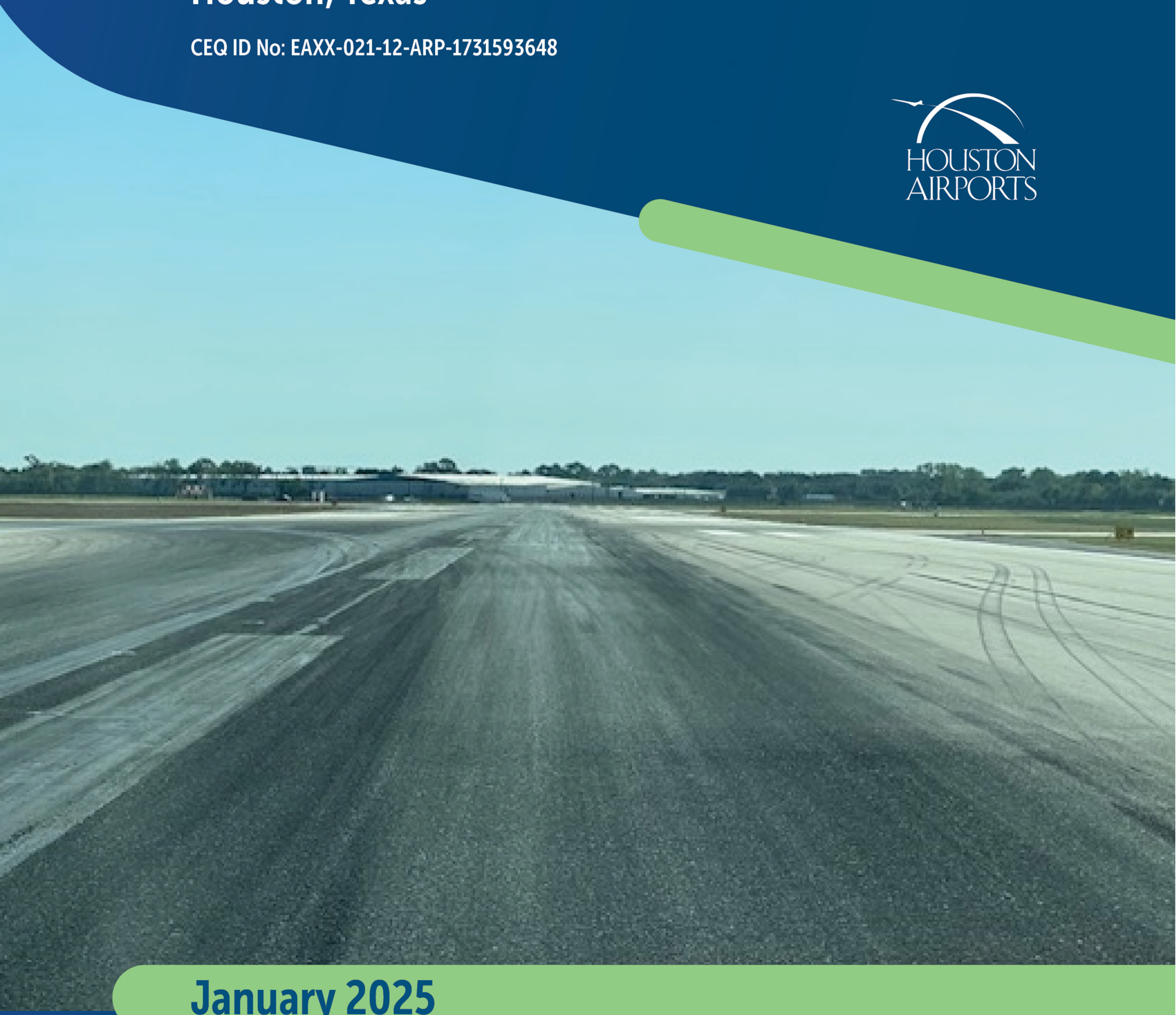
HOU William P. Hobby Airport

DRAFT ENVIRONMENTAL ASSESSMENT

Reconstruction of Runway 13R-31L
Houston, Texas

CEQ ID No: EAXX-021-12-ARP-1731593648

HOUSTON AIRPORTS



January 2025

FEDERAL AVIATION ADMINISTRATION

This Environmental Assessment becomes a Federal document when evaluated, signed, and dated by the Responsible FAA Official.

DRAFT ENVIRONMENTAL ASSESSMENT

Reconstruction of Runway 13R-31L at William P. Hobby Airport (HOU)

Houston, Texas

Prepared for:

Texas Airport Development Office [ASW-650]

Federal Aviation Administration

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Responsible FAA Official **Date**

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ACRONYMS AND ABBREVIATIONS

µq/m³	micrograms per cubic meter
AAD	Average Annual Day
AAF	Aviation Activity Forecast
AC	Advisory Circular
ACA	Airport Carbon Accreditation
ACHP	Advisory Council on Historic Preservation
ACI	actual condition index
AEDT	Airport Environmental Design Tool
ALCMS	Airport Lighting Control and Monitoring System
APE	Area of Potential Effects
APU	Auxiliary Power Unit
AQCR	Air Quality Control Region
BMP	Best Management Practice
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CCR	Constant current regulator
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH_4	methane
CMP	HAS Carbon Management Plan
CMMP	Construction Materials Management Plan
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
CWA	Clean Water Act
dB	Decibel
DNL	Day-Night Average Sound Level
DRP	Domestic Redevelopment Program
EA	Environmental Assessment
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
FR	Federal Register
FY	fiscal year
GHG	Greenhouse Gases
GSE	Ground Support Equipment
H-GAC	Houston-Galveston Area Council
IPaC	Information for Planning and Consultation
IPCC	International Panel on Climate Change
IWG	Interagency Working Group
LWCF	Land and Water Conservation Fund
MALSR	Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
MBTA	Migratory Bird Treaty Act
mi^2	square miles
MOVES	EPA Motor Vehicles Emissions Simulator
MSW	Municipal Solid Waste
N_2O	Nitrous Oxide
NAA	No Action Alternative
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NHRP	National Register of Historic Places
nmi	Nautical Miles
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOMS	Noise and Operations Monitoring System
NO_x	Nitrogen Oxides
NPDES	National Pollution Discharge Elimination System

NPL	National Priorities List
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRI	National River Inventory
NSA	Noise Study Area
NSR	New Source Review
NW	Northwest
O_3	Ozone
OFA	Object Free Area
OPSNET	FAA's Operational Network
Pb	Lead
PCI	pavement condition index
PDD	Project Definition Document
PFAS	polyfluoroalkyl substances
PM	Particulate Matter
PM_{10}	Particulate matter with a diameter less than 10 micrometers
$PM_{2.5}$	Particulate matter with a diameter less than 2.5 micrometers
ppb	parts per billion
ppm	parts per million
ROD	Record of Decision
SC-CH_4	Social Cost of Methane
SC-CO_2	Social Cost of Carbon Dioxide
SC-GHG	Social Cost of Greenhouse Gases
SC-N_2O	Social Cost of Nitrogen Oxides
SFHA	Special Flood Hazard Areas
SH	State Highway
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SMP	Sustainability Management Plan
SO_2	Sulphur Dioxide
SPCC	Spill Prevention, Counter-Measures and Control Plan
SWPPP	Stormwater Pollution Prevention Plan
SWS	Stormwater System
TAF	Terminal Area Forecast
TCEQ	Texas Commission on Environmental Quality
TDG	Taxiway Design Group
TexN	Texas NONROAD
THC	Texas Historical Commission
THSA	Texas Historic Sites Atlas
TPDES	Texas Pollution Discharge Elimination System
TPH	total petroleum hydrocarbons
TPWD	Texas Parks and Wildlife Department
tpy	tons per year
TX CMP	The Texas Coastal Management Plan
TxDOT	Texas Department of Transportation
TxNDD	Texas Natural Diversity Database
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
VOC	Volatile Organic Compound
WOTUS	Waters of the United States

1.0 BACKGROUND AND PURPOSE AND NEED

This Environmental Assessment (EA) analyzes the potential environmental impacts of the reconstruction of Runway 13R-31L (Proposed Action) at William P. Hobby Airport (HOU or "Airport"). This EA also includes public and agency coordination documents used to communicate the Proposed Action and results of the environmental analyses, as well as to gather input from the public and regulatory agencies consulted. The Federal Aviation Administration (FAA) will use the findings in the EA to determine whether an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI) will be prepared.

This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, the President's Council on Environmental Quality (CEQ) regulations to implement NEPA (40 Code of Federal Regulations [CFR] §1500 to 1508), FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, as well as other applicable federal, state, and local requirements. NEPA requires federal agencies to analyze and consider alternatives to the environmental impacts of their proposed actions, to disclose and consider mitigation for those impacts, and to provide interested parties with an opportunity to participate in the environmental review process.

Under NEPA, FAA is required to consider potential environmental impacts before funding or approving projects over which it has authority. Recent changes in federal law have required FAA to revisit whether FAA approval is needed for certain types of projects. In 2024, the "FAA Reauthorization Act of 2024" was signed into law (H.R. 3935).[1] Section 743 provides that FAA retains authority to regulate activities that "materially impact the safe and efficient operation of aircraft at, to, or from the airport, adversely affect the safety of people or property on the ground as a result of aircraft operations, or adversely affect the value of prior Federal investments to a significant extent." After examination, FAA has determined that it has approval authority over the reconstruction of Runway 13R-31L assessed in this EA.[2]

This EA includes the following chapters:

- *Chapter 1: Background and Purpose and Need*
- *Chapter 2: Alternatives*
- *Chapter 3: Affected Environment and Environmental Consequences*
- *Chapter 4: Public Involvement*
- *Chapter 5: List of Preparers*

1.1 Project Sponsor

The Project Sponsor is Houston Airport System (HAS), located in the City of Houston, Texas.

1.2 Background

HOU is a commercial service airport owned and operated by HAS, a department of the City of Houston. HAS also owns and operates George Bush Intercontinental Airport (IAH) and Ellington Airport/Houston Spaceport (EFD).

[1] Section 743 of the Reauthorization Act of 2024 replaced Section 163(a) of the FAA Reauthorization Act of 2018.

[2] FAA reviewed the Proposed Action relative to Section 743 of the FAA Reauthorization Act of 2024 (H.R. 3935). FAA has authority over the Proposed Action and thus, compliance with NEPA is required.

The Airport is located in Harris County, Texas, approximately seven miles southeast of downtown Houston on approximately 1,502 acres, adjacent to Interstate Highway 45 (I-45) and Texas State Highway (SH) 35 (see **Figure 1**). The Airport lies at an elevation of approximately 46 feet above mean sea level. The FAA's National Plan of Integrated Airports System classifies the Airport as a medium hub airport, meaning that it serves between a quarter percent to one percent of all annual passengers boarding aircraft in the United States.

As shown in **Figure 2**, the Airport has three runways as well as associated taxiways, aprons, and other airfield facilities.

1.3 Existing and Future Operations and Enplanements

The number of operations and passengers at HOU are forecasted to continue to grow in the future. Growth is expected to occur at the Airport regardless of whether the Proposed Action is constructed. Detailed information about projected future activity levels can be found in the *West Concourse Expansion Project Finding of No Significant Impact and Record of Decision (FONSI/ROD)*, dated January 2024.

1.4 Proposed Action

HAS proposes to reconstruct Runway 13R-31L and replace and improve existing exit taxiways including high speed exits (*Proposed Action*; see **Figure 4**). Runway 13R-31L stretches from northwest to southeast. It is 7,602 linear feet long with a surface area of 1,140,300 square feet. The Proposed Action would include the following elements:

- **Runway 13R-31L:** Reconstruct Runway 13R-31L in-kind (full-depth concrete on existing horizontal alignment) to accommodate current FAA standards for Airplane Design Group (ADG) III
- **Taxiway H, Taxiway L, and Taxiway K:** Demolish and reconstruct intersections with Runway 13R-31L on the current horizontal alignment and incorporate current taxiway geometry design guidelines to ensure compliance with FAA AC 5300-13B
- **Taxiway M1:** Demolish existing Taxiway M1 and reconstruct its entrance closer to the Runway 31L threshold to avoid potential conflicts with the planned Taxiway D realignment that is part of a separate project; incorporate new high speed exist taxiway geometry guidelines to comply with FAA AC 5300-13B
- **Taxiway F:** Mill and overlay of the center 50 feet (keel section) of the taxiway and conversion to a TDG 3 taxiway to allow general aviation aircraft to exit when arriving on Runway 31L
- **Taxiway M3:** Incorporate new high speed exist taxiway geometry guidelines per FAA AC 5300-13B
- **Taxiway Q:** Demolish existing angled taxiway intersection and replace it with a standard 90-degree intersection
- **Runway Approach Lighting:** Improvements to the FAA-owned Runway 13R Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR)
- **North Vault:** Improvements to the equipment inside the existing North Vault building
- Install pavement marking, electrical signage, and lighting system upgrades that use light-emitting diode (LED) technology
- Construct pavement shoulder upgrades and storm drainage improvements as needed to comply with FAA guidelines

