APPENDIX A: OBSTRUCTION STUDY

EDWARD F. KNAPP STATE AIRPORT (MPV)

AIRPORT OBSTRUCTION STUDY

November 2020

VERMONT
AGENCY OF TRANSPORTATION

Prepared By:

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1 INTRODUCTION

An airport's airspace is a valuable asset to the overall infrastructure of the facility. The airspace must safely accommodate the approach and departure of aircraft by remaining free of all potential obstructions. As such, an airport obstruction study was conducted for the areas beyond the runways at the Edward F. Knapp State Airport ('MPV' or 'the Airport') to evaluate the Airport's compliance with Federal Aviation Administration (FAA) airspace standards within the respective runway approach and departure corridors.

For the purposes of this Study, the following airspace surfaces were evaluated.

1.1 FEDERAL AVIATION REGULATION (FAR) PART 77 APPROACH SURFACE

FAR Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, establishes areas of protected airspace surfaces used to define the maximum allowable height of objects surrounding an airport. The five FAR Part 77 surfaces include the Primary Surface, Transitional Surface, Approach Surface, Horizontal Surface, and the Conical Surface. The overall design, location, and heights of the FAR Part 77 surfaces at each airport vary based upon runway elevation, runway designation, and available instrument approach procedures.

The Approach Surface is considered of high importance as this area facilitates the arrival and departure of aircraft. The Approach Surface is located beyond each runway end and slopes upward at either a 20:1, 34:1, or 50:1 slope based upon the type of runway designation and instrument approach procedure; therefore, this Study focuses on obstructions within each of the relevant FAR Part 77 Approach Surfaces at MPV.

Table 1-1 lists the FAR Part 77 Approach Surface dimensions and slopes for each runway at MPV.

Table 1-1 – MPV FAR PART 77 Approach Surface Dimensions

Runway	Approach Type	Approach Slope	Inner Width	Outer Width	Length
17	Precision	50:1 & 40:1*	1,000	16,000	50,000
35	Non-Precision	34:1	1,000	3,500	10,000
5	Visual	20:1	250	1,250	5,000
23	Visual	20:1	250	1,250	5,000

Source: FAR Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*
*50:1 for the first 10,000 ft., then 40:1 thereafter
Note: Approach Surface begins 200 feet beyond end of runway
Dimensions are in Feet

1.2 OBSTACLE CLEARANCE SURFACES

In addition to the FAR Part 77 surfaces, the *United States Standard for Terminal Instrument Procedures* (TERPS) are used by the FAA to develop instrument approach procedures at airports. These procedures are used by aircraft while operating under Instrument Flight Rules. TERPS is defined within FAA Order 8260.3D and includes numerous approach and departure surfaces surrounding runways. As the TERPS surfaces can be complex and differ from the FAR Part 77

surfaces, the FAA has provided overall airport design standards for obstruction clearing beyond runways.

These obstruction clearing standards, known as the Obstacle Clearance Surfaces (OCS), are defined within FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, and FAA Engineering Brief No. 99.[1] The OCS applicable to the runway is based upon the type of runway approach, landing visibility minimum, and type of aircraft the runway accommodates. **Table 1-2** lists the various OCSs along with the criteria used to determine runway applicability. OCS determine the minimum obstruction removal required for a runway end. In locations off-airport property, clearing each OCS may be the most feasible alternative.

Table 1-2 – MPV Obstacle Clearance Surface Dimensions

OCS #	Runway Type	OCS Slope
1	Approach end of runways expected to serve small airplanes with approach speeds less than 50 knots. (Visual runways only, day/night).	15:1
2	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more. (Visual runways only, day/night).	20:1
3	Approach end of runway expected to serve large airplanes. (Visual runways only, day/night).	20:1
4	Approach end of runways expected to accommodate instrument approaches having visibility greater than or equal to 3/4 statute mile.	20:1
5	Approach end of runways expected to accommodate instrument approaches having visibility minimums less than 3/4 statute mile.	34:1
6	Approach end of runways expected to accommodate instrument approaches with vertical guidance.	30:1

Source: FAA Engineering Brief No. 99

Table 1-3 lists the applicable OCS dimensions and slopes for each runway at MPV.

Table 1-3 – MPV Obstacle Clearance Surface Dimensions

Runway	OCS #	OCS Slope	Distance from Runway End (Dim. A)	Inner Width (Dim. B)	Outer Width (Dim. C)	Length 1 (Dim. D)	Length 2 (Dim. E)
17	4	20:1	200	400	3,400	10,000	0
	6	30:1	0	300	1,520	10,000	0
35	4	20:1	200	400	3,400	10,000	0
5	2	20:1	0	250	700	2,250	2,750
	4	20:1	200	400	3,400	10,000	0
23	2	20:1	0	250	700	2,250	2,750
	4	20:1	200	400	3,400	10,000	0

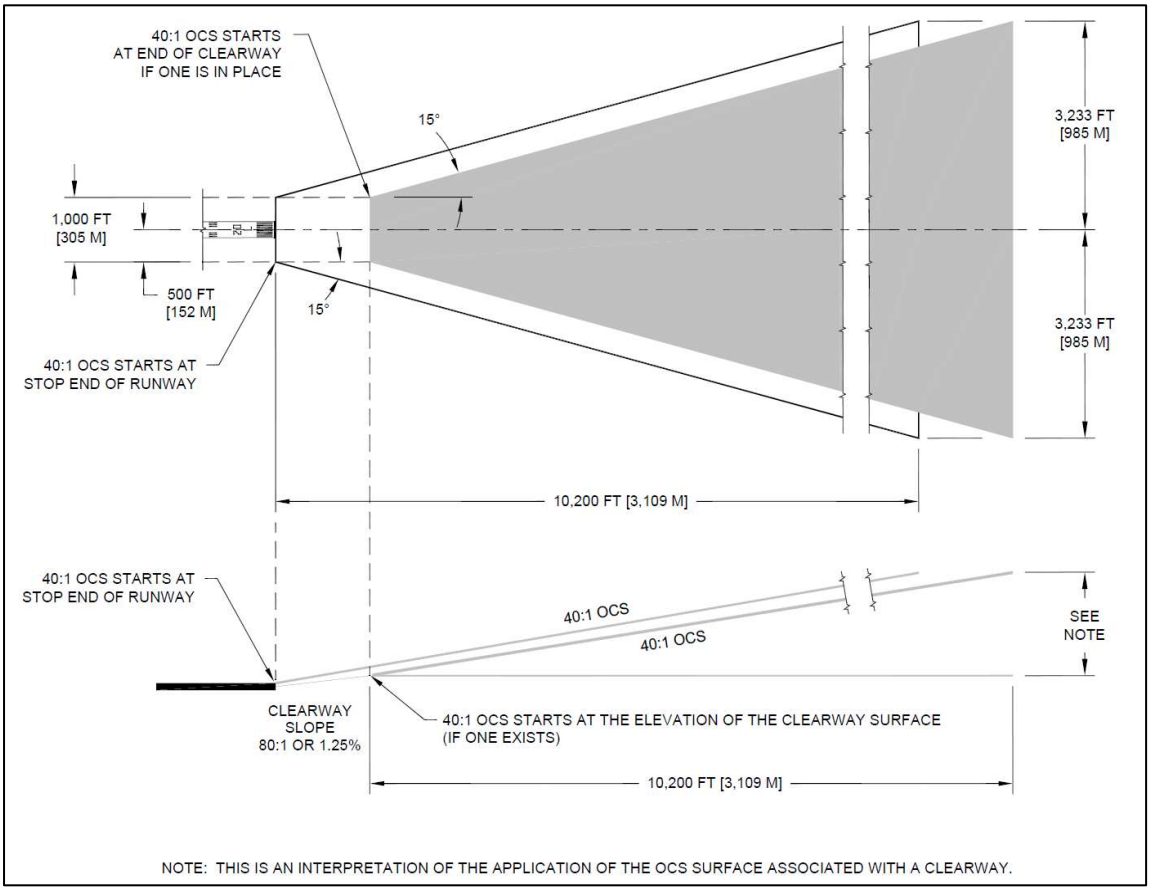
Source: FAA AC 150/5300-13A & FAA Engineering Brief No. 99
Note: Dimensions are in Feet

[1] Although this Study references Engineering Brief No. 99, an update to this guidance (Engineering Brief No. 99A) was issued July 24, 2020 after initial draft of this report. Therefore, all references and OCS criteria will remain specific to Engineering Brief No. 99.

1.3 DEPARTURE SURFACE

As part of the instrument approach procedure evaluation, the FAA examines obstructions within the runway's Departure Surface. When a runway with an instrument approach procedure contains objects that penetrate the 40:1 Departure Surface, a "departure procedure" may be evaluated. A departure procedure may reduce the runway takeoff distance available, require non-standard aircraft climb rates, or require non-standard departure minimums. **Figure 1-1** depicts the dimensions and associated OCS slope of the Departure Surface.

Figure 1-1 – Departure Surface for Instrument Runways



Source: FAA AC 150/5300-13A

At MPV, the Runway 17 and Runway 35 Departure Surfaces were examined. **Table 1-4** lists the applicable Departure Surface dimensions for each runway.

Table 1-4 – MPV Departure Surface Dimensions

Runway	Surface Slope	Inner Width	Outer Width	Length
17	40:1	1,000	6,466	10,200
35	40:1	1,000	6,466	10,200

Source: FAA AC 150/5300-13A
Note: Surface begins at stop end of runway
Dimensions are in Feet

2 OBSTRUCTION EVALUATION

For the purpose of identifying the objects beyond each runway end at MPV, a survey was conducted in the fall of 2019. This survey used both aerial- and ground-based surveying methods meeting standards outlined within AC 150/5300-I8B, *General Guidance and Specifications for Submission of Aeronautical Surveys to NGS: Field Data Collection and Geographic Information System (GIS) Standards.*

The following sections discuss the survey data through a series of figures detailing the obstructions within each airspace surface. The approximate height of the objects above each surface are shown using color coded symbols to depict height ranges. For planning purposes, each figure depicts vegetational objects (i.e., trees and bushes) that are below, but within 10 feet of each surface. Fixed objects (i.e., buildings, poles, and roads) below the surfaces are not shown within the figures; however, a sampling of all points is shown on the runway plan and profile sheets accompanying this report.

Due to higher terrain beyond the Runway 35 end, this runway end contains the greatest number of obstructions, both fixed and vegetational. For clarity, a separate figure is provided to depict the fixed objects within the Runway 35 airspace surfaces.

2.1 RUNWAY 17

The Runway 17 end is located in the western quadrant of the Airport. The ground between the runway threshold and approximately 330 feet beyond the runway end decreases approximately 10 feet in elevation. Beyond this point, the elevation decreases between 45 and 65 feet along Comstock Road. The area north of Comstock Road, adjacent to the Runway 17 approach lighting system, is owned by the Vermont Agency of Transportation (VTrans). The area south of Comstock Road, adjacent to the runway end, is also airport-owned property. **Figure 2-1** depicts the MPV property boundary near the Runway 17 end.

Runway 17 is equipped with an Instrument Landing System (ILS) with a landing visibility minimum of ¾ mile. As such, the runway is classified as a precision instrument approach, providing both lateral and vertical guidance to landing aircraft.

Figure 2-1 – Runway 17 Property Boundary

Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

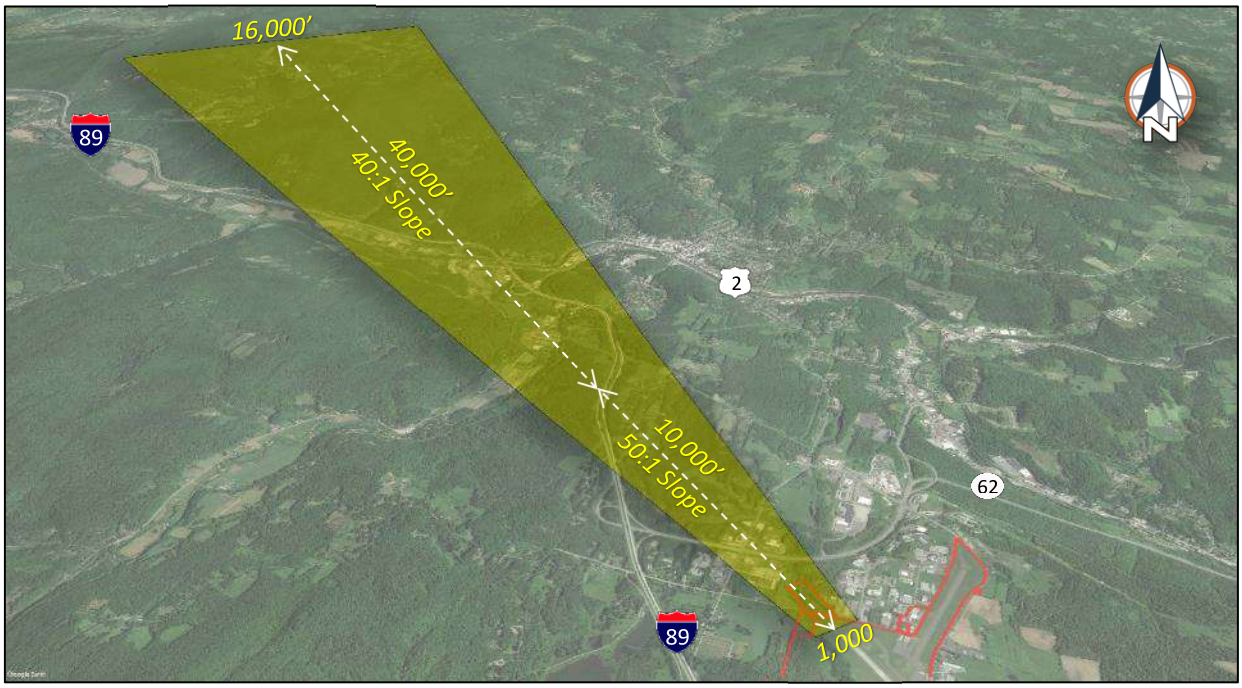
As mentioned previously, there are four airspace surfaces applicable to Runway 17:

- FAR Part 77 Approach Surface
- Obstacle Clearance Surface #4
- Obstacle Clearance Surface #6
- Departure Surface

2.1.1 Runway 17: FAR Part 77 Approach Surface

The Runway 17 FAR Part 77 Approach Surface begins 200 feet beyond the runway end and extends outward and upward at a 50:1 slope for 10,000 feet and then at a 40:1 slope for an additional 40,000 feet. **Figure 2-2** depicts the Runway 17 Part 77 Approach Surface.

