Williams Aviation Consultants

Summary

Williams Aviation Consultants, Inc. (WAC) has been retained by Barbara Lichman of Buchalter to complete an obstruction evaluation and airspace analysis for the 410 Noor Avenue Mixed-Use Project, proposed by SyRES Properties, LLC, located in the City of South San Francisco, California. The project includes three proposed buildings; one at three stories, one at four stories, and one at five stories.

The purpose of the analysis was to determine the maximum elevation to which a building can be erected at the project site without having an adverse effect upon the safe and efficient use of the navigable airspace. The proposed structure's location in relation to San Francisco International Airport (SFO) is shown in ***Figure 1***.

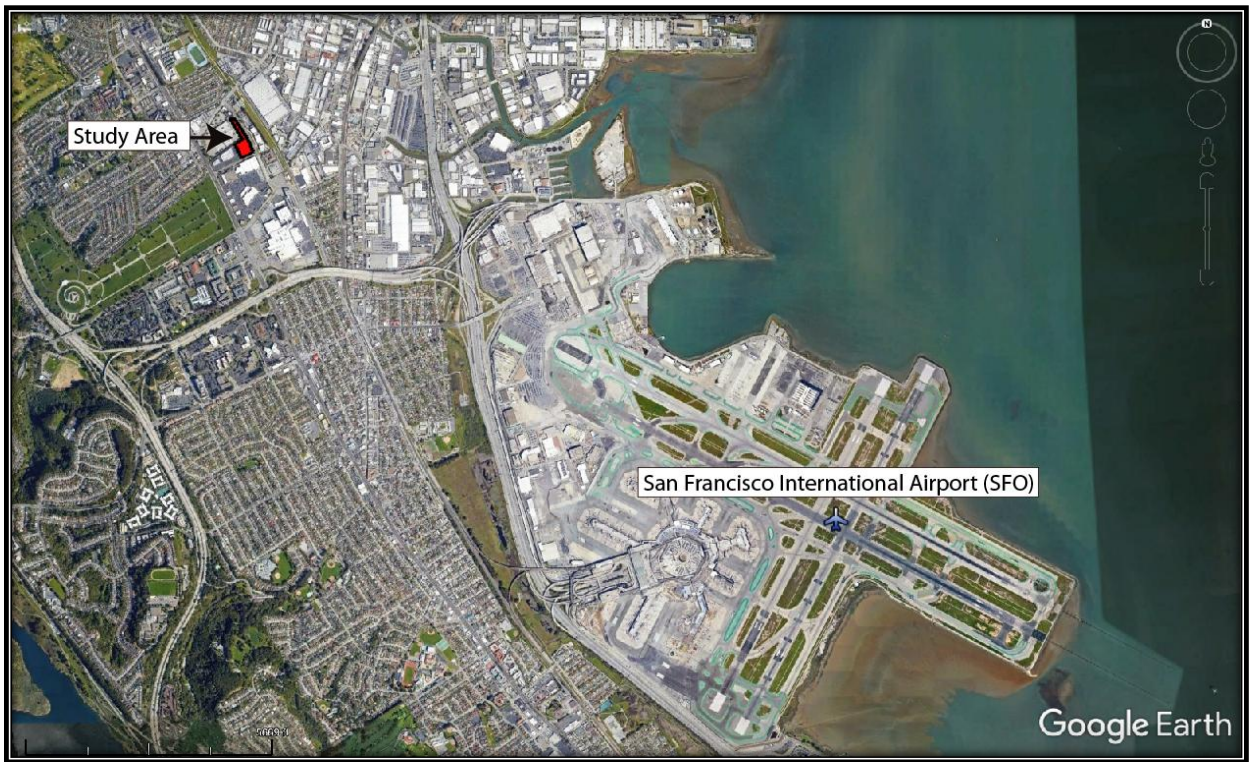

Figure 1 - Project Location

FAA Review Process

The FAA utilizes the criteria contained in FAR Part 77 to determine reporting requirements, the impact of a proposed structure on navigable airspace, and whether the structure, if constructed, will require lighting and/or marking.

FAR Part 77 defines the criteria for determining if a structure will require reporting to the FAA, if the structure exceeds the stated criteria and requires the submittal of FAA Form 7460-1, and/or whether or not the structure has an impact on navigable airspace.

If the FAA determines that there is an impact to navigable airspace, a Notice of Presumed Hazard (NPH) will be issued and an aeronautical study will be conducted. Concurrent with the NPH the project is distributed to the FAA divisions having the responsibility for air traffic control, flight procedures, airport infrastructure and navigational aids. Each of these divisions then evaluates the project for impacts within their area of jurisdiction. These divisions submit their comments to the Air Traffic division who will issue a determination.

If the FAA determines that the proposed structure has a substantial adverse impact they will issue a Determination of Hazard. In some cases they will offer the project proponent options to mitigate the adverse impact, i.e., lower the structure, redesign etc.

It is not uncommon for the FAA's initial analysis to disregard factors unique to a specific airport such as existing structures or special procedures that have been developed for that airport.

Once the FAA's initial analysis is complete, additional data can be presented to the FAA for their consideration which may result in the approval of the proposed structure.

