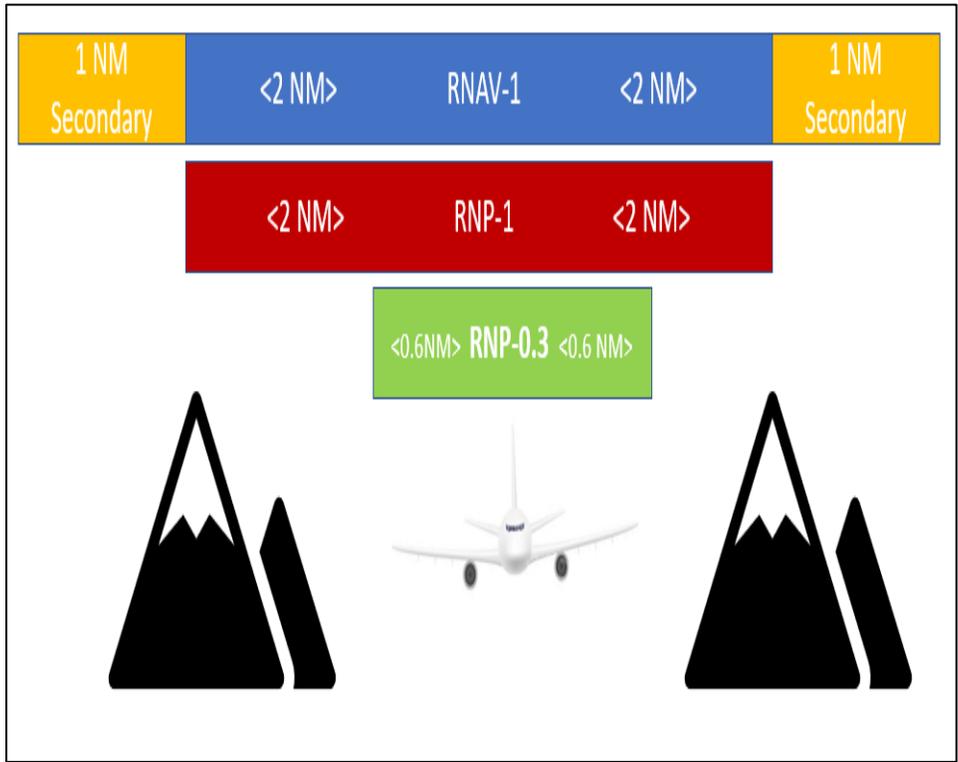


Figure 11: Obstacle Accountability Area (OAA) Lateral Dimensions

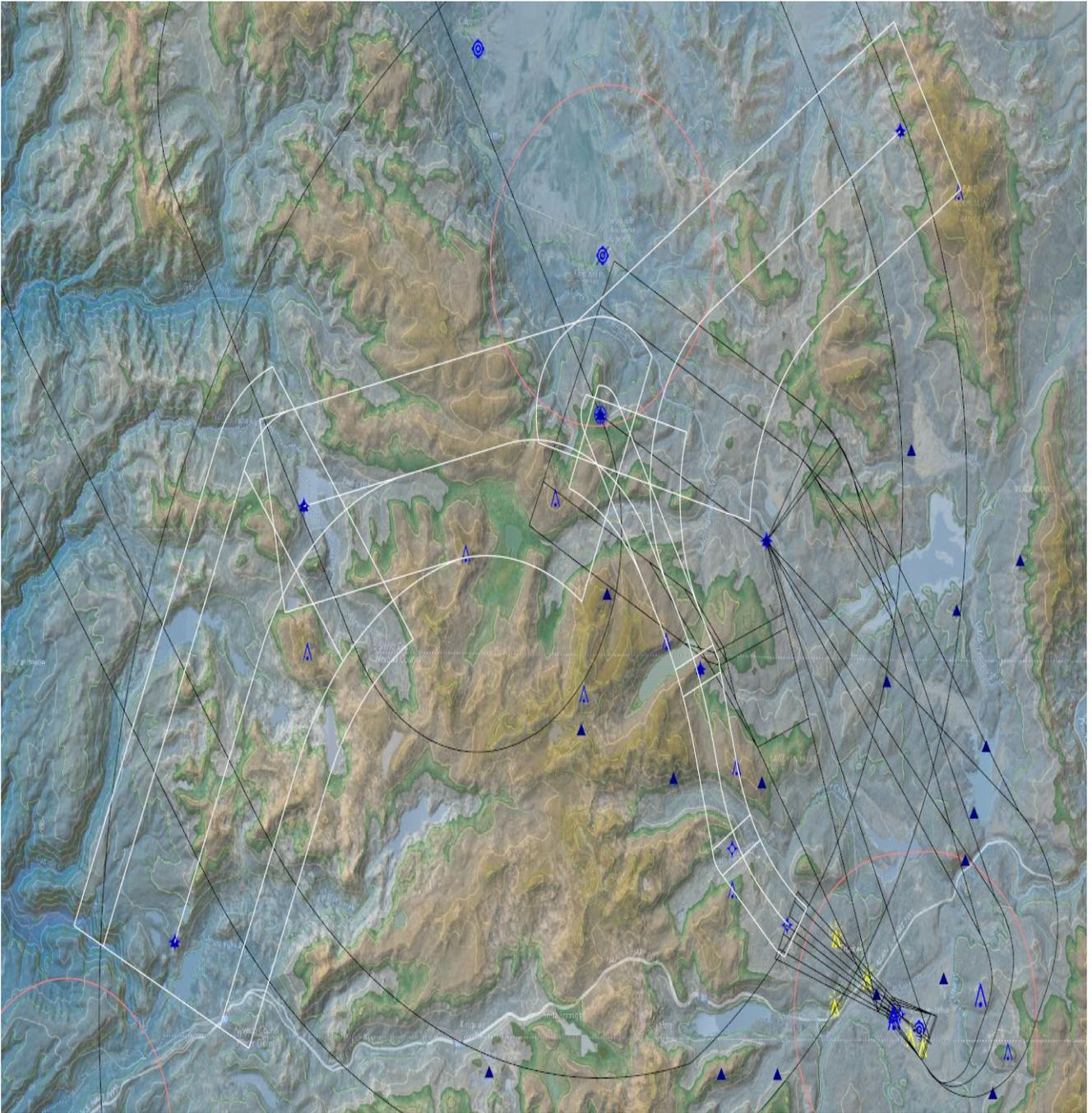


Figure 12: RWY 11 RNP to LPV Approach. White lines are RNP 0.30 surface

TRUCKEE, CALIFORNIA



**TRUCKEE  
TAHOE  
AIRPORT**

**RNAV (GPS) RWY 11**

20257

