

Obstruction Survey Memorandum and Analysis



INTRODUCTION

As part of the Obstruction Removal Plan, Mead & Hunt (with Flightline Geomatics) performed a survey of trees at Truckee Tahoe Airport (TRK) June 9 through 11, 2020. The June 2020 survey helped further identify the location and elevation of trees that are penetrations to various airspace surfaces. This memorandum details the findings from this survey and is intended to guide the forester to help identify which trees are tagged or marked for removal. This memorandum also provides additional analysis of the June 2020 survey data points on Lahontan Hill.

Background

The purpose of the June 2020 survey was to identify in the field obstructions from the Obstruction Removal Plan. The data source for the Obstruction Removal Plan was the 2017 AGIS survey, which produced high quality object data with elevations. While the FAA considers AGIS survey data an official data source, the Airport and Mead & Hunt have found this data to be intermittently reliable. AGIS data only contains a portion of true objects because the AGIS survey only collects the highest point in a certain area, typically about 100 feet by 100 feet. Other objects penetrating airspace in this area may be shadowed by the highest point and end up excluded from the true count of obstructions.

For a more comprehensive obstruction analysis, supplemental AGIS data was obtained from the orthophoto created through the 2017 AGIS. The supplemental AGIS data shows most data points within a random 100-foot-by-100-foot grid, whereas original AGIS data only reports the highest and most critical points. However, even the supplemental AGIS data may not contain all data points due to clustering of trees and shadows.

In the past, the FAA has identified an obstruction to an approach surface or instrument approach procedure at TRK, and the Airport removes and reports this obstruction removal, only for the FAA to identify another obstruction nearby. This is the result of the previous obstruction overshadowing the newly revealed obstruction. The June 2020 survey was performed to precisely identify obstructions in predetermined areas near the approach ends of Runways 11 and 20, so the Airport may attempt to mitigate these at once. This will help avoid delays and expenses caused by identifying and removing obstructions one at a time. The trees identified on Lahontan Hill were documented strictly for inventory purposes.

The Airport boundary was the second component of the June 2020 survey. New T-posts were inserted near the approach ends of Runway 11 and 20 to delineate the property boundary. Delineating this property line allows the Airport and forester to identify whether trees marked for removal are located on or off TRK property so that permission can be acquired to mitigate obstructions off Airport property.

Survey Process

The June 2020 field survey utilized data from the previous AGIS data to identify obstructions near the approach ends of Runways 11 and 20, plus Lahontan Hill. The survey focused on trees in the FAA obstacle database and Priority 1 obstructions from the Obstruction Removal Plan in these areas. The June 2020 survey resulted in the graphics and tables in this memorandum plus a database for use by the forester.

The survey team prioritized tagging the most critical trees, based on a combination of AGIS data points and field observations. Trees surveyed in June 2020 were identified with an aluminum tag with three digits, starting at 200. Tags were nailed into the tree at eye level. All tagged trees are in the June 2020 database, except where noted.

Trees were also marked for removal with red spray-paint. Not all trees that were spray-painted were surveyed or available in the June 2020 survey database. The graphics provided are intended to illustrate the location of trees at the approach ends of Runway 11 and Runway 20 that are tagged and marked with paint to assist the forester. Although trees were tagged for inventory, no trees were marked with paint for removal on Lahontan Hill.

The painted marks on trees consisted of three letters, indicating different dispositions:

- **R:** Tree to be removed, on TRK property.
- **O:** Tree to be removed, off TRK property.
- **P:** Priority tree to be removed (either on or off TRK property). The priority trees have been identified by the FAA as obstacles and in some cases restrict instrument approach capabilities.

The survey process included setting up the total station on the bluffs overlooking areas near the approaches to Runways 11 and 20 and identifying the obstructions from the Obstruction Removal Plan. This process was complemented with the survey team using the ESRI Collector GIS application to identify obstructions while standing next to a tree. Additional trees, that were not in the AGIS database due to clustering or shadowing, were also marked for removal if these were found to be an obstruction, near obstruction, or of significant diameter.

While in the field, it became apparent that surveying every tree for removal was not a beneficial use of resources. For one, the survey total station must be set at a location with a clear shot to each treetop. The density of trees within the groves created a curtain that made surveying each tree in the middle or back of the grove difficult. Moving into the grove, under the trees does not allow the station to find the top of the tree and limits GPS communication.