WAC Analysis

The WAC airport and airspace compatibility analysis includes a review of the following criteria to determine possible adverse impacts to aeronautical operations:

1. Public and private airports in the vicinity of the proposed structure.
2. Federal Aviation Regulation Part 77, Objects Affecting Navigable Airspace.
3. Terminal Instrument Procedures (TERPS) including instrument approach and departure procedures.
4. Visual Flight Rule (VFR) Traffic Pattern Airspace.
5. One Engine Inoperative (OEI) Criteria

Public/Private Airports:

San Francisco International Airport (SFO) is located approximately 9,139 Feet South East of the proposed site location ***(Figure 2).*** San Francisco International Airport (SFO) is a commercial use, publicly-owned airport located within the City of San Francisco, CA. The airport currently maintains four runways; Runway 10L/28R with a length of 11,870 feet, Runway 10R/28L with a length of 11,381 feet, Runway 1R/19L with a length of 8,650 feet, and Runway 1L/19R with a length of 7,650 feet.

Half Moon Bay Airport (HAF) is located approximately 8.5 Nautical Miles (NM) South West of the proposed project, however only SFO was identified as requiring detailed analysis to determine whether or not the proposed structures would have a significant adverse impact on flight procedures.

An in depth analysis of SFO was conducted to determine possible impacts on navigable airspace, flight procedures, and determine the maximum achievable structure elevation which will not adversely impact aeronautical operations.

Figure 2 - Project in relation to SFO

FAR Part 77 Analysis:

FAR Part 77 Reporting Requirements and Obstruction Standards

An analysis of FAR Part 77 reporting requirements was conducted and it was determined that a proposed mixed use project would require formal submission to the FAA.

An analysis of FAR Part 77 obstruction standards was completed to determine the maximum elevation and height to which a structure could be erected without exceeding FAR Part 77 Obstruction Standards. FAA Order 7400.2M Procedures for Handling Airspace Matters paragraph 6-3-9b.

"Obstruction standards are used to identify potential adverse effects and are not the basis for a determination. The criteria used in determining the extent of adverse affect are those established by the FAA to satisfy operational, procedural, and electromagnetic requirements. These criteria are contained

in regulations, advisory circulars, and orders (e.g., the 8260 Order series and Order 7110.65). Obstruction evaluation personnel must apply these criteria in evaluating the extent of adverse effect to determine if the structure being studied would actually have a substantial adverse effect and would constitute a hazard to air navigation."

The proposed project is located within 14 CFR Part 77.19 (a) Horizontal Surface ***(Figure 3)***, which is a flat horizontal plane 150 feet above the established airport elevation and extends outward 10,000 feet from the center of each Primary Surface at SFO[1]. The airport elevation at SFO is 13 feet, making the Horizontal Surface height 163' Above Mean Sea Level (AMSL).

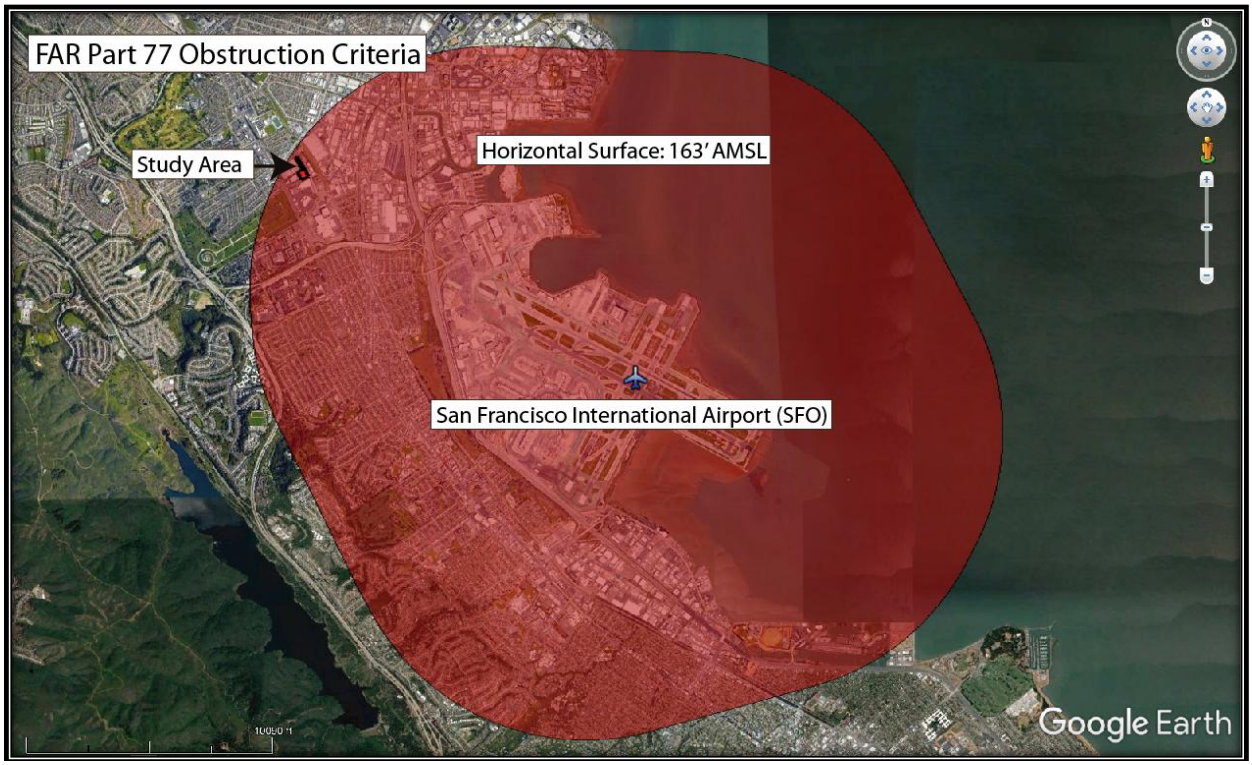

Figure 3 - Obstruction Criteria

Conclusion: At the study location, the proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the Horizontal Surface at SFO, if the overall total height of the proposed buildings stay below 163' AMSL.