SBAS Chan <b>12345</b> <b>W11A</b>	APCH CRS <b>103</b>	Rwy Idg <b>6999</b> TDZE <b>5904</b> Arpt Elev <b>5901</b>
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(F I E P R O T O I Y P E)

TRUCKEE-TAHOE (KTRK)

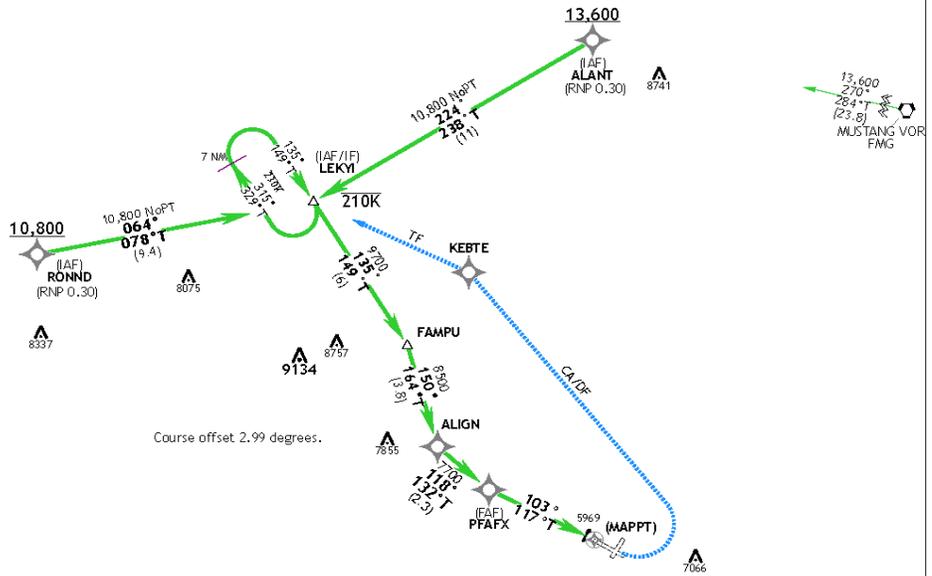
▼ Visibility Reduction by Helicopters NA.