Figure 2-2 – Runway 17 FAR Part 77 Approach Surface



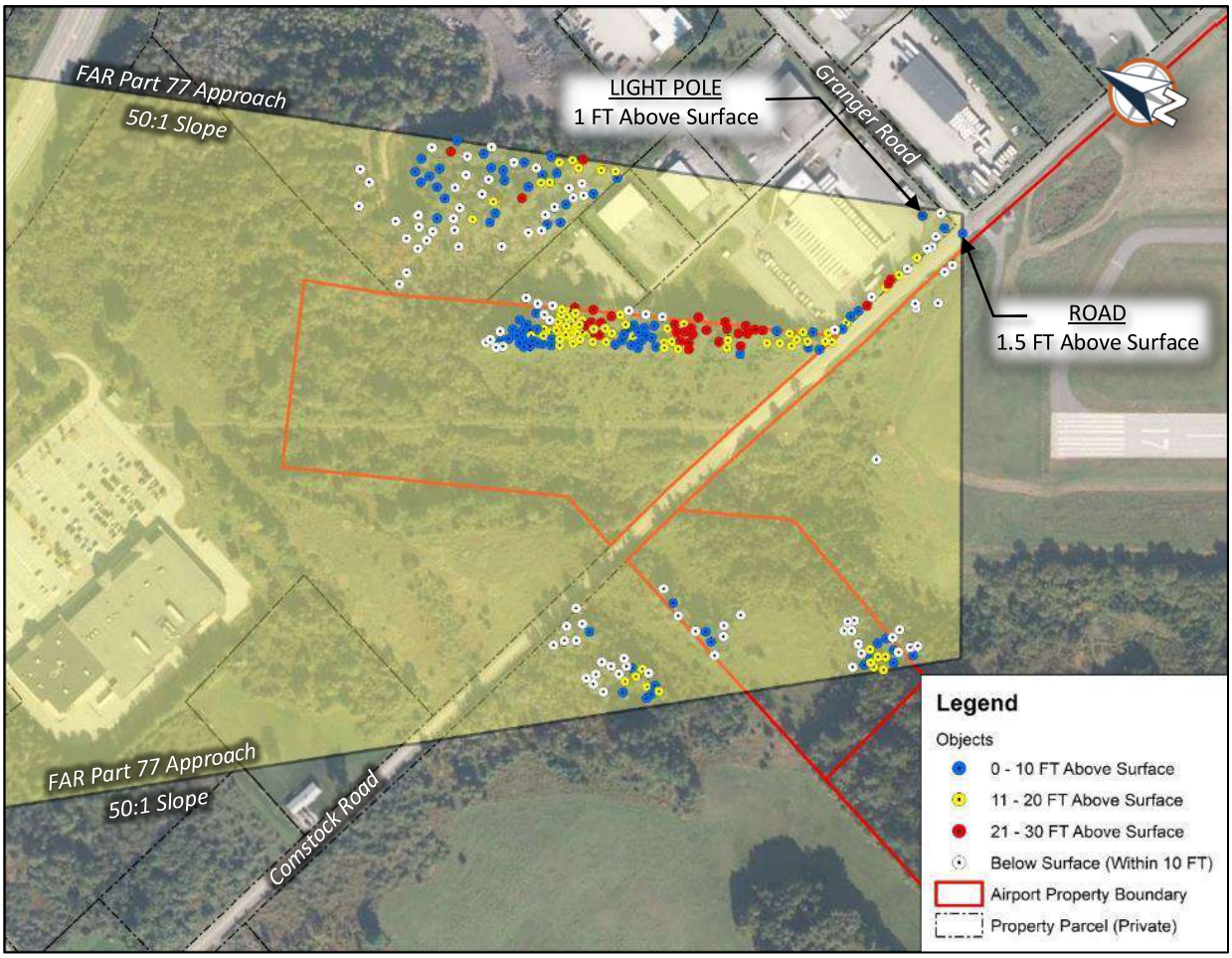
Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

Figure 2-3 depicts the objects penetrating the Runway 17 Part 77 Approach Surface, as well as all vegetational objects 10 feet below the surface. The surface penetrations range from at or near zero (i.e., equal with the surface elevation) to approximately 30 feet above the surface.

As shown, the majority of the objects are located north of Comstock Road, adjacent to the Runway 17 approach lighting system. While a number of the objects are located on airport property, several are located off airport-owned property.

Although the majority of the objects shown are vegetational, a light pole located within the FedEx Freight parking lot at the corner of Granger and Comstock Roads, as well as a portion of Comstock Road, penetrate the surface by just over one foot.[2]

Figure 2-3 – Runway 17 FAR Part 77 Approach Obstructions



Source: Quantum Spatial, Vermont Open Geodata Portal, CHA, 2020

2.1.2 Runway 17: Obstacle Clearance Surfaces

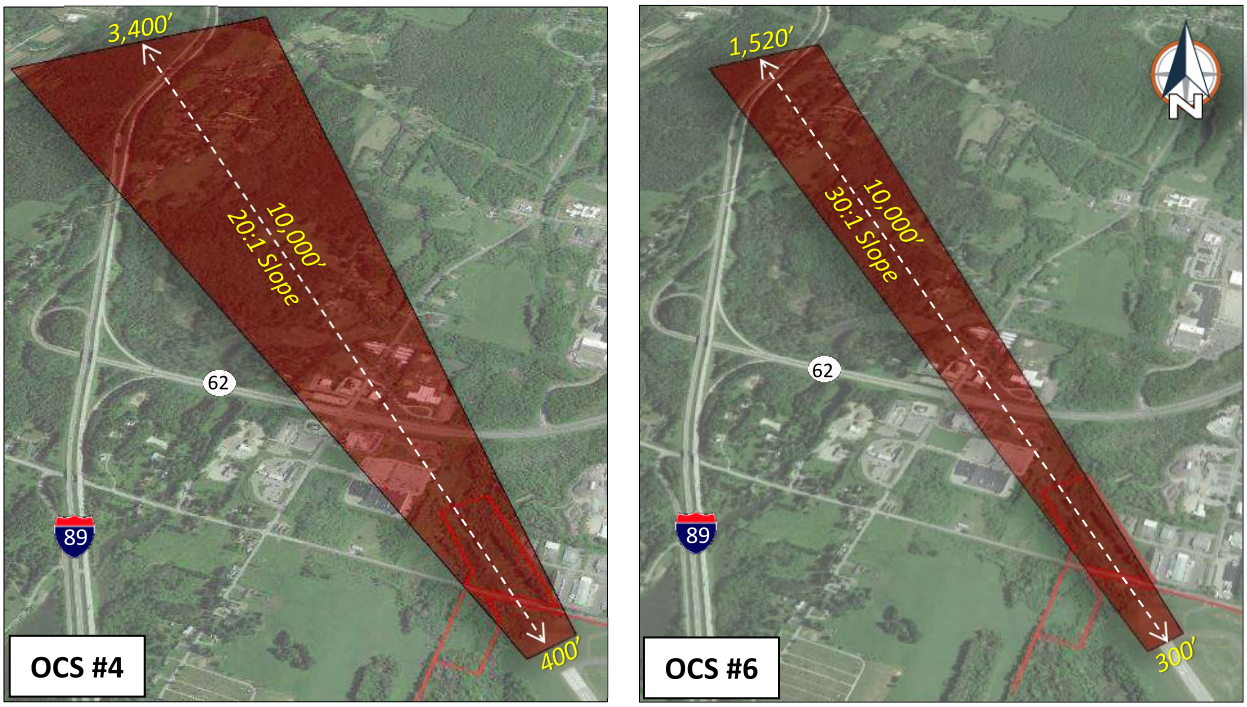
FAA Engineering Brief No. 99 lists the siting criteria, dimensions, and clearance slopes for each OCS. Since the Runway 17 ILS provides vertical landing guidance and a landing visibility minimum of ¾ mile, both OCS #4 and OCS #6 apply.

OCS #4 begins 200 feet beyond the Runway 17 end and extends outward and upward at a 20:1 slope for 10,000 feet. OCS #6 begins at the Runway 17 threshold and extends outward and upward at a 30:1 slope for 10,000 feet. Due to the respective starting points and slopes of each surface, OCS #4 and OCS #6 intersect at approximately 610 feet from the runway threshold. It is

[2]A traverse way elevation of 10 feet for private roads, 15 feet for public roads, and 17 feet for interstate highways is added to all roadways per FAR Part 77.

important to note that each surface also varies in width, resulting in some of the objects that penetrate OCS #4 being located outside of OCS #6. **Figure 2-4** depicts the Runway 17 OCSs.

Figure 2-4 – Runway 17 Obstacle Clearance Surfaces



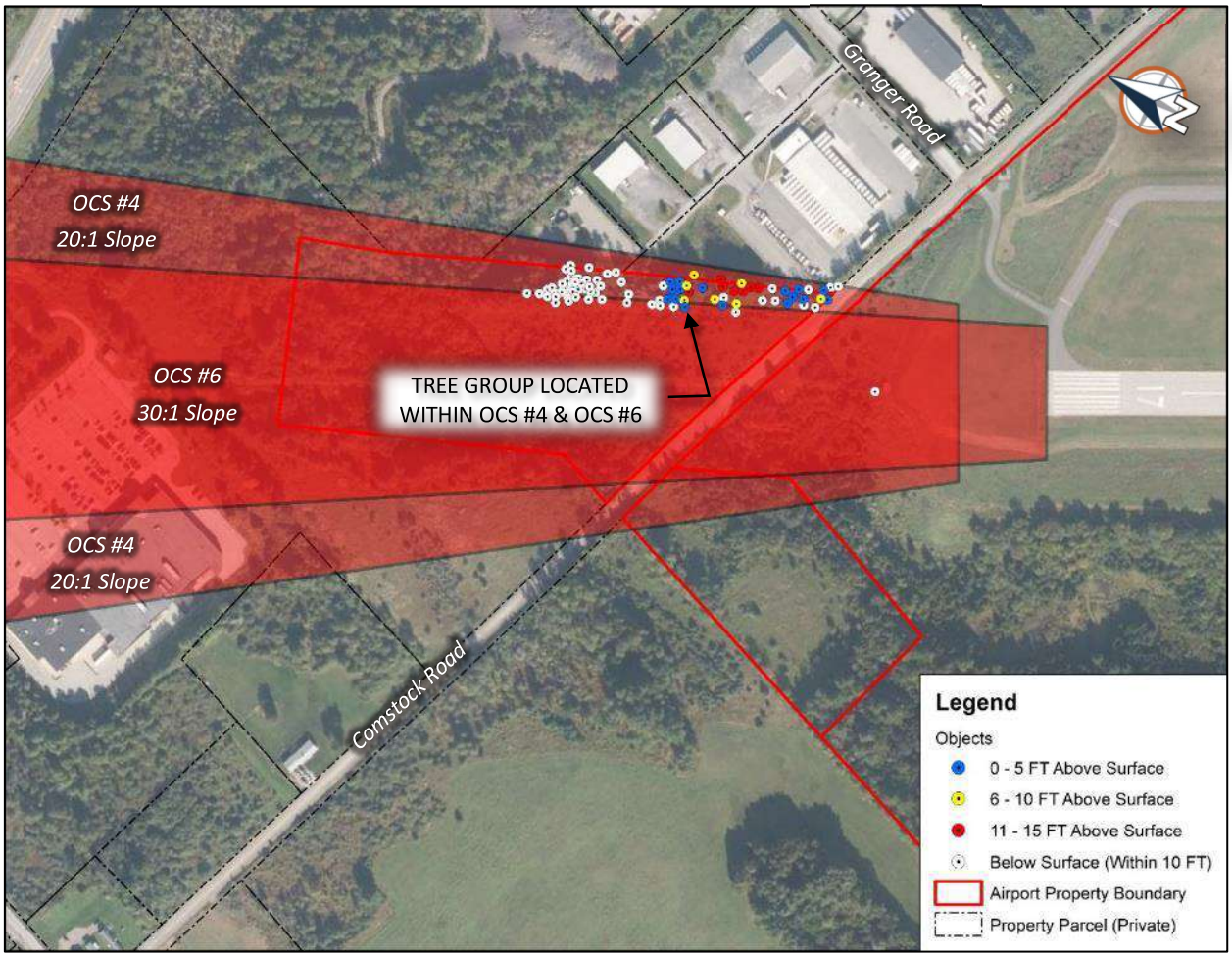
Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

Figure 2-5 depicts the objects penetrating the Runway 17 OCSs, as well as all vegetational objects 10 feet below the surfaces. The surface penetrations range from at or near zero (i.e., equal with the surface elevation) to approximately 15 feet above the surface.