However, even if there had been a penetration of Obstruction Criteria, that does not mean the structure will have an adverse impact on operations, rather the airport's specific procedures, such as Instrument Approach/Departure and VFR Traffic Pattern procedures, must be studied to determine if the specific procedures will be impacted. The results are discussed below.

[1] CFR Title 14: Aeronautics and Space. Part 77 - Safe, Efficient Use, and Preservation of the Navigable Airspace. Subpart C - Standards for Determining Obstructions to Air Navigation or Navigational Aids or Facilities.

Terminal Instrument Procedures (TERPS)

An analysis of the Terminal Instrument Procedures (TERPS) criteria was completed to determine the maximum elevation to which a structure could be erected without impacting San Francisco International Airport (SFO) instrument approach and departure procedures.

Order 8260.3D United States Standard for Terminal Instrument Procedures (TERPS), Order 8260.58A United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design, and Order 7400.2M Procedures for Handling Airspace Matters were used to construct the instrument approach and departure procedures at SFO.

SFO Approach Procedures

Approach Procedures to SFO include; Instrument Approach Procedures (IAP), Circle-to-Land Procedures, and VFR Traffic Pattern Procedures.

A penetration to the Obstacle Clearance Surfaces (OCS) by a proposed structure would result in the need to increase the procedure's Minimum Descent Altitude (MDA) (the lowest altitude that a pilot can descend on an approach) and would likely receive a Hazard Determination from the FAA.

SFO Instrument Approach Procedures

A review of SFO's Instrument Approach Procedures (IAP) revealed that approaches for aircraft landing on Runways 10R and 10L have the lowest Obstacle Clearance Surfaces (OCS) over the proposed location.

Lateral Navigation (LNAV) IAP OCS include the Primary Area with a Required Obstacle Clearance (ROC) of 250 feet, and a Secondary Area with a ROC is 250 feet at the primary boundary, tapering uniformly to zero feet at the outer edge.[2]

Required Navigation Performance (RNP) IAP OCS has a Final Segment Obstacle Evaluation Area (OEA) that is 2 x RNP and a OCS based on Vertical Error Budget (VEB).[3]

Figures 4 through 7 display an overview of the OCS associated with IAP's to Runway 27.

- ***Figure 4*** - SFO Runway 10L LNAV OCS
- ***Figure 5*** - SFO Runway 10R LNAV OCS
- ***Figure 6*** - SFO Runway 10R RNP OCS
- ***Figure 7*** - SFO Runway 10R RNP OCS

[2] 8260.58A CHG 2United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design Chapter 3. RNAV (GPS) Approach. Section 3-2 General Non-Vertically Guided Final Segment.
[3] 8260.58A CHG 2 United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design Chapter 4. RNAV (RNP) Approach. Section 4-2. Final Approach Segment (FAS).