↑ MISSED APPROACH: (Do not exceed 200 KIAS until initial turn completion.) Climb to 6400 then climbing left turn to 12000 direct KEBTE, track 282 to LEKYI and hold, continue climb-in-hold to 12000. \*\*\*Missed Approach requires a minimum climb of 389 ft per NM to 7300 ft.

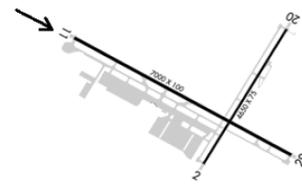
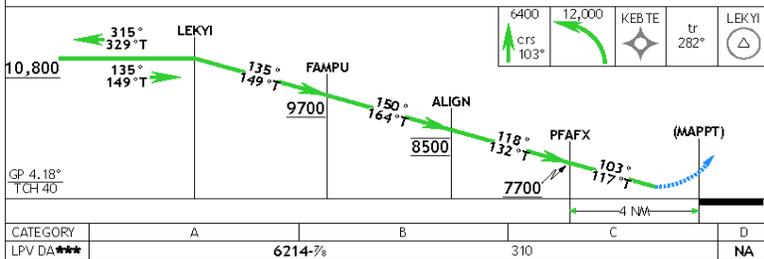
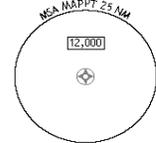
↑ CAUTION: Missed Approach  
Minimum Climb Rate to 7300