The survey team also found that one AGIS data point may be numerous trees in the field. Canopies may appear to be one tree or data point in AGIS, but are rather numerous stems. On the figures in this memorandum, certain single data points on the graphic are actually two or more tree stems nearby that form one "top." The survey team used the Collector application and best judgment to tag and mark for removal trees that form a canopy. These additional trees, while not shown on the figures, are clearly marked in the field.

It was found during the June 2020 survey that most treetops matched the AGIS dataset horizontally and vertically to within 5 feet. In the figures included in this memorandum, the field survey tagged trees (black dot) may be next to an AGIS data point (green dot). This is not an error, but rather two different survey sources finding the same obstruction. The discrepancy may be from the AGIS survey locating the top of the tree and the field survey locating the base of the tree.

The elevations of trees documented in the June 2020 survey were found to be at or near the vertical data from the AGIS survey. Any discrepancies to vertical data were expected due to growth of trees since 2017 and the vertical margin of error in the AGIS data.

RUNWAY 11 APPROACH

Trees that were tagged and marked for removal at the north side of the approach to Runway 11 are shown on **Figure 1**. Twenty-eight trees were tagged in this area that were found to be at or near the critical airspace surface. All trees identified as Priority 1 and 2 in the Obstruction Removal Plan were surveyed and tagged (12). The one exception is obstruction number 5071, which was tagged (#229) but not surveyed. For trees tagged at the approach end of Runway 11, tags were typically placed on the southeast side of the tree.

The green dots on **Figure 1** are trees from the AGIS survey that were marked in the field for removal. An additional 10 to 15 trees, not captured in the AGIS survey or the June 2020 survey, were marked for removal with paint in this area and are noted on the figure.

All trees were surveyed using a total station. The one exception is tree #205, which was obscured and was shot somewhere near the top and is identified in the point description as "SIDE." The elevation value for tree #205 is not the top of the tree.

The property line was delineated between the Highway 267 right-of-way to a point lateral (north) of the approach end of Runway 11. There were existing T-posts marking this line, all of which were found to be within 1 foot of the property line. Additional T-posts were set where needed. All posts were painted orange and flagged.

RUNWAY 20 APPROACH

Trees that were tagged and marked for removal at the east side of the approach to Runway 20 are shown on **Figure 2**. Ten trees were tagged in this area that were found to be at or near the critical airspace surface. All trees identified as Priority 1 and 2 in the Obstruction Removal Plan were surveyed and tagged (5). The one exception was tagged (#239) but not surveyed. At the Runway 20 approach end, tags were generally placed on the southwest side of the tree.

The green dots on Figure 2 are trees from the AGIS survey that were marked in the field for removal. An additional 15 to 20 trees, not captured in the AGIS survey or the June 2020 survey, were marked for removal with paint in this area and are noted on the figure.

All trees were surveyed using a total station. The one exception is tree #233, which was obscured and was shot somewhere near the top and is identified in the point description as "SIDE." The elevation value for tree #233 is not the top of the tree.