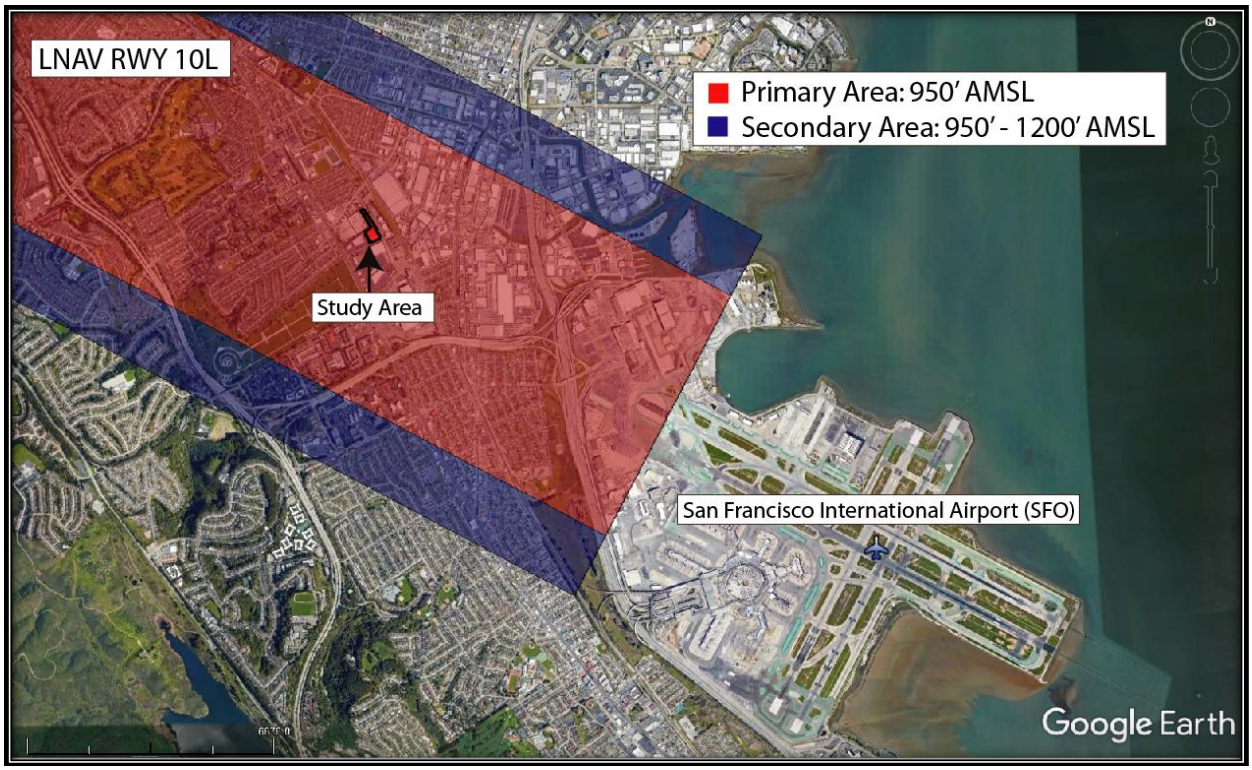

Figure 4 - LNAV RWY 10L

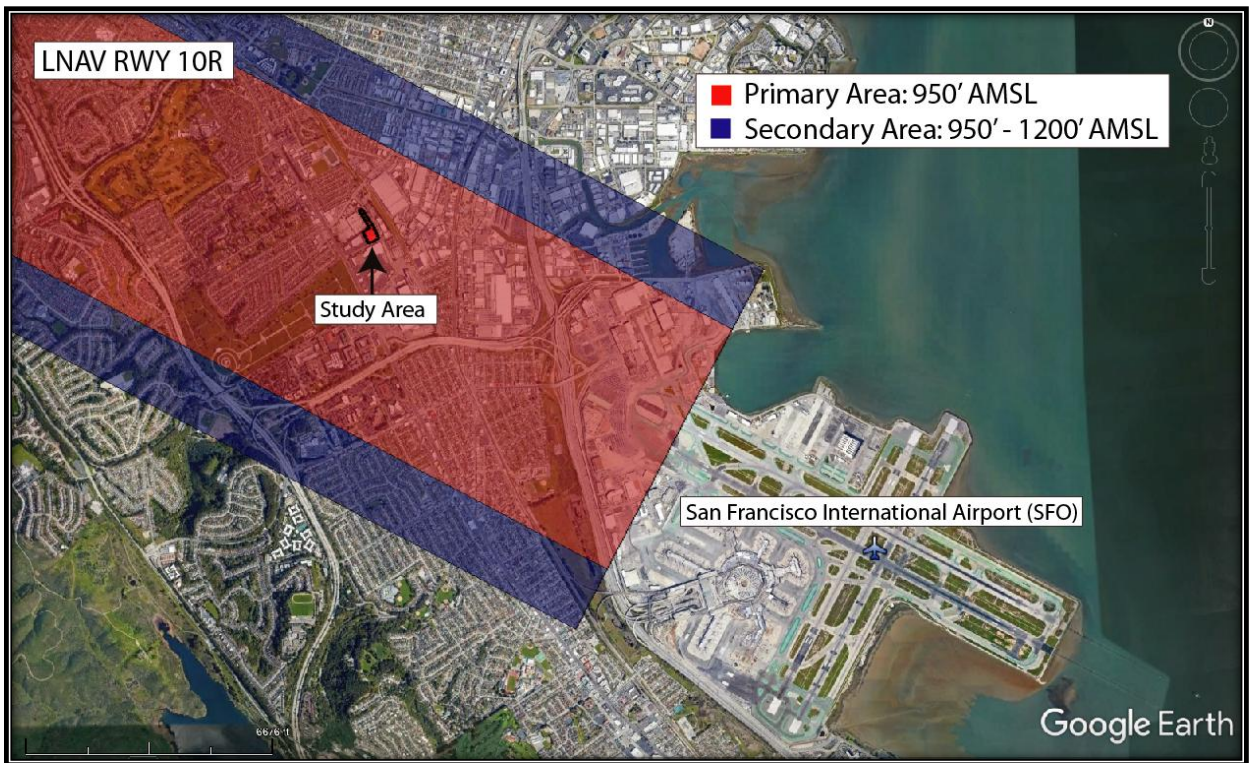

Figure 5 - LNAV RWY 10R

Figure 6 - RNP RWY 10R

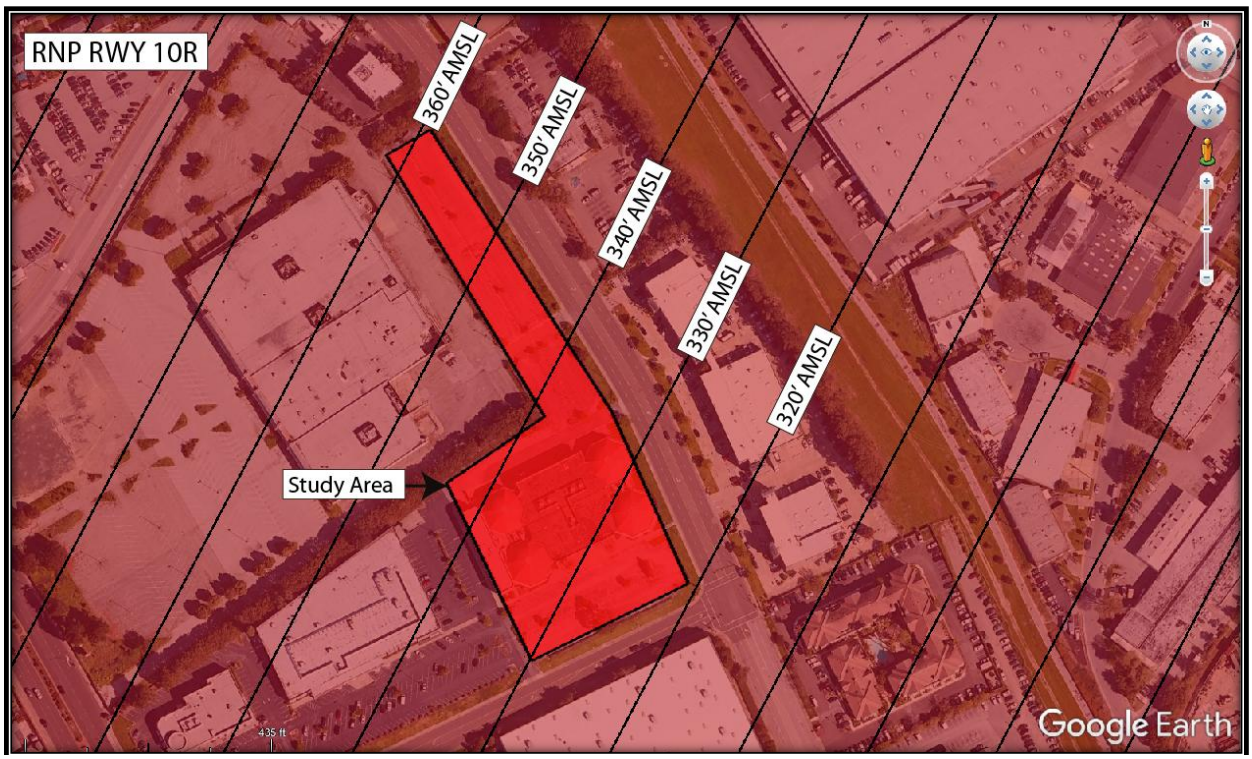

Figure 7 - RNP RWY 10R

Conclusion: The lowest IAP over the proposed project is the RNP RWY 10R. The maximum elevation of the study area is approximately 320' AMSL on the south eastern corner, and approximately 360' AMSL on the north western corner.

The proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the RNP RWY 10R, if the overall total height of the proposed buildings stay below 320' AMSL to the south and 360' AMSL to the north.

Circle-to-Land Instrument Approach Procedure

Each instrument approach procedure to SFO contains a circle-to-land option. The circle-to-land portion of the procedure allows a pilot to approach the airport in instrument conditions then, once he has the airport environment in sight, the pilot can maneuver the aircraft to the opposite end of the runway to land. A pilot would execute this type of instrument approach procedure if the winds were not favorable for landing on the primary runway for which the procedure was designed.

The surfaces which protect the circle-to-land consist of horizontal circular surfaces which extend from the end of each runway. The radius of each circle is dependent on the category of aircraft utilizing the circle-to-land approach. The minimum ROC in the circling approach OEA is 300 feet.[4]

Figure 8 display an overview of the lowest OCS associated with the Circle-to-Land Category B Approach to Runways 10R and 10L.

[4] Order 8260.3D United States Standard for Terminal Instrument Procedures (TERPS) Chapter 2. General Criteria . Section 2-7. Circling Approach and Sidestep Maneuvers.

