

Appendix J

Potential Hazards to Flight - Policy Considerations



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Table of Contents

Appendix J	Potential Hazards to Flight - Policy Considerations.....	J-1
J.1	Potential Hazards to Flight.....	J-1
J.1.1	Glint and Glare Impacts.....	J-1
J.1.2	Lighting Impacts.....	J-5
J.1.3	Dust, Smoke, and Water Vapor Impacts.....	J-5
J.1.4	Electromagnetic Interference.....	J-5
J.1.5	Thermal Exhaust Plume Impacts.....	J-5
J.1.6	Hazardous Wildlife Attractant Impacts.....	J-8
J.2	Federal Aviation Administration Regulations and Guidance Regarding Potential Hazards to Flight.....	J-8
J.2.1	Glint and Glare.....	J-9
J.2.2	Lighting.....	J-10
J.2.3	Dust, Smoke, and Water Vapor.....	J-11
J.2.4	Electromagnetic Interference.....	J-11
J.2.5	Thermal Exhaust Plumes.....	J-11
J.2.6	Hazardous Wildlife Attractants.....	J-12
J.3	Airport Land Use Compatibility Planning Handbook Guidance.....	J-13
J.4	Policy Considerations.....	J-14
J.5	Summary.....	J-20

List of Tables

Table J-1	Potential Hazards to Flight.....	J-15
Table J-2	2014 Airport Land Use Compatibility Plan - Standards for Potential Hazards to Flight and Considerations for Update.....	J-17

List of Exhibits

Exhibit J-1	Examples of Glare.....	J-3
Exhibit J-2	Elements of a Glare Analysis and Example Output Graph.....	J-4
Exhibit J-3	Exhaust Plume Analyzer Output Graphs for Hypothetical Examples.....	J-7

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Appendix J

Potential Hazards to Flight - Policy Considerations

To preserve the navigable airspace near airports and, ultimately, the utility of airports, it is necessary to prevent obstacles from encroaching into the navigable airspace. The Federal Aviation Administration (FAA) is responsible for preserving the safety of flight by designating minimum height requirements for airspace and designing flight procedures to ensure aircraft are safely separated from obstacles. The FAA has established regulations governing the review of proposed construction and alterations to existing structures to determine if they would be obstructions or potential hazards to air navigation. However, the FAA does not have the authority to regulate the use of land and the construction of objects that could become obstructions or hazards. Land use regulatory power rests with state governments, which typically authorize municipal and county governments to exercise that power. Thus, an effective airspace protection system requires local government action in recognition of and in coordination with the FAA.

In addition to tall structures that might be obstructions or hazards, certain other land uses and land use features may create hazards to flight. These hazards include interference with the vision of pilots and air traffic controllers, interference with the safe operation of aircraft, and interference with electronic navigational aids and radar.

This appendix describes these potential hazards, the role of the FAA in evaluating them, and the policy options for consideration in the updated Airport Land Use Compatibility Plan (ALUCP) for San Diego International Airport (SDIA or the Airport).

J.1 POTENTIAL HAZARDS TO FLIGHT

Certain attributes of land use and development projects can create hazards to the safety of flight. They include the following:

- glint and glare that can interfere with pilot or air traffic controller vision
- lighting that can interfere with vision or be confused with airport identification and navigational lighting
- dust, smoke, and water vapor that can obscure pilot or air traffic controller vision
- electromagnetic interference with communications, radar, and navigational signals
- thermal exhaust plumes of sufficient velocity to interfere with the safe control of aircraft
- hazardous wildlife attractants, especially birds, which can cause engine and airframe damage

J.1.1 Glint and Glare Impacts

Glint (a momentary flash of bright light) and glare (a continuous source of bright light) can interfere with the vision of pilots and air traffic controllers. Expanses of highly reflective materials may cause visual after-images or flash blindness for pilots and air traffic controllers, thus compromising flight safety. This can be most problematic in situations where pilots and controllers must try to look through the glare to keep their eyes on air traffic or the runway approach. The intensity of the glare and the amount of the visual field

occupied by the source of the glare are important considerations in determining the potential for adverse effects.

Smooth surfaces reflect a more concentrated amount of sunlight back to the receiver, which is referred to as specular reflection. The more polished the surface, the more it shines. Rough or uneven surfaces reflect light in a diffused or scattered manner; therefore, the light received by the viewer is not as bright.

Potential problems can be caused by flat walls and roofs composed of reflective materials, such as glass, aluminum, stainless steel, polished stone, or glossy white surfaces. Concentrating solar power plants that use mirrors to concentrate solar rays on pipes or towers of heat transfer fluids may also create glare. Under certain circumstances, large photovoltaic cell arrays may create unacceptable levels of glare. Only expansive installations, such as large office buildings, industrial buildings or warehouses with large amounts of roof space, or industrial-scale solar installations, would potentially cause problems. Rooftop solar installations and roof and wall materials on low-rise housing/residential and small-scale commercial buildings (such as fast-food restaurants, convenience stores, and small office buildings) are unlikely to create potentially severe glare effects. **Exhibit J-1** depicts some examples of glare from various facilities.

In 2015, an FAA-sponsored laboratory study was published that described the effects of glare from solar energy installations on general aviation pilots. The study found that glare most seriously impaired the pilots' ability to view their instruments and fly the aircraft when the glare was straight ahead or slightly to the side. The study concluded that glare at an angle greater than 25 degrees from the direction the pilot is looking is not a serious problem. The study recommended that solar installations be placed such that pilots "will not have to face glare that is straight ahead of them or within 25 degrees of straight ahead during final approach."¹ At air carrier airports with little general aviation activity, the areas of greatest concern are along the final approach. At general aviation airports with a high proportion of traffic operating under visual flight rules (VFR), the primary areas of concern are aligned with the downwind, base, and final approach legs of the local traffic pattern.

The impact of glint and glare on vision can be measured and evaluated through techniques developed by the scientists at Sandia National Laboratories (Sandia),² who developed the Solar Glare Hazard Analysis Tool (SGHAT).³ SGHAT is no longer available for public use, but Sandia has made the source code and algorithms available for licensing.⁴ ForgeSolar is a Sandia licensee that has developed a refined version of SGHAT called GlareGauge. It is a commercially available tool that supports the analysis of glare impacts along entire flight paths and for a variety of surfaces, including vertical building surfaces.⁵ The algorithms account for the changing position of the sun throughout the day and throughout the year to enable comprehensive assessments of glare impacts, including the potential for after-image, flash blindness, and eye damage. **Exhibit J-2** depicts elements of a glare analysis and an example output graph.