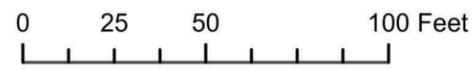
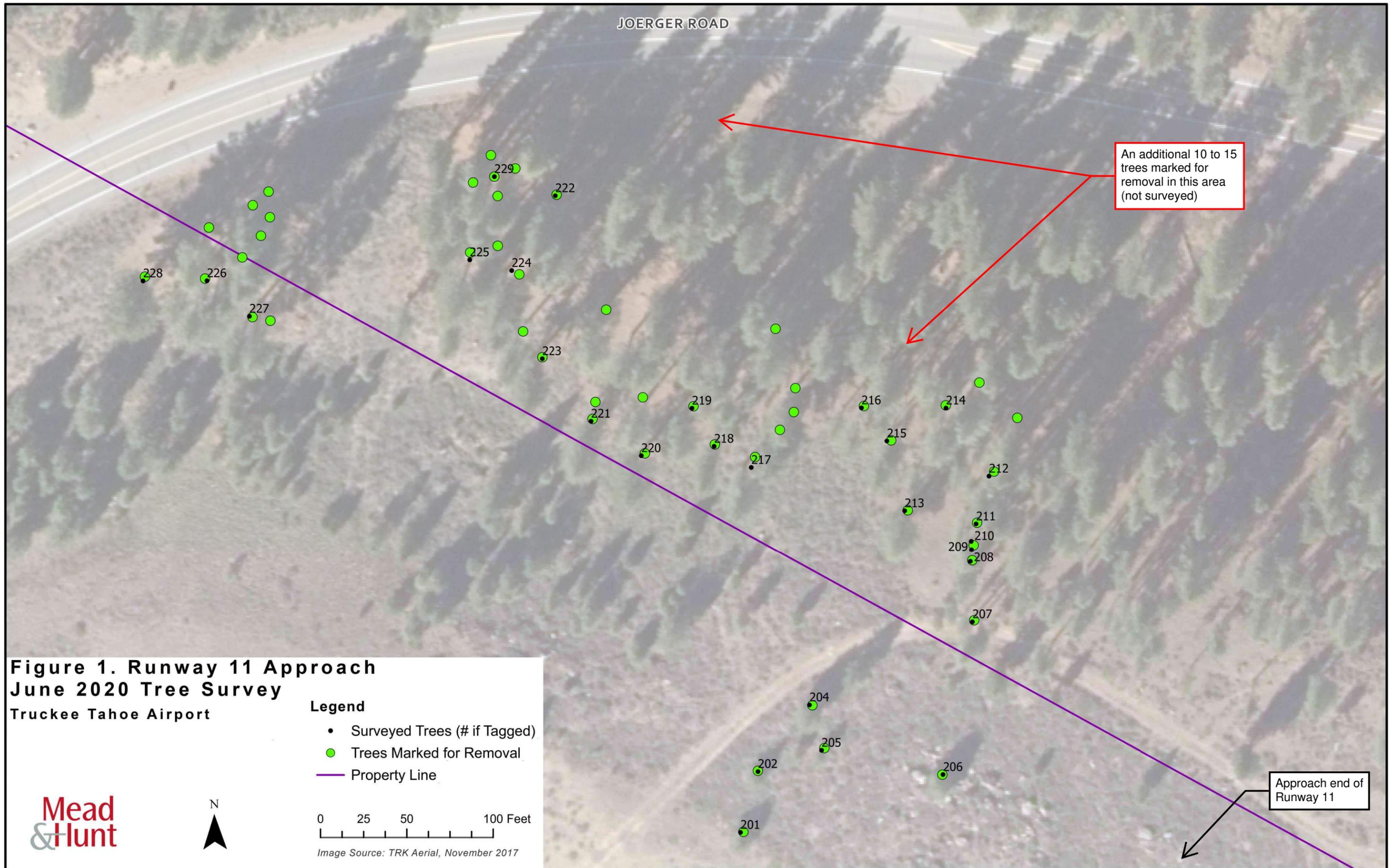