Figure 1. HOU General Location Map

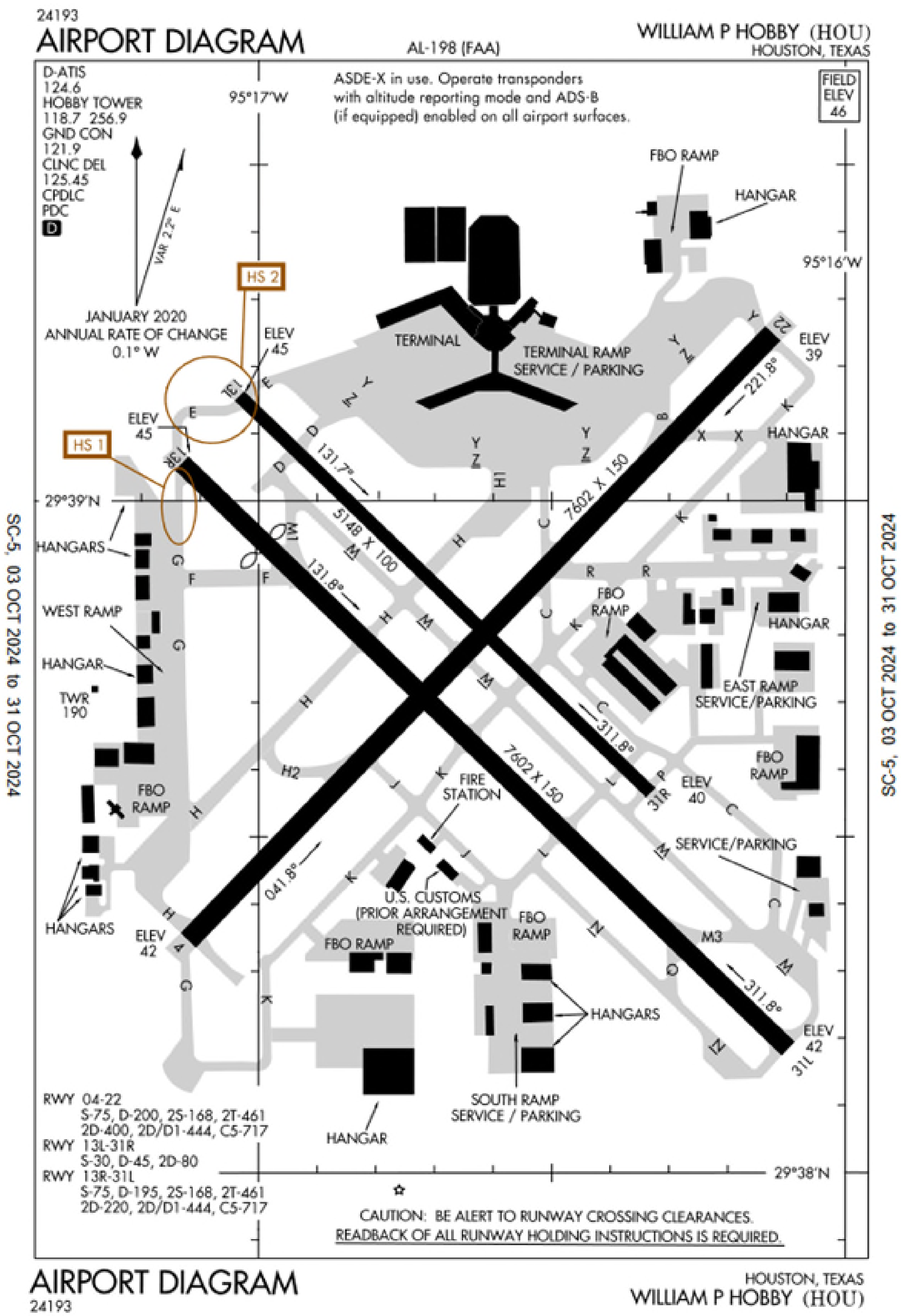

Figure 2. FAA HOU Airport Diagram

1.5 Purpose and Need

1.5.1 Purpose

The purpose of the Runway 13R-31L reconstruction project is to meet FAA runway and taxiway design criteria while improving operational efficiency and overall safety of the Airport.

1.5.2 Need

The Proposed Action is needed to address deficiencies in Runway 13R-31L and its associated taxiway connectors. These deficiencies present operational and safety concerns and include cracking and deteriorated pavement, outdated taxiway alignments that no longer meet FAA geometry guidelines, and obsolete electrical infrastructure and equipment.

1.5.2.1 Runway Pavement

FAA Advisory Circular 150/5320-6F states that pavement surfaces on federally funded FAA projects are designed for a 20-year structural life. Originally constructed in 1944, Runway 13R-31L was lengthened and straightened sometime between 1954 and 1957. The most recent pavement rehabilitation project on Runway 13R-31L occurred in 2007, so the runway surface is approaching its design life as expected by the FAA. Runway 13R-31L and its associated taxiway connections have deteriorated due to age and aircraft traffic volumes. Existing deterioration includes cracking, alligator cracking, and depressions. The deterioration presents operational safety concerns that, if left unaddressed, will result in severe pavement deterioration that will bring about reduced efficiency and closure of the runway.

An *Airside Pavement Condition Assessment* was performed for HOU in 2023. The assessment assigns existing and future predicted pavement condition index (PCI) values to Runway 13R-31L and its associated taxiway components. The assessment found that Runway 13R-31L, its associated taxiway pavements/connections, and run-up areas exhibit unacceptable PCI values. Runway 13R-31L has an actual condition index (ACI) of 5, which means it has "5+ years of remaining service life except for specific components that may be identified" and a PCI of 67, which is Fair. PCI values are based on a scale of 100 to 0 with the best to worst conditions being Good (PCI 100 to 86), Satisfactory (85 to 71), Fair (PCI 70 to 56), Poor (PCI 55 to 41), Very Poor (PCI 40 to 26), Serious (25 to 11), and Failed (10 to 0). Pavement in a Fair condition or lower is the threshold for initiating rehabilitation. FAA Advisory Circular 150/5380-6C states that "timely maintenance and repair of pavements is essential in maintaining adequate load-carrying capacity, good ride quality necessary for the safe operation of aircraft, good friction characteristics under all weather conditions, and minimizing the potential for foreign object debris. [3]"

Numerous sections of Runway 13R-31L were identified as candidates for full concrete pavement reconstruction to address severe cracking identified. With a PCI value of 43, Runway 31L run-up is rated as Poor and has one of the lowest PCI values at HOU due to shrinkage cracking and a number of shattered slabs. The Runway 13R-31L reconstruction project is listed as a Priority project that needs to be complete within three years of the pavement condition assessment.

1.5.2.2 Taxiway Alignment

To meet FAA Advisory Circular 150/5300-13A, change 1, Airport Design standards, realignments and improvements to several taxiway connectors are needed to modify runway/taxiway intersections to

[3] Source: *2022 Airside Pavement Condition Assessment,* prepared for Houston Airport System, dated March 2023

reduce the risk of runway incursions. Runway incursions are instances of unintentional or unauthorized presence of objects—including aircraft—on a runway that may increase the potential for an accident. Methods to reduce runway incursions include:

- Avoiding/eliminating wide expanses of pavement at runway/taxiway crossings that may inhibit a pilot's situational awareness
- Avoiding/eliminating high energy taxiway intersections located in the middle third of the runway
- Avoiding/eliminating acute angle runway crossings
- Avoiding/eliminating direct access from an apron area to a runway

The current airport configuration includes the following taxiway connectors to Runway 13R-31L:

- Taxiway H, Taxiway M1, Taxiway L, Taxiway K, Taxiway F, Taxiway M3, and Taxiway Q.
- Taxiways H, L, and K do not currently comply with the taxiway geometry design guidelines set forth in FAA AC 5300-13B.
- Taxiway M1 is in close proximity to the new realigned Taxiway D planned under the HOU FAA Non-Standard Taxiways project that was bid in March 2023, potentially resulting in inadequate separation distance between the two taxiways. The existing Taxiway M1 does not meet new high speed exit taxiway geometry guidelines per FAA AC 5300-13B.
- Taxiway F is a non-standard angled exit taxiway for Runway 31L that is primarily used by general aviation aircraft and has low utilization.
- Taxiway M3 does not currently comply with new high speed exit taxiway geometry guidelines per FAA AC 5300-13B.
- Taxiway Q is a non-standard angled exit taxiway that connects to Taxiway N. The separation distance between Taxiway Q and Taxiway N is currently insufficient per FAA AC 150/5300-13B.

1.6 Timeframe for Implementation

Construction of Runway 13R-31L and the associated improvements is expected to take approximately 26 months to complete. It is anticipated that construction would begin in August 2026 and end around September 2028.

1.7 Federal Actions

The federal actions necessary in connection with the Proposed Action include:

1. Determinations under 49 U.S. Code (USC) §47106 and §47107, relating to the eligibility of the Proposed Action for federal funding under the Airport Improvement Program,
2. Determination under 49 USC §44502(b) that the Proposed Action is reasonably necessary for use in air commerce or in the interests of national defense, and

3. Continued close coordination with the Project Sponsor and appropriate FAA program offices, as required, to ensure safety during construction in accordance with 14 CFR Part 139, Airport Certification, under 49 USC §44706.
4. Unconditional approval of portions of the ALP that depict those portions of the Proposed Project subject to Federal Aviation Administration (FAA) review and approval pursuant to 49 USC § 47107(a)(16).

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2.0 ALTERNATIVES

FAA Orders 1050.1F, *Environmental Impacts Policies and Procedures*, and 5050.4B, *Implementing Instructions for Airport Actions*, set forth policies and procedures to be followed when assessing the environmental impacts of aviation-related projects, in compliance with NEPA. FAA Orders and 40 CFR § 1502.14 require a thorough, objective assessment of all “reasonable” alternatives that would achieve the stated purpose and need of the Proposed Action, as well as a succinct discussion of the reasons for their elimination from detailed study. At a minimum, the range of reasonable alternatives must include the Proposed Action and the No Action Alternative.

The alternatives analysis presented in this EA is consistent with the requirements of FAA Orders 1050.1F and 5050.4B. Only those alternatives that would satisfy the purpose and need were carried forward in the environmental impact analysis.

As indicated in **Chapter 1**, the purpose and need for the Proposed Action has been carefully examined and documented. This alternatives analysis was prepared to determine which alternatives might feasibly meet the purpose and need.

2.1 Alternatives Considered and Dismissed

HAS considered milling and overlaying the pavement with 4 inches of asphalt pavement to minimize impacts and the length of time the runway will be out of commission. However, HAS expressed concern with milling and overlaying the runway as it would likely only provide a few years of service before another major rehabilitation project would be needed. Additionally, 16 panels of the runway would require full-depth concrete reconstruction.[4] Due to the fact that the runway is at the end of its life (with less than five years remaining), it was determined that partial reconstruction and milling and overlaying the runway would not be an appropriate course of action because it would not provide a runway that meets current FAA design and safety criteria (geometry) in a reasonable timeframe. Additionally, this alternative would result in multiple interruptions to aircraft operations and would not support airport operations.

2.2 No Action Alternative

Inclusion of a No Action Alternative in the environmental analysis and documentation is required under NEPA. The No Action Alternative is used to evaluate the effects of not constructing the project, thus providing a benchmark against which action alternatives may be evaluated. Under the No Action Alternative, Runway 13R-31L would remain in its current state, and improvements would not be implemented. Runway and taxiway pavements would continue to deteriorate, continuing to create unsafe conditions for aircraft operations. Repairs and/or replacements of panels on runways or taxiways would continue to occur on an as-needed basis requiring temporary closures. FAA safety criteria would not be met, and the airfield would not meet operational needs for airfield safety and efficiency. Eventually, the runway would be closed to operations because it could not be safely operated, adversely affecting airport operations.

Under the No Action Alternative, the taxiway connectors would remain in their current state. FAA safety standards would not be met, and operational inefficiencies would occur. **Figure 3** displays the existing conditions at the Airport.

[4] See *2022 Airside Pavement Condition Assessment*, prepared for Houston Airport System, dated March 2023.

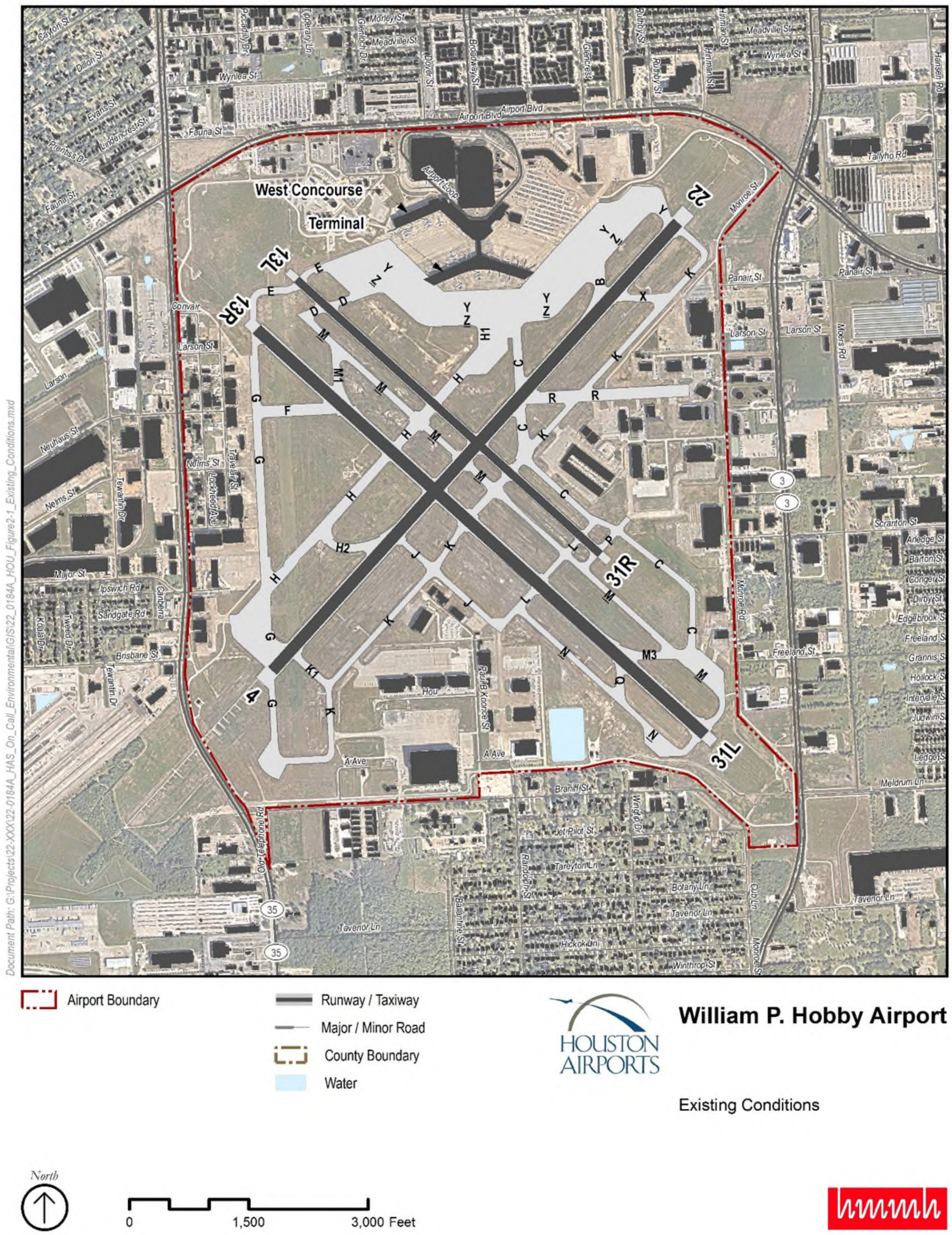

Figure 3. Existing Conditions

The No Action Alternative does not meet the project purpose and need but is carried forward in the analysis of environmental consequences as the baseline, in accordance with NEPA, FAA Order 1050.1F: *Environmental Impacts Policies and Procedures*, and FAA Order 5050.4B: *Implementing Instructions for Airport Actions*.