¹ US Department of Transportation, Federal Aviation Administration, Office of Aerospace Medicine, *Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach*, July 2015.

² Ho, Clifford K., et al., "Methodology to Assess Potential Glint and Glare Hazards from Concentrating Solar Power Plants: Analytical Models and Experimental Validation," *Journal of Solar Energy Engineering*, Vol. 133, August 2011.

³ Ho, Clifford K., et al., *Solar Glare Hazard Analysis Tool (SGHAT) User's Manual v. 2G*, March 2, 2015.

⁴ US Department of Energy, <https://www.sandia.gov/glare-tools/> (accessed June 23, 2023).

⁵ ForgeSolar, <https://www.forgesolar.com/tools/glaregauge/> (accessed May 26, 2023).

Photovoltaic solar array



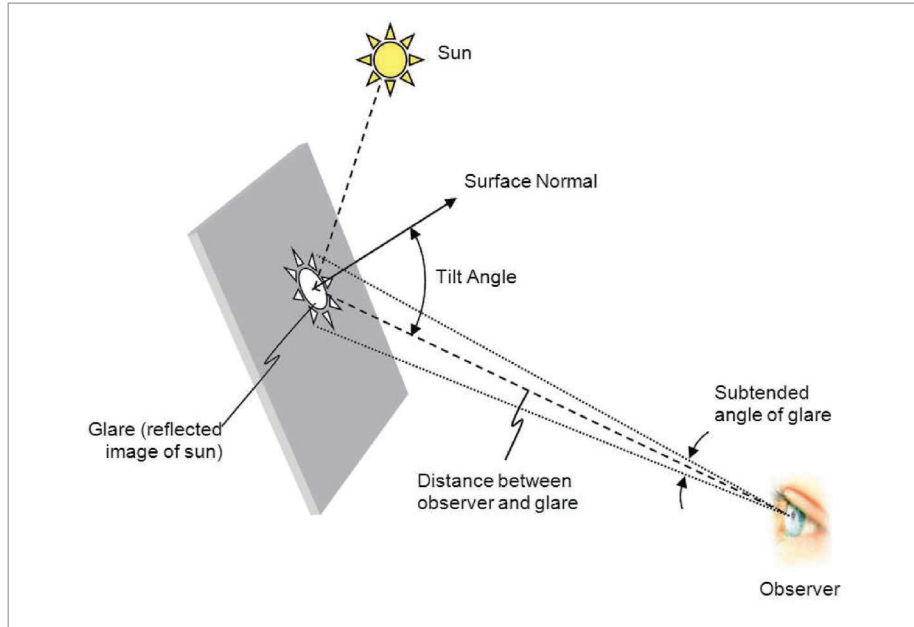
Heliostats and central receiver at Sandia National Laboratories, Albuquerque, New Mexico



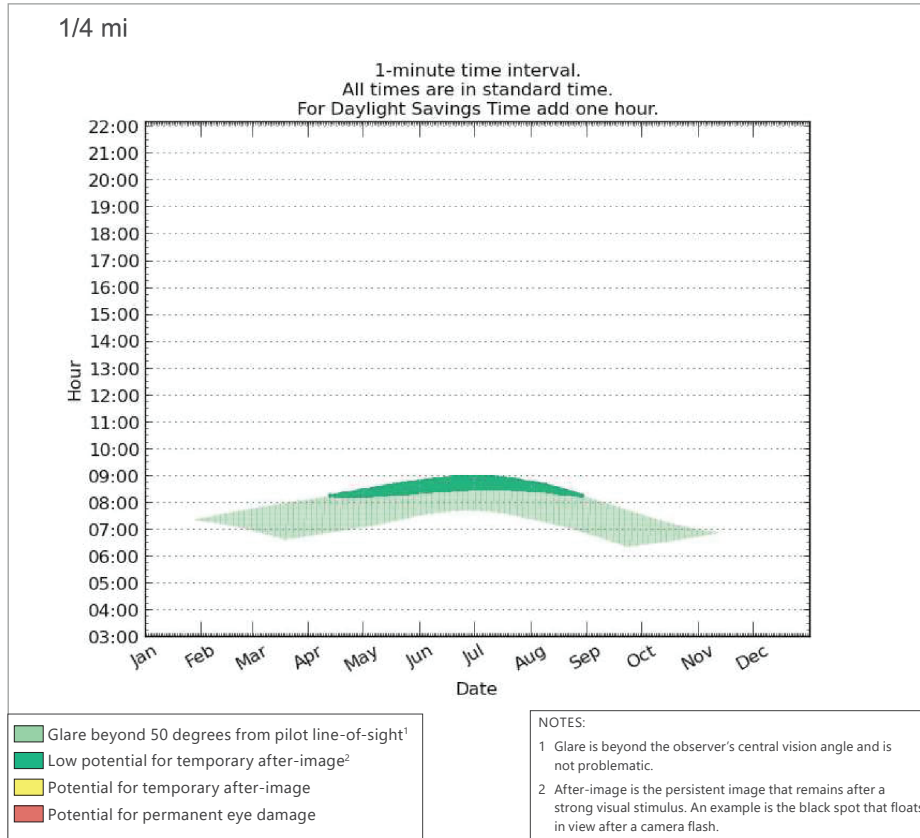
Sun flare between buildings in Midtown Manhattan



Elements of a Glare Analysis



Solar Glare Hazard Analysis Tool Output Graph for Hypothetical Example



J.1.2 Lighting Impacts

Some lighting systems can interfere with pilot or air traffic controller vision if they are directed toward the airport traffic control tower (ATCT) or upward toward aircraft, especially aircraft on approach to a runway. These systems, which are especially problematic at night, include laser light displays, searchlights, and stroboscopic lights. Large jumbotron screen displays, parking lot lights, and stadium lighting can also be distracting to pilots in certain circumstances.

Pilots can mistake other lighting systems for airport identification or navigational lighting. Examples include:

- rotating beacons or alternating blinking lights of green and white, mimicking airport identification lighting
- linear arrays of steady lights or sequenced flashing lights mimicking runway approach lighting
- stroboscopic lights mimicking runway end identifier lights

J.1.3 Dust, Smoke, and Water Vapor Impacts

Land use projects that may create dust, water vapor, or smoke dense enough to impair pilot or air traffic controller vision can compromise flight safety. Perhaps the most hazardous sources of smoke and dust are natural phenomena, including dust storms and wildfires. Land uses of potential concern are limited to the following:

- electric power generation plants
- large heating and cooling plants
- refineries
- heavy industrial plants with tall exhaust stacks

These land uses are of greatest concern in areas where cold air favors the formation of dense clouds of water vapor.