Image Source: TRK Aerial, November 2017

Figure 2. Runway 20 Approach June 2020 Tree Survey

Truckee Tahoe Airport

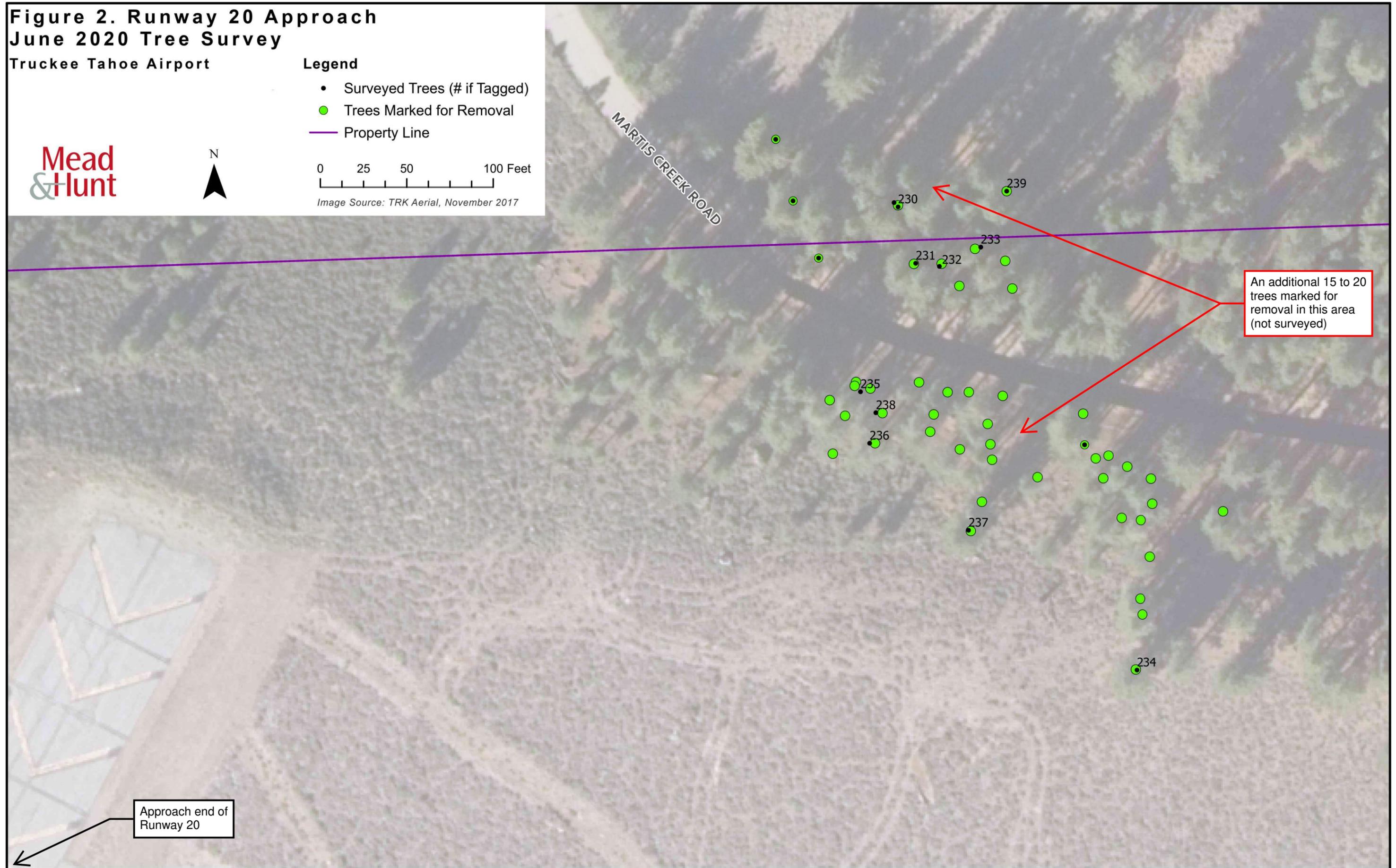


Legend

- Surveyed Trees (# if Tagged)
- Trees Marked for Removal