2.3 Proposed Action (Preferred Alternative)

This section describes the elements of the Proposed Action and how the Proposed Action addresses the stated Purpose and Need described in **Chapter 1** of this EA. If approved, construction of the Proposed Action is anticipated to begin in August 2026. **Figure 4** displays the Proposed Action.

The Proposed Action would include full reconstruction of Runway 13R-31L and taxiway connections at Taxiways H, M1, L, K, Q, M3, and M/N. Reconstruction activities include demolition and excavation of existing pavement, grading, and installation of new sub-base, base course, and pavement. Taxiway F would include milling and overlaying the center 50 feet (keel section) of the taxiway for general aviation use. The estimated square footage of the runway and taxiway components is shown in **Table 1**.

Table 1. Estimated Disturbance Areas by Project Component

Project Component	Estimated Disturbance Area (square feet)	Type(s) of Work
Runway 13R-13L	1,399,850	Demolition and reconstruction
Taxiway H	20,100	Demolition and reconstruction
Taxiway M1	108,150	Demolition and reconstruction
Taxiway L	40,850	Demolition and reconstruction
Taxiway K	31,400	Demolition and reconstruction
Taxiway F	44,400	Reconstruction (mill and overlay)
Taxiway Q	34,625	Demolition and reconstruction
Taxiway M3	74,000	Demolition
Taxiway M3	106,950	Reconstruction
Taxiway M/N connections at Runway 31L runway end	78,125	Demolition and reconstruction

The Proposed Action also includes replacement of equipment inside the existing North Vault building. This would include replacing all the existing constant current regulators (CCRs) and the Airfield Lighting Control and Monitoring System (ALCMS). Improvements could include replacement of the power distribution equipment, replacement of input cables, and replacement of field circuits. The existing emergency generator may also be replaced. All improvements would be confined to the existing North Vault building. ALCM improvements would include upgrading the control interface at each node, which are the North Vault, South Vault, Air Traffic Control Tower, and the Airfield Service Center. Work would include replacing the PC controllers at both the north and south vaults and removing the existing relay panels at both vaults. At the tower and airfield service center, the touch screen interfaces would also be replaced.

The Proposed Action would also involve pavement shoulder upgrades, pavement marking, electrical signage, lighting system upgrades (including upgrades to the MALSR at the north end of Runway 13R), and drainage improvements. These components would be designed and constructed to support the efficient use of the proposed runway and taxiway connectors.

The proposed location of the MALSR and North Vault improvements as well as the contractor haul routes and contractor staging areas are shown on **Figure 4**.

Construction activities are expected to begin in August 2026 and end around September 2028. Reconstruction of Runway 13R-31L would take approximately 26 months to complete. Taxiway connectors would be constructed at various times during the runway reconstruction period. Work on the taxiways would be planned in a way that minimizes impacts on airport operations during construction.

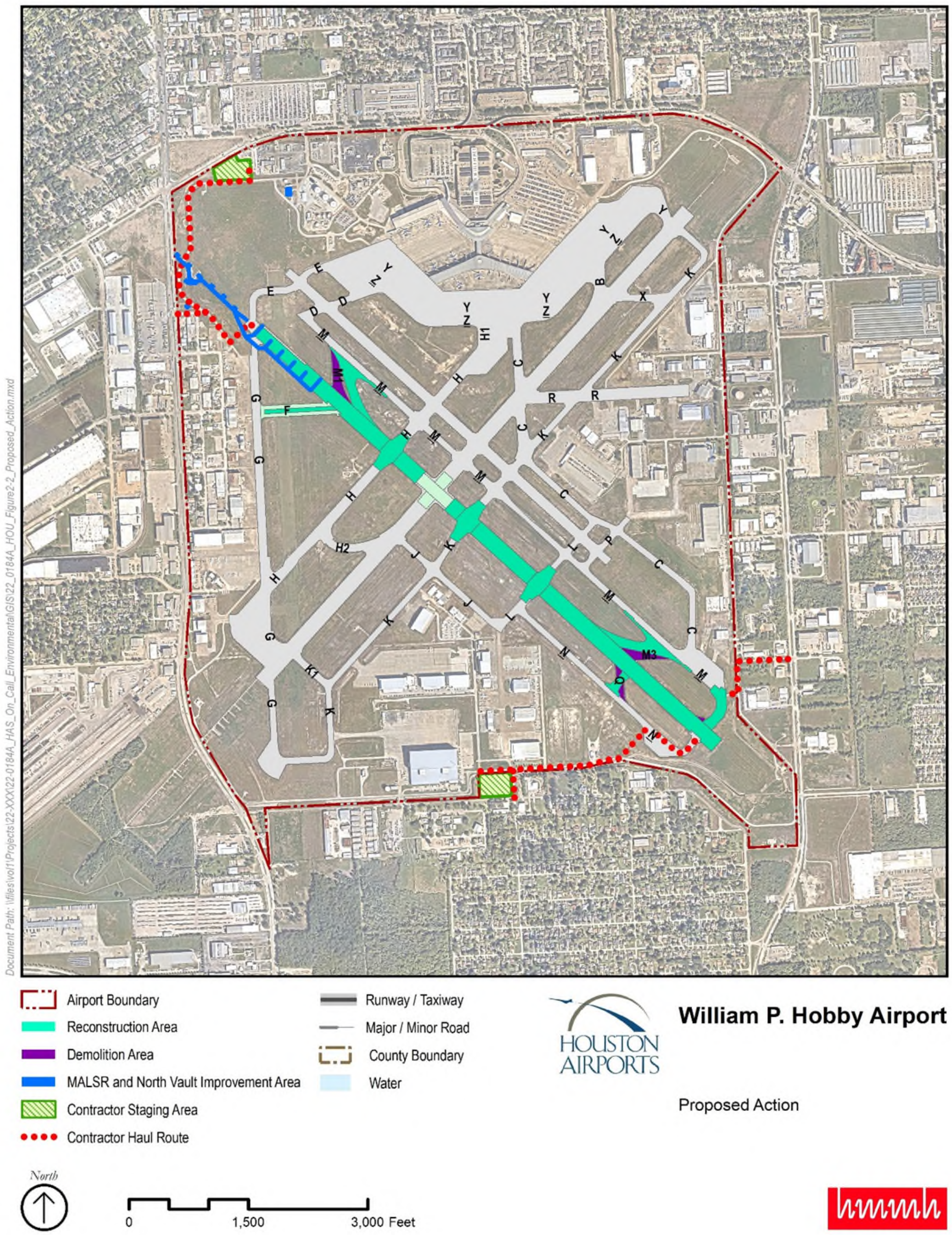

Figure 4. Proposed Action

2.4 Connected Actions

The FAA defines connected actions as "closely related actions that (a) automatically trigger other actions; (b) cannot or will not proceed unless other actions are taken previously or simultaneously; or (c) are interdependent parts of a larger action and depend on the larger action for their justification. Connected actions and other proposed actions or parts of proposed actions that are related to each other closely enough to be, in effect, a single course of action must be evaluated in the same EA or EIS."[5]

Actions that are located in close geographic proximity and timing to the Proposed Action include the following:

- Runway 4-22 electrical and shoulder upgrades
- Taxiway M Rehabilitation.

The FAA has determined that the two actions listed above have independent utility because each project can occur and satisfy a purpose and need even if no other project (or portion of another project) is implemented; therefore, while they are connected by geographic proximity and proposed construction schedules, they are not, in effect, a single course of action and therefore do not need to be evaluated in this EA as connected actions.

[5] See FAA Order 1050.1F, Section 2-3 b (1).

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter provides a description of the affected environment and potential environmental effects for the environmental impact categories that have the potential to be affected by the No Action Alternative and the Proposed Action.

All analyses follow the guidance included in FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions; FAA Order 1050.1F, Environmental Impacts: Policies and Procedures; and the provisions of appropriate CEQ, FAA environmental regulations and guidance, and all applicable federal, state, and local laws.

As required by FAA Order 1050.1F, the environmental impact categories assessed in this EA include:

- Air quality
- Biological resources (including fish, wildlife, and plants)
- Climate
- Department of Transportation Act, Section 4(f)
- Historical, architectural, archeological, and cultural resources
- Land use
- Natural resources and energy supply
- Noise and noise-compatible land use
- Socioeconomics, environmental justice, and children's environmental health and safety risks
- Visual effects
- Water resources
- Cumulative impacts

The level of detail provided in this chapter is commensurate with the importance of the potential impact on the resources (40 CFR § 1502.15). EAs are intended to be concise documents that focus on aspects of the human environment that may be affected by the proposed action.

The FAA uses thresholds that serve as specific indicators of significant impact for some environmental impact categories (FAA Order 1050.1F, Paragraph 4-3). Proposed actions that would result in impacts at or above these thresholds require the preparation of an EIS, unless impacts can be reduced below threshold levels. The FAA has not established significance thresholds for all impact categories; for those impact categories without a significance threshold, the FAA has identified factors to consider in evaluating the significance of potential environmental impacts. If these factors exist, there is not necessarily a significant impact. After consideration of all relevant factors, the FAA determines whether there would be a significant impact.

3.1 Environmental Impact Categories Not Analyzed in Detail

This section describes resources that would not be affected by the Proposed Action and are therefore not discussed further in this EA.

- **Coastal Resources:** The Texas Coastal Management Plan (TX CMP) governs the management of coastal resources along the Gulf Coast. The closest point of HOU property is located approximately 0.5 mile from the TX CMP boundary. HOU is not located within the area covered under the TX CMP, nor would the Proposed Action have reasonably foreseeable impacts on coastal resources.
- **Farmlands:** The Proposed Action would be completed on existing Airport right-of-way, purchased prior to August 4, 1984. Per Natural Resource Conservation Service guidance, construction within an existing right-of-way purchased on or before August 4, 1984, is not subject to the Farmland Protection Policy Act.
- **Hazardous Materials, Solid Waste, and Pollution Prevention:** The West Concourse EA that was approved in 2024 included a detailed American Society Testing and Material database search and review of the Texas Railroad Commission Public GIS Viewer.[6] No sites of concern that would be affected by the Proposed Action were identified.
- **Wild and Scenic Rivers:** The U.S. Department of the Interior designates Wild and Scenic Rivers to protect rivers with remarkable scenic, recreational, geological, fish and wildlife, historic, or other similar values. The Rio Grande at Big Bend is the only river in Texas that is designated as a Wild and Scenic River. The Rio Grande at Big Bend is located in Big Bend National Park, approximately 600 miles from HOU. The closest designated Wild and Scenic River is Saline Bayou in Louisiana, approximately 225 miles northeast of HOU. The Proposed Action would not affect these Wild and Scenic Rivers due to their distance from the Airport.
- **Visual Effects:** Visual effects deal broadly with the extent to which a project would either (1) produce light emissions that create annoyance or interference with activities or (2) contrast with, or detract from, the visual resources and/or the visual character of the existing environment. The Proposed Action would replace the existing Runway 13R-31L and its associated taxiway connectors and improvements in-kind. As a result, the Proposed Action would not result in a change in light emissions that would create annoyance or interference with activities, nor would it contrast with or detract from the visual resources or visual character of the existing environment which is an active airfield.

3.2 Area of Analysis

The Airport is located approximately seven miles southeast of downtown Houston in Harris County, Texas. The affected environment consists of the project area and components illustrated in **Figure 4**.

3.3 Air Quality

The Clean Air Act (CAA) is the comprehensive federal law that regulates air pollutant emissions from stationary and mobile sources and authorizes the U.S. Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) for certain “criteria” air pollutants to protect public health and welfare.

The USEPA established NAAQS for six criteria pollutants: ozone (O_3), lead (Pb), carbon monoxide (CO), nitrogen dioxide (NO_X), sulfur dioxide (SO_X), and particulate matter with an aerodynamic diameter equal to or less than 10 microns (PM_{10}, or coarse particles) and 2.5 microns ($PM_{2.5}$). Areas where concentrations of the criteria pollutants are below (i.e., within) the NAAQS are classified as attainment areas. All areas of the country are required to demonstrate attainment with the NAAQS. Areas that currently do not meet these standards are referred to as nonattainment areas. Other areas, where prior exceedance occurred,

[6] See Appendix E of the *Finding of No Significant Impact and Record of Decision for the West Concourse Expansion Project, William P. Hobby Airport, Houston, Texas,* signed by FAA on January 18, 2024

but that now achieve the standards, are referred to as maintenance areas. Such areas are subject to State Implementation Plans (SIP), which reflect plans by the state for how to achieve (and maintain) compliance with the NAAQS.

3.3.1 Affected Environment

Air emissions at HOU arise from the operation of aircraft, auxiliary power units, ground support equipment, motor vehicles, stationary combustion sources and other miscellaneous airport sources. Air emissions may also result from construction-related activities at HOU.