J.1.4 Electromagnetic Interference

Certain land uses can cause electromagnetic interference with aircraft instrumentation and satellite or ground-based radar and navigational aids. Projects of potential concern include the following:

- microwave towers
- cellular towers
- radio and television transmission antennas
- wind farms involving large arrays of wind power turbines

J.1.5 Thermal Exhaust Plume Impacts

Land uses that produce thermal exhaust plumes can interfere with the safety of flight, particularly for aircraft operating at low altitudes and in critical phases of flight, including takeoff, climbout, and final approach. Thermal exhaust plumes have the potential to interfere with the safe control of aircraft, but the impact can vary based on several factors, such as stack size, number, and height; proximity of stacks to the airport flight paths; temperature and vertical speed of the heated air; size and speed of aircraft; and local winds, ambient temperatures, and stratification of the atmosphere at the plume site.⁶ Exhaust plumes can be most hazardous in cold or calm air when the plumes tend to disperse slowly. Potential risks are described in the *Aeronautical Information Manual*:⁷

High temperature exhaust plumes can cause significant air disturbances such as turbulence and vertical shear. Other identified potential hazards include, but are not necessarily limited to: reduced visibility, oxygen depletion, engine particulate contamination, exposure to gaseous oxides, and/or icing. Results of encountering a plume may include airframe damage, aircraft upset, and/or engine damage/failure. These hazards are most critical during low altitude flight in calm and cold air, especially in and around approach and departure corridors or airport traffic areas.

Land uses capable of producing thermal plumes of sufficient velocity at altitudes high enough to interfere with aircraft are rare. They may include the following:

- hydrocarbon-fueled electrical generation plants
- cooling towers associated with concentrating solar power plants and nuclear power plants
- heavy industrial processing plants with exhaust stacks

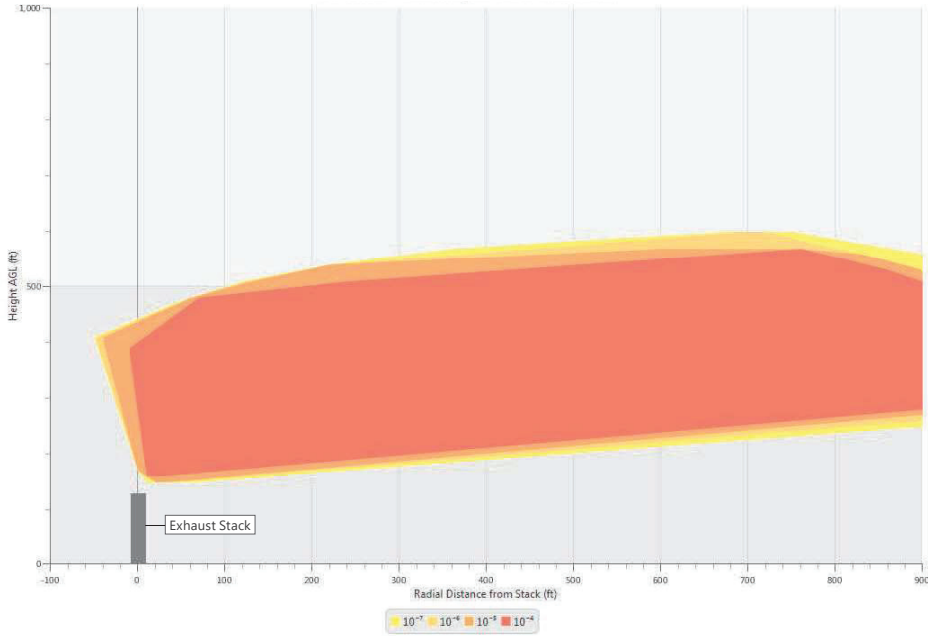
The FAA contracted with the MITRE Corporation to develop a tool to assess the potential for thermal exhaust plumes to interfere with the safe control of aircraft. The Exhaust Plume Analyzer assesses the potential for adverse impacts, including turbulence and the potential for aircraft upset, on four classes of aircraft: light sport aircraft, light general aviation aircraft, business jets, and large jets. The tool is available through a no-cost license.⁸ **Exhibit J-3** presents output graphs depicting the results of hypothetical analyses.

⁶ US Department of Transportation, Federal Aviation Administration, Office of Airport Planning and Programming and Office of Airport Safety and Standards, *Technical Guidance and Assessment Tool for Evaluation of Thermal Exhaust Plume Impact on Airport Operations* (Memorandum), September 24, 2015, p. 2.

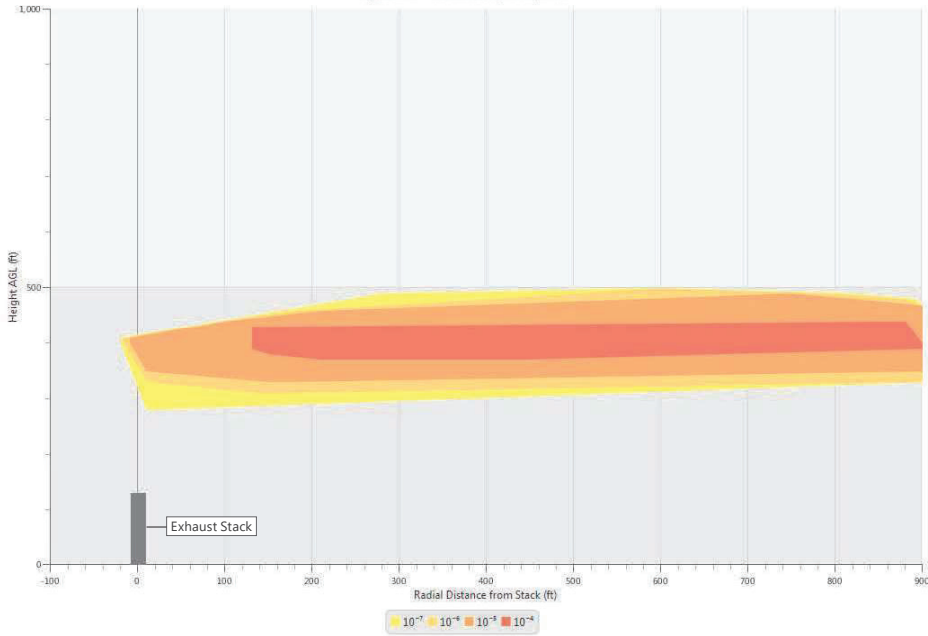
⁷ US Department of Transportation, Federal Aviation Administration, *Aeronautical Information Manual*, Section 7-6-16.a, https://www.faa.gov/air_traffic/publications/atpubs/aim_html/chap7_section_6.html (accessed May 19, 2023).