- Property Line

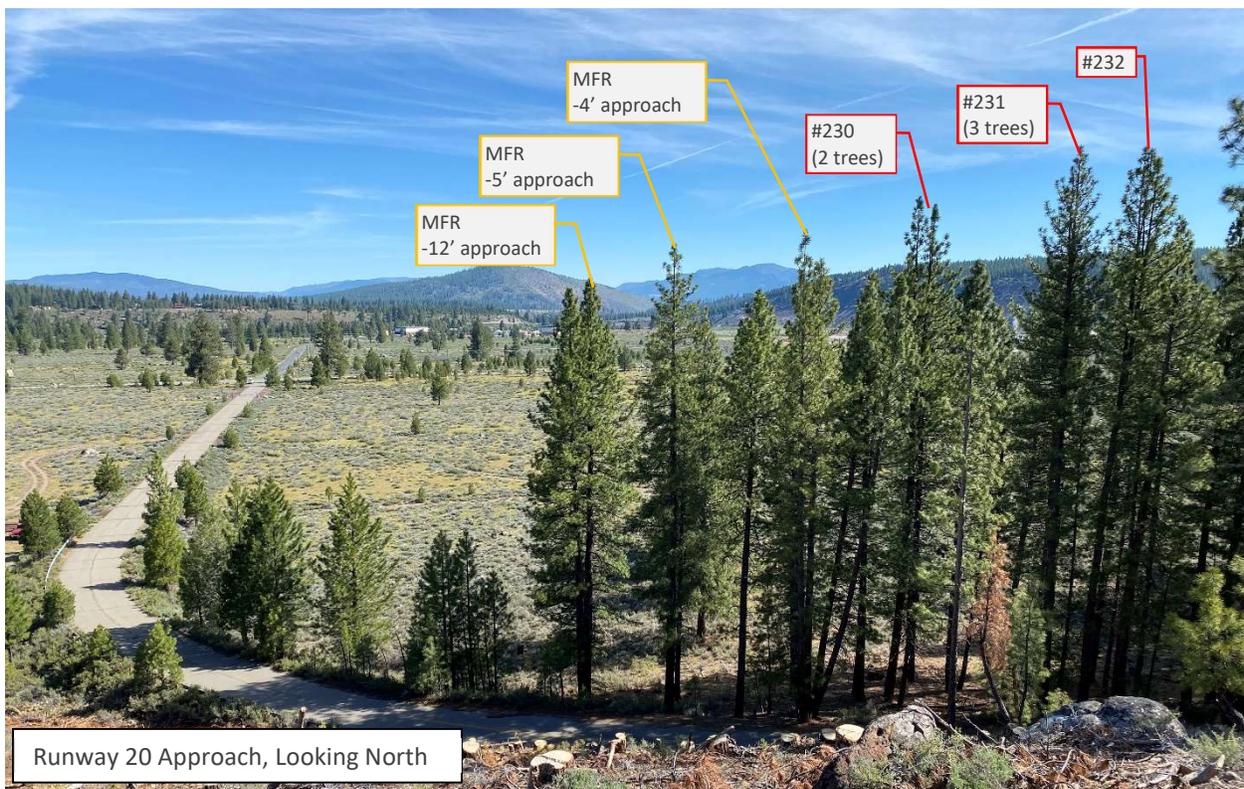
0 25 50 100 Feet

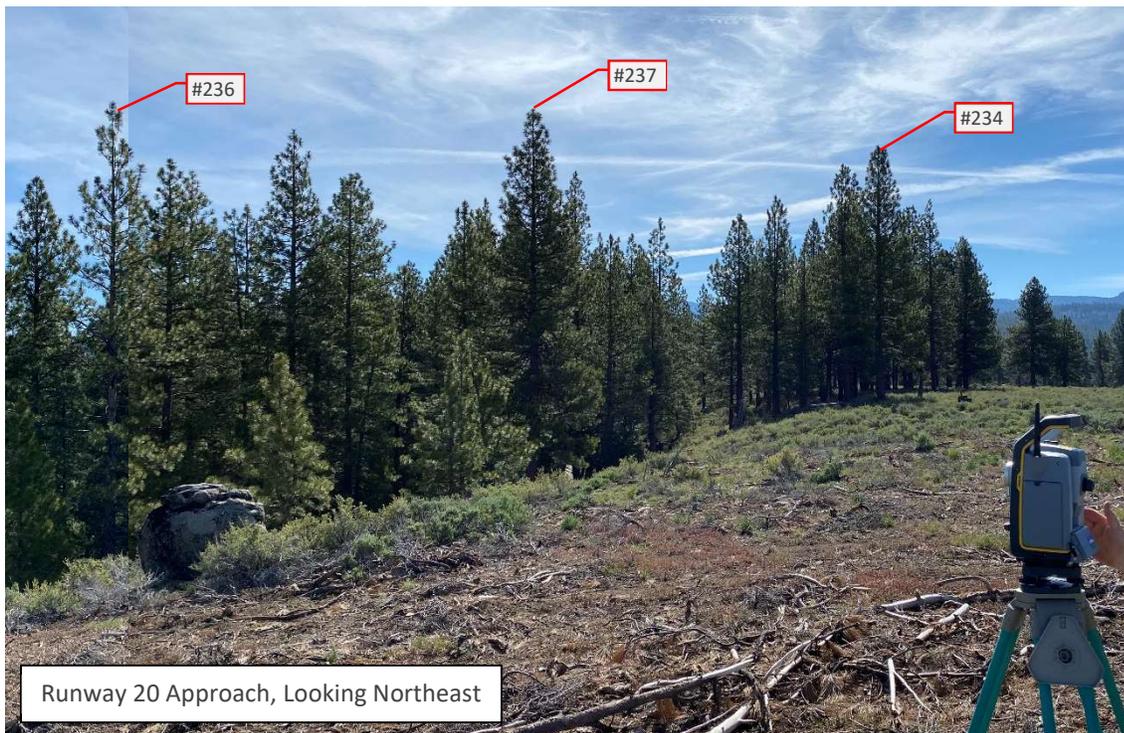
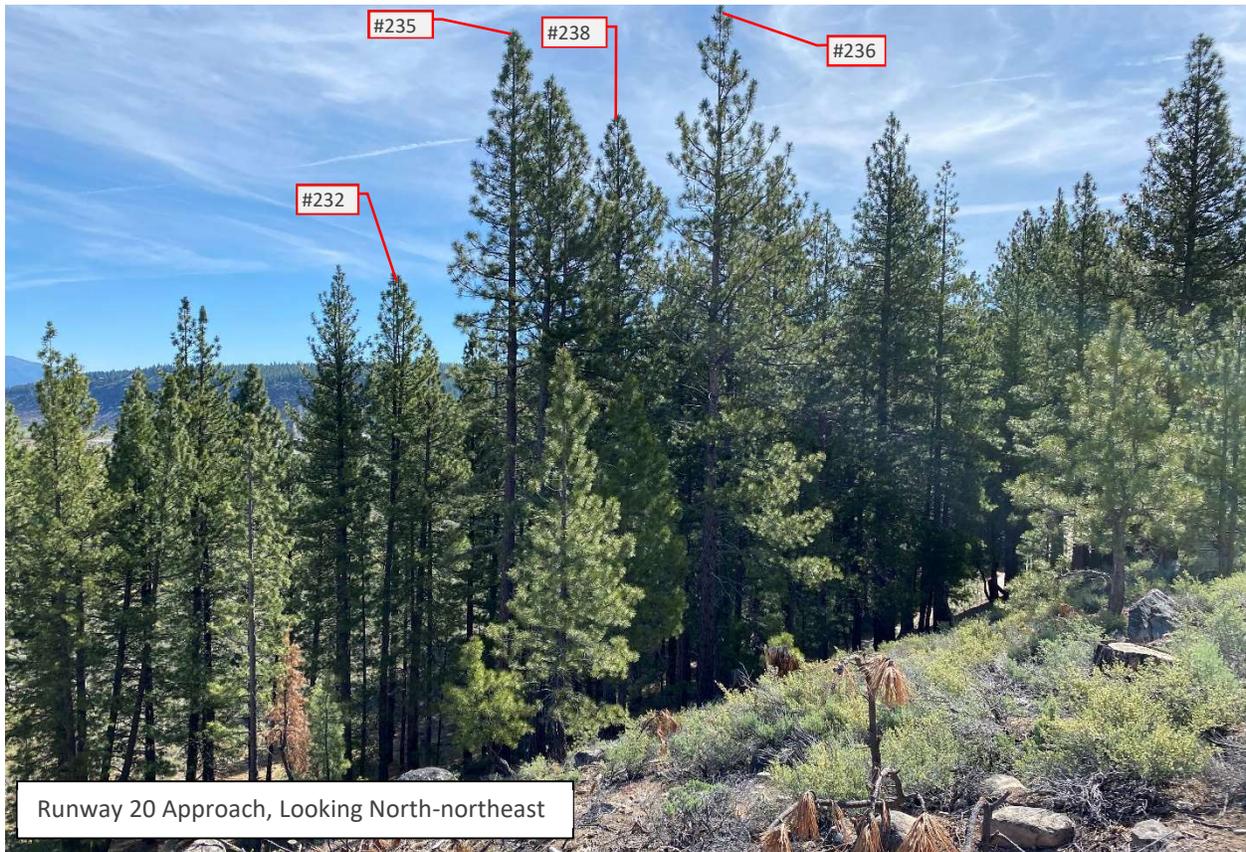
Image Source: TRK Aerial, November 2017