When determining air quality impacts, it is important to determine whether the project is in an attainment or nonattainment area for the NAAQS. Air quality in the Houston-Galveston-Brazoria area (which includes Harris County) is currently designated as being in attainment for all criteria pollutants except for the 2008 and 2015 8-hour ozone (O_3) standard, which is designated by the USEPA as nonattainment. It should be noted that the USEPA recently reclassified the Houston-Galveston-Brazoria area, including Harris County, for the 2008 ozone standard from serious to severe and the 2015 ozone standard from marginal to moderate. This redesignation will determine the *de minimis* thresholds used for General Conformity Applicability.

3.3.2 Environmental Consequences

The Proposed Action constitutes a federal action being undertaken by the Airport Sponsor and therefore must comply with the CAA. To comply with the CAA, project-related impacts to air quality must conform to the conditions of the applicable SIP, also known as General Conformity.

If a project's net emissions are less than the *de minimis* levels (described below), then the action is considered to be too small to adversely affect the air quality status of the area and is automatically considered to conform with the applicable SIP, thereby complying with General Conformity requirements. The SIP includes the air quality standards and monitoring requirements set by Texas Commission on Environmental Quality (TCEQ) rules.

The USEPA defines *de minimis* levels as the minimum threshold for which a conformity determination must be performed. Under the existing regulations, *de minimis* emission levels are listed for each criteria pollutant by their level of attainment. Annual emission rates in tons of pollutant per calendar year are used. Because O_3 is not directly emitted by mobile sources but is formed when heat and sunlight cause chemical reactions between NO_X and volatile organic compounds (VOCs) in the atmosphere, it affects the *de minimis* thresholds of NO_X and VOC emissions. The relevant *de minimis* thresholds of these two pollutants for Harris County, Texas are 25 tons per year, based upon the severe nonattainment status for O_3.

The FAA considers air quality impacts to be significant if an action will cause pollutant emissions above annual *de minimis* thresholds, or cause pollutant concentrations to exceed one or more of the NAAQS for any of the time periods analyzed or increase the frequency or severity of any existing violations.

HOU is located in Harris County, which is currently designated by the USEPA Greenbook as being in nonattainment with the 2008 (severe) and 2015 (moderate) 8-hour O_3 standard.[7] The remaining criteria pollutants, SO_2, CO, PM_{10}, $PM_{2.5}$ and Pb are designated attainment with the NAAQS. Because the Houston-

[7] US EPA Green Book, https://www3.epa.gov/airquality/greenbook/anayo_tx.html. Accessed September 2024

Galveston-Brazoria area is designated nonattainment for some pollutants, the General Conformity Rule applies to the Proposed Action.

Federal USEPA *de minimis* emission thresholds for nonattainment areas relevant to Harris County are listed in **Table 2**. As noted in the table, pollutants designated as attainment do not have USEPA *de minimis* thresholds; therefore, as a conservative assumption, the maintenance *de minimis* thresholds were used to determine significant impacts under NEPA for attainment pollutants.

Table 2. General Conformity USEPA *De Minimis* Pollutant Emission Thresholds

Pollutants	Attainment Status (Severity)	Pollutants	Threshold (tons per year)
CO	**Attainment** Note 2	CO	**100**
O_3 Note 1	**Severe**	NO_X	**25**
O_3 Note 1	**Severe**	VOC	**25**
$PM_{2.5}$	**Attainment** Note 2	$PM_{2.5}$	**100**
PM_{10}	**Attainment** Note 2	PM_{10}	**100**
SO_2	**Attainment** Note 2	SO_2	**100**
Pb	**Attainment** Note 2	Pb	**25**

Source: US EPA *De Minimis* Tables https://www.epa.gov/general-conformity/de-minimis-tables, US EPA, 2024
Notes:
1. Following standard industry practice, O_3 was evaluated by evaluating emissions of VOC and NOx, which are precursors in the formation of O_3.
2. Pollutants designated as attainment, no *de minimis* threshold exists for attainment pollutants. As a conservative approach, the *de minimis* threshold for maintenance was assumed for determining significance under NEPA.

3.3.2.1 No Action Alternative

The No Action Alternative would not change traffic patterns, increase the number of operations, or otherwise change air quality in the Houston area beyond the existing projected future activity.

3.3.2.2 Proposed Action

Implementation of the Proposed Action would not increase the number of aircraft or change the fleet mix compared to the No Action Alternative; however, runway redistribution of aircraft from Runway 13R-31L to Runway 4-22 would occur during construction. Taxi times were assumed to not change during construction and are based on the Aviation Environmental Design Tool (AEDT) default values for both the Proposed Action and the No Action Alternative. Therefore, emission changes from aircraft operations during construction of the Proposed Action were quantified for the 2027 construction year using the AEDT model. To satisfy NEPA requirements, the operational emission changes of the No Action Alternative and the Proposed Action along with concurrent construction emissions were compared to General Conformity *de minimis* levels for significance.

For the Proposed Action, the runway configuration and redistribution of aircraft are summarized as follows:

- Aircraft that would typically use Runway 13R-31L would move to Runway 4-22 while Runway 13R-31L is being reconstructed. Operations that use Runway 13L-31R would remain the same in the Proposed Action and No Action Alternative.
- No changes to taxi times compared to the No Action Alternative.

AEDT was run using the same set of model inputs that were used for the noise calculations in the Noise Technical Report (see **Appendix C**).

Operational Emissions

Table 3 provides the 2027 aircraft operational emissions for the No Action and Proposed Action as calculated by AEDT. The table also includes Pb emissions utilizing Avgas.

The emissions presented in **Table 3** are the total of the aircraft modes including climb and descent below the mixing height, which includes taxi-in and taxi-out, along with ground support equipment (GSE) and auxiliary power unit (APU). The individual mode contribution to these totals is included in **Appendix A** for each pollutant.

Changes in emissions for the Proposed Action are primarily attributed to the runway redistribution of aircraft during construction from Runway 13R-31L to Runway 4-22. More specifically, the changes in emissions primarily occur during landing and takeoff modes. The emission changes are very slight during landing and takeoff modes for all criteria pollutants between the No Action and Proposed Action. The main contributor to the difference in emissions between the Proposed Acfion and No Acfion Alternafive is the difference in runway end elevafions between Runway 13R-31L and Runway 4-22 (with Runway 13R-31L having a lower elevafion than Runway 4-22). While minor, runway end elevafion does play a part in AEDT's emissions calculafion. Generally speaking, the higher the runway end elevafion, the lower the emissions for most pollutants compared to lower elevafion runway ends at the same airport. This slight change in runway end elevafions contributes to the AEDT's calculafion of most aircraft's climb and descent below the mixing height. Further information on the operational emissions calculation methodology and inputs can be found in **Appendix A**.

Table 3. Operational Criteria Pollutant Emissions Inventory (in TPY) of the 2027 Proposed Action and the No Action During Construction

Activity	Relevant Criteria Pollutant Emissions (tons per year) Note 1						
	CO	VOC[1]	NO_x [1]	SO_2	PM_{10}	$PM_{2.5}$	Pb [2]
2027 No Action							
Climb and Descent below the Mixing Height[3]	131.87	46.94	572.11	45.56	3.829	3.829	0.024180
Taxi In/Taxi Out	405.63	88.05	54.47	18.84	1.305	1.305	0
APU	37.88	2.25	31.25	4.87	4.059	4.059	0
GSE	341.04	9.19	8.84	0.07	0.465	0.427	0
Total 2027 No Action Alternative	**916.41**	**146.42**	**666.67**	**69.35**	**9.66**	**9.62**	**0.024180**
2027 Proposed Action							
Climb and Descent below the Mixing Height[3]	131.96	46.94	571.14	45.49	3.823	3.823	0.024182
Taxi In/Taxi Out	405.63	88.05	54.47	18.84	1.305	1.305	0
APU	37.88	2.25	31.25	4.87	4.059	4.059	0
GSE	341.04	9.19	8.84	0.07	0.465	0.427	0
Total 2027 Proposed Action	**916.51**	**146.42**	**665.69**	**69.28**	**9.65**	**9.61**	**0.024182**
Net Change							
Proposed vs. No Action[4]	**0.09**	**0.00**	**-0.97**	**-0.07**	**-0.01**	**-0.01**	**0.000002**

Source: HMMH, October 2024
APU = Auxiliary Power Units
GSE = Ground Support Equipment

Notes:

1. Following standard industry practice, O_3 was evaluated by evaluating emissions of VOC and NOx, which are precursors in the formation of O_3.
2. Pb emissions were estimated externally using EPA's Pb emissions calculation procedures as referenced in Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2011 National Emissions Inventory.
3. Criteria pollutant emissions were estimated for aircraft operations below the mixing height (3,000 feet) for departure and approach.
4. Totals may not exactly match due to rounding.

<u>*Construction Emissions*</u>

Airport Cooperative Research Program Report 102, *Guidance for Estimating Airport Construction Emissions*, published in 2014, provided a software tool (the Airport Construction Emissions Inventory Tool, or ACEIT) to analyze the construction emissions for airport construction projects. The ACEIT incorporates default emission factors from the EPA MOVES 2014 model and other sources to capture the resulting Non-Road, On-Road, and fugitive emissions produced by airport construction projects. However, since the ACEIT was published, the USEPA has released updates to MOVES (2014b, 3.0.x, and 3.1.0) and recommends that the current MOVES 3.1.0 (released November 2022) be used to determine the appropriate emission rates to use in current projects.

This effort was therefore carried out using the ACEIT tool to estimate construction equipment uses and using MOVES 3.1.0 emission rates to estimate the construction emissions of the project and assess whether they meet the requirements for environmental approval.

The methodology and level of analysis for any conformity analysis is determined by the expected emissions and potential environmental impacts due to a project. This project was expected to result in emissions below *de minimis* levels. Therefore, a high-level, conservative approach was used to verify that this is indeed the case. The recently updated MOVES includes changes to the non-road emission factors which include a number of enhancements including changes to the non-road emission factors.

The approach for construction emissions analysis included the following steps:

- Use the ACEIT software to estimate the project parameters for construction activities, their equipment types, and intensities for the project (hours and load factors)
- Use the MOVES software to develop new Non-Road and On-Road emission rates by vehicle type, activity, and intensity (horsepower-hours, or vehicle miles traveled).
- Apply the MOVES emission rates to the ACEIT project parameters to estimate updated emissions by criteria pollutant and compare with the EPA de-minimis thresholds for additional conformity analyses.

Temporary emissions would occur during construction of the Proposed Action. Emissions for all included project elements were calculated using the construction equipment fleet and usage outputs from the ACEIT.

On-road emissions for material transportation were included, but emissions from construction worker commutes were not considered, because commute emissions are typically not factored into project-specific emissions. While project construction will likely span approximately 26 months, construction emissions were calculated to occur within a single year to most conservatively analyze emissions. If the project would not exceed the NAAQS if condensed into one year, it would not do so in any given year of construction. **Table 4** shows that *de minimis* thresholds will not be exceeded for full project construction for the pollutants related to the production of O_3, NO_x and VOCs. Further information on the construction emissions calculation methodology and inputs can be found in **Appendix A**.

Table 4 presents the construction emissions associated with demolition and construction of the Proposed Action and the net Aircraft Operation emissions (Proposed Action minus No Action) for the construction year periods compared with the appropriate USEPA *de minimis* thresholds.

As discussed above, demolition and construction activities associated with the Proposed Action are expected to begin in August 2026 and be completed around September 2028. Similarly for aircraft operations, representative years were also evaluated for periods during the construction for Alternative 2027 which represents the worst-case construction year. The corresponding construction and net operational emissions were added together to get a total net increase in emissions for each year and compared to the appropriate *de minimis* thresholds.

Table 4. Construction and Net Operational Emissions for the Proposed Action for Each Year Compared to USEPA *De Minimis* Thresholds

Construction Year	Relevant Criteria Pollutant Emissions (tons per year)[2]						
	CO[1]	NOx	SO_2[1]	PM_{10}[1]	$PM_{2.5}$[1]	VOC	Lead[1]
2026 **Construction Emissions**	9.32	5.90	0.036	2.36	0.38	1.20	0
USEPA de minimis Threshold	***100***	***25***	***100***	***100***	***100***	***25***	***25***
Emissions below de minimis thresholds?	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***
2027 Construction Emissions	28.06	9.05	0.065	3.91	0.60	4.99	0
2027 Net Aircraft **Operational Emissions Delta** ***(Proposed Action minus No Action)***[3]	0.09	-0.97	-0.07	-0.01	-0.01	0.0	0.000002
2027 Total Emissions (Construction + Net Operational)	28.15	8.08	-0.005	3.90	0.59	4.99	0.000002
US EPA de minimis Threshold	***100***	***25***	***100***	***100***	***100***	***25***	***25***
Emissions below de minimis thresholds?	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***

Source: HMMH, October 2024
Notes:
1. General Conformity does not apply for these pollutants in the HOU area because the area is designated attainment/unclassifiable for these NAAQS. The General Conformity *de minimis* threshold for maintenance area were conservativity used to determine significance under NEPA for these pollutants.
2. Pb emissions for construction emissions were not estimated since the fuel use for these sources are gasoline and diesel which do not contain Pb.
3. Net Aircraft emissions minus Total Proposed No Action Aircraft.

As shown in **Table 4**, the total emissions each representative year for construction and net aircraft emissions would be below established *de minimis* thresholds for all pollutants. Therefore, a General Conformity determination is not required for the construction and demolition activities for the Proposed Action. Additionally, in accordance with the FAA 1050.1 Desk Reference,[8] the Proposed Action can be determined to "not cause a significant air quality impact, since it is unlikely the pollutant concentration

[8] FAA 1050.1 Desk Reference, https://www.faa.gov/about/office_org/headquarters_offices/apl/environ_policy_guidance/policy/faa_nepa_order/desk_ref. Accessed August 2024

analyzed would exceed a NAAQS." No significant adverse air quality impacts would be expected to result from construction of the Proposed Action.