⁸ MITRE, Exhaust Plume Analyzer, <https://www.mitre.org/research/technology-transfer/technology-licensing/exhaust-plume-analyzer> (accessed April 29, 2022).

Business Jet - Probability of Severe Turbulence



Light General Aviation Aircraft - Probability of Upset



NOTES:

AGL - Above Ground Level

Probabilities are expressed in scientific notation:

$10^{-7} = 0.0000001$; $10^{-6} = 0.000001$; $10^{-5} = 0.00001$; $10^{-4} = 0.0001$

The Exhaust Plume Analyzer requires the input of weather data, including wind direction and speed. In this example, the wind is from the left. Most of the plume is downwind of the exhaust stack, but a small amount is upwind of the stack, indicated by the negative distance to the left of the zero point.

J.1.6 Hazardous Wildlife Attractant Impacts

Hazardous wildlife can include land animals, such as deer and coyotes, as well as birds. Land uses attracting potentially hazardous land animals are of greatest concern immediately adjacent to airport property. On the other hand, large birds (e.g., raptors and geese) and flocks of small birds (e.g., starlings) can pose a danger to aircraft in flight, potentially causing airframe and engine damage leading to accidents.

Potentially hazardous wildlife attractants include:

- facilities handling putrescible waste, such as sanitary landfills and certain composting operations;
- certain agriculture and aquaculture operations; and
- outdoor water features providing resting areas for waterbirds and feeding opportunities.

J.2 FEDERAL AVIATION ADMINISTRATION REGULATIONS AND GUIDANCE REGARDING POTENTIAL HAZARDS TO FLIGHT

Title 14 Code of Federal Regulations (CFR) Part 77, *Safe, Efficient Use, And Preservation of the Navigable Airspace* provides the FAA with authority for the protection of airspace and the safety of flight. The FAA is authorized to review proposed development projects and assess their potential effects on navigable airspace. Although the FAA can issue recommendations and determinations based on its review of proposed projects, it does not have the authority to regulate development or construction. That power is reserved to the states and local governments.

Sponsors of proposed projects anywhere in the country are required to notify the FAA of proposed construction or the alteration of structures meeting criteria described in 14 CFR 77.9. Proposals for buildings or structures must be submitted to the FAA for review if the buildings or structures are taller than 200 feet above the ground or penetrate an imaginary surface extending upward from airport runways at a slope rising one foot for every 100 feet of lateral distance.⁹ In addition, project sponsors are required to notify the FAA of proposed projects that exceed the following heights or penetrate defined surfaces:¹⁰

- a height that encroaches into the required obstacle clearance areas separating designated flight altitudes from obstacles
- a height that increases a minimum obstacle clearance under en-route criteria
- the surface of a takeoff and landing area of an airport or any imaginary surface defined around the airport in accordance with Part 77, Subpart C

For projects meeting the notification provisions, project sponsors are required to file Form 7460-1, “Notice of Proposed Construction or Alteration,” with the FAA. The FAA Obstruction Evaluation Group circulates Form 7460-1 to various FAA offices and divisions for review and comment. The FAA Obstruction Evaluation / Airport Airspace Analysis (OE/AAA) process is described in FAA Joint Order (JO) 7400.2P, *Procedures for Handling Airspace Matters*.

⁹ This is referred to as a 100 to 1 slope. It reaches 200 feet above the runway at a distance of 20,000 feet from the runway.

¹⁰ 14 CFR 77.17(a).

After completing its initial OE/AAA report, the FAA issues one of four notices or determinations:¹¹

- Does Not Exceed (DNE) Determination - for structures that do not exceed obstruction standards and do not have substantial adverse physical or electromagnetic interference effects on navigable airspace or air navigation facilities.
- Exceeds But Okay (EBO) Determination - for certain temporary structures and alterations to existing structures not involving increases in height, where obstruction standards are exceeded but without causing a substantial effect on air navigation.
- Notice of Preliminary Findings (NPF) - for structures that exceed obstruction standards and/or have an adverse effect on navigable airspace or air navigation facilities and further study is necessary to fully determine the extent of the adverse effect. Typically, the FAA initiates further study only after a request by the project sponsor.
- Determination of No Hazard (DNH) - for structures that exceed obstruction standards but would not have a substantial adverse effect on air navigation.¹² This determination applies to structures that would not qualify for an EBO determination.

If a project sponsor who receives an NPF requests additional study, then the FAA undertakes a detailed aeronautical study, concluding with either a DNH or a Determination of Hazard (DOH) to air navigation. A DOH is issued for proposed construction that would exceed an obstruction standard and have a “substantial adverse effect,” and negotiations with the project sponsor have failed to result in alterations to the proposed structure to eliminate the substantial adverse effect.¹³ Issuance of a DOH does not constitute disapproval of the construction, since the FAA has no land use regulatory or permitting authority.

Most often the FAA OE/AAA process evaluates the effect of proposed tall structures on navigable airspace. However, the FAA has the authority to assess other potentially adverse impacts, including ocular impacts from various sources. The FAA must rely on information provided by the project sponsor on Form 7460-1. Instructions on Form 7460-1 request the project sponsor to provide all relevant information about the proposed project, which include building features that could have non-height-related effects on air navigation.

J.2.1 Glint and Glare

In 2018, the FAA published a technical report providing guidance for evaluating solar projects on airport property.¹⁴ The report also addressed potential concerns that could be caused by nearby off-airport solar projects. The report notes that “the FAA has broad authority for airspace review and the evaluation of any solar project that could pose a potential hazard to air navigation.” It further states, “Currently, no defined

¹¹ US Department of Transportation, Federal Aviation Administration, Joint Order 7400.2P, *Procedures for Handling Airspace Matters*, Paragraph 7-1-3, April 20, 2023.

¹² 14 CFR 77.31(e)

¹³ 14 CFR 77.31(d); US Department of Transportation, Federal Aviation Administration, Order JO 7400.2P, *Procedures for Handling Airspace Matters*, Paragraphs 6-3-3, 6-3-4, 6-3-5, 7-1-3, and 7-1-4(c), April 20, 2023. According to Paragraph 6-3-5, a proposed project would have a “substantial adverse effect” if it would have an adverse effect on a significant volume of activity or if it would cause electromagnetic interference with navigational aid or aircraft communication signals.