Currently, all objects penetrating the Runway 17 OCSs are tree groups north of Comstock Road located on airport property and the adjacent privately-owned parcel. While the majority of the objects are located within OCS #4, there is one tree group also located within OCS #6.

No fixed objects penetrate either of the Runway 17 OCSs.

Figure 2-5 – Runway 17 Obstacle Clearance Surface Obstructions



Source: Quantum Spatial, Vermont Open Geodata Portal, CHA, 2020
Note: No fixed object penetrations

2.1.3 Runway 17: Departure Surface

The Departure Surface is designed for aircraft departing from the opposite end of the runway. That is, the Departure Surface located beyond the Runway 17 end serves aircraft departing from Runway 35.

Unlike other airspace surfaces whose dimensions and slopes vary based upon runway type and landing visibility minimums, each Departure Surface begins at the end of the runway and extends outward and upward at a 40:1 slope for 10,200 feet. **Figure 2-6** depicts the Runway 17 Departure Surface.

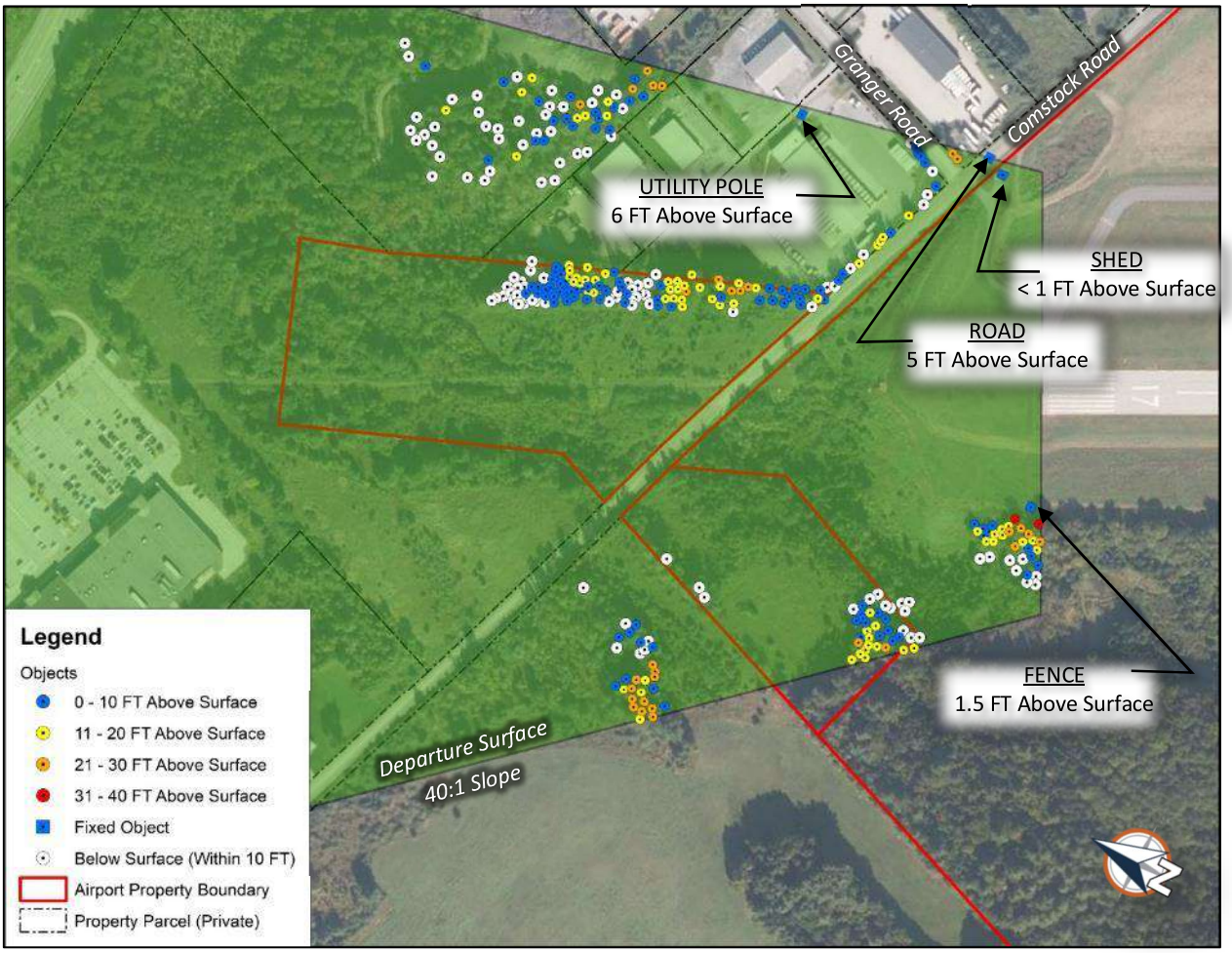
Figure 2-6 – Runway 17 Departure Surface

Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

Figure 2-7 depicts the objects penetrating the Runway 17 Departure Surface, as well as all vegetational objects 10 feet below the surface. The surface penetrations range from at or near zero (i.e., equal with the surface elevation) to approximately 40 feet above the surface.

The Runway 17 Departure Surface contains many of the same tree groups within and 10 feet below the FAR Part 77 Approach Surface due to the lower clearance slopes associated with each surface (Approach Surface = 50:1 and Departure Surface = 40:1); however, since the Runway 17 Departure Surface begins at the end of the runway rather than 200 feet beyond, there are four fixed objects penetrating the Departure Surface that are not within the Approach Surface: a utility pole, a shed, a portion of Airport fencing, and a portion of Comstock Road. The shed and fencing are both located on Airport property. The light pole is located within FedEx Freight's parking lot.

Figure 2-7 – Runway 17 Departure Surface Obstructions



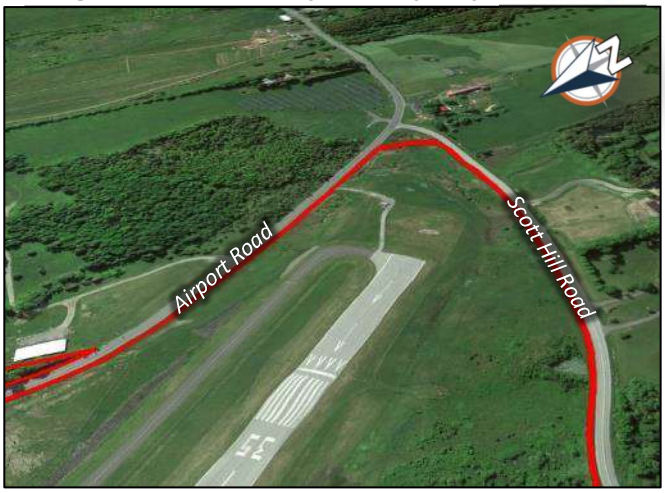
Source: Quantum Spatial, Vermont Open Geodata Portal, CHA, 2020

2.2 RUNWAY 35

The Runway 35 end is located in the southeastern quadrant of the Airport. The Airport property boundary extends near the intersection of Airport Road and Scott Hill Road. The terrain within the Airport property boundary decreases approximately 15 feet in elevation between the Runway 35 end and roadway intersection.

Approximately 1,500 feet southeast of the runway. Approximately 4,000 feet beyond this area, the terrain increases in elevation, with some areas 60 feet higher than the Runway 35 end. Approximately 4,000 feet

Figure 2-8 – Runway 35 Property Boundary



Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

beyond this area, the terrain increases to approximately 140 feet above the Runway 35 end elevation with densely forested areas.

Runway 35 is classified as a non-precision runway with two published instrument approach procedures: an RNAV (GPS) approach providing landing visibility minimums as low as 1-mile, and a VOR approach providing a landing visibility minimum as low as 1 ¼-mile. It is important to note that the VOR final approach course is offset eight degrees counterclockwise from the Runway 35 magnetic heading, resulting in an offset OCS plane discussed within subsequent sections.

Additionally, unlike the other runways at MPV, the Runway 35 threshold is displaced approximately 500 feet from the runway end. The displaced portion of the runway is only used for aircraft takeoff from Runway 35 and landing rollout from the Runway 17 end.

Similar to Runway 17, there are three airspace surfaces applicable to Runway 35:

- FAR Part 77 Approach Surface
- Obstacle Clearance Surface #4
- Departure Surface

2.2.1 Runway 35: FAR Part 77 Approach Surface

The Runway 35 FAR Part 77 Approach Surface begins 200 feet beyond the runway end and extends outward and upward at a 34:1 slope for 10,000 feet.

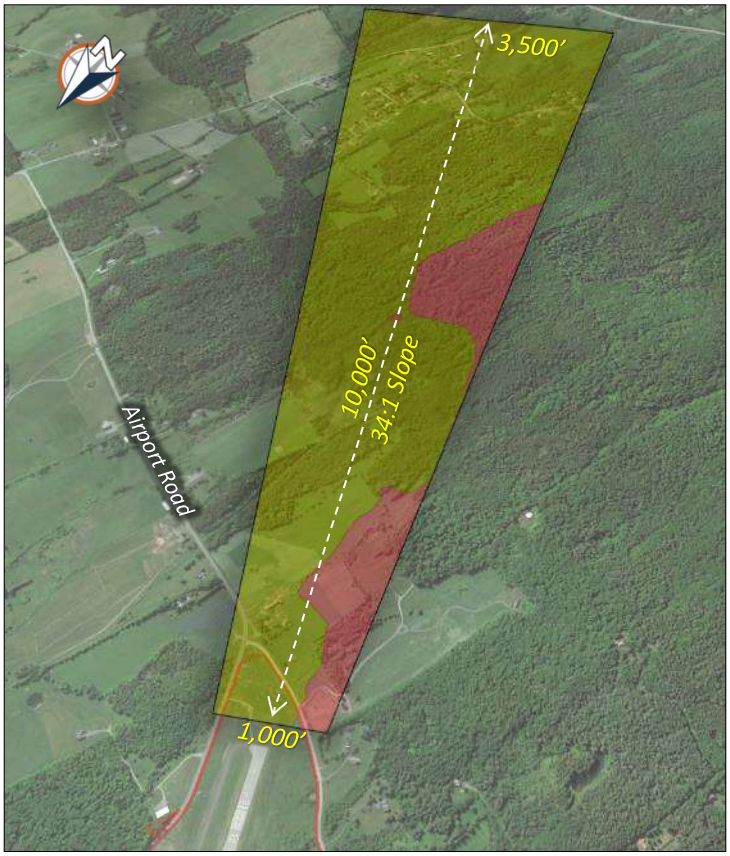
Figure 2-9 depicts the Runway 35 Approach Surface. The red highlighted areas within the figure denote the areas of higher terrain above the Approach Surface elevation.

Due to the higher terrain beyond the Runway 35 end, there are a significant number of objects that penetrate the Approach Surface.

For clarity, all fixed object penetrations are presented separately on **Figure 2-15**.

Figure 2-10 depicts the vegetational objects penetrating the Runway 35 Approach Surface, as well as all vegetational objects 10 feet below the surface. The surface penetrations range from at or near zero (i.e., equal with the surface elevation) to approximately 200 feet above the surface, with the greatest

Figure 2-9 – Runway 35 FAR Part 77 Approach Surface

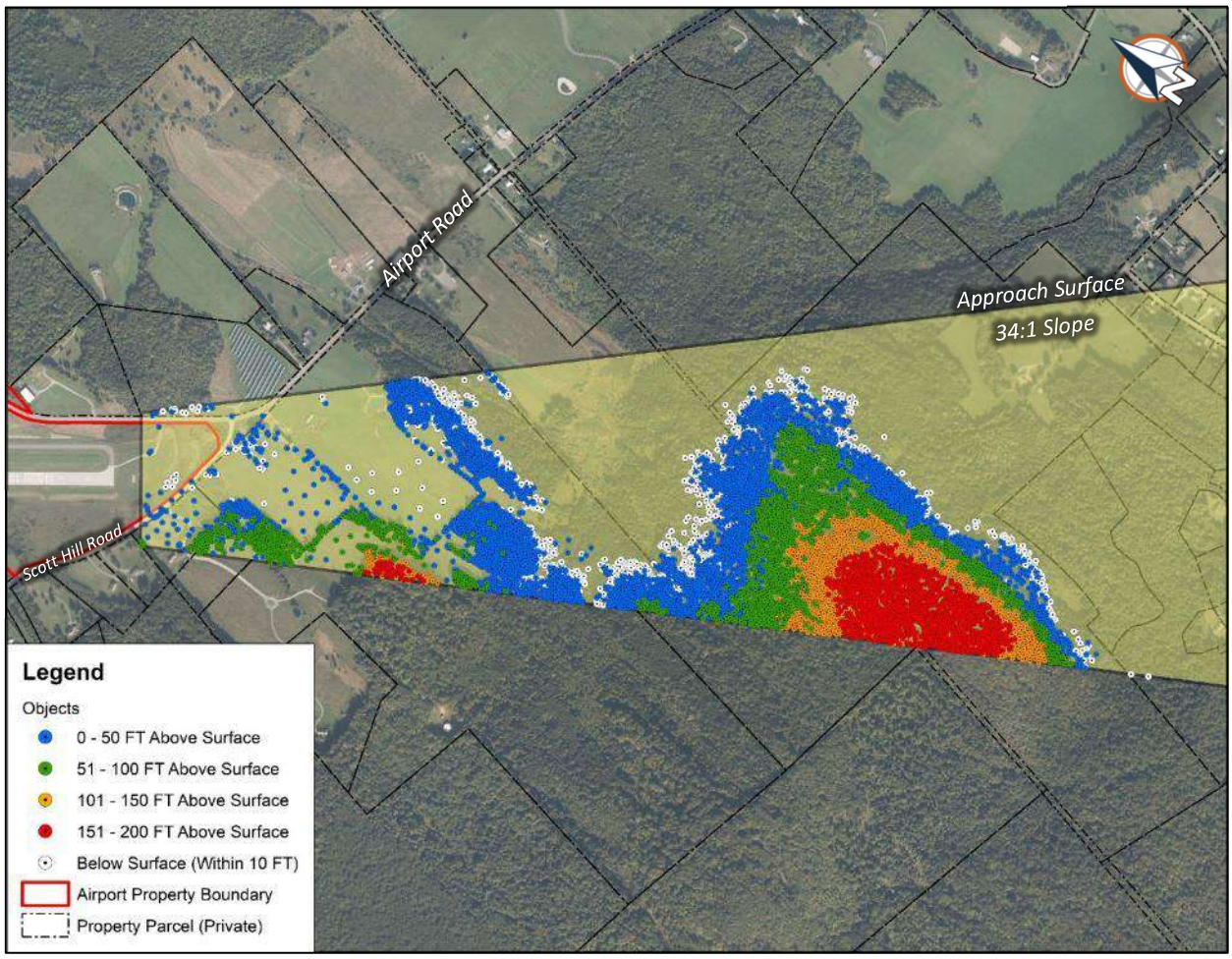


Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

concentration of obstructions located within the higher terrain southeast of the runway.