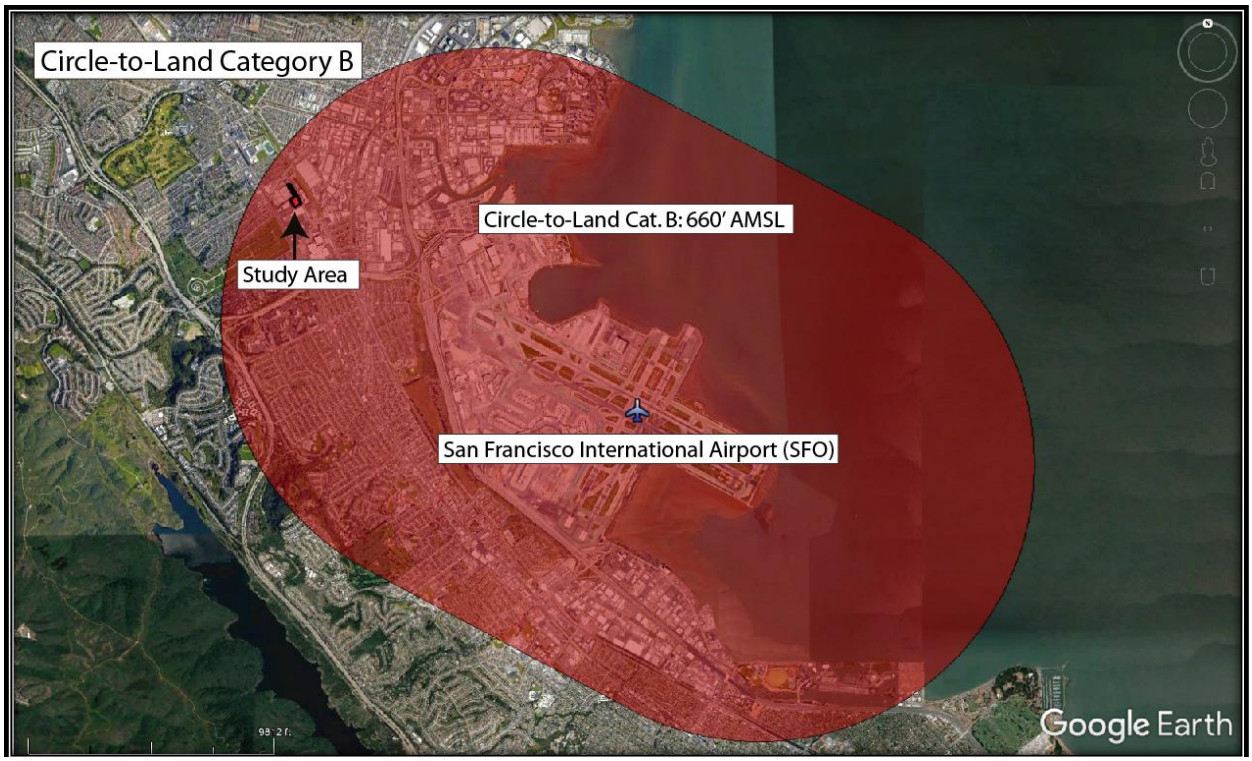

Figure 8 –Circle-to-Land Category B OCS

Conclusion: At the study location, the proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the Circle-to-Land Cat. B at SFO, if the overall total height of the proposed buildings stay below 660' AMSL.

Visual Flight Rule (VFR) Traffic Pattern Airspace

An analysis of SFO's VFR Traffic Pattern Airspace was completed to determine the maximum elevation to which a structure could be erected without impacting aircraft operating in visual conditions at SFO. A structure that exceeds FAR Part 77 Obstruction Criteria (as applied to visual approach runways) could have an impact on aircraft operating in an airport's VFR Traffic Pattern.

The study area is located beyond the lateral limits of the Conical Surface (as applied to visual approach runways) and is in the climb/descent area, which is 350 feet above airport elevation or the height of 14 CFR section 77.17(a)(2), whichever is greater not to exceed 499 feet Above Ground Level (AGL).[5]

Figure 9 displays the elevation to which a structure could be erected without penetrating the surfaces associated with obstruction standards (as applied to visual approach runways).

[5] Order 7400.2M Procedures for Handling Airspace Matters. Chapter 6. Aeronautical Studies. Section 3. Identifying/Evaluating Aeronautical Effect.

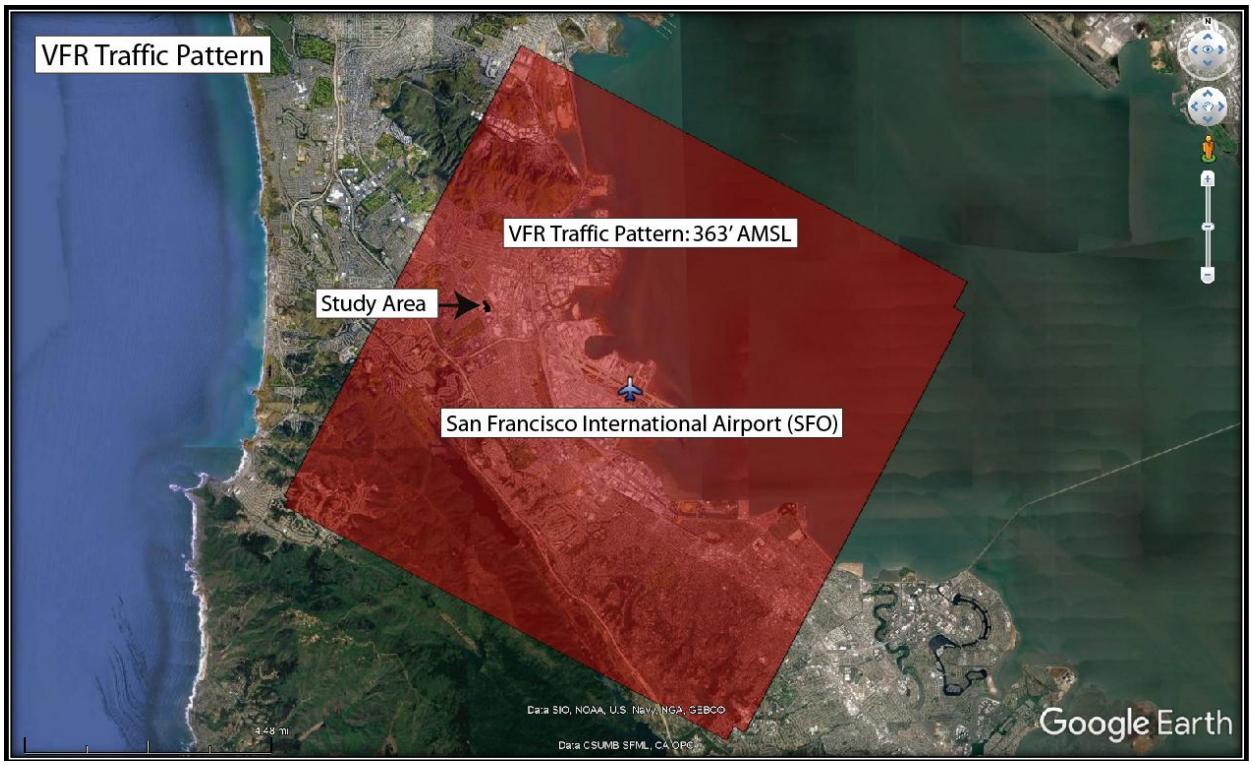

Figure 9 – SFO VFR Traffic Pattern

Conclusion: At the study location, the proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the VFR Traffic Pattern at SFO, if the overall total height of the proposed buildings stay below 363' AMSL.