¹⁴ US Department of Transportation, Federal Aviation Administration, Office of Airports, Office of Airport Planning and Programming, Airport Planning and Environmental Division (APP-400), *Technical Guidance for Evaluating Selected Solar Technologies on Airports*, Version 1.1, April 2018.

thresholds for project size, type, or distance from the airport are available that automatically trigger FAA airspace review. However, proximity to the airport and CSP [concentrated solar power] technology are two indicators of likely FAA interest in a solar project.”¹⁵

As previously discussed, the FAA exercises its airspace review authority and its consideration of potential hazards through its OE/AAA review process. Sponsors of proposed solar projects that exceed any of the height criteria in 14 CFR 77.9 must file Form 7460-1 with the FAA. The project sponsor should thoroughly describe the proposed project to give the FAA enough information to evaluate the potential effects of the project, including glint and glare, through the OE/AAA process. The FAA has the authority to issue a determination addressing the glint and glare impacts of the proposed project.

The FAA has a specific policy applying to proposed solar installations on the property of federally-obligated airports.¹⁶ That policy requires airport sponsors to notify the FAA of the proposed project and to analyze the glint and glare impacts of the proposed project on the ATCT.

J.2.2 Lighting

The FAA does not have specific policies for the review of proposed lighting off airport property, except for outdoor laser installations and high-intensity lighting designed to penetrate the navigable airspace. Those policies and procedures are described in FAA Order JO 7400.2P, *Procedures for Handling Airspace Matters*, Chapters 29 and 30. FAA Advisory Circular (AC) 70-1B, *Outdoor Laser Operations*, provides more information specifically relating to laser installations.

Sponsors of proposed outdoor laser installations are required to inform the FAA of the project by filing Form 7140-1, “Notice of Proposed Outdoor Laser Operation(s),” with the FAA Air Traffic Organization.¹⁷ The project sponsor is required to provide detailed information about the proposed installation, including location and characteristics of the laser beams (e.g., directions and intensity).¹⁸

The FAA reviews the proposal “to identify any potential negative effects to aviation safety from the proposed operation.” After the review, the FAA issues a letter of determination, stating that it either objects or has no objection to the proposed project. If the FAA objects, then it requests that the proposed project should not proceed until the project sponsor has resolved the objectionable effects.¹⁹

¹⁵ US Department of Transportation, Federal Aviation Administration, Office of Airports, Office of Airport Planning and Programming, Airport Planning and Environmental Division (APP-400), *Technical Guidance for Evaluating Selected Solar Technologies on Airports*, Version 1.1, April 2018, p. 45.

¹⁶ “Federal Aviation Administration Policy: Review of Solar Energy System Projects on Federally-Obligated Airports,” *Federal Register*, Vol. 86, No. 89, May 11, 2021, pp. 25801 - 25803.

¹⁷ US Department of Transportation, Federal Aviation Administration, Advisory Circular 70-1B, *Outdoor Laser Operations*, February 14, 2022, p. 2.

¹⁸ US Department of Transportation, Federal Aviation Administration, Advisory Circular 70-1B, *Outdoor Laser Operations*, February 14, 2022, p. A-1.

¹⁹ US Department of Transportation, Federal Aviation Administration, Advisory Circular 70-1B, *Outdoor Laser Operations*, February 14, 2022, p. 3.

Sponsors of high-intensity lighting installations are subject to the same review requirements and determination procedures as the sponsors of outdoor laser installations.²⁰

J.2.3 Dust, Smoke, and Water Vapor

The FAA does not have specific standards related to effects from dust, smoke, and water vapor. However, the FAA OE/AAA process provides the agency the opportunity to review the potential effects of these conditions on the visibility of the airport and aircraft from the ATCT and from other aircraft. Development projects most likely to have these effects have tall exhaust stacks or cooling towers, which would require the filing of FAA Form 7460-1 based on height alone. In preparing Form 7460-1, the project sponsor should include a description of the characteristics of the emissions from the exhaust stacks to enable the FAA to consider the potential aeronautical effects.

Among the adverse effects the FAA considers in its OE/AAA process, two could potentially be caused by these emissions:

- interference with VFR operations, requiring aircraft to change their regular flight courses or altitudes
- interference with a clear view of the runways, helipads, taxiways, or traffic patterns from the ATCT²¹

J.2.4 Electromagnetic Interference

The FAA is authorized under 14 CFR 77.29(a)(6) to consider potential interference with “air navigation, communication facilities, and other surveillance systems.” The sponsors of proposed transmitting stations and antennas are required to describe the electromagnetic properties of the proposed project on FAA Form 7460-1.

FAA Order JO 7400.2P, Paragraph 6-3-2, requires that an FAA obstruction evaluation must assess the effect of a proposed structure on electromagnetic interference with air navigation, communications, radar, and control systems facilities. FAA Order JO 7400.2P, Paragraph 6-3-5, states that electromagnetic interference with the operation of a navigation facility or a signal used by aircraft would be a substantial adverse effect, resulting in a DOH, unless the effect can be mitigated through a change in the development project.

J.2.5 Thermal Exhaust Plumes

The FAA does not have specific standards for thermal exhaust plumes, but it considers them potentially hazardous near airports. In a memorandum released in 2015, the FAA described its concerns relating to thermal exhaust plumes:

After thorough analysis, the FAA has determined the overall risk associated with thermal exhaust plumes in causing a disruption of flight is low. However, the FAA has determined that thermal exhaust plumes in the vicinity of airports may pose a unique hazard to aircraft

²⁰ US Department of Transportation, Federal Aviation Administration, Order JO 7400.2P, *Procedures for Handling Airspace Matters*, Chapter 30, April 20, 2023.

²¹ 14 CFR 77.31(d); US Department of Transportation, Federal Aviation Administration, Order JO 7400.2P, *Procedures for Handling Airspace Matters*, Paragraph 6-3-3, April 20, 2023.

in critical phases of flight (particularly takeoff, landing and within the [airport traffic] pattern) and therefore are incompatible with airport operations.

Flight within the airport traffic pattern, approach and departure corridors, and existing or planned flight procedures may be adversely affected by thermal exhaust plumes. The FAA-sponsored research indicates that the plume size and severity of impact on flight can vary greatly depending on several factors at a site such as:

- Stack size, number, and height; type of exhaust or effluent (e.g., coolant tower cloud, power plant smoke, etc.);
- Proximity of stacks to the airport flight paths;
- Temperature and vertical speed of the effluent;
- Size and speed of aircraft encountering exhaust plumes; and
- Local winds, ambient temperatures, stratification of the atmosphere at the plume site.²²

The OE/AAA process provides the FAA the opportunity to review proposed projects that may create thermal exhaust plumes and determine their effects on airspace. It is important for project sponsors to describe the proposed project as thoroughly as possible on Form 7460-1.