Knots	60	90	120	150	180	240	300
V/V (fpm)	389	584	778	973	1167	1556	1945

**A-RNP-GPS APCH  
MIN RNP 0.30**



**PROTOTYPE  
NOT FOR NAVIGATION**



CATEGORY	A		B		C		D
LPV DA***	6214-7%		310				NA
TRUCKEE, CALIFORNIA			39°19'N - 120°08'W				
Orig TERPS							

TRUCKEE-TAHOE (KTRK)  
**RNAV (GPS) RWY 11**

Figure 13: RWY 11 xLS to LPV Approach Concept

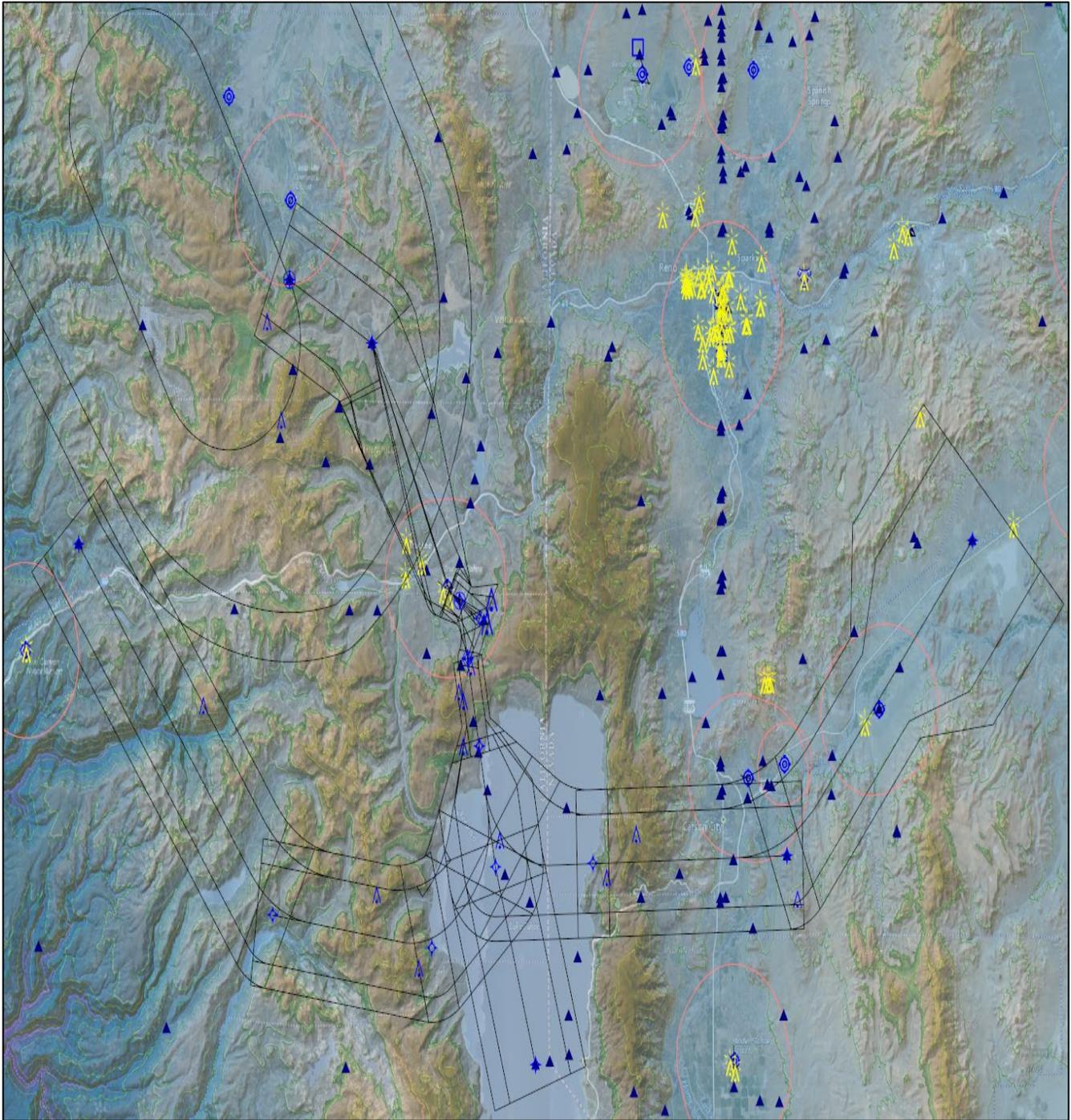


Figure 14: RWY 29: TAHOE Fly Visual Concept #1

TRUCKEE, CALIFORNIA



RNAV (GPS) RWY 29

20257

APCH CRS	Rwy Idg	6999
286°	TDZE	5899
	Airp Elev	5901

(F IL PRU (I) YPE)