The property line was delineated from the northeast corner of Airport property west to the north 1/16th corner. It was found the property line was partially marked with T-posts, all of which were within 1 foot of the property line. Additional T-posts were set where needed. All T-posts were painted orange and flagged. One survey monument previously unknown to the surveyor was found along the line at the end of a SW-NE running barbed wire fence. The surveyor believes this corner to be out of position by approximately 6 feet. Additional work will be required to research this monument and conduct a boundary survey to resolve any conflicts.

Photos below are of the approach end of Runway 20 to help the Airport and forester identify the tagged trees on the ground. The photos were taken June 10, 2020, with the photographer standing on the edge of the bluff looking northeast.





LAHONTAN HILL

The purpose of the survey on Lahontan Hill is to provide the Airport with more detail and inventory on existing and potential obstructions to the 20:1 FAA Visual Surface. This includes identifying additional obstructions and clusters or a canopy of trees that may be identified as one data point. This section analyzes that data.

Figure 3 illustrates 40 trees that were tagged on Lahontan Hill near James McIver Drive with black dots and numbers. No trees were marked with paint for removal on Lahontan Hill since this is private property. All trees were surveyed at ground level using TRK GPS observations. Tree heights were then measured using a Nikon Forestry Pro II. Survey points were created in which the ground point was adjusted to the true horizontal position of the tree, and the elevation adjusted by adding the measured height to the observed ground elevation.