Although the majority of the obstructions are trees, there are fixed objects located both on- and off-Airport property that penetrate the Runway 35 FAR Part 77 Approach Surface. As mentioned, these obstructions are depicted on **Figure 2-15**.

Figure 2-10 – Runway 35 FAR Part 77 Approach Surface Obstructions



Source: Quantum Spatial, Vermont Open Geodata Portal, CHA, 2020

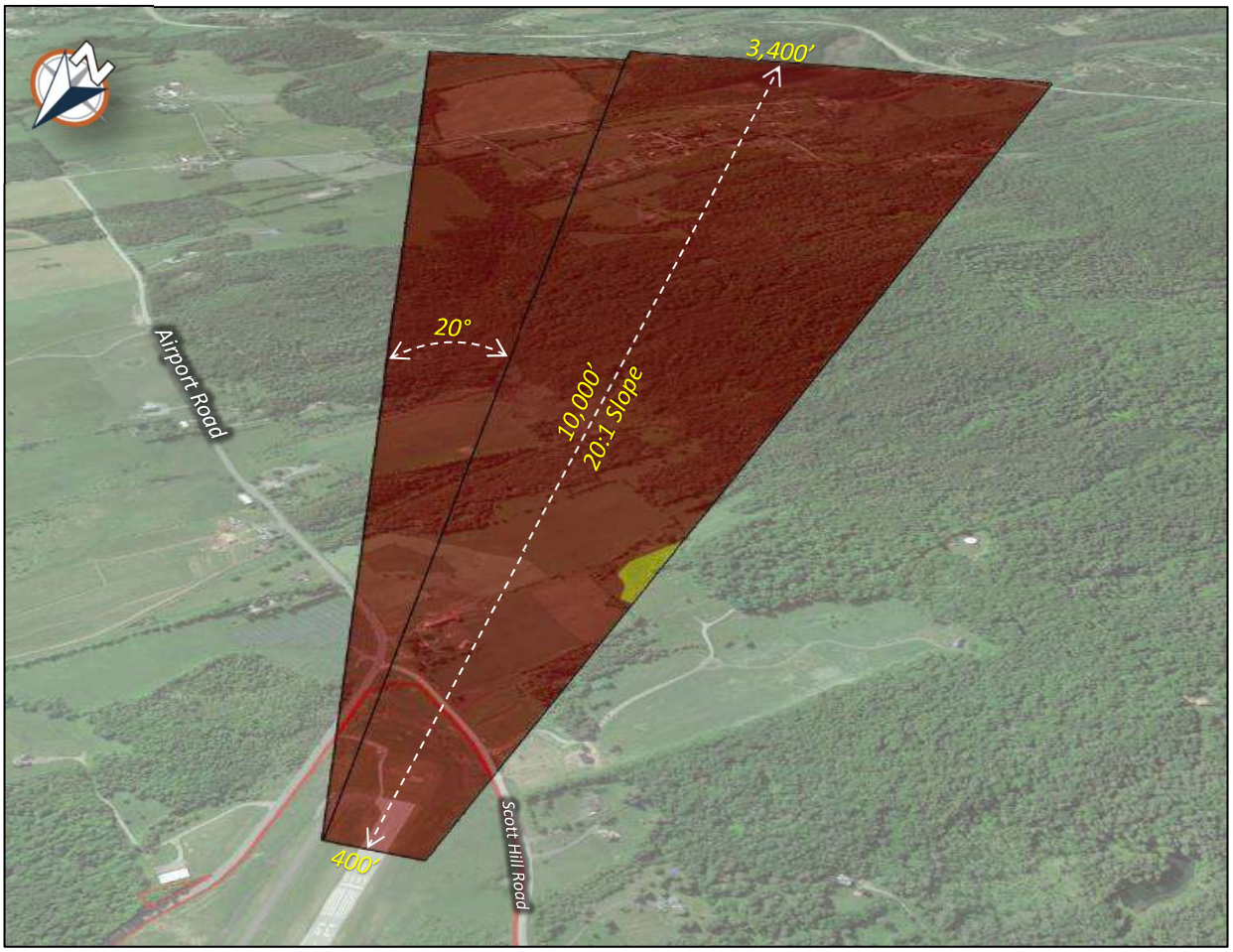
2.2.2 Runway 35: Obstacle Clearance Surface

As discussed, Runway 35 has two published instrument approach procedures: an RNAV (GPS) approach and a VOR approach. Of the two, the RNAV approach provides the lowest landing visibility minimum of 1-mile. Neither of the Runway 35 instrument approach procedures provide vertical landing guidance. Therefore, in accordance to the standards listed within FAA Engineering Brief No. 99, only OCS #4 applies to Runway 35. The higher terrain beyond the runway that penetrates the slope is highlighted in yellow within **Figure 2-11**.

Similar to the Runway 17, the Runway 35 OCS extends outward and upward at a 20:1 slope for 10,000 feet beginning 200 feet beyond the Runway 35 displaced threshold. As mentioned

previously, the VOR approach has an offset final approach course eight degrees counterclockwise from the Runway 35 magnetic heading of 348 degrees; therefore, in addition to the standard OCS #4 dimensions, the Runway 35 OCS also has an "offset approach plane". This additional surface area has the same slope (i.e., 20:1), but extends 20 degrees counterclockwise per FAA guidance.[3] **Figure 2-11** depicts both the OCS and offset OCS.

Figure 2-11 – Runway 35 Obstacle Clearance Surface

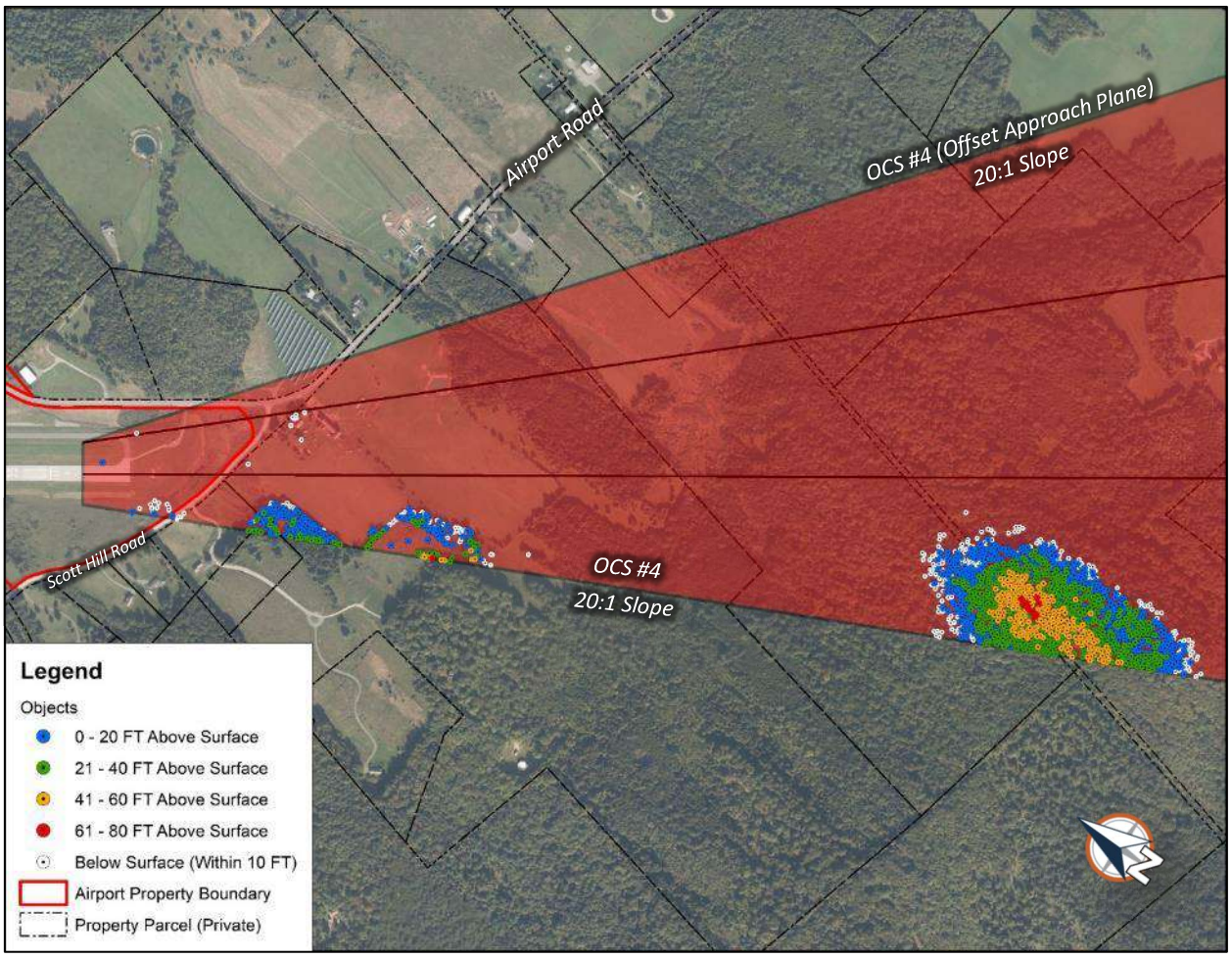


Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

[3] FAA Advisory Circular 150/5300-13A, *Airport Design*, Figure 3-3

Figure 2-12 depicts the vegetational objects penetrating the Runway 35 OCS, as well as all vegetational objects 10 feet below the surface. The surface penetrations range from at or near zero (i.e., equal with the surface elevation) to approximately 80 feet above the surface. As with the Runway 35 FAR Part 77 Approach Surface, the areas of higher terrain beyond the runway contain several tree groups that penetrate the OCS. Although the Runway 35 OCS has an extended offset approach plane, all obstructs are concentrated within the western portion of the surface. Fixed object penetrations within the Runway 35 OCS are depicted on **Figure 2-15**.

Figure 2-12 – Runway 35 Obstacle Clearance Surface Obstructions



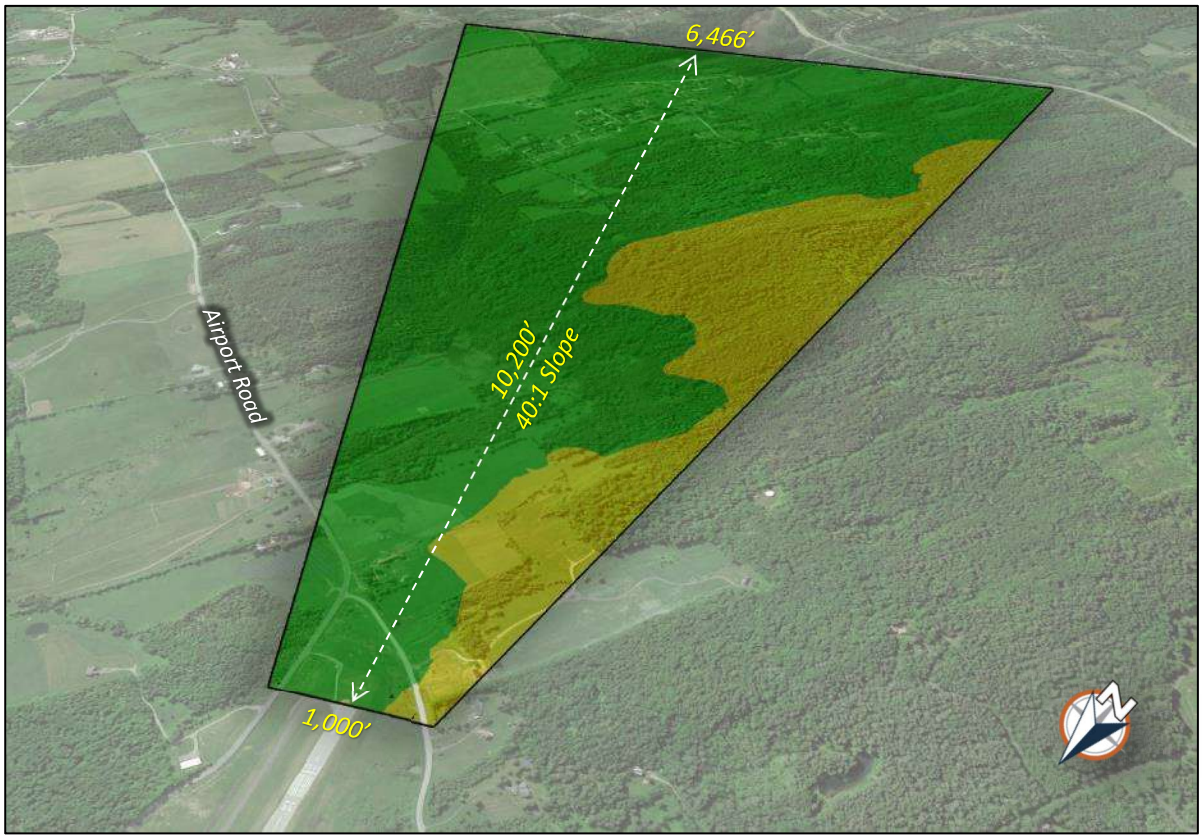
Source: Quantum Spatial, Vermont Open Geodata Portal, CHA, 2020

2.2.3 Runway 35: Departure Surface

The Runway 35 Departure Surface begins at the end of the runway and extends outward and upward at a 40:1 slope for 10,200 feet. This surface is intended for aircraft departing from the Runway 17 end.