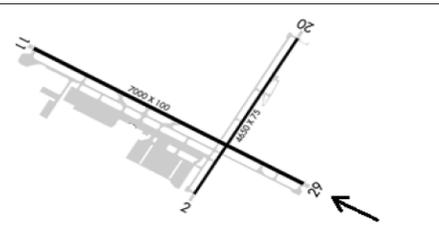
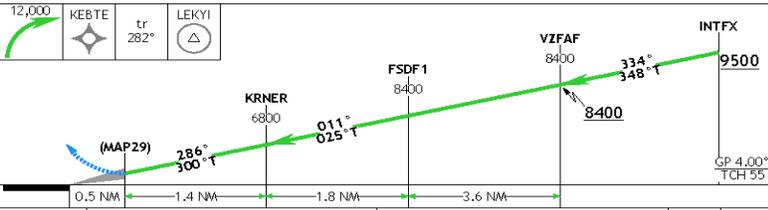
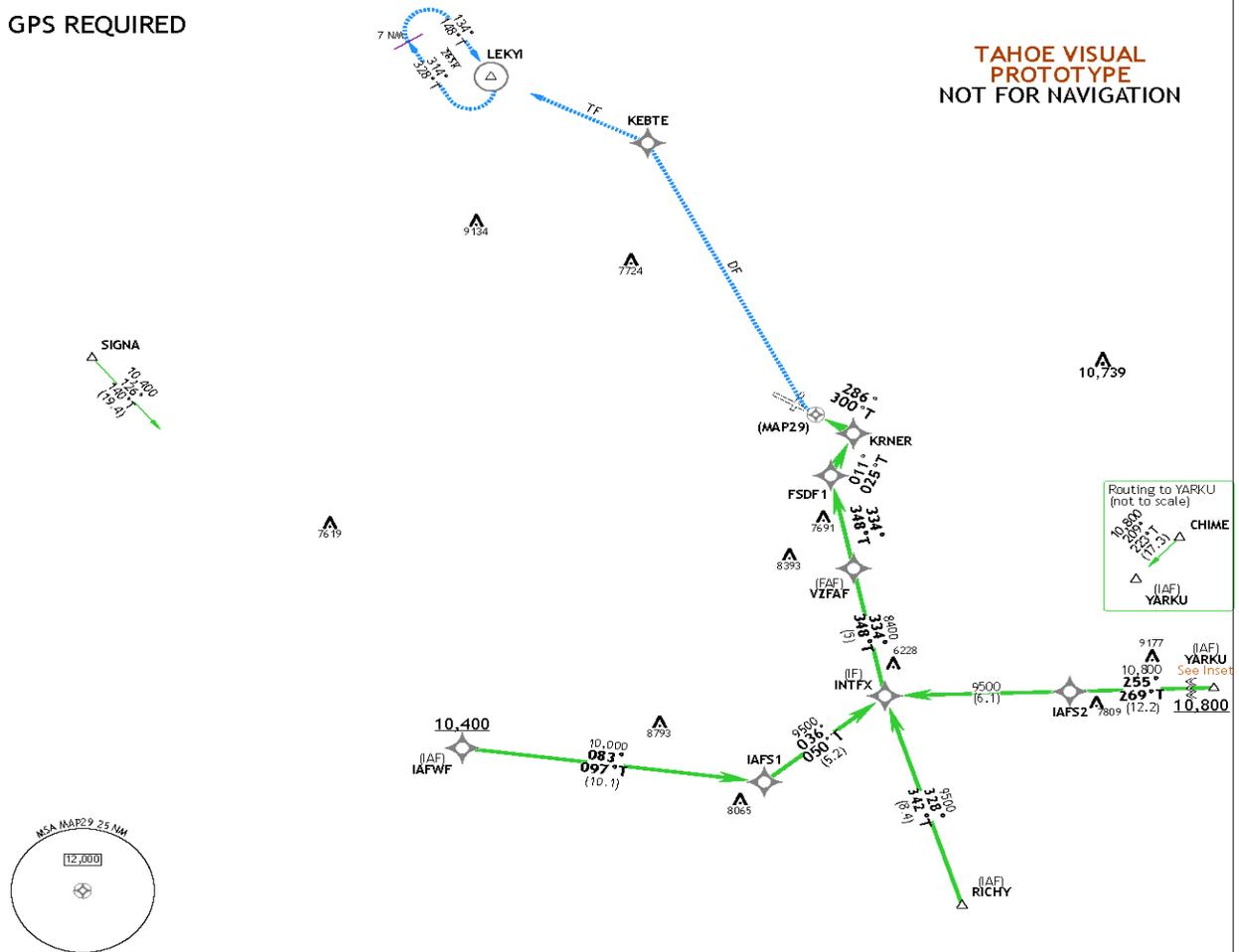
TRUCKEE-TAHOE (KTRK)

TAHOE VISUAL CONCEPT. Procedure NA at night. Fly Visual from FSDF1 to Runway 29.

MISSED APPROACH: Climb to 6400 then climbing right turn to 12000 direct KEBTE, track 282 to LEKYI and hold, continue climb-in-hold to 12000.