Obstacle Departure Procedures

The OCS associated with SFO's published departure procedures was analyzed. A penetration to the Departure procedure Initial Climb Area (ICA) could result in the need for the departure procedure to be modified. Departure procedure obstacle clearance is based on a minimum climb gradient performance of 200 feet per Nautical Mile (NM).[6]

Departures off Runways 28R and 28L have the lowest OCS over the proposed project. ***Figures 10 and 11*** display ICA associated with the obstacle departure procedure from Runway 28L. ***Figures 12 and 13*** display ICA associated with the obstacle departure procedure from Runway 28R.

[6] Order 8260.3D United States Standard for Terminal Instrument Procedures (TERPS) Chapter 14. Departure Procedure Construction. Section 14-1. General Criteria.

Figure 10 - Departure RWY 28L ICA

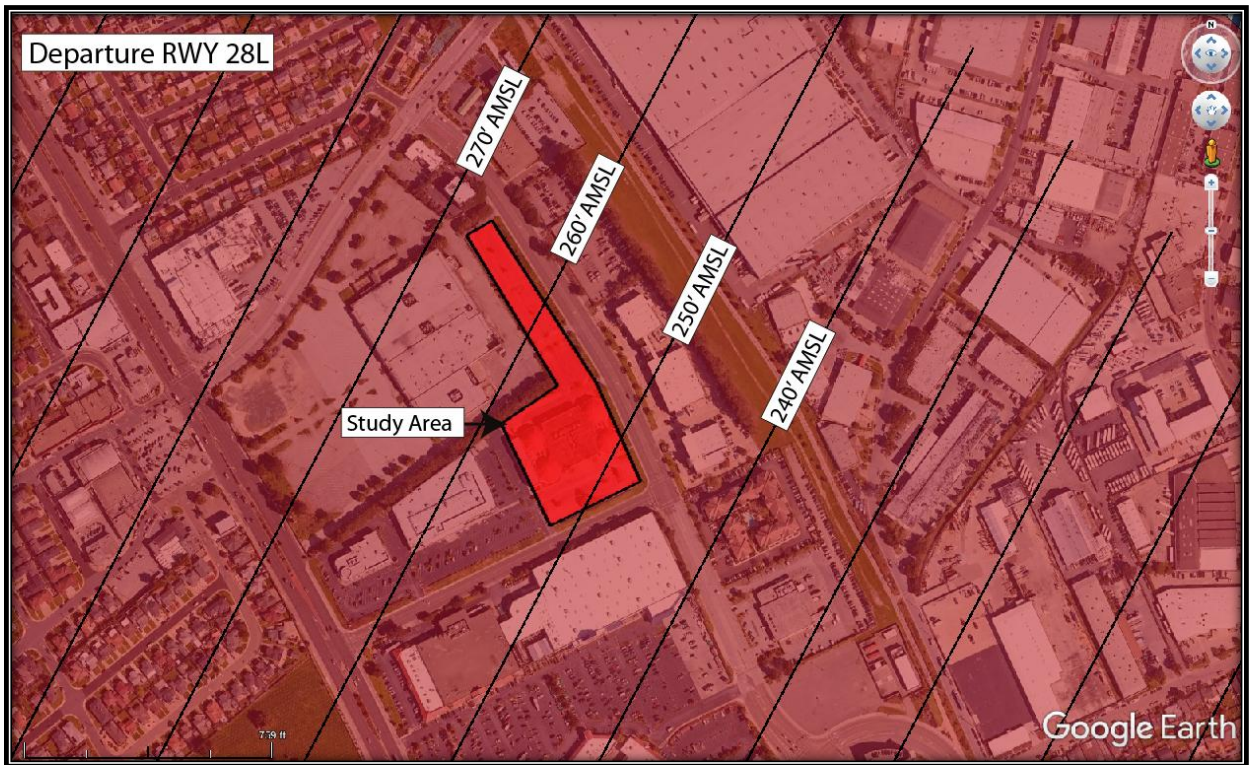

Figure 11 - Departure RWY 28L ICA AMSL Heights

Figure 12 - Departure RWY 28R ICA

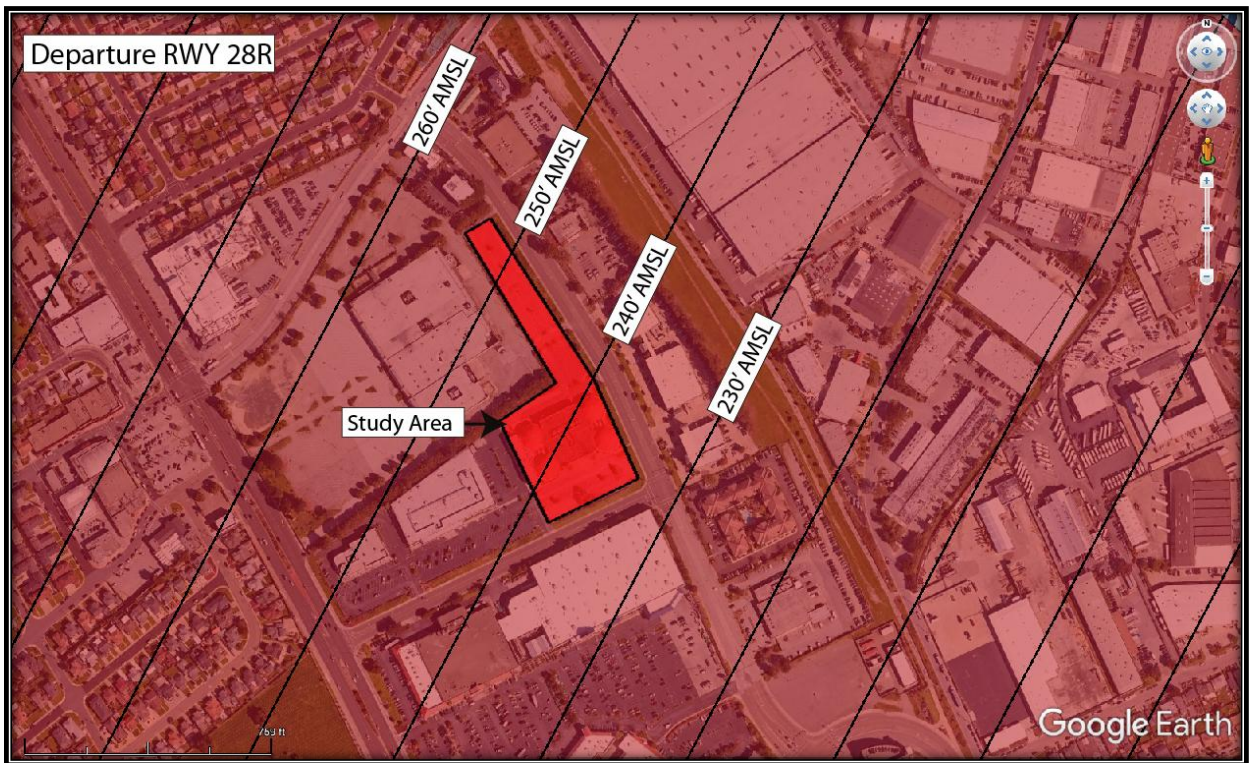

Figure 13 - Departure RWY 28R ICA AMSL Heights

Conclusion: The Departure RWY 28R ICA has the lowest OCS over the proposed project. The maximum height is approximately 232' AMSL on the south eastern corner, and approximately 253' AMSL on the north western corner.

At the study location, the proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the Departure ICA at SFO, if the overall total height of the proposed buildings stay below 232' AMSL to the south and 253' AMSL to the north.

One Engine Inoperative (OEI)

All commercial airlines are required to develop OEI procedures for each airport / runway out of which they conduct flight operations. The Federal Aviation Regulations (FARs) prescribe that in the event of an engine failure on takeoff, commercial air carrier type aircraft must be loaded in such a manner that they are able to clear obstacles along their intended route of flight by either 35 feet vertically or 300 feet laterally.

Advisory Circular (AC) 120-91 Obstacle Accountability Area is used to identify all obstacles that must be cleared vertically. The Obstacle Accountability Area off Runways 28L and 28R is shown in ***Figure 14. Figure 14*** shows an existing 82' AMSL Obstruction closer to the end of the Runways which must be cleared vertically before proceeding over the proposed project. This existing obstruction will provide shielding to the proposed project heights, therefore the proposed project will not have an effect on OEI at SFO.