Figure 2-13 depicts the Runway 35 Departure Surface, along with the areas of terrain (highlighted in yellow), that penetrate the surface.

Figure 2-13 – Runway 35 Departure Surface

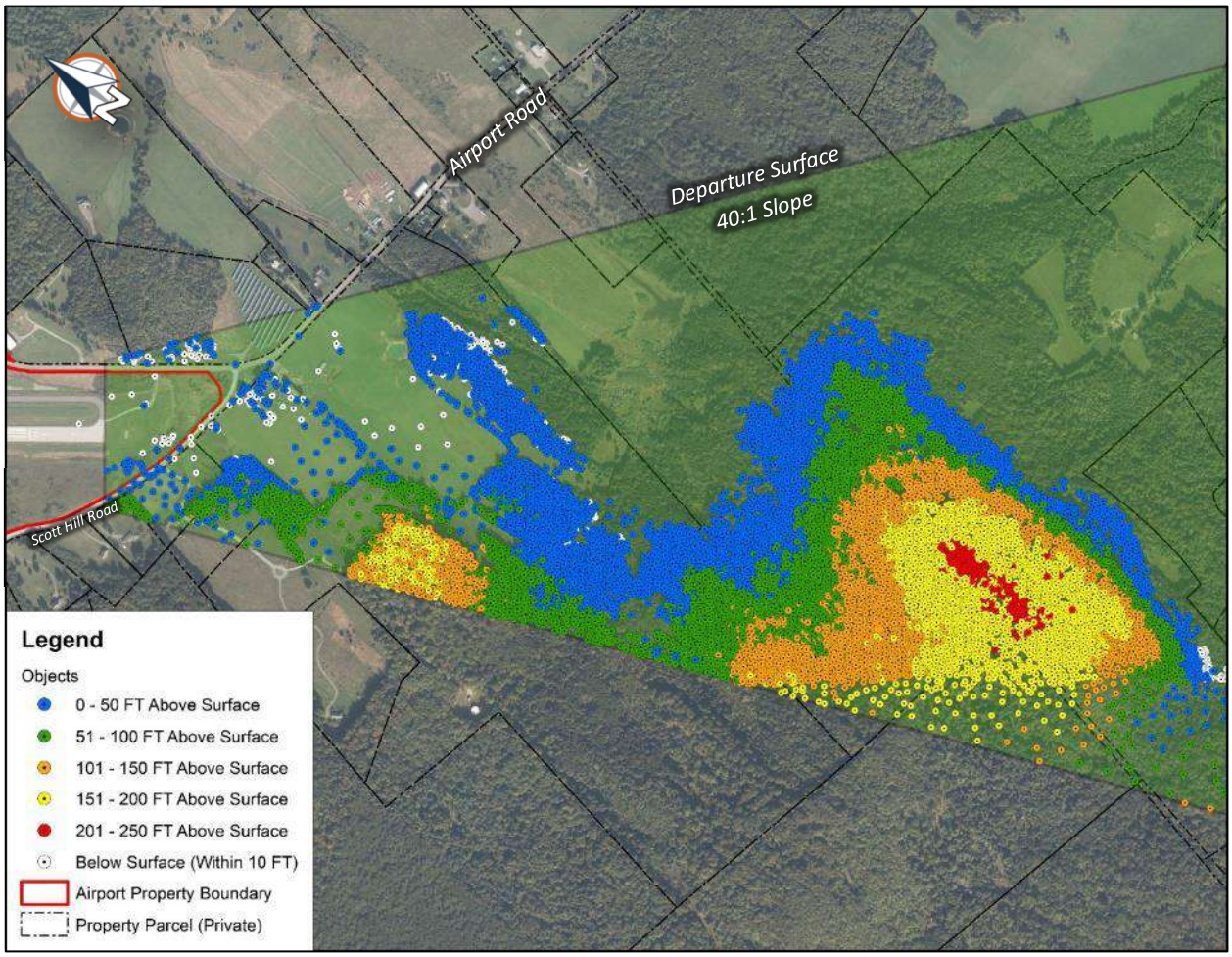


Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

Due to the 40:1 slope, the Runway 35 Departure Surface contains the greatest amount of obstructions as compared to the other surfaces. Similar to the other surfaces, however, the majority of the obstructions are tree groups located within the higher areas of terrain.

Figure 2-14 depicts the vegetational objects penetrating the Runway 35 Departure Surface, as well as all vegetational objects 10 feet below the surface. The surface penetrations range from at or near zero (i.e., equal with the surface elevation) to approximately 250 feet above the surface. As mentioned, the Runway 35 Departure Surface contains the greatest amount of obstructions. As with the other surfaces, the majority of these obstructions are trees.

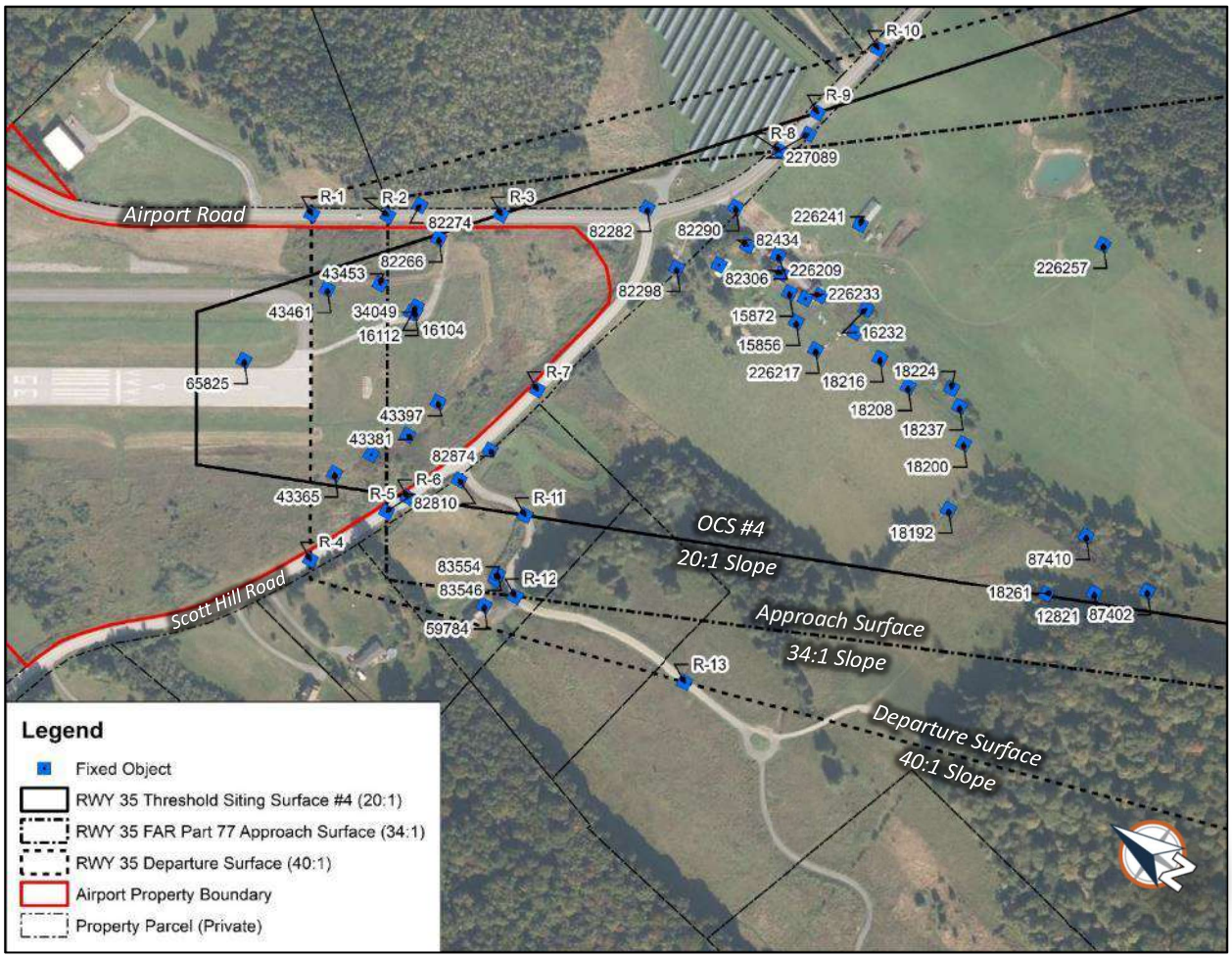
Figure 2-14 – Runway 35 Departure Surface



Source: Quantum Spatial, Vermont Open Geodata Portal, CHA, 2020

Figure 2-15 depicts the location of all fixed obstructions within each of the Runway 35 surfaces (e.g., FAR Part 77 Approach Surface, OCS, and Departure Surface). **Table 2-1** and **Table 2-2** lists the obstructions by their identification along with their respective height above each surface.

Figure 2-15 – Runway 35 Fixed Object Obstructions



Source: Quantum Spatial, Vermont Open Geodata Portal, CHA, 2020

Table 2-1 – Runway 35 Fixed Object Obstructions

					OBSTACLE CLEARANCE SURFACE #4 (20:1)		PART 77 APPROACH (34:1)		DEPARTURE SURFACE (40:1)	
OBJECT ID	OBJECT TYPE	EASTING	NORTHING	OBJECT ELEV.	SURFACE ELEV.	PENETRATION (FT)	SURFACE ELEV.	PENETRATION (FT)	SURFACE ELEV.	PENETRATION (FT)
12821	UTILITY_LINE	1625521.705	615579.784	1302.3	1276.1	*26.2*	1220.3	*82.0*	1217.0	*85.3*
15848	BUILDING	1625837.847	616615.383	1217.5	1239.5	-22.0	1197.8	*19.7*	1198.0	*19.5*
16232	POLE	1625889.725	616462.309	1219.7	1247.5	-27.8	1202.4	*17.3*	1201.9	*17.8*
18192	FENCE	1625531.815	616020.681	1244.8	1256.7	-11.9	1208.9	*35.9*	1207.4	*37.4*
18237	POLE	1625783.219	616124.291	1241.9	1258.9	-17.0	1209.8	*32.1*	1208.1	*33.8*
18261	POLE_UTIL	1625460.136	615690.068	1346.3	1269.9	*76.4*	1216.6	*129.7*	1213.9	*132.4*
34049	ANTENNA	1625312.465	617506.769	1177.5	1186.6	-9.1	1167.3	*10.2*	1172.0	*5.5*
43365	FENCE	1624845.246	617483.709	1174.7	1176.1	-1.4	-	-	1167.1	*7.6*
43381	FENCE	1625025.508	617362.745	1171.7	1185.7	-14.0	1167.1	*4.6*	1171.8	-0.1
43461	FENCE	1625261.526	617731.523	1165.5	1175.7	-10.2	-	-	1166.5	-1.0
59792	BUILDING	1625808.417	616856.713	1196.8	1228.4	-31.6	1191.1	*5.7*	1192.3	*4.5*
82266	POLE_UTIL	1625517.948	617537.449	1172.0	1191.2	-19.2	1169.5	*2.5*	1173.8	-1.8
82274	POLE_UTIL	1625570.004	617621.959	1173.6	-	-	1167.9	*5.7*	1172.5	*1.1*
82282	POLE_UTIL	1625848.946	617093.649	1188.7	1219.5	-30.8	1185.6	*3.1*	1187.6	*1.1*
82290	POLE_UTIL	1625962.054	616890.715	1196.3	1231.4	-35.1	1192.4	*3.9*	1193.4	*2.9*
82298	POLE_UTIL	1625747.939	616951.356	1198.5	1222.6	-24.1	1187.8	*10.7*	1189.4	*9.1*
83546	TRANSFORMER	1624817.625	616981.088	1202.5	-	-	1174.1	*28.4*	1177.8	*24.7*
83554	POST	1624804.092	616979.636	1205.7	-	-	1174.0	*31.7*	1177.7	*28.0*
87402	POLE_UTIL	1625592.474	615459.995	1291.4	1283.0	*8.4*	1224.3	*67.1*	1220.5	*70.9*
87410	POLE_UTIL	1625643.638	615670.207	1271.2	1274.9	-3.7	1219.6	*51.6*	1216.5	*54.7*
104293	GROUND	1625241.598	615956.724	1255.6	-	-	1206.6	*49.0*	1205.4	*50.2*
104325	GROUND	1625097.096	615853.621	1256.7	-	-	-	-	1205.9	*50.8*
226057	GROUND	1625003.713	616430.736	1222.6	-	-	1191.0	*31.6*	1192.1	*30.5*
226073	GROUND	1625104.83	616713.342	1190.6	1216.1	-25.5	1185.0	*5.6*	1187.1	*3.5*
226249	GROUND	1625547.129	615774.484	1278.4	1268.2	*10.2*	1215.6	*62.8*	1213.1	*65.3*
226321	GROUND	1625843.873	615078.452	1238.3	1305.5	-67.2	1237.7	*0.6*	1231.9	*6.4*
227089	POLE_UTIL	1626221.127	616814.095	1206.4	1242.0	-35.6	-	-	1198.1	*8.3*