J.2.6 Hazardous Wildlife Attractants

The FAA provides guidance for the avoidance of hazardous wildlife attractants on and near airports in AC 150/5200-33C, *Hazardous Wildlife Attractants on or near Airports*. It includes information related to the following:

- separation criteria for hazardous wildlife attractants on or near airports
- land use practices that potentially attract hazardous wildlife
- procedures for wildlife hazard management by operators of public-use airports
- recommended procedures for the FAA, airport operators, and other government entities regarding off-airport attractants

For airports serving turbine-powered aircraft, the FAA recommends a separation distance of 10,000 feet between the air operations area and any hazardous wildlife attractants. For all airports, the FAA recommends a distance of 5 statute miles between the closest point of the airport's aircraft operations area and the hazardous wildlife attractant to protect circling, approach, and departure airspace.²³ "The separation distances are based on (1) flight patterns and performance criteria of piston-powered aircraft and turbine-powered aircraft, (2) the altitude at which most strikes happen (78 percent occur under 1,000 feet and 90

²² US Department of Transportation, Federal Aviation Administration, Office of Airport Planning and Programming and Office of Airport Safety and Standards, *Technical Guidance and Assessment Tool for Evaluation of Thermal Exhaust Plume Impact on Airport Operations* (Memorandum), September 24, 2015.

²³ US Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5200-33C, *Hazardous Wildlife Attractants on or near Airports*, Paragraphs 1.3 and 1.4, February 21, 2020.

percent occur under 3,000 feet above ground level), and (3) National Transportation Safety Board recommendations.”²⁴

The US Environmental Protection Agency requires landfill operators proposing new or expanded landfills within 5 statute miles of a runway end to notify the appropriate FAA Regional Airports Division Office and the airport operator of the proposal. This is directed by 40 CFR 258.10, *Criteria for Municipal Solid Waste Landfills*, “Airport Safety.”²⁵

With regard to other wildlife attractants, according to AC 150/5200-33C, “the FAA may review development plans, proposed land-use changes, operational changes, major federal actions or wetland mitigation plans” within 5 statute miles of an airport aircraft operations area to determine potential risks to airport safety caused by attracting hazardous wildlife. The AC notes the FAA is not a land use permitting agency; “therefore, such reviews are typically initiated by state or federal permitting agencies seeking FAA input on new or revised permits.”²⁶ Local permitting agencies can also seek FAA review of land use projects that may attract hazardous wildlife. Airport operators who are aware of proposed projects that involve hazardous wildlife attractants within 5 statute miles of the airport are encouraged to inform the FAA Airport Certification Safety Inspector or Airports District Office of the proposals. Project sponsors are also encouraged to inform the FAA of such proposed projects. Airport operators and project sponsors may use FAA Form 7460-1 to notify the FAA.

Mitigation measures for hazardous wildlife attractants are discussed in AC 150/5200-33C, Chapter 2. In addition, the FAA and the US Department of Agriculture developed *Wildlife Hazard Management at Airports: A Manual for Airport Personnel*, which provides hazardous wildlife management guidance for airport operators, including suggestions for mitigating impacts of selected wildlife attractants.²⁷

J.3 AIRPORT LAND USE COMPATIBILITY PLANNING HANDBOOK GUIDANCE

According to the California Department of Transportation’s (Caltrans’) *California Airport Land Use Planning Handbook* (the Handbook), hazards to flight can be grouped into three main categories: obstructions to airspace, wildlife hazards, and other forms of interference (visual, electronic, thermal). In the case of airspace obstructions, Caltrans recommends limiting the heights of structures in accordance with 14 CFR Part 77 to avoid airspace interference hazards.

The Handbook also recommends consulting FAA AC 150/5200-33B (currently AC 150/5300-33C) for guidance on mitigating wildlife hazards and confirms that the FAA does not provide specific standards for other flight hazards, like visual hazards, electronic hazards, and thermal hazards. These hazards are instead evaluated on

²⁴ US Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5200-33C, *Hazardous Wildlife Attractants on or near Airports*, Paragraph 1.1.4, February 21, 2020.

²⁵ US Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5200-33C, *Hazardous Wildlife Attractants on or near Airports*, Paragraph 4.2.1.2, February 21, 2020.

²⁶ US Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5200-33C, *Hazardous Wildlife Attractants on or near Airports*, Paragraph 4.1.1, February 21, 2020.

²⁷ US Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, and US Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, *Wildlife Hazard Management at Airports: A Manual for Airport Personnel*, Second Edition, Sections 5.2 and 9.2b, July 2005.

a case-by-case basis. According to the Handbook, “ALUCs [Airport Land Use Commissions] can request an FAA evaluation of proposed development when certain features appear to be potentially hazardous.”²⁸

Additionally, the Handbook acknowledges that California law encourages the development of alternative energy sources, including wind and solar energy installations. The land use compatibility of the placement of these facilities should be considered during planning, even if the projects would otherwise be considered compatible regarding other factors like noise.

J.4 POLICY CONSIDERATIONS

The foregoing discussion has the following implications for land use compatibility planning policy:

- The adverse impacts of hazards to flight can be serious, jeopardizing the safe operation and control of aircraft.
- The potential hazards occur only with selected land uses and development features. They are not characteristic of most kinds of development.
- The FAA is legally authorized to review many, but not all, potential hazards to flight safety under the requirements of 14 CFR Part 77 (the OE/AAA process).
- FAA OE/AAA determinations with respect to potential hazards to flight should be considered in local determinations of airport land use compatibility.
- Local land use compatibility policies should acknowledge the role of the FAA in the review of the flight safety implications of proposed projects, ensuring that the FAA is fully informed of all relevant design and operating features of proposed projects.
- Analytical tools are available for the quantitative evaluation of potential hazards associated with glare and thermal exhaust plumes. Project sponsors can submit these analyses to the FAA with Form 7460-1 to facilitate thorough OE/AAA review.

Table J-1 lists land uses and development features that create potential hazards to flight. These land uses and development features, in addition to others that are demonstrably similar, merit land use compatibility review when they are proposed anywhere within the airspace protection area, depicted on Exhibit I-19 in Appendix I. The list is organized by land use type or development feature, and potential hazards associated with each land use or feature are indicated in the table. Land uses are designated as conditionally compatible within the Airport Influence Area based on the potential for mitigation of adverse impacts or the potential absence of impacts. Some land uses are designated as incompatible based on their potentially significant adverse impacts and the lack of effective mitigation measures.