3.3.3 Mitigation and Minimization

Air quality impacts associated with construction or operation of the Proposed Action would not be significant; therefore, no mitigation measures are required for construction or operational emissions. However, HAS is committed to best management practices and reasonably available control measures to further minimize air emissions. Some examples may include but are not limited to:

- Construction sequencing or phasing,
- Use of equipment that meets Tier IV emission standards, and
- Minimization of exposed soils at any given time during construction activities.

3.4 Biological Resources

Biological resources are defined as the various types of flora and fauna in a particular area as well as rivers, lakes, wetlands, forests, upland communities, and other habitats supporting flora and aquatic and avian fauna. Although the existence and preservation of biological resources are intrinsically valuable, these resources also provide aesthetic, recreational, and socioeconomic values to society. This analysis focuses on species or vegetation types that are protected under federal or state law or statute.

Regulations and guidance related to biological resources include the Endangered Species Act (ESA) (16 U.S.C. §§ 1531-1544), the Fish and Wildlife Coordination Act (16 U.S.C. §§ 661-667d), the Migratory Bird Treaty Act (16 U.S.C. § 703 et seq.), Executive Order 13112 (Invasive Species), as well as various state and local regulations. The US Fish and Wildlife Service (USFWS) is the federal agency responsible for the ESA, the Fish and Wildlife Coordination Act and the Migratory Bird Treaty Act (MBTA).

The ESA requires all federal agencies to conserve threatened and endangered species and, in consultation with the USFWS, to ensure federal actions do not jeopardize the existence or destroy critical habitat of threatened and endangered species. Coordination on species and habitats of concern is administered under Section 7 of the ESA, which requires federal agencies to consult the USFWS and appropriate state and tribal fish and wildlife agencies when a federal project may adversely affect fish or wildlife resources.

A species is considered endangered if it is in danger of extinction throughout all or a significant amount of its range. Threatened species are those that are likely to become endangered in the foreseeable future. Candidate species, which may be listed as threatened or endangered in the future, are not provided any protection under the ESA.

Texas Parks and Wildlife Department (TPWD) is the state agency that is responsible for conservation and wildlife management within the state. TPWD regulations prohibit the taking, possession, transportation, or sale of any of the animal species designated by state law as endangered or threatened without a permit.

3.4.1 Affected Environment

The existing habitat at the project site consists of predominantly existing pavement and some maintained grasses within a previously disturbed, active airfield that does not contain habitats for listed species or nests of protected bird species. Furthermore, in compliance with airport safety standards related to aircraft striking wildlife, vegetation, surface water, and other potential habitat features within HOU are controlled to reduce wildlife attractants. Vegetated areas on the property primarily consist of mowed areas of grasses and herbs such as Bermudagrass (*Cynodon dactylon*), little bluestem (*Schizachyrium scoparium*), bahiagrass (*Paspalum notatum*), and St. Augustine grass (*Stenotaphrum secundatum*). In addition, fencing is maintained around the airport which further limits wildlife presence within the property.

A site visit was conducted on November 16, 2022, to document habitats and the presence/absence of threatened and endangered species. Photographs of the project area were taken in October 2024 to confirm conditions had not changed since the site visit. No threatened or endangered species or their habitats were observed during the site visit. Furthermore, the Proposed Action area does not contain any USFWS-designated critical habitat or any suitable migratory bird or eagle nesting habitat.

Invasive Species

Executive Order 13112, *Invasive Species*, dictates that federal agencies whose actions may affect invasive species must, to the extent feasible within budgetary limits, prevent the introduction of invasive species and restore native species or habitats. Invasive species are plants or animals that are non-native to the ecosystem and may harm native ecological or economic conditions of a region once introduced. Texas Administrative Code (4 TAC §19.300(a)) lists 26 noxious and six invasive plant species that have serious potential to cause economic or ecological harm to the state. None of the plants on this list were identified at HOU during the site visit.

“Texas Invasives" is a partnership organization run by the Texas Invasive Plant and Pest Council; Texas Invasive Plant and Pest Council provides a database of plants and animals considered to be invasive in the state of Texas. The database identified Bermudagrass and bahiagrass to be on the Invasive Plant Atlas of the U.S. No other plants identified at HOU during the site visit were included in the database.[9]

Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act

The MBTA of 1918 (16 U.S.C. §§703-711) prohibits taking, selling, or other activities that harm migratory birds, bird eggs, or nests unless authorized by a special USFWS permit. Migratory bird species protected under the MBTA are listed in 50 CFR 10.13.

The Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. §§668-668d) provides protection to eagles and nests from unauthorized capture, purchase, or transportation. This regulation prevents the exploitation of eagles and protects their continued survival in the U.S.

No trees or vegetation suited to serve as nesting habitat for migratory birds or eagles are located within the Proposed Action area.

Endangered Species Act

Databases identifying threatened and endangered species within Harris County are available through the USFWS Information for Planning and Consultation (IPaC) website[10] and the TPWD Texas Natural Diversity Database (TxNDD).[11] The USFWS IPaC lists four species with federal-listing status (one endangered and

[9] See www.texasinvasives.org
[10] See https://ipac.ecosphere.fws.gov/location/index
[11] See https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/txndd/

three threatened), one proposed endangered species, one proposed threatened species, and one candidate species for Federal listing as potentially occurring in the Proposed Action area.

The species federally-listed as endangered is the Whooping Crane (*Grus Americana*). The three species Federally-listed as endangered are the Eastern Black Rail (*Laterallus jamaicensis*), Piping Plover (*Charadrius melodus*), and Red Knot (*Calidris canutus rufa*). The Tricolored Bat (*Perimyotis subflavus*), a proposed endangered species, the Alligator Snapping Turtle (*Macrochelys temminckii*), a proposed threatened species, and the Monarch Butterfly (*Danaus plexippus*) a candidate species, were also included on the IPaC. There is no USFWS-designated critical habitat for any listed species in the Proposed Action area. No endangered or threatened species were documented during the 2022 site visit.

The TPWD maintains the TxNDD, which provides occurrence records of federally and state-listed threatened and endangered species throughout Texas. The TPWD lists an additional 20 species with federal listing status as potentially occurring in Harris County, found in the natural resources report in **Appendix B**. A review of the TxNDD information indicates that there are no TxNDD occurrence records for any federally listed species within a one-mile radius of the Proposed Action area.

3.4.2 Environmental Consequences

According to the FAA 1050.1F Desk Reference, the FAA considers impacts on listed species to be significant if the "U.S. Fish and Wildlife Service or the National Marine Fisheries Service determines that the action would be likely to jeopardize the continued existence of a Federally listed, threatened, or endangered species, or would result in the destruction or adverse modification of Federally designated critical habitat." The FAA has not established a significance threshold for non-listed species.

3.4.2.1 No Action Alternative

The No Action Alternative would not change existing site conditions or habitats. Therefore, there would be no impacts to fish, wildlife, or plants.

3.4.2.2 Proposed Action

The Proposed Action includes demolition and reconstruction of approximately 1,938,450 square feet of pavement, and actions that enhance pavement markings, electrical signage, and lighting systems. Highly disturbed areas, buildings, pavement for taxiways and runways, and mowed/maintained grasses do not allow a hospitable environment for the Red Knot, Eastern Black Rail, Piping Plover, Whooping Crane, or Alligator Snapping Turtle, all of which require marsh, shore, or wetlands to thrive. Additionally, these areas do not allow a hospitable environment for the Tricolored Bat, which requires mature trees and/or road-associated culverts. No federally listed species have the potential to be impacted by the Proposed Action due to airport development, ongoing vegetation management practices, and lack of suitable habitat as an active airport environment.

With regard to TPWD listed species and species protected under the MBTA, the area affected by the Proposed Action likewise does not contain habitat suitable for state-listed species or that would contain nests.

Based on the information above and established FAA thresholds of significance, there are no significant impacts to biological resources associated with the Proposed Action.

3.4.3 Mitigation and Minimization

No mitigation or minimization is required or recommended.

3.5 Climate

Greenhouse gases (GHGs) are those that trap heat in the earth's atmosphere, both naturally occurring and anthropogenic (manmade). The FAA 1050.1F Desk Reference defines GHG emissions as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The guide notes that CO_2 is the most important GHG emitted by human activity because of its long life of up to 100 years in the earth's atmosphere. It is also the only GHG that is a direct aircraft combustion product.

Research has shown that there is a direct link between fuel combustion and GHG emissions. Therefore, sources that require fuel or power at an airport are the primary airport GHG sources. The FAA 1050.1F Desk Reference states that considering GHG emissions for a NEPA review should follow the basic procedure of considering the potential incremental change in carbon dioxide equivalent (CO_2e) emissions that result from the Proposed Action compared to the No Action Alternative for the same timeframe.

An EA should also discuss the context for interpreting and understanding the potential changes. In January 2023, CEQ issued the *Interim Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*.[12] In this interim Guidance, the CEQ states, "NEPA reviews should quantify proposed actions, place GHG emissions in appropriate context and disclose relevant GHG emissions and relevant climate impacts and identify alternatives and mitigation measures to avoid or reduce GHG emissions."

Airport development has the potential to both affect climate change and to be affected by it. Changes in resource categories such as air quality and natural resources and energy supply can potentially contribute to climate change by increasing the amount of GHGs emitted. Conversely, some airport projects may be impacted by the potential effects of climate change, such as rising sea levels and increased/more intense storm events. As such, when conducting climate change analyses in NEPA reviews, agencies should consider the potential effects of a Proposed Action on climate change, including changes to GHG emissions, as well as the effects of climate change on a Proposed Action.

3.5.1 Affected Environment

Based on FAA data, operations activity at HOU relative to aviation throughout the United States represents less than 1 percent of U.S. aviation activity. Assuming that GHG emissions occur in proportion to the level of activity, GHG emissions associated with existing aviation activity at HOU would be expected to represent less than 0.03 percent of U.S.-based GHGs.

3.5.2 Environmental Consequences

Neither the FAA 1050.1F Desk Reference, nor the 2023 CEQ interim guidance have established a set of GHG emissions thresholds for aviation. NEPA documents typically do not attempt to link specific project emissions to climatological changes because the specific impacts are difficult to analyze. The overall reduction of aviation related GHG emissions impacts on climate is a goal, but it is not a regulatory mandate.

[12] 2023-01-CEQ interim guidance on GHG emissions and climate change.pdf (energy.gov)

For this analysis, GHG emissions were quantified to enable the FAA to make an informed decision whether the Proposed Action would have the potential to cause significant climate change effects. GHG emissions inventories were modeled using MOVES3 for the construction emissions and AEDT version 3e for the operational emissions.

The inventories were conducted to provide the estimate of the annual rate of GHG emissions attributable to airport sources (direct and indirect) for the No Action Alternative and the Proposed Action. The GHG emissions inventories were prepared using the same data and assumptions as developed for the air quality criteria pollutant emissions inventories.

GHG emissions inventories were developed for the construction years of 2026 and 2027.

3.5.2.1 No Action Alternative

The No Action Alternative would not result in development or a change in the number of aircraft operations or air traffic routes; therefore, no new impacts to the climate associated with construction would occur. GHG emissions would continue to increase based on forecasted operations due to natural growth.

3.5.2.2 Proposed Action

Greenhouse Gas Emissions

Table 5 presents the annual GHG emissions for construction activities associated with the Proposed Action for years of 2026 and 2027, respectively. **Table 6** presents the annual GHG emissions for aircraft operations during the 2027 construction period (representative worst-case construction year) for the No Action and Proposed Action.

According to the FAA Order 1050.1F Desk Reference, there are no federal significance thresholds for GHG emissions, nor has the FAA identified specific factors to consider in making a significance determination for GHG emissions. As ongoing scientific research works to improve the understanding of aviation's relationship to climate change, FAA guidance will evolve if new federal requirements are established. Given the low percentage of overall emissions generated at HOU, the increase in construction and operational emissions as a result of the project is not substantial on a national or global scale.

Table 5. GHG Emissions Associated with Construction/Demolition for Proposed Action for Each Construction Year

Construction Year	Relevant Greenhouse Gas Emissions (metric tons per year)			
	CO_2	N_2O	CH_4	CO_{2e}
2026	5,104	0.055	0.018	5,119
2027	10,413	0.090	0.059	10,439

Source: HMMH, 2024
Notes:
1. Construction emissions derived from ACEIT, MOVES, and TEX2.2 consistent with FAA Emission and Air Quality Handbook Version 4.
2. GWP values derived from IPCC Sixth Assessment Report were used in the calculations of CO_2e.
3. Emissions presented in the table include the GWP for each pollutant.

Table 6. GHG Emissions Associated with Aircraft Operations for the 2027 Construction Year No Action and Proposed Action

Activity	Relevant Greenhouse Gas Emissions (metric tons per year)			
	CO_2	N_2O	CH_4	CO_{2e}
2027 No Action				
Aircraft Operations	243,228	6.800	0.160	245,089
2027 Proposed Action				
Aircraft Operations	243,096	6.796	0.160	244,956
Delta (Proposed Action – No Action)	**-132**	**-0.004**	**0.00**	**-134**

Source: HMMH, October 2024
Notes:
1. Emissions in the table include the GWP for each pollutant.
2. Aircraft GHG emissions were derived from AEDT full flight fuel burn consistent with FAA AQ Handbook Version 4 and includes all aircraft modes, GSE and APUs.
3. GSE GHG emissions were calculated externally using TEXN2.2 NONROAD emission factors and were added to the aircraft GHG totals.
4. GWP values for aircraft derived from IPC 6th Assessment Report were used in the calculation of CO_2e.

Estimated Social Cost

The CEQ's Interim *Guidance on Consideration of Greenhouse Gas Emissions and Climate Change* provides directions to better assess and disclose climate impacts. The interim guidance recommends contextualizing GHG emissions by developing the social cost of carbon dioxide equivalents (SC-CO_2e) for proposed actions. This is consistent with the FAA Handbook Version 4, which also includes contextualizing GHG emissions and climate effects using the SC-GHG. This contextualization method translates the metric tons of emissions for a project into a monetary value that describes the net social costs of increasing GHG emissions as well as the net social benefits of reducing such emissions.