Table 2-2 – Runway 35 Roadway Obstructions

					OBSTACLE CLEARANCE SURFACE #4 (20:1)		PART 77 APPROACH (34:1)		DEPARTURE SURFACE (40:1)	
ROAD ID	NAME	EASTING	NORTHING	ROAD ELEV.	SURFACE ELEV.	PENETRATION (FT)	SURFACE ELEV.	PENETRATION (FT)	SURFACE ELEV.	PENETRATION (FT)
R-1	Airport Rd.	1625414.075	617860.984	1160.0	-	-	-	-	1165.5	-5.5
R-2	Airport Rd.	1625506.408	617683.552	1155.0	-	-	1165.5	-10.5	1170.5	-15.5
R-3	Airport Rd.	1625651.189	617423.355	1154.0	1199.9	-45.9	1174.2	-20.2	1177.9	-23.9
R-4	Scott Hill Rd.	1624615.293	617431.326	1106.0	-	-	-	-	1165.5	-59.5
R-5	Scott Hill Rd.	1624822.831	617315.862	1192.0	-	-	1165.5	*26.5*	1170.5	*21.5*
R-6	Scott Hill Rd.	1624882.161	617285.105	1190.0	1185.8	4.2	1167.1	*22.9*	1171.9	*18.1*
R-7	Scott Hill Rd.	1625292.529	617120.371	1178.0	1202.7	-24.7	1177.1	*0.9*	1180.3	-2.3
R-8	Airport Rd.	1626146.776	616859.317	1180.0	1238.0	-58.0			1196.2	-16.2
R-9	Airport Rd.	1626281.944	616820.074	1189.0	1243.5	-54.5	1199.0	-10.0	1198.7	-9.7
R-10	Airport Rd.	1626506.021	616760.577	1198.0	-	-	-	-	1202.6	-4.6
R-11	Dodge Farm Rd.	1624987.602	616991.341	1199.0	1201.2	-2.2	1176.2	*22.8*	1179.6	*19.4*
R-12	Dodge Farm Rd.	1624788.435	616912.636	1221.0	-	-	1175.5	*45.5*	1179.0	*42.0*
R-13	Dodge Farm Rd.	1624805.489	616411.234	1250.0	-	-	-	-	1190.2	*59.8*

Source: Quantum Spatial, CHA, 2020

2.3 RUNWAY 5

The Runway 5 end is located in the central portion of the Airport, northeast of Runway 17/35.

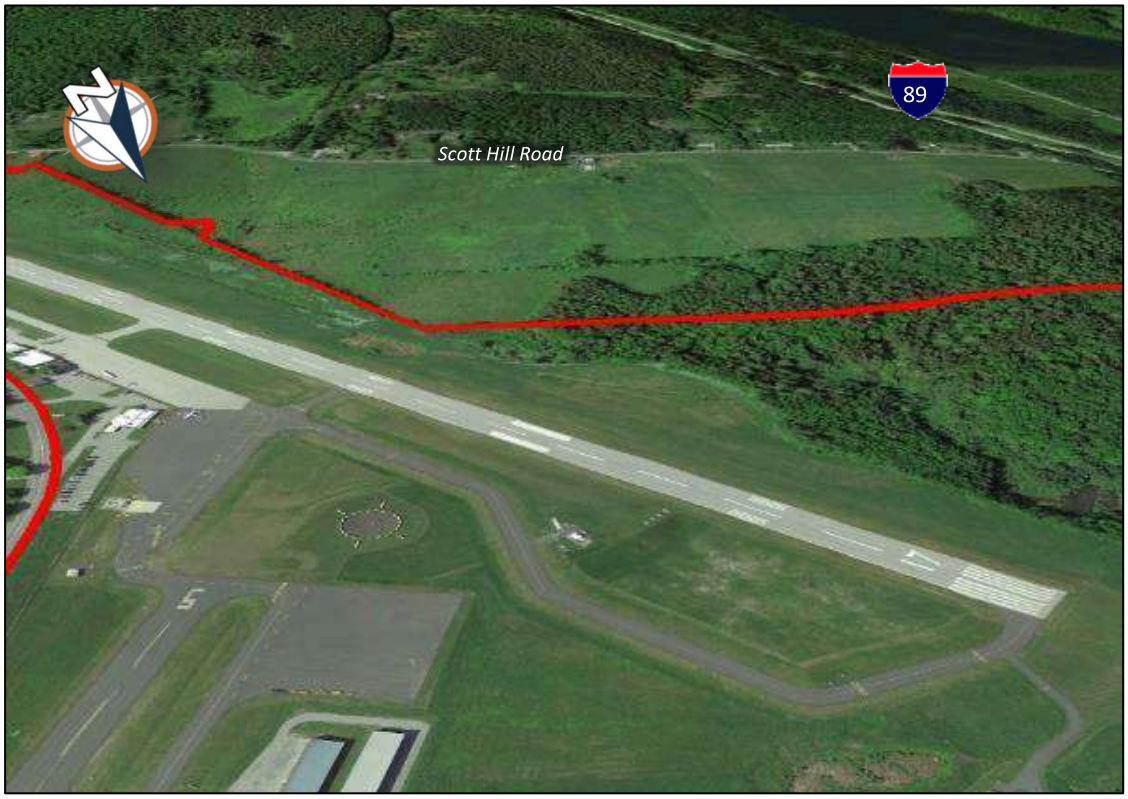
The terrain between Runway 5 and Taxiway 'A' remains relatively even. Beyond the taxiway, the terrain decreases to approximately seven feet below the Runway 5 end elevation.

The terrain between the Airport property boundary and Scott Hill Road increases, with some areas approximately 50 feet above the runway end elevation. The terrain between Scott Hill Road and Interstate 89 increases further, with some areas approximately 90 feet above the Runway 5 end elevation.

Runway 5 is a secondary (or crosswind) runway and is not equipped with a published instrument approach procedure. Although a visual-approach runway, Runway 5 is authorized for daytime circling from the Runway 17 and 35 instrument approach procedures. There are three airspace surfaces are applicable to Runway 5:

- FAR Part 77 Approach Surface
- Obstacle Clearance Surface #2
- Obstacle Clearance Surface #4

Figure 2-16 – Runway 5 Property Boundary



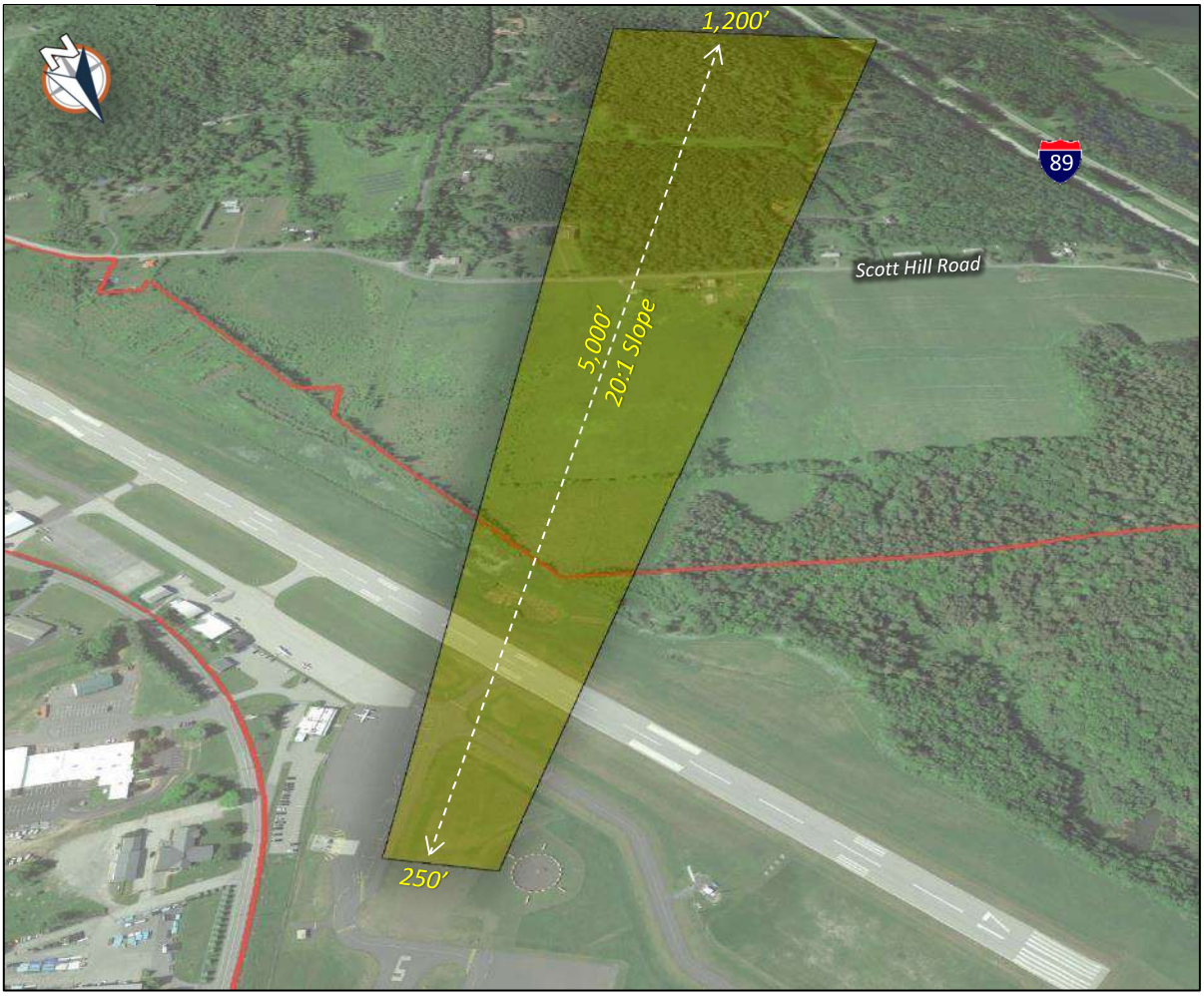
Source: Vermont Open Geodata Portal, CHA, 2020

2.3.1 Runway 5: FAR Part 77 Approach Surface

The Runway 5 FAR Part 77 Approach Surface begins 200 feet beyond the runway end and extends outward and upward at a 20:1 slope for 5,000 feet.

Figure 2-17 depicts the Runway 5 Part 77 Approach Surface.

Figure 2-17 – Runway 5 FAR Part 77 Approach Surface

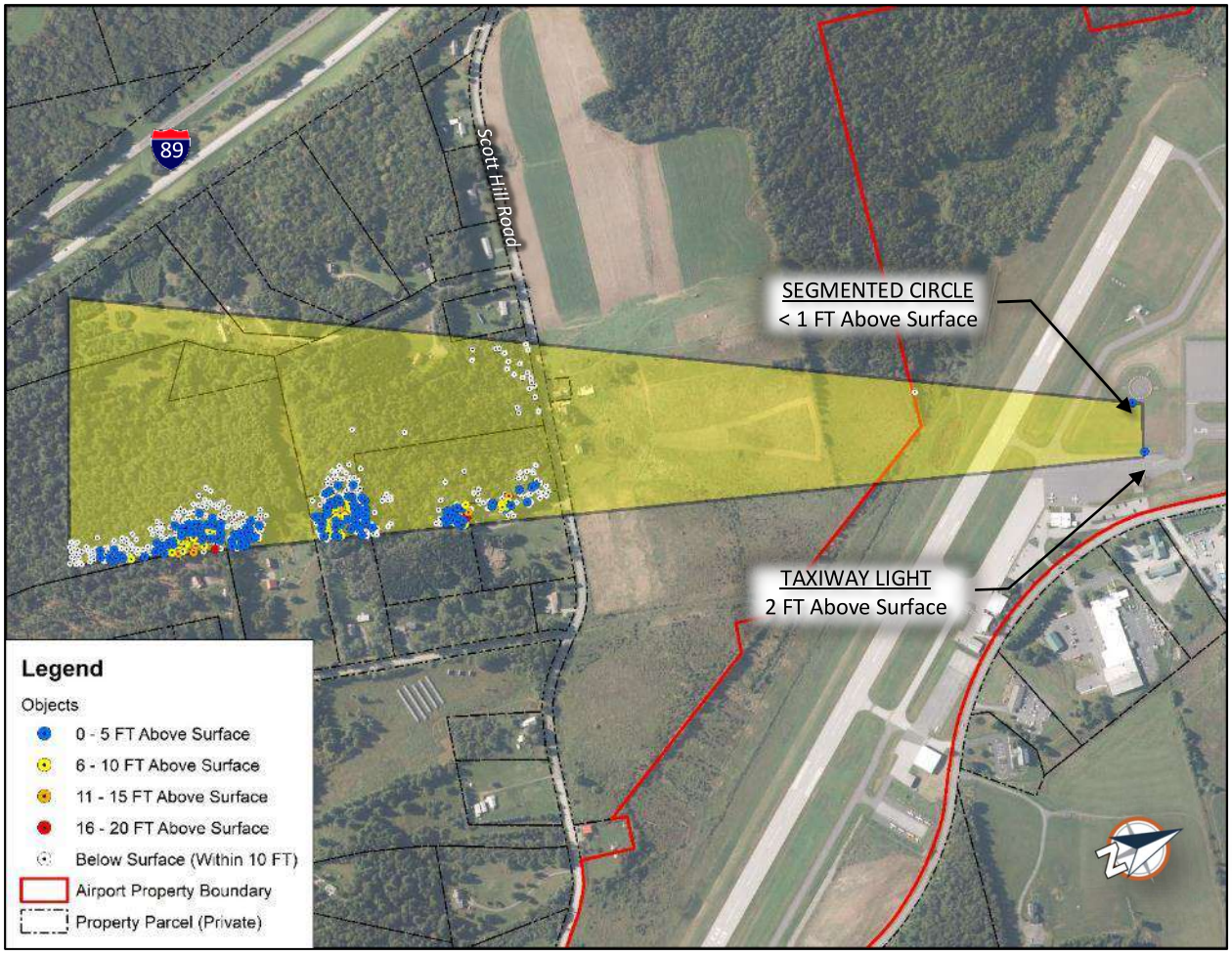


Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

Figure 2-18 depicts the objects penetrating the Runway 5 Part 77 Approach Surface, as well as all vegetational objects 10 feet below the surface. As shown, the majority of the obstructions are trees penetrating the surface within five feet.