RNP APCH  
GPS REQUIRED

TAHOE VISUAL  
PROTOTYPE  
NOT FOR NAVIGATION



CATEGORY	A	B	C	D
LNAV MDA	8400-3	2501	NA	NA

TRUCKEE, CALIFORNIA  
ORIG TERPS  
39°19'N - 120°08'W

TRUCKEE-TAHOE (KTRK)  
RNAV (GPS) RWY 29

Export Date: 13 Sep 2020 22:59:55

Figure 15: Approach Chart Prototype for RWY 29 Option #1

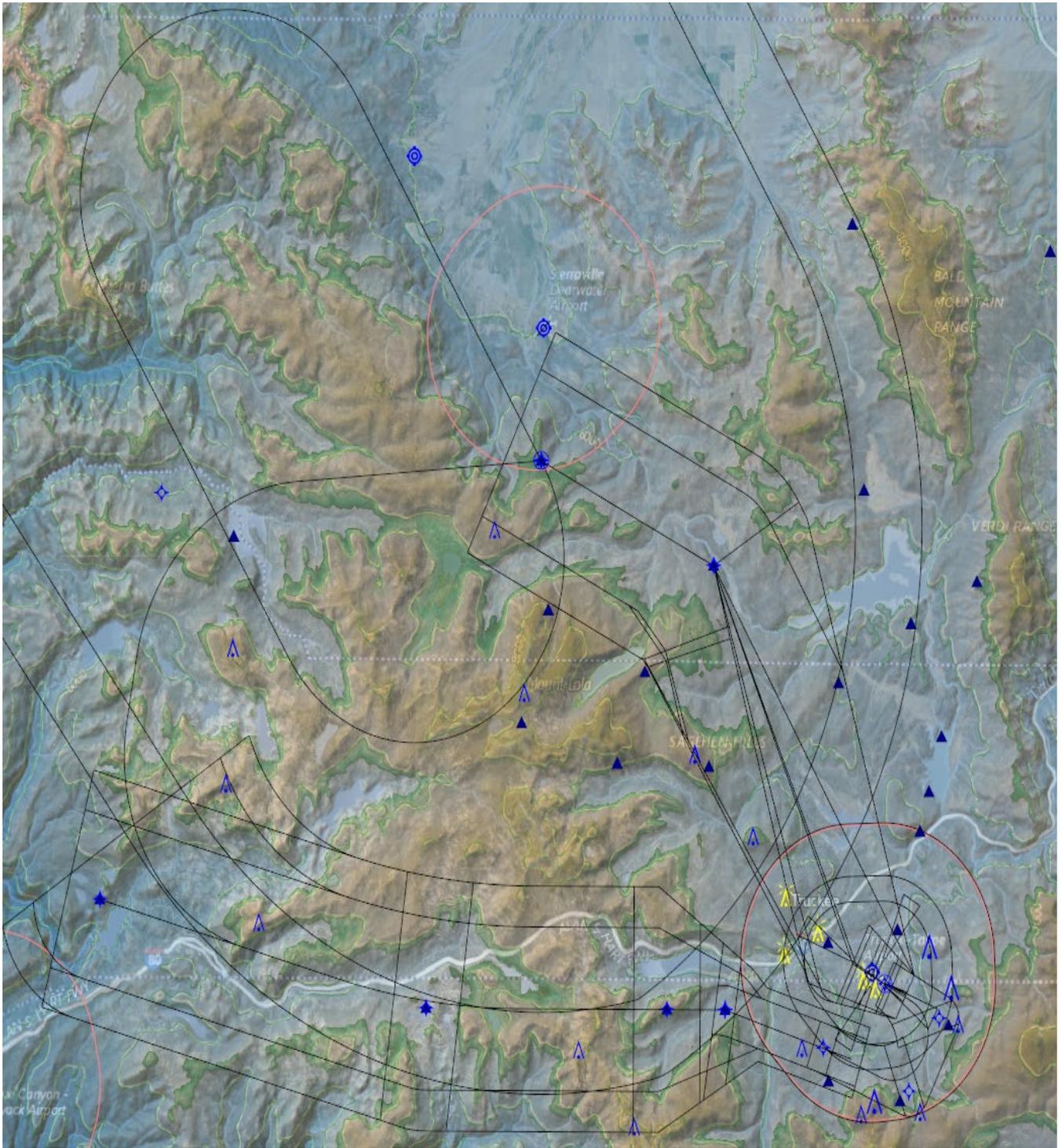


Figure 16: RWY 29 Design Surfaces for Approach Option #2 (Donner Lake Visual)