SC-CO_2e is an estimate of the economic costs of emitting one additional ton of CO_2 into the atmosphere, and thus the benefits of reducing emissions. It provides a monetary measure (in U.S. dollars) of the future damages associated with specified quantities of GHG resulting from the Proposed Action (e.g., changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services). To provide a contextualized monetary measure of the three main GHGs, the SC-GHG was calculated for the CO_2e, CH_4, and N_2O emissions for the Proposed Action (construction and net operations), summarized in **Table 7**. These costs were calculated using the Interagency Working Group (IWG) 2021 *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990*.[13]

Table 7. Proposed Action Estimated Social Cost of Carbon Dioxide Equivalents (SC-CO2e) in U.S. Dollars by IWG Average Discount Rates for Construction and Net Operations Activity

Year	Estimated Social Cost by Pollutant (in 2020 Dollars)			
	CO_2	CH_4	N_2O	Total
Construction - Build Alternative 1 (2026)				
5%	$88,810	$15	$384	$89,209
3%	$291,949	$32	$1,175	$293,155
2.5%	$429,757	$41	$1,680	$431,478
3% 95th Percentile	$880,950	$83	$3,031	$884,065
Construction - Build Alternative 1 (2027)				
5%	$185,351	$50	$647	$186,048
3%	$608,119	$107	$1,958	$610,183
2.5%	$889,270	$136	$2,802	$892,208
3% 95th Percentile	$1,834,771	$280	$5,065	$1,840,115
Net Operations - 2027				
5%	$-2,350	$0	$-29	$-2,378
3%	$-7,709	$0	$-87	$-7,796
2.5%	$-11,273	$0	$-125	$-11,398
3% 95th Percentile	$-23,258	$0	$-226	$-23,484

Notes:
Construction emissions from Table 5 were used to estimate social costs by pollutant for each construction year.
Net Operations emissions from Table 6 were used to estimate social costs by pollutant for Net Operations 2027 year.
Source: United States Government, Technical Support Document, https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

The SC-GHGs were calculated using the IWG average discount rates: 5 percent, 3 percent, 2.5 percent and the 95th percentile damage estimate using the 3-percent discount rate interpolated between 2025, 2030, 2035, and 2040 to get the years between reflective of the construction and operations period for each Alternative. The 5 percent, 3 percent, and 2.5 percent discount rates reflect the average damages from the multiple simulations at each of the three discount rates. The 95th percentile of damages estimated by applying the 3-percent discount rate reflect higher-than-expected economic impacts from climate change and the associated future economic effects; this is a low probability and high damage scenario that represents an upper bound of damages within the 3-percent discount rate model.

The calculations of social costs for the four discount rates (5 percent, 3 percent, 2.5 percent, and 95th percentile of the 3 percent) were completed for GHG construction emissions for the representative construction and operations representative years. The term "discount rate" refers to the reduction or discount in value per year as a future cost or benefit is adjusted to be comparable with a current cost or benefit from a Proposed Action. For this analysis, all three discount rates were used to estimate a range of global social costs from the increase in GHG emissions from the Proposed Action.

[13] United States Government, Technical Support Document, https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

The social cost of GHG total equivalents for construction is estimated to range from $89,209 to $884,065 in 2026 and $186,048 and $1,840,115 in 2027. Similarly for the net operations changes, GHG total equivalents are estimated to range from -$2,378 to -$23,484 for 2027 due to an expected slight reduction in GHG emissions from the runway redistribution of aircraft during construction. This range in costs represents the potential social costs associated with adding GHGs to the atmosphere each year. It includes the value of all climate change impacts, including but not limited to changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services.

It should be noted that the foregoing social costs are estimates only and are subject to change depending on a variety of factors. They are provided for disclosure and context, but such estimated costs may not actually result.

There are no defined significance thresholds for aviation GHG emissions, nor has FAA identified any factors to consider in making a significance determination for GHG emissions. Any increases in GHG emissions from construction and aircraft operations associated with the Proposed Action would be temporary and essential for implementation of the Proposed Action.

Increases in construction and operational emissions compared to the No Action Alternative would be temporary, but necessary for the proposed improvements at HOU. However, the increases would comprise a small portion of the HOU 2016 GHG emissions of 36,000 MT CO2e, the US-based emissions of 6,348 MMT CO2e, and even less than the 49 gigatons of CO2e global GHG emissions.[14,15] Based on all this information, no significant impact on GHGs or climate is expected as a result of the Proposed Action.

3.5.3 Mitigation and Minimization

In the absence of potentially significant impacts, no mitigation measures are proposed. However, HAS published its *Carbon Management Plan* (CMP) in April 2024, which identifies several sustainability goals, including reducing energy use by 5 percent per year on a per-square-foot basis and quantifying and tracking GHG emissions as a performance indicator of energy and solid waste performance. The CMP also lists numerous measures that HAS will implement to address carbon emissions at all levels of operations. These measures include renewable or low carbon energy, alternative fuel use, green electricity, resilient design and energy efficient buildings, energy efficiency measures, vehicle fleet modernization and electrification, solid waste management, public transportation, and stakeholder partnerships and tenant initiatives.

3.6 Department of Transportation Act, Section 4(f) and Section 6(f)

The FAA must consider land use impacts under Section 4(f) of the U.S. DOT Act of 1966 (now codified at 49 U.S.C. § 303), which protects publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites listed or eligible for listing on the National Register of Historic Places (NRHP). Section 4(f) provides that the Secretary of Transportation may approve a transportation program or project requiring the use of publicly owned land only if there is no feasible and prudent alternative to

[14] https://www.epa.gov/system/files/documents/2023-02/US-GHG-Inventory-2023-Main-Text.pdf

[15] IPCC, *AR4 Climate Change 2007 Synthesis Report*, http://ipcc.ch/publications_and_data/ar4/syr/en/contents.html.

using that land and the program or project includes all possible planning to minimize harm resulting from the use.

Section 6(f) of the Land and Water Conservation Fund Act of 1965, covers outdoor recreation properties planned, developed, or improved with Land and Water Conservation Fund (LWCF) grants.

3.6.1 Affected Environment

A review of potential Section 4(f) resources included a search of City of Houston Parks and Recreation, Harris County Parks, and recreational facilities associated with Harris County schools within one mile of the Proposed Action. There are two public schools, Lewis Elementary and Ortiz Middle School, and one City of Houston Park, Dow Park, located within one mile of the Proposed Action area (see **Figure 5**). In addition, the 1940 Houston Municipal Airport Terminal (1940 Terminal) is located approximately 0.43-mile southwest of the Proposed Action area. The 1940 Terminal was listed on the NRHP in March 2019.

No wildlife or waterfowl refuges are located within one mile of the Airport.

The Trust for Public Land's database shows no LWCF funded resources within one mile of the Airport.[16]

3.6.2 Environmental Consequences

The FAA considers an impact to 4(f) resources be significant when an action causes more than minimal physical use or a "constructive use" that would substantially impair the resource.

3.6.2.1 No Action Alternative

No development would occur on the project site under the No Action Alternative. The No Action Alternative would not result in the physical or constructive use of any Section 4(f) resource.

3.6.2.2 Proposed Action

All nearby 4(f) resources are outside of the Proposed Action area and no land use changes will occur because of the Proposed Action. The Proposed Action would not result in physical or constructive use of, or indirect impact to, any Section 4(f) resource, including the nearby historic 1940 Terminal. While the NRHP-listed 1940 Terminal was identified as being near the Proposed Action area, no physical use would occur because all development would take place within the boundaries of the project area. Indirect impacts associated with the Proposed Action (e.g., air emissions aircraft noise) are not expected to be significant, as noted by other sections of this chapter, thus the potential for impacts from constructive use (where indirect impacts would substantially impair a resource) is low. Additionally, this resource is related to aviation, and therefore is compatible with the Proposed Action which maintains the existing land use.

[16] https://lwcf.tplgis.org/mappast/

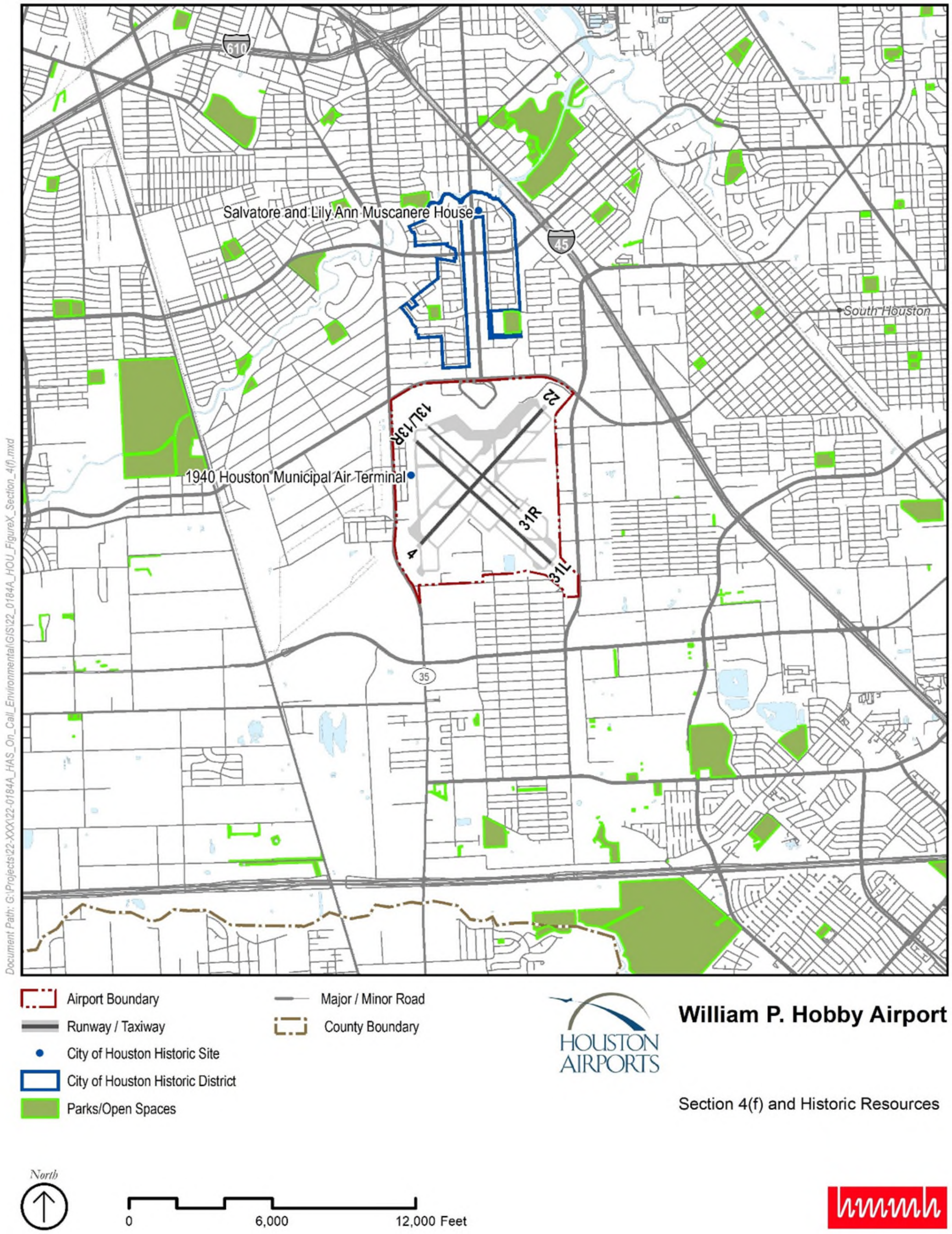

Figure 5. Section 4(f) and Historic Resources

Based on the above information, no Section 4(f) resources (publicly owned parks, recreation areas, wildlife and waterfowl refuges, or public and private historic properties) would be affected by the Proposed Action.

3.6.3 Mitigation and Minimization

No mitigation or minimization is required or recommended.

3.7 Historical, Architectural, Archeological, and Cultural Resources

The National Historic Preservation Act (NHPA) and the Archeological and Historic Preservation Act govern the preservation of historic and prehistoric resources, encompassing art, architecture, archaeological, and other cultural resources. Section 106 of the NHPA requires that federal agencies consider the effects of an undertaking on properties listed on or eligible for listing on the NRHP before a project or a permit may be approved.

The responsible federal agency must first determine whether the undertaking is a type of activity that has the potential to affect historic properties. Historic properties are properties included on the NRHP, or those eligible for listing on the NRHP. If the undertaking could affect historic properties, the federal agency then defines the Area of Potential Effect (APE) in consultation with the State Historic Preservation Officer (SHPO). In Texas, the designated SHPO is the Texas Historical Commission (THC). The APE is then reviewed to identify any potential historical resources. If no historic properties are present, then the federal agency submits this information to the SHPO for their concurrence. If historic properties are identified, additional analyses are required to determine if the undertaking will impact the property.

3.7.1 Affected Environment

Prior airport construction activities associated with the runways and taxiways have disturbed the Proposed Action area to the point that it is highly unlikely that any intact archeological resources remain in the area.

Six cultural resources surveys have been previously conducted within a one-mile radius of the Proposed Action, with the most recent survey being performed as part of the Domestic Redevelopment Project at HOU in July 2023.[17] These surveys indicate that there are no previously inventoried or NRHP-listed archeological or architectural resources within the Proposed Action area. One NRHP-listed resource, the Houston Municipal Airport Terminal (1940 Terminal), listed in 2019, is located approximately 400 feet southwest of Taxiway F (see **Figure 5**).

3.7.2 Environmental Consequences

The FAA has not established a significance threshold for Historical, Architectural, Archeological, and Cultural Resources. However, the FAA Order 1050.1F advises the agency to consider whether the action would result in an adverse effect under Section 106 of the NHPA.

[17] See Appendix D of the *Finding of No Significant Impact and Record of Decision for the West Concourse Expansion Project, William P. Hobby Airport, Houston, Texas,* signed by FAA on January 18, 2024.