On **Figure 3**, different symbols represent trees of different characteristics:

- **Red dots:** Priority 1 trees, as identified in the Obstruction Removal Plan. All Priority 1 trees in the work area were surveyed and tagged. The one exception being FAA Obstruction Number 06-196176, which the survey teams believes was cut down.
- **Green Dots:** Trees surveyed in June 2020 that were found to be penetrations to the Runway 2 20:1 visual surface.
- **Purple Dots:** Trees surveyed in June 2020 that were found to be within 10 feet of the Runway 2 20:1 visual surface.
- **Yellow Triangles:** Trees from the 2017 AGIS survey that were found to be within 10 feet of the Runway 2 20:1 visual surface.

The Obstruction Removal Plan identified 11 trees as Priority 1 obstructions to the Runway 2, 20:1 visual surface. Of these, nine are in the FAA Instrument Flight Procedures Automation (IFPA) obstacle database (although only seven showed in a recent query). These are illustrated on **Figure 3** as red dots and documented in **Table 1** below. This shows the original analysis from the Obstruction Removal Plan with the location and elevation of each tree. This data was produced from the AGIS data set.

Table 1 Lahontan Hill Priority 1 Trees

	FAA or GIS #	Survey Tag #	Latitude	Longitude	Top Elevation ¹ (Feet MSL)	20:1 Visual Surface Pen. ¹ (Feet)	Notes
FAA IFPA ID #	06-194553	240	N39° 18' 06.62"	W120° 08' 54.53"	6138.0	-2.0	
	06-199660	246	N39° 18' 06.68"	W120° 08' 56.39"	6146.4	2.8	
	06-199460	247	N39° 18' 08.44"	W120° 08' 56.20"	6142.0	-4.6	Believed to be since topped
	06-199660	249	N39° 18' 06.68"	W120° 08' 56.39"	6143.6	8.1	
	06-199882	254	N39° 18' 06.92"	W120° 08' 58.22"	6152.6	6.4	
	06-195896	274	N39° 18' 09.53"	W120° 08' 58.67"	6136.9	1.3	
	06-197182	281	N39° 18' 11.98"	W120° 08' 56.54"	6140.1	0.3	
	06-200047	280	N39° 18' 09.55"	W120° 09' 00.89"	6121.1	0.4	
	06-196176	N/A	N39° 18' 07.96"	W120° 09' 00.72"	6150.3	3.7	Believed to be removed
M&H SUPP ID #	01F2DB3A	266	N39° 18' 07.83"	W120° 08' 59.51"	6145.3	0.6	
	0505FE1A	279	N39° 18' 08.91"	W120° 09' 00.00"	6145.1	4.0	

1. Top elevation and 20:1 Visual Surface based on 2017 AGIS survey data previously analyzed in the Obstruction Removal Plan. Table 2 shows analysis for these points based on the June 2020 Survey.

**Figure 3. Lahontan Hill
June 2020 Tree Survey
Truckee Tahoe Airport**

Legend

- June 2020 Surveyed Trees with Tag Number
- Priority 1 Obstructions (As Identified in ORP)
- FAA 20:1 Approach Surface Obstructions (June 2020 Survey)
- FAA 20:1 Approach Surface Near-Obstructions (June 2020 Survey)
- FAA 20:1 Approach Surface Near-Obstructions (AGIS Survey)

0 37.5 75 150 Feet

Image Source: TRK Aerial, November 2017



**Mead
& Hunt**



Priority 1 Tree believed to be removed (FAA # 06-196176)

Table 2 details all trees surveyed in June 2020 with tag number, elevation, and notes. **Table 2** also shows if the tagged trees were a part of the AGIS survey data, and the elevation from the AGIS survey. As discussed, elevation differences exist between the AGIS survey data and the June 2020 data due to tree growth or margin of error in vertical data.