TRUCKEE, CALIFORNIA



TRUCKEE  
TAHOE  
AIRPORT

RNAV (GPS) RWY 29 20258

APCH CRS	Rwy Idg	6999
283°	TDZE	5899
	Aprt Elev	5901

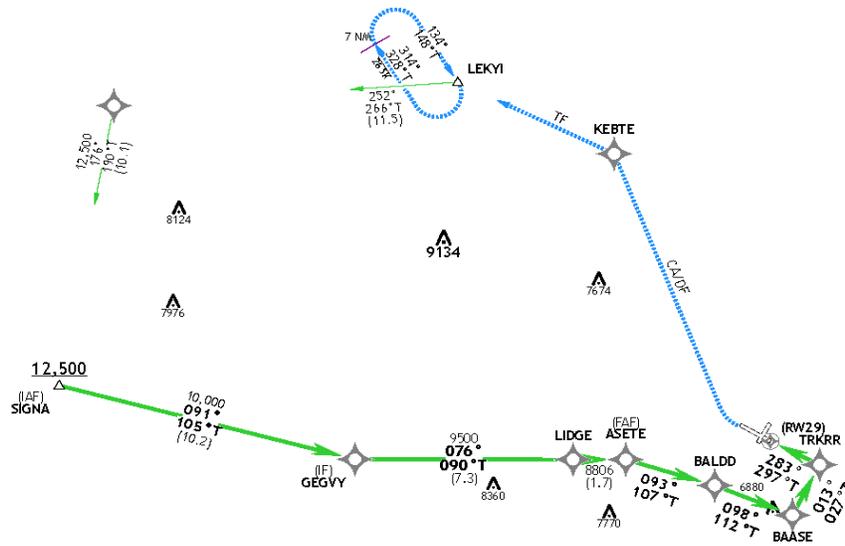
(FILE PKU101TYPE)

TRUCKEE-TAHOE (KTRK)

▼ DONNER VISUAL CONCEPT. Procedure NA at night. Fly Visual from ASETTE to Runway 29.

MISSED APPROACH: Climb to 6400 then climbing right turn to 12000 direct KEBTE, track 282 to LEKYI and hold, continue climb-in-hold to 12000.

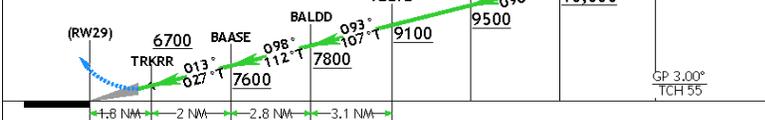
**RNP APCH**  
**GPS REQUIRED**



**DONNER VISUAL  
PROTOTYPE  
NOT FOR NAVIGATION**

6400	12,000	KEBTE	tr 282°	LEKYI	SIGNA
crs 283°					

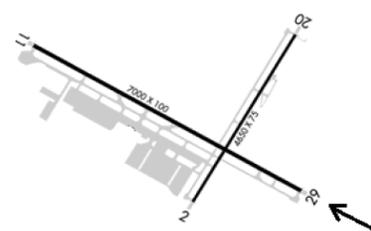
\*Fly Visual ASETTE to RWY 29



CATEGORY		A	B	C	D
LNAV MDA		7500-3	1796		NA

TRUCKEE, CALIFORNIA  
Orig TERPS

39°19'N - 120°08'W



TRUCKEE-TAHOE (KTRK)

RNAV (RNP) RWY 29

Figure 17: Prototype Approach Chart for RWY 29 Option #2 - Donner Lake Visual