Table J-1 should be incorporated into the updated ALUCP to aid planners in screening proposed projects for ALUCP consistency review.

²⁸ California Department of Transportation, Division of Aeronautics, *California Airport Land Use Planning Handbook*, October 2011, p. 4-39. The Handbook does not explain how or to which organization these requests should be made. Presumably, the request could be made through the airport sponsor to the FAA Airports District Office.

Table J-1 (1 of 2) Potential Hazards to Flight

Potentially Hazardous Land Use or Development Feature ¹	Glint and Glare	Problem Lighting	Smoke, Dust, Water Vapor	Electromagnetic Interference	Thermal Exhaust Plumes	Hazardous Wildlife Attractants
Development Features						
Buildings with large, highly reflective roof or wall surfaces	Yellow					
Green and white alternating lights or rotating beacon of green and white lights directed upward		Red				
High-intensity lighting (e.g., searchlights and stroboscopic lights) directed upward toward aircraft	Yellow	Yellow				
Jumbotron screens		Yellow				
Laser light displays directed upward toward aircraft	Yellow	Yellow				
Linear array of steady or sequenced flashing lights of amber, green, red, white, or yellow, directed upward within 25 degrees of the runway centerline		Red				
Outdoor stadiums illuminated for nighttime activities		Yellow				
Agriculture						
Aquaculture activities conducted outside fully enclosed buildings						Red
Industrial						
Grain or oil seed (e.g., sunflower, cotton, rapeseed) processing facilities involving outdoor storage of product or waste materials						Red
Heavy industrial plants with tall exhaust stacks			Yellow		Yellow	
Utilities and Communication						
Cellular and microwave relay towers				Yellow		
Composting operations that accept food waste						Red
Disposal of ash from general incinerators (not including resource recovery and power/heat-generating facilities)						Red
Dredge spoil containment areas						Red
Power plants - fossil fuel or with cooling towers			Yellow		Yellow	
Power plants - concentrating solar or photovoltaic	Yellow					
Radio and television transmission towers				Yellow		

Table J-1 (2 of 2) Potential Hazards to Flight

Potentially Hazardous Land Use or Development Feature ¹	Glint and Glare	Problem Lighting	Smoke, Dust, Water Vapor	Electromagnetic Interference	Thermal Exhaust Plumes	Hazardous Wildlife Attractants
Utilities and Communication (continued)						
Solid waste landfills						Yellow
Stormwater management facilities, including water detention, retention, groundwater recharge ponds, flood control projects, or stream channelization/deepening/widening projects, which create areas of above-ground standing water of 5,000 square feet or more ²						Yellow
Trash transfer stations handling putrescible waste, which are not fully enclosed or lack ventilation and air filtration systems adequate to control odors escaping to the outdoors (odor-masking is not acceptable)						Red
Underwater discharges of food waste						Red
Wastewater treatment facilities, including settling ponds and devices or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes and artificial marshes designed for wastewater treatment ^{2,3}						Yellow
Water treatment and intake facilities serving public water distribution systems						Yellow
Wind turbine arrays				Yellow		
Parks and Open Space						
Water features incorporated into landscaping, open space, or golf courses with 5,000 square feet or more of water surface area ³						Yellow
Wetlands development and mitigation projects with 5,000 square feet or more of wetlands						Yellow

LEGEND



- The land use or development feature is conditionally compatible within the airspace protection area boundary, subject to compliance with ALUCP Policies A.7.1 through A.7.6 (refer to Table J-2 below).
- The land use or development feature is incompatible within the airspace protection area boundary.

NOTES:

- This list is illustrative and is not intended to comprehensively describe all potentially hazardous land uses and development features. Other land uses and development features with the potential to cause effects similar to those listed here, as determined by the ALUC, are subject to these policies.
- Project sponsors should consult with airport management and the Federal Aviation Administration's Airports District Office for assistance. Measures can be taken to reduce the risk of attracting birds (US Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5200-33C, *Hazardous Wildlife Attractants on or near Airports*, Paragraph 2.3.2, February 21, 2020); and US Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, and US Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, *Wildlife Hazard Management at Airports: A Manual for Airport Personnel*, Second Edition, Sections 5.2 and 9.2b, July 2005).
- Retention ponds of treated wastewater should be considered the same as stormwater management facilities.

SOURCE: Ricondo & Associates, Inc., June 2024.

Table J-2 provides the 2014 ALUCP policies for potential hazards to flight.²⁹ The third column presents considerations for policy refinements.

Table J-2 (1 of 3) 2014 Airport Land Use Compatibility Plan - Standards for Potential Hazards to Flight and Considerations for Update

2014 ALUCP POLICY NUMBER	2014 ALUCP POLICY	CONSIDERATIONS FOR UPDATED POLICY
Policy A.7.0	none	A new policy should include Table J-1, describing land uses and development features that are incompatible or conditionally compatible. Subsequent policies should include standards applying to conditionally compatible land uses and development features.
Policy A.7.1	<p>Sources of Glare</p> <p>Highly reflective materials may cause visual after-images or flash blindness in pilots, thus compromising flight safety. Such materials are incompatible unless the ALUC finds that either of the following conditions applies:</p> <ul style="list-style-type: none"> The project sponsor has prepared a technical study, certified by a lighting engineer or an expert approved by the ALUC, demonstrating to the ALUC's satisfaction that the proposed building materials would not create reflections intense enough to cause visual after-images or flash blindness in pilots on approach to either runway end at any time of day during any season of the year. <p>The FAA has reviewed the land use project and has issued a final Notice of Determination within which it raises no objections to the potential glare impacts of the project.</p>	<p>This policy should be revised to ensure coordination with the FAA OE/AAA review process and adherence to FAA findings and determinations.</p> <p>Project sponsors should fully describe project features that may cause glint or glare on FAA Form 7460-1 and submit a glare analysis to the FAA with Form 7460-1.</p> <p>Compatibility should be based on an FAA Determination of No Hazard (DNH).</p>
Policy A.7.2	<p>Lighting</p> <p>The following lighting systems are incompatible with this ALUCP when casting light toward the approach paths of aircraft:</p> <ul style="list-style-type: none"> Searchlights; Laser lights; Sequenced flashing lights; and Stroboscopic lights. <p>Any other lighting systems that in the ALUC's determination produce effects that mimic airport identification lighting, runway end identification lighting, or runway approach lighting are also incompatible with this ALUCP.</p>	<p>This policy should be revised to ensure coordination with the FAA OE/AAA review process and adherence to FAA findings and determinations.</p> <p>Project sponsors should fully describe project features related to lighting on FAA Form 7140-1 for laser installations or FAA Form 7460-1 for all other proposed projects.</p> <p>Compatibility should be based on an FAA DNH or letter of determination with no objections to the proposed project.</p>

²⁹ Airport Land Use Commission, San Diego County Regional Airport Authority, *San Diego International Airport Land Use Compatibility Plan*, May 2014 (amended), pp. 4-16 - 4-18.