3.7.2.1 No Action Alternative

No development would occur with the No Action Alternative. Therefore, there is no potential for impacts to historic or archaeological resources.

3.7.2.2 Proposed Action

There are no known NRHP-listed or eligible archeological resources within the area that would be disturbed by the Proposed Action. Because of the highly disturbed nature of the project area and its location on an active airfield, it is very unlikely that any intact archaeological resources remain in the area. Ground-disturbing activities would be limited to within the active airfield in previously disturbed areas. The Proposed Action would not result in visual effects on the landscape because construction will take place within the existing airfield and will remain the same use. For these reasons, it has been determined that the undertaking would have no potential to affect historic properties.

3.7.2.3 Mitigation and Minimization

If unanticipated archeological deposits are encountered during construction, work should be halted immediately, and the FAA and Archeology Division of the THC should be contacted.

3.8 Land Use

Section 1502.16(c) of the CEQ regulations requires the discussion of possible conflicts between the Proposed Action and federal, state, regional, and local land use plans, policies, and controls. Where an inconsistency exists, the NEPA document should describe the extent to which the agency would reconcile its action with the plan. Notably, the FAA also requires agreement to written grant assurances from Airport Sponsors prior to providing federal funding for airport improvements. This section should also demonstrate the required Airport Sponsor's assurance under 49 USC § 47107(a)(10) that "appropriate action, including the adoption of zoning laws, has been or will be taken, to the extent reasonable," to restrict existing and planned land use next to and near the Airport to activities compatible with Airport operations.

3.8.1 Affected Environment

Land uses incompatible with airports include those that hinder safe and efficient airport operations or those that expose people living or working nearby to noise or other aviation hazards. Land uses that are least compatible with airports include densely populated residential or office buildings; streetlamps and structures that emit bright light; dust-producing smokestacks that cause visual and physical obstructions; and ponds, large wetlands, and agricultural practices that can attract wildlife. Other incompatible land uses include residential developments and places where people gather in large numbers.

Land use around the Airport is shown in **Figure 6**. The project area is made up of commercial airport uses. North of the Airport are office and industrial uses, with single-family and multi-family residential areas beyond. West of the Airport is largely industrial and commercial.

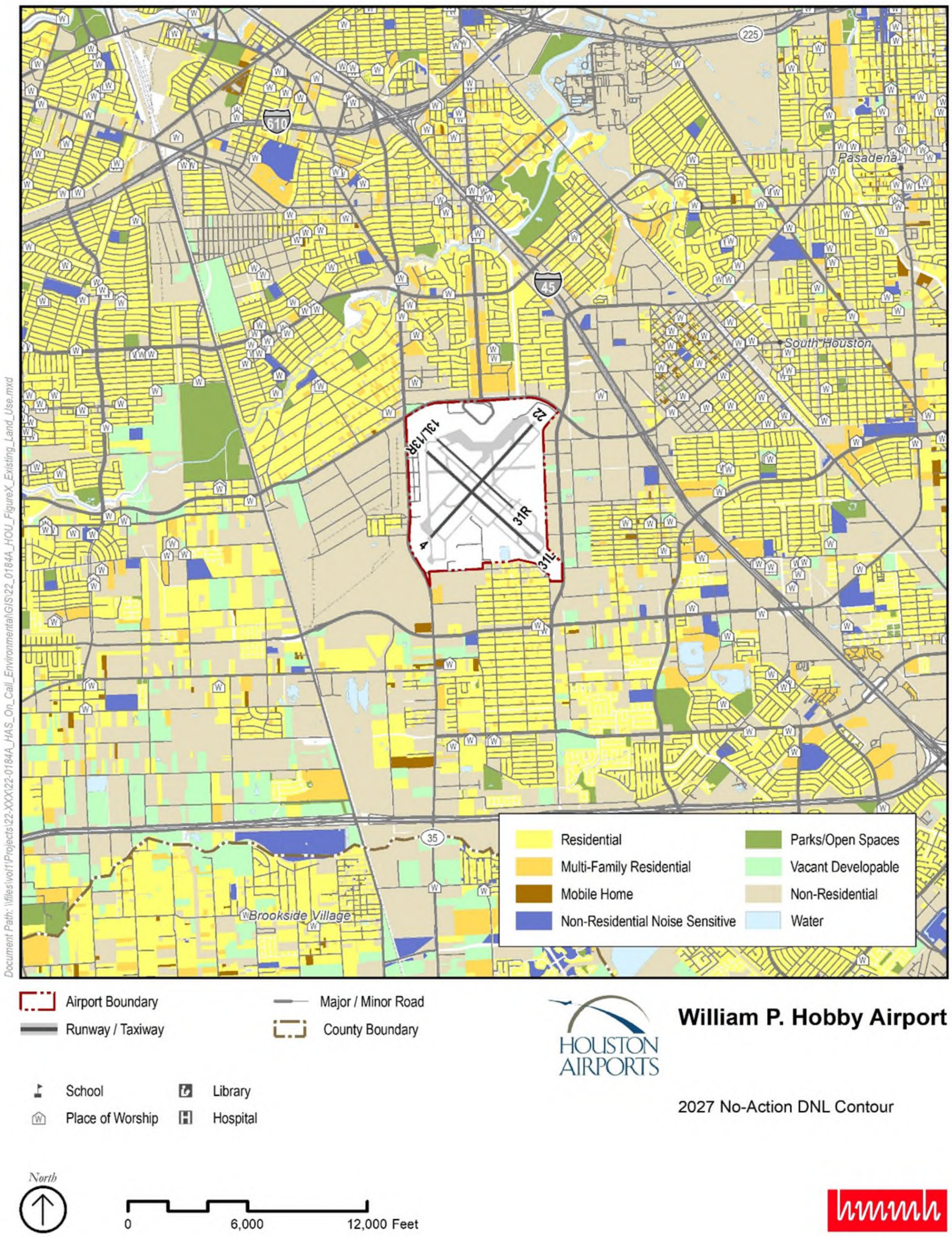

Figure 6. Existing Land Use

The City of Houston does not have zoning, but development is governed by ordinance codes that address how property can be subdivided. The City of Houston has two ordinances related to incompatible land uses near all three Houston Airport System facilities, including HOU. The first is the Airport Hazard Area Regulations (COH Ordinance #09-1301), which is based on airspace surfaces associated with the runways. Chapter 241 of the Texas Local Government Code allows for municipalities to impose regulations within a 3-by-5-mile area (1.5 miles from each side of a runway centerline and 5 miles from a runway end) to mitigate hazards to air navigation. A second City ordinance, the Airport Compatible Land Use Regulations (COH Ordinance #08-1052), is based on noise contours associated with runways. The most restrictive land use regulations are areas within the 65 day-night average sound level (DNL) noise contour designated as Tier One. Noise-sensitive land uses are either prohibited or allowed with sound attenuation construction requirements.

3.8.2 Environmental Consequences

The FAA has not established a significance threshold for land use, or factors to consider when determining significance of a project's effects on land use.

3.8.2.1 No Action Alternative

The No Action Alternative would not result in any construction activity and would not result in changes in land use.

3.8.2.2 Proposed Action

The immediate project area is airport use, which is compatible with the Proposed Action which is of a replace-in-kind nature. While there are residential areas north of the project area, disturbance from the Proposed Action will not extend beyond the Proposed Action area, and the project will not change any adjacent land use. Likewise, no increases to area traffic or other indirect impacts are anticipated, nor are any zoning changes required or anticipated. Based on this information, the Proposed Action is not expected to result in significant impacts to land use.

3.8.3 Mitigation and Minimization

No mitigation measures are required or recommended.

3.9 Natural Resources and Energy Supply

Airport activities, including construction, operation, and maintenance have the potential to modify a facility's consumption of natural resources (such as water or construction materials) and use of energy supplies (electricity, natural gas, or fuel for aircraft and ground vehicles). Natural resource and energy supply impacts are those actions that could increase the amount of energy required to operate aircraft, airport-related service vehicles, terminal lighting, and other uses such as heating and air-conditioning. Except for electricity necessary to operate airfield lighting, navigational aids, and other energy dependent components, energy requirements for an airport largely depend upon aviation activity levels.

The FAA defines two types of energy use that should be considered when determining the potential natural resource and energy supply impacts of a Proposed Action:

- Natural resource and energy supply related to major changes in stationary facilities such as airfield lighting, or building heating and cooling needs that may exceed local supply or capacities and

- Natural resource and energy supply related to major changes in the movement of aircraft and ground vehicles to the extent that demand exceeds available energy supply.

3.9.1 Affected Environment

Existing lighting systems on the airfield require electricity. Aircraft, maintenance vehicles, and GSE that use the existing runway and taxiways consume fuel to drive and taxi in and out of the area and to take off and land. None of these existing uses place atypical demands on natural resource or energy supplies.

3.9.2 Environmental Consequences

According to FAA Order 1050.1F, "the FAA has not established a significance threshold for natural resources and energy supply; however, the FAA has identified a factor to consider when evaluating the context and intensity of potential environmental impacts for natural resources and energy supply." This factor "includes, but is not limited to, situations in which the Proposed Action…would have the potential to cause demand to exceed available or future supplies of these resources. For most actions, changes in energy demands or other natural resource consumption for FAA projects will not result in significant impacts."

3.9.2.1 No Action Alternative

The No Action Alternative would not change the existing conditions. Therefore, no new natural resources or energy supplies would be used.

3.9.2.2 Proposed Action

The Proposed Action is not anticipated to result in a significant, permanent change to energy demands or natural resource consumption. There are no known natural resources within the project site that are unusual in nature or are in short supply. The sediment and rock base materials and concrete mixtures that would be used to reconstruct the runway and taxiway connections are not in short supply. Materials needed for pavements for the Proposed Action would not meet or exceed available supplies of energy or natural resources.

Consumption of energy and natural resources during the construction phase of the Proposed Action would primarily consist of construction machinery fuel and construction materials. New lighting would be more energy efficient LED systems, which would likely result in a small decrease in regulator loads. Operation and maintenance of the Proposed Action would not noticeably change compared to the existing conditions. For these reasons, no significant impacts to natural resources and energy supply are expected to be associated with the Proposed Action.

3.9.2.3 Mitigation and Minimization

No mitigation measures are required or recommended.

The HAS *Sustainable Management Plan* published in August 2018 includes a goal that over the next 10 years, new construction will achieve a minimum improvement of 20 percent energy performance over the most current version of the local energy code. As noted in the CMP, HAS has begun implementing strategies to achieve this goal. Strategies that have been implemented include use of renewable energy sources, such as solar arrays; completion of an energy audit to identify opportunities to reduce energy consumption; conversion of the Red Garage at HOU to all LED lighting; conversion of airfield lighting to

LED when taxiways and runways are rehabilitated or reconstructed; obtaining federal grant funding to install gate electrification systems; installation of charging stations to support electric vehicles; and designation of a waste management champion to increase the landfill diversion rate.

3.10 Noise and Noise-Compatible Land Use

Noise is considered unwanted sound that disturbs or interrupts routine activities. Aviation noise includes sounds made by aircraft during departure, arrival, flight, taxiing, and other activities. The FAA uses DNL as its primary noise metric. DNL accounts for the levels of aircraft events, the number of times those events take place, and the timeframe in which they occur (day or night). Noise levels greater than 65 DNL are considered a potential impact.

As established by FAA's land use compatibility guidelines outlined in 14 CFR Part 150, most land uses are compatible with noise levels below 65 DNL. The compatibility of land use around an airport is typically determined based on the level of aircraft noise. The degree of annoyance which people suffer from aircraft noise varies depending upon their activities at any given time.

Noise sensitive areas are those where noise interferes with normal activities and include residential, educational, health, religious structures and sites, parks, recreational areas, wilderness areas, wildlife refuges, and cultural and historical sites. In the context of airport noise, such facilities or areas within the 65 DNL contour are considered noise sensitive.

Per FAA Order 1050.1F and the Environmental Desk Reference for Airport Actions, any airport that exceeds 90,000 annual piston-powered aircraft operations or 700 annual jet-powered aircraft operations, 10 or more daily helicopter operations, or any project that includes the construction of a new airport, a runway relocation, runway strengthening, or a major runway expansion requires a noise analysis.

The FAA Office of Environment and Energy recognizes that the environmental consequences stemming from aircraft operations—primarily noise, emissions, and fuel consumption—are highly interdependent and occur simultaneously throughout all phases of flight. AEDT is the FAA-approved software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise estimates. AEDT is designed to estimate the long-term effects of noise using average annual input conditions. The model uses the FAR Part 150 (14 CFR Part 150) yearly DNL metric, which is measured in decibels. DNL is a cumulative noise metric that represents the average daily noise level, accounting for the added intrusiveness of noise at night compared. A nighttime penalty (equivalent to increasing decibel levels by ten) for increased annoyance is added to flights occurring between 10:00 p.m. and 7:00 a.m.

The forecast developed for the Domestic Redevelopment Program (DRP) was used as the basis for this EA. The EA forecast was compared to the FAA Terminal Area Forecast (TAF) released in January of 2024 and while higher than the 2023 TAF, the forecast was within 5 percent of the total forecast operations and within 10 percent for commercial operations, which is within FAA guidelines. Therefore, the interpolated DRP EA forecast was used for the future 2027 operational levels in this EA, which are shown in **Table 8**.

Table 8. 2027 Forecast Operations Compared to the FAA TAF

2027 Forecast	Air Carrier	Air Taxi	General Aviation	Military	Total
Interpolated DRP EA Forecast	153,162	**29,960**	**54,967**	**670**	**238,759**
FAA TAF	142,598	**29,418**	**54,716**	**596**	**227,328**
Difference	10,564	542	251	74	11,431
Percent Difference	7%	2%	0%	12%	5%

Source: HMMH, 2024; FAA 2023 TAF, HOU DRP EA Forecast

The interpolated DRP EA forecast for 2027 is used for the 2027 No Action and Proposed Action modeling for this EA. The following scenarios were evaluated:

- 2027 No Action Alternative
- 2027 Proposed Action Alternative

Appendix C details noise modeling information, including fleet mix and other factors used in each of these scenarios.