There are two airfield-related objects located above the surface near the Runway 5 end. These objects include a portion of the segmented circle and a taxiway edge light. Both objects are considered fixed-by-function, lighted for nighttime operations, and are not considered a negative impact to the Approach Surface. Additionally, all roadways are more than 10 feet below the Part 77 Approach Surface.

Figure 2-18 – Runway 5 FAR Part 77 Approach Surface Obstructions

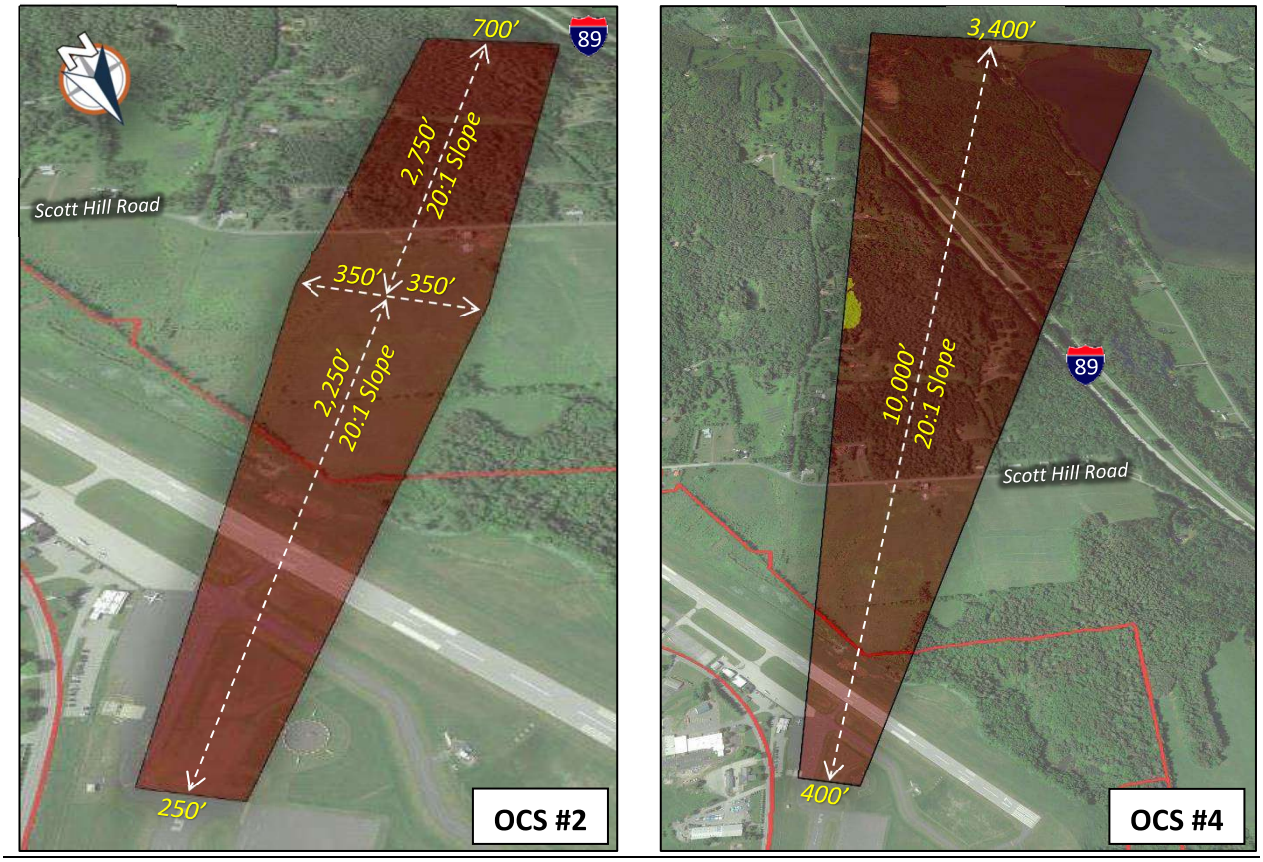


Source: Quantum Spatial, Vermont Open Geodata Portal, CHA, 2020

2.3.2 Runway 5: Obstacle Clearance Surface

As Runway 5 is a visual-approach runway and authorized for daytime circling, both OCS #2 and #4 are applicable. OCS #2 begins at the runway threshold and extends outward and upward at a 20:1 slope for 5,000 feet. OCS #4 begins 200 beyond the runway threshold and extends outward and upward at a 20:1 slope for 10,000 feet. Due to the higher ground elevation between the runway and Interstate 89, a portion of densely forested terrain penetrates OCS #4. This area is highlighted in yellow within **Figure 2-19**.

Figure 2-19 – Runway 5 Obstacle Clearance Surfaces



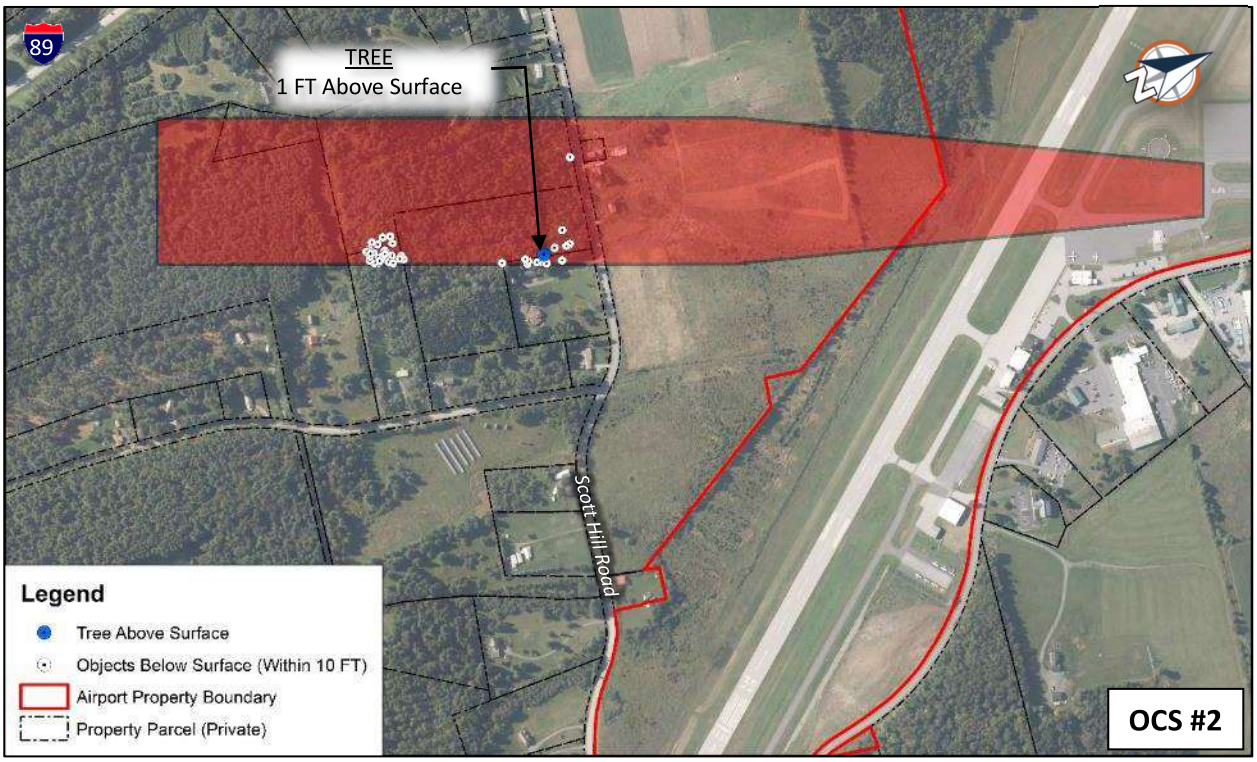
Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

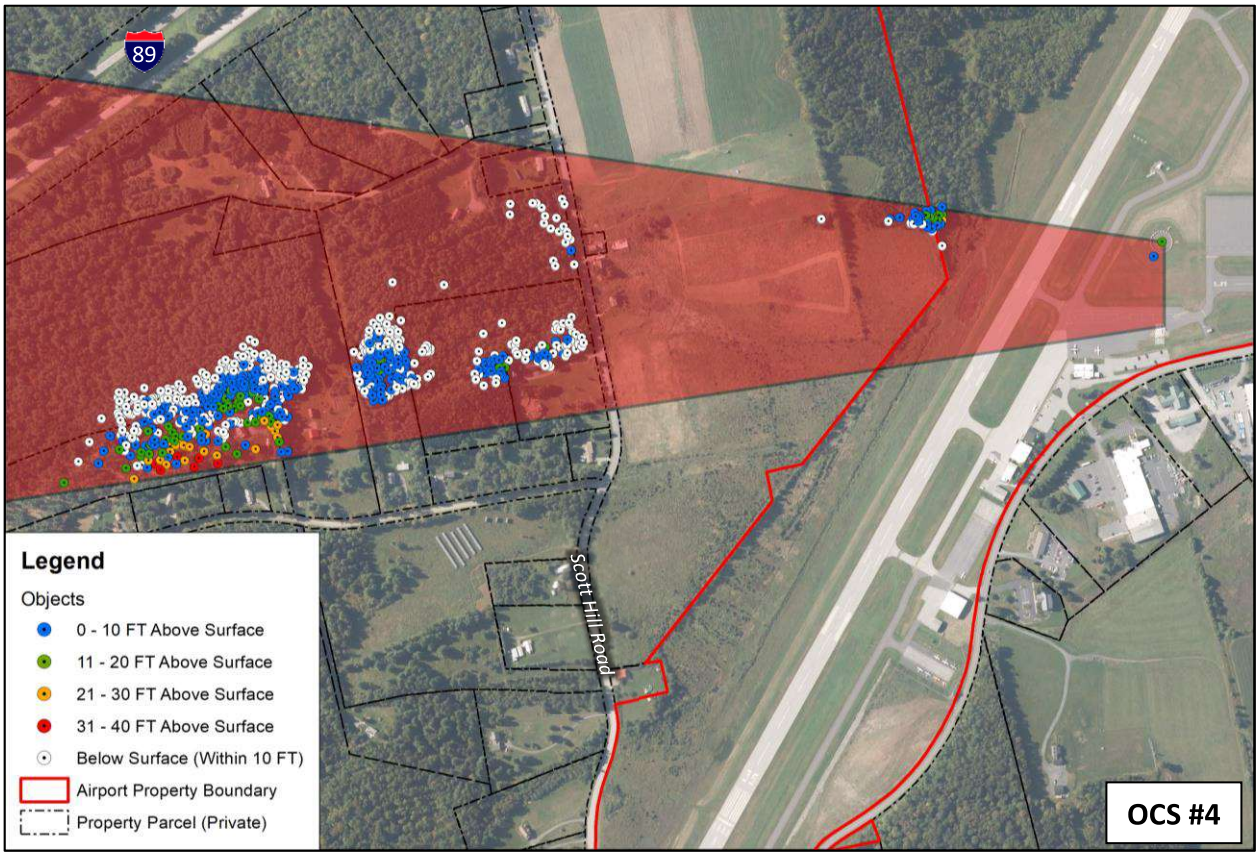
Since the Runway 5 OCS #2 begins at the runway threshold (as opposed to 200 feet beyond), there is additional clearance within OCS #2 than the FAR Part 77 Approach Surface. As such, there is only one object (a tree) that penetrates OCS #2.

However, given the shared starting location and slope of the Runway 5 OCS #4 and the FAR Part 77 Approach Surface, all of the penetrations discussed in Section 2.3.1 are also within OCS #4. Due to its larger width, additional penetrations, including the area of higher terrain, are located toward the east and west edges of the surface.

Figure 2-20 depicts the location of the tree penetrating the Runway 5 OCS #2 and additional penetrations within OCS #4. All vegetational objects 10 feet below each surface are shown.

Figure 2-20 – Runway 5 Obstacle Clearance Surface Obstructions





Source: Quantum Spatial, Vermont Open Geodata Portal, CHA, 2020

2.4 RUNWAY 23

The Runway 23 end is located in the northern portion of the Airport and is surrounded by Airport Road and Industrial Lane.