Table J-2 (2 of 3) 2014 Airport Land Use Compatibility Plan - Standards for Potential Hazards to Flight and Considerations for Update

2014 ALUCP POLICY NUMBER	2014 ALUCP POLICY	CONSIDERATIONS FOR UPDATED POLICY
Policy A.7.3	<p>Sources of Dust, Water Vapor and Smoke</p> <p>Land use projects that in the opinion of the ALUC may create columns of dust, steam, water vapor, or smoke dense enough to impair pilot vision and compromise flight safety are incompatible with this ALUCP.</p>	<p>This policy should be revised to ensure coordination with the FAA OE/AAA review process and adherence to FAA findings and determinations.</p> <p>Project sponsors should fully describe project features that may produce smoke, dust, or water vapor on FAA Form 7460-1. Compatibility should be based on an FAA DNH.</p>
Policy A.7.4	<p>Electromagnetic Interference</p> <p>Sources of electromagnetic interference with aircraft instrumentation and ground-based radar and navigational aids are incompatible with this ALUCP. If a land use project may result in electromagnetic interference, the ALUC must consult with the FAA to ensure that the FAA is aware of the potential for electronic interference. The ALUC must require the project sponsor to modify the land use project to comply with any FAA recommendations and conditions.</p>	<p>This policy should be revised to ensure coordination with the FAA OE/AAA review process and adherence to FAA findings and determinations. Project sponsors should fully describe project features that may cause electromagnetic interference on FAA Form 7460-1.</p> <p>Compatibility should be based on an FAA DNH.</p>
Policy A.7.5	<p>Sources of Thermal Plumes</p> <p>Land use projects that in the opinion of the ALUC may create thermal plumes with the potential to interfere with the safe control of aircraft are incompatible with this ALUCP. Thermal plumes rising 200 feet or more above the ground at upward velocities of 14.1 feet per second or greater are capable of jeopardizing the safe control of aircraft.</p>	<p>This policy should be revised to ensure coordination with the FAA OE/AAA review process and adherence to FAA findings and determinations.</p> <p>Project sponsors should fully describe features of the proposed project that may cause thermal exhaust plumes on FAA Form 7460-1 and submit an exhaust plume analysis to the FAA with Form 7460-1.</p> <p>Compatibility should be based on an FAA DNH.</p>
Policy A.7.6	<p>Bird Attractants</p> <p>The following land uses, if they have the potential to attract birds, are incompatible with this ALUCP and are not permitted within the Airport Influence Area (AIA).¹</p> <ol style="list-style-type: none"> 1. Agricultural, recreational, open space activities and facilities that include: <ol style="list-style-type: none"> a. Aquaculture activities conducted outside of fully enclosed buildings; b. A water feature incorporated into landscaping, open space areas or golf courses are incompatible unless it is less than 2,500 square feet of surface area and measures are taken to control hazardous wildlife. 	<p>By adding Table J-1 to the ALUCP, specific land uses no longer need to be identified in this policy.</p> <p>The policy should also be revised to ensure that sponsors of proposed projects with the potential to attract hazardous wildlife, based on Table J-1, coordinate with the Airport operator and the FAA Airports District Office to identify suitable measures to mitigate the potential for attracting hazardous wildlife. ALUCP consistency determinations should reflect the recommended mitigation measures.</p>

Table J-2 (3 of 3) 2014 Airport Land Use Compatibility Plan - Standards for Potential Hazards to Flight and Considerations for Update

2014 ALUCP POLICY NUMBER	2014 ALUCP POLICY	CONSIDERATIONS FOR UPDATED POLICY
<p>Policy A.7.6 (cont.)</p>	<p>2. Waste Disposal Operations:</p> <ul style="list-style-type: none"> a. Municipal solid waste landfills; b. Trash transfer stations that handle waste, are not fully enclosed or that lack ventilation and air filtration systems adequate to control odors escaping to the outdoors (odor masking is not acceptable); c. Commercial or institutional composting operations that accept food waste. <p>3. Water Management Facilities:</p> <ul style="list-style-type: none"> a. Storm water management facilities that create above-ground standing water, unless required by other provisions of municipal, county, or State law. Where storm water detention ponds are necessary and must be allowed, measures should be taken to minimize the risks of attracting potentially hazardous wildlife. b. Wastewater treatment facilities and associated settling ponds, including any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes and artificial marshes designed for wastewater treatment. c. Wetlands mitigation projects, unless they provide unique functions that must remain onsite or are otherwise directed by state or federal law, state or federal regulatory decision, or court order. d. Dredge spoil containment areas (also known as confined disposal facilities) if the spoils contain material that would attract hazardous wildlife. 	

NOTES:

ALUC – Airport Land Use Commission

ALUCP – Airport Land Use Compatibility Plan

FAA – Federal Aviation Administration

OE/AAA – Obstruction Evaluation / Airport Airspace Analysis

1 US Department of Transportation, Federal Aviation Administration, Advisory Circular 150/5200-33C, *Hazardous Wildlife Attractants on or Near Airports*, February 21, 2020.

SOURCES: San Diego County Regional Airport Authority, Airport Land Use Commission, *San Diego International Airport Land Use Compatibility Plan*, May 2014 (amended; columns 1 and 2), pp. 4-16 – 4-18; Ricondo & Associates, Inc., June 2024 (column 3).

J.5 SUMMARY

Potential non-height-related hazards to flight are relatively uncommon, but they can be serious. The FAA is authorized by 14 CFR Part 77 to review many proposed projects with potentially hazardous features through its OE/AAA process. ALUCP policy should ensure that sponsors of proposed projects notify the FAA of these proposed projects through the filing of Forms 7460-1, “Notice of Proposed Construction or Alteration,” or 7140-1, “Notice of Proposed Outdoor Laser Operation(s),” as appropriate. For proposed projects with potentially hazardous features that do not require FAA review, ALUCP policy should ensure that project sponsors consult with the Airport operator and the FAA to determine if mitigation measures should be incorporated into the project design.