Table 2 Lahontan Hill June 2020 Survey Data

Survey Tag #	Location		Elevation (Z) (Feet MSL)	Diameter (Inches)	20:1 Visual Surface Penetration (Feet)		Notes
	Northing (Y)	Easting (X)			June 2020 Survey Analysis ¹	AGIS Survey Analysis ²	
240	2241270.5	7085560.8	6136.9	34	-3.3	-2.0	Priority 1, FAA# 06-194553
241	2241248.5	7085558.0	6124.0	26	-17.3	N/A	
242	2241241.4	7085548.3	6128.1	30	-13.7	N/A	
243	2241349.2	7085540.9	6132.2	36	-5.1	N/A	
244	2241289.6	7085427.3	6148.6	26	6.0	N/A	
245	2241293.3	7085421.6	6144.7	27	2.2	N/A	Priority 1, FAA# 06-199660
246	2241273.6	7085414.5	6144.5	30	0.9	2.8	Priority 1, FAA# 06-141054
247	2241261.0	7085394.3	6131.5	34	-13.2	-4.6	Previously Topped
248	2241372.8	7085395.1	6127.2	28	-12.5	N/A	Priority 1, FAA# 06-199460
249	2241446.8	7085417.5	6146.6	27	9.9	8.1	
250	2241469.2	7085402.0	6134.4	27	-1.0	N/A	
251	2241271.1	7085316.5	6151.2	29	5.0	N/A	
252	2241259.5	7085300.8	6150.7	26	3.7	-2.9	
253	2241267.6	7085297.4	6152.1	24	5.4	N/A	
254	2241293.8	7085267.9	6154.6	34	8.3	6.4	Priority 1, FAA# 06-199882, TDPUD survey tag
255	2241292.1	7085228.2	6154.0	26	6.7	N/A	
256	2241300.6	7085153.7	6138.1	26	-10.6	N/A	
257	2241253.5	7085093.6	6149.5	26	-2.8	N/A	
258	2241221.8	7085117.4	6134.5	26	-18.6	N/A	
259	2241171.6	7085154.7	6134.7	28	-19.7	N/A	
260	2241360.0	7085101.7	6130.7	24	-16.7	N/A	4 trees
261	2241388.9	7085115.2	6130.9	24	-14.9	N/A	
262	2241372.1	7085125.5	6124.2	15	-22.1	N/A	4 trees
263	2241375.7	7085087.7	6122.3	17	-24.7	N/A	
264	2241353.3	7085143.9	6133.9	22	-12.8	N/A	
265	2241364.8	7085147.8	6127.3	24	-18.8	N/A	
266	2241384.5	7085168.9	6147.6	30	2.9	0.6	Priority 1
267	2241357.3	7085199.4	6141.4	24	-3.7	-7.1	3 trees
268	2241368.3	7085206.4	6149.4	30	4.9	N/A	+2 trees NNW
269	2241424.9	7085235.5	6138.6	27	-2.8	-4.5	3 trees
270	2241406.1	7085141.2	6137.1	17	-7.3	N/A	5 trees
271	2241449.6	7085167.1	6135.0	22	-6.8	N/A	5 trees spaced
272	2241472.2	7085184.5	6134.5	21	-5.5	-5.3	3 trees in line
273	2241490.0	7085231.0	6147.3	28	8.6	N/A	Near chimney
274	2241558.4	7085226.6	6133.8	29	-1.9	1.3	Priority 1, FAA# 06-195896, +3 nearby
275	2241567.1	7085181.6	6139.6	30	3.0	-0.8	3 trees
276	2241532.8	7085188.4	6130.5	28	-7.0	N/A	
277	2241529.0	7085162.2	6128.3	24	-10.1	N/A	
278	2241527.8	7085138.0	6120.7	20	-17.9	N/A	2 trees
279	2241491.4	7085115.6	6151.2	27	9.4	4.0	Priority 1
280	2241551.1	7085052.9	6136.1	32	-4.1	0.3	Priority 1, FAA# 06-200047, 4 trees
281	2241809.2	7085395.0	6120.9	24	0.3	0.4	Priority 1, FAA# 06-197182, On golf course

Notes:
1. June 2020 Survey Analysis: Penetration to 20:1 Visual Surface based on June 2020 survey data
2. AGIS Survey Analysis: Penetration to 20:1 Visual Surface based on 2017 AGIS survey data
N/A – Indicates tree was not found as part of the AGIS survey.

The data in **Table 2** with **Figure 3** may be used by the Airport to determine if mitigation on Lahontan Hill is practical and economical.

- Table 2 provides the Airport an inventory of trees that are penetrations to or are near to the Runway 20 20:1 Visual Surface.
- While the vertical data has some minor discrepancies, the June 2020 survey data correlates well with the 2017 AGIS data.
- Analysis shows that FAA flagged some trees as obstacles that are clear of the 20:1 Visual Surface. This suggests the FAA may flag any trees as obstacles in the future that are near penetrations to the surface.
- Table 2 also shows that individual data points captured in the AGIS or June 2020 surveys are actually multiple trees. The survey team looked to group trees that had similar elevations, proximity, and diameter.



Photos taken on June 11, 2020, are included below to help the Airport identify trees on the ground, and trees that were grouped together.