The area directly beyond the Runway 23 ends remains relatively even; however, the elevation decreases by approximately 30 feet below the Runway 23 elevation along Airport Road, and 310 feet below the runway end elevation along Vermont 62.

Figure 2-21 – Runway 23 Property Boundary

Source: Google Earth, Vermont Open Geodata Portal, CHA, 2020

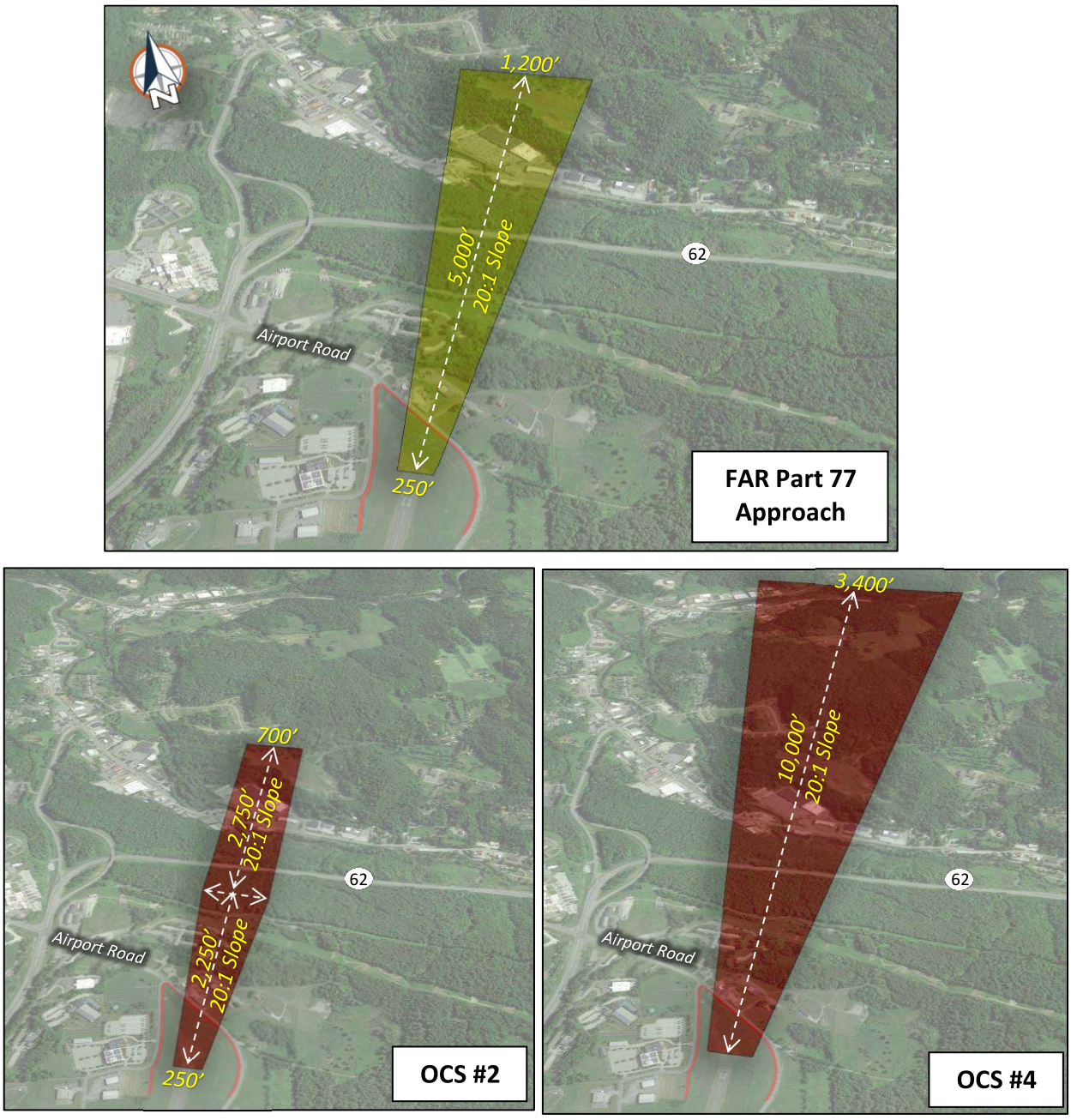
2.4.1 Runway 23 Surfaces: FAR Part 77 Approach Surface & OCS #2

Runway 23 is a visual-approach runway authorized for circling (daytime & nighttime). Similar to Runway 5, there are three surfaces applicable to Runway 23:

- FAR Part 77 Approach Surface
- Obstacle Clearance Surface #2
- Obstacle Clearance Surface #4

Figure 2-22 shows each surface.

Figure 2-22 – Runway 5 Approach Surfaces



Source: Google Earth, CHA, 2020

Due to the lower ground elevation beyond the Runway 23 end, there are no obstructions, vegetational or fixed, within the FAR Part 77 Approach Surface or OCSs. The Plan and Profile sheets associated with this report provide a depiction of the terrain elevation differences.

3 OBSTACLE ACTION PLAN

Due to terrain and vegetation, three of the four runways ends at MPV have object penetrations to their airspace surfaces. The Runway 23 end currently remains clear of all objects. The MPV obstruction evaluation discussed each runway and identified the objects (both fixed and vegetational) penetrating the various airspace surfaces.

As a final component of the obstruction evaluation, an Obstacle Action Plan (OAP) is presented. Although objects penetrating the FAR Part 77 Approach and/or 40:1 Departure Surface should be considered for removal, due to the off-airport location and extensive nature of the penetrations, object removal within these areas may not be practical. As such, this OAP focuses on obstructions within the 20:1 and 30:1 Obstacle Clearance Surfaces (OCS). As discussed within the evaluation, the majority of the penetrations are tree groups rather than individual objects. Therefore, sample points have been identified for use within the corresponding runway plan and profile sheet set and the OAP. Future tree trimming/clearing projects should consider the additional trees within the group that also require trimming/clearing to clear the OCS.

Table 3-1 provides a summary of the OCS sample points along with a breakdown of the number of property parcels containing the sample points.

Table 3-1 – MPV Obstacle Action Plan Summary

	Runway 17	Runway 35	Runway 5	Runway 23
Obstacle Clearance Surface	4 & 6	4	2 & 4	2 & 4
# of Sample Obstruction Points	3	16	10	0
# of on-Airport Sample Obstructions	2	14	1	0
# of off-Airport Sample Obstructions	1	2	9	0
# of Parcels with Sample Obstructions	1	4	6	0

Source: CHA 2020

Table 3-2 – Runway 17 Obstacle Action Plan Sample Points

OBJECT ID	OBJECT TYPE	EASTING	NORTHING	OBJECT ELEV.	OBSTACLE LOCATED ON OR OFF AIRPORT	UNDER SPONSOR CONTROL	SPAN/ PARCEL ID	OBSTACLE CLEARANCE SURFACE #4 (20:1)		OBSTACLE CLEARANCE SURFACE #6 (30:1)		PROPOSED OBJECT PENETRATION MITIGATION						MITIGATION COMPLETE TO DATE
								SURFACE ELEV. (MSL)	PENETRATION (FT)	SURFACE ELEV. (MSL)	PENETRATION (FT)	TOP TREE	REMOVE OBJECT	ACQUIRE EASEMENT	ACQUIRE PROPERTY	OTHER	NO ACTION	
40444	TREE	1622521.103	622756.214	1130.8	ON	YES	N/A	1115.8	*15*	-			X					
40532	TREE	1622427.198	622854.905	1124.5	ON	YES	N/A	1122.3	*2.2*	1118.7	5.8		X					
R-2	COMSTOCK RD.	1622949.758	622437.9772	1093.0	OFF	PUBLIC RIGHT OF WAY	N/A	1093.4	-0.4	1098.8	-5.8						X	

Table 3-3 – Runway 35 Obstacle Action Plan Sample Points

OBJECT ID	OBJECT TYPE	EASTING	NORTHING	OBJECT ELEV.	OBSTACLE LOCATED ON OR OFF AIRPORT	UNDER SPONSOR CONTROL	SPAN/ PARCEL ID	OBSTACLE CLEARANCE SURFACE #4 (20:1)		PROPOSED OBJECT PENETRATION MITIGATION						MITIGATION COMPLETE TO DATE
								SURFACE ELEV. (MSL)	PENETRATION (FT)	TOP TREE	REMOVE OBJECT	ACQUIRE EASEMENT	ACQUIRE PROPERTY	OTHER	NO ACTION	
10595	TREE	1627185.757	611125.268	1521.2	OFF	NO	039-012-10080	1511.6	*9.6*	X		X				
11243	TREE	1627179.846	612190.14	1509.6	OFF	NO	039-012-10080	1466.1	*43.5*	X		X				
12821	UTILITY_LINE	1625521.705	615579.784	1302.3	OFF	NO	060-018-10458	1276.1	26.2	X		X				
15798	TREE	1625609.836	615893.62	1301.1	OFF	NO	060-018-10458	1264.4	36.7	X		X				
18261	POLE_UTIL	1625460.136	615690.068	1346.3	OFF	NO	060-018-10458	1269.9	76.4	X		X				
34049	ANTENNA	1625312.465	617506.769	1177.5	ON	YES	060-018-11996	1186.6	-9.1					MONITOR		
43365	FENCE	1624845.246	617483.709	1174.7	ON	YES	060-018-11996	1176.1	-1.4					MONITOR		
87402	POLE_UTIL	1625592.474	615459.995	1291.4	OFF	NO	060-018-10458	1283	8.4	X		X				
87410	POLE_UTIL	1625643.638	615670.207	1271.2	OFF	NO	060-018-10458	1274.9	-3.7					MONITOR		
93941	TREE	1625582.79	615445.86	1336.5	OFF	NO	060-018-10458	1283.6	52.9	X		X				
170077	TREE	1627026.552	612265.047	1523.6	OFF	NO	039-012-10080	1458.7	64.9	X		X				
180093	TREE	1626941.565	612822.008	1439.3	OFF	NO	060-018-10890	1432.4	6.9	X		X				
189421	TREE	1627262.091	611358.32	1520.7	OFF	NO	039-012-10080	1503.8	16.9	X		X				
197021	TREE	1626953.934	611639.009	1533.9	OFF	NO	039-012-10080	1483.7	50.2	X		X				
226249	GROUND	1625547.129	615774.484	1278.4	OFF	NO	060-018-10458	1268.2	10.2	X		X				
R-6	SCOTT HILL RD.	1624882.161	617285.105	1190.0	OFF	PUBLIC RIGHT OF WAY	N/A	1185.8	4.2					LIGHT		

Table 3-4 – Runway 5 Obstacle Action Plan Sample Points

OBJECT ID	OBJECT TYPE	EASTING	NORTHING	OBJECT ELEV.	OBSTACLE LOCATED ON OR OFF AIRPORT	UNDER SPONSOR CONTROL	SPAN/ PARCEL ID	OBSTACLE CLEARANCE SURFACE #2 (20:1)		OBSTACLE CLEARANCE SURFACE #4 (30:1)		PROPOSED OBJECT PENETRATION MITIGATION						MITIGATION COMPLETE TO DATE
								SURFACE ELEV. (MSL)	PENETRATION (FT)	SURFACE ELEV. (MSL)	PENETRATION (FT)	TOP TREE	REMOVE OBJECT	ACQUIRE EASEMENT	ACQUIRE PROPERTY	OTHER	NO ACTION	
4559	TREE	1622908.435	620504.184	1194.8	ON	YES	060-018-11996	-		1168.6	*26.2*		X					
22755	TREE	1622079.495	618934.731	1256.6	OFF	NO	060-018-11399	1266.8	-10.2	1256.8	-0.2					MONITOR		
22771	TREE	1622403.406	618581.987	1274.0	OFF	NO	060-018-11456	1273.2	*0.8*	-		X		X				
206381	TREE	1622329.947	618389.536	1280.9	OFF	NO	060-018-11456	1283.1	-2.2	1273.2	7.7	X		X				
206541	TREE	1622346.975	618336.966	1282.3	OFF	NO	060-018-11456	-		1275.0	7.3	X		X				
207573	TREE	1622104.858	617833.371	1311.7	OFF	NO	060-018-10960	-		1302.7	9.0	X		X				
207949	TREE	1622023.164	617886.481	1314.0	OFF	NO	060-018-10960	1312.7	*1.3*	*1302.7*	*11.3*	X		X				
207957	TREE	1622006.229	617885.669	1312.3	OFF	NO	060-018-10960	1313.0	-0.7	1303.1	9.2	X		X				
209853	TREE	1621800.63	617245.176	1345.5	OFF	NO	060-018-11079	-		1335.7	9.8	X		X				
212749	TREE	1621908.763	616717.93	1393.2	OFF	NO	060-018-11243	-		1355.3	*37.9*	X		X				

Table 3-5 – Runway 23 Obstacle Action Plan Sample Points

OBJECT ID	OBJECT TYPE	EASTING	NORTHING	OBJECT ELEV.	OBSTACLE LOCATED ON OR OFF AIRPORT	UNDER SPONSOR CONTROL	SPAN/ PARCEL ID	OBSTACLE CLEARANCE SURFACE #2 (20:1)		OBSTACLE CLEARANCE SURFACE #4 (30:1)		PROPOSED OBJECT PENETRATION MITIGATION						MITIGATION COMPLETE TO DATE
								SURFACE ELEV. (MSL)	PENETRATION (FT)	SURFACE ELEV. (MSL)	PENETRATION (FT)	TOP TREE	REMOVE OBJECT	ACQUIRE EASEMENT	ACQUIRE PROPERTY	OTHER	NO ACTION	
NO OBJECT PENETRATIONS																		