Figure 14 - Obstacle Accountability Area

Conclusion: With shielding from the existing obstruction, the proposed project will not have an effect on OEI at SFO.

WAC Summary

The WAC technical analysis revealed:

- ***An analysis of FAR Part 77 reporting requirements was conducted and it was determined that a proposed mixed use project would require formal submission to the FAA.***

- ***At the study location, the proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the Horizontal Surface at SFO, if the overall total height of the proposed buildings stay below 163' AMSL.***

- ***The lowest IAP over the proposed project is the RNP RWY 10R. The maximum elevation of the study area is approximately 320' AMSL on the south eastern corner, and approximately 360' AMSL on the north western corner.***

- ***The proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the RNP RWY 10R, if the overall total height of the proposed buildings stay below 320' AMSL to the south and 360' AMSL to the north.***

- ***At the study location, the proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the Circle-to-Land Cat. B at SFO, if the overall total height of the proposed buildings stay below 660' AMSL.***

- ***At the study location, the proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the VFR Traffic Pattern at SFO, if the overall total height of the proposed buildings stay below 363' AMSL.***

- ***The Departure RWY 28R ICA has the lowest OCS over the proposed project. The maximum height is approximately 232' AMSL on the south eastern corner, and approximately 253' AMSL on the north western corner.***

- ***At the study location, the proposed 3, 4, and 5 story buildings, with a ground elevation of approximately 50' AMSL, will not penetrate the Departure ICA at SFO, if the overall total height of the proposed buildings stay below 232' AMSL to the south and 253' AMSL to the north.***

- ***With shielding from the existing obstruction, the proposed project will not have an effect on OEI at SFO.***