The City of Houston has two ordinances related to incompatible land uses near all three Houston Airport System facilities, including HOU. The first is the Airport Hazard Area Regulations (COH Ordinance #09-1301), which is based on airspace surfaces associated with the runways. Chapter 241 of the Texas Local Government Code allows for municipalities to impose regulations within a 3-by-5-mile area (1.5 miles from each side of a runway centerline and 5 miles from a runway end) to mitigate hazards to air navigation. A second City ordinance, the Airport Compatible Land Use Regulations (COH Ordinance #08-1052), is based on noise contours associated with runways. The most restrictive land use regulations are areas within the 65 DNL noise contour designated as Tier One. Noise-sensitive land use is either prohibited or allowed with sound attenuation construction requirements.

3.10.1 Affected Environment

This section describes current aircraft noise conditions within the project area. Existing Condition (2025) noise contours are presented in **Figure 7**, showing how noise from HOU aircraft operations is currently spread over the surrounding area. Noise contours extend from HOU along each extended runway centerline, to the north- and southeast and north- and southwest, reflecting the flight paths of aircraft operations. A summary of land area and population within noise contours is found in **Table 9**.

Table 9. Land and Population within Existing (2025) Noise Contours

DNL (dB) Noise Contour	Population Census	Housing Units	Area (acres)
65	1,847	650	2,189.37
70	74	23	781.30
75	1	330.41	1

Source: HMMH, 2023; U.S. Census Bureau, 2020

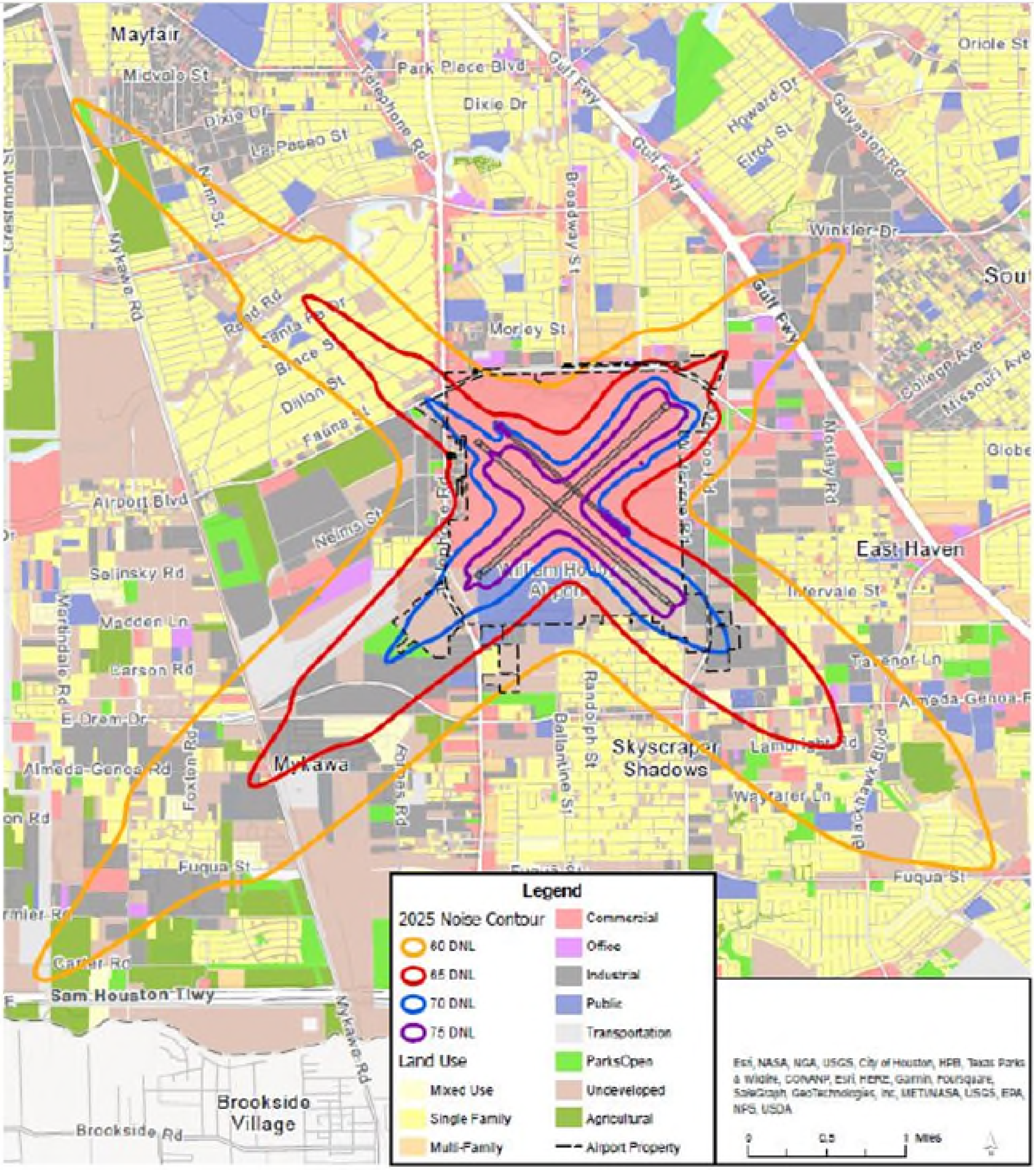

Figure 7. 2025 Existing Condition Noise Contours

3.10.2 Environmental Consequences

The noise analysis for this EA compares the No Action Alternative with the Proposed Action for the future year using the FAA's thresholds of significance. When an action (compared to the No Action Alternative for the same timeframe) would cause noise-sensitive areas to have a DNL greater than or equal to 65 dB and experience a change in noise of at least 1.5 dB, the impact is considered significant. For example, as noted in FAA Order 1050.1F Exhibit 4-1[18] (parenthetical added), "an increase from 65.5 DNL (No Action) to 67 DNL (Proposed Action) is considered a significant impact, as is an increase from 63.5 DNL (No Action) to 65 DNL (Proposed Action)."

3.10.2.1 No Action Alternative

Figure 8 displays the 60 – 75 decibels (dB) DNL noise contours for the 2027 No Action over a map of the existing land use in the study area. The FAA's guidelines for land use compatibility presented in Appendix A of 14 CFR Part 150 state that all land uses are generally compatible with aircraft noise below DNL 65 dB. The DNL 65 dB noise contour for Runway 13R-31L extends into residential land use to the northwest and southeast of the airport. The DNL 65 dB noise contour for Runway 4-22 extends into residential land use to the southwest and northeast of the airport. There are residential land uses south of Runway 31L end within the DNL 70 dB or higher contours. The DNL 65 dB contour extends away from the airport in the following areas:

- The contour extends to the northwest of Runway 13R-31L along the extended runway centerline into residential land use to almost Sims Bayou.
- The contour extends to the southeast of the Runway 13R-31L along the extended runway centerline into residential land use to past Almeda Genoa Rd and Blackhawk Blvd.
- The contour extends to the southwest of Runway 4-22 along the extended runway centerline into residential land use to past Almeda Genoa Rd.
- The contour extends to the northeast of Runway 4-22 along the extended runway centerline into residential land use to just past Monroe Rd.

Table 10 provides the population exposure, housing unit count, and contour areas for the 2027 Future No Action DNL noise contours. The DNL 65+ dB noise contour which covers approximately 2,223 acres, contains 1,251 residents and 462 housing units. In addition, two noise-sensitive locations, Houston ISD Mykawa Farm and the New Vision Church, are within the 2027 Future No Action DNL 65+ dB noise contour.

Table 10. 2027 No Action Noise Contours Population, Housing, and Area

DNL (dB) Noise Contour	Population Census	Housing Units	Area (acres)
65 - 70	1,228	456	1,427.88
70 - 75	23	6	445.06
> 75	0	0	350.06
Total	1,251	462	2,223.00

Source: HMMH, 2024; U.S. Census Bureau, 2020

[18] See https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf

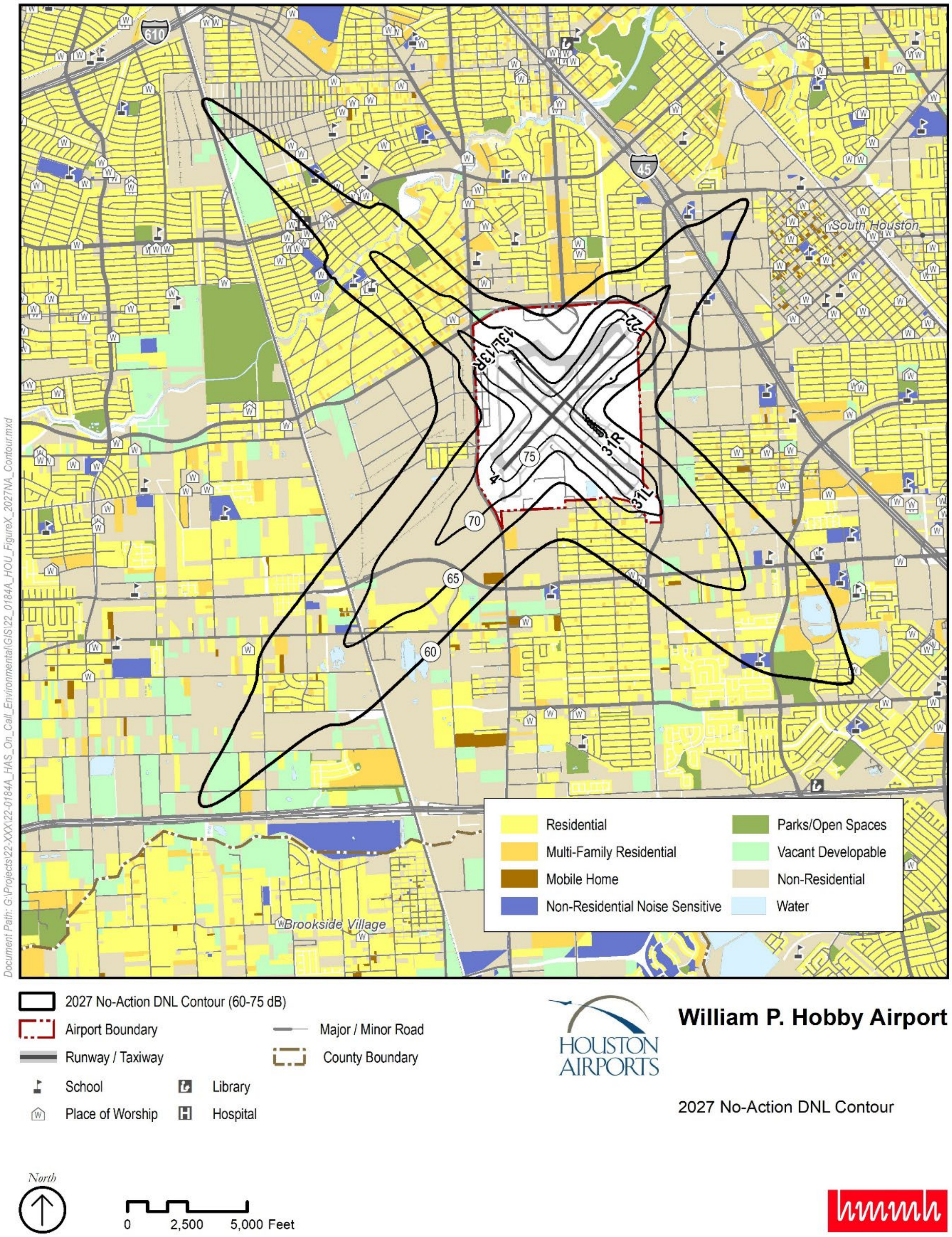

Figure 8. 2027 No Action Noise Contours

3.10.2.2 Proposed Action

Figure 9 displays the 60 – 75 dB DNL noise contours for the 2027 Proposed Action over a map of the existing land use in the study area. The FAA's guidelines for land use compatibility presented in Appendix A of 14 CFR Part 150 state that all land uses are generally compatible with aircraft noise below DNL 65 dB. The DNL 65 dB noise contour for Runway 4-22 extends into residential land use to the northeast and southwest of the airport. The DNL 65 dB contour extends away from the airport in the following areas:

- The contour extends to the southwest of Runway 4-22 along the extended runway centerline into residential land use to past Fuqua Street.
- The contour extends to the northeast of the Runway 4-22 along the extended runway centerline into residential land use to almost Winkler Drive.

There are residential land uses within the DNL 70 dB or higher contours northeast of the Runway 4-22 and west of Monroe Road.

Table 11 provides the population exposure, housing unit count, and contour areas for the 2027 Proposed Action DNL noise contours. The DNL 65+ dB noise contour covers approximately 2,130.84 acres, contains 1,985 residents and 679 housing units. There are single-family and multi-family residential uses in Minnetex and Glenbrook Valley neighborhoods along the extended runway centerline of Runway 4-22. The DNL 65 dB noise contour for the 2027 Proposed Action expands farther into these residential uses due to the increased operations on Runway 4-22. This causes an increase in population and housing units in the 2027 Future Proposed Action DNL noise contour as compared to the 2027 No Action DNL noise contour. In addition, KIPP Prime College Preparatory, Texans Can Academy, YES Prep Hobby Elementary, and Houston ISD Mykawa Farm are within the 2027 Proposed Action DNL 65+ dB noise contour.

Table 11. 2027 Proposed Action Noise Contours Population, Housing, and Area

DNL (dB) Noise Contour	Population Census	Housing Units	Area (acres)
65 - 70	1,970	674	1,409.23
70 - 75	15	5	439.46
> 75	0	0	282.15
Total	1,985	679	2,130.84

Source: HMMH, 2024; U.S. Census Bureau, 2020

The analysis shows that there would be a 1.5 dB change in noise that exceeds the FAA's threshold for significance (see **Figure 9**); however, these changes in noise would only occur during construction and would be temporary. After construction, noise would return to the levels shown in the 2027 No Action Alternative noise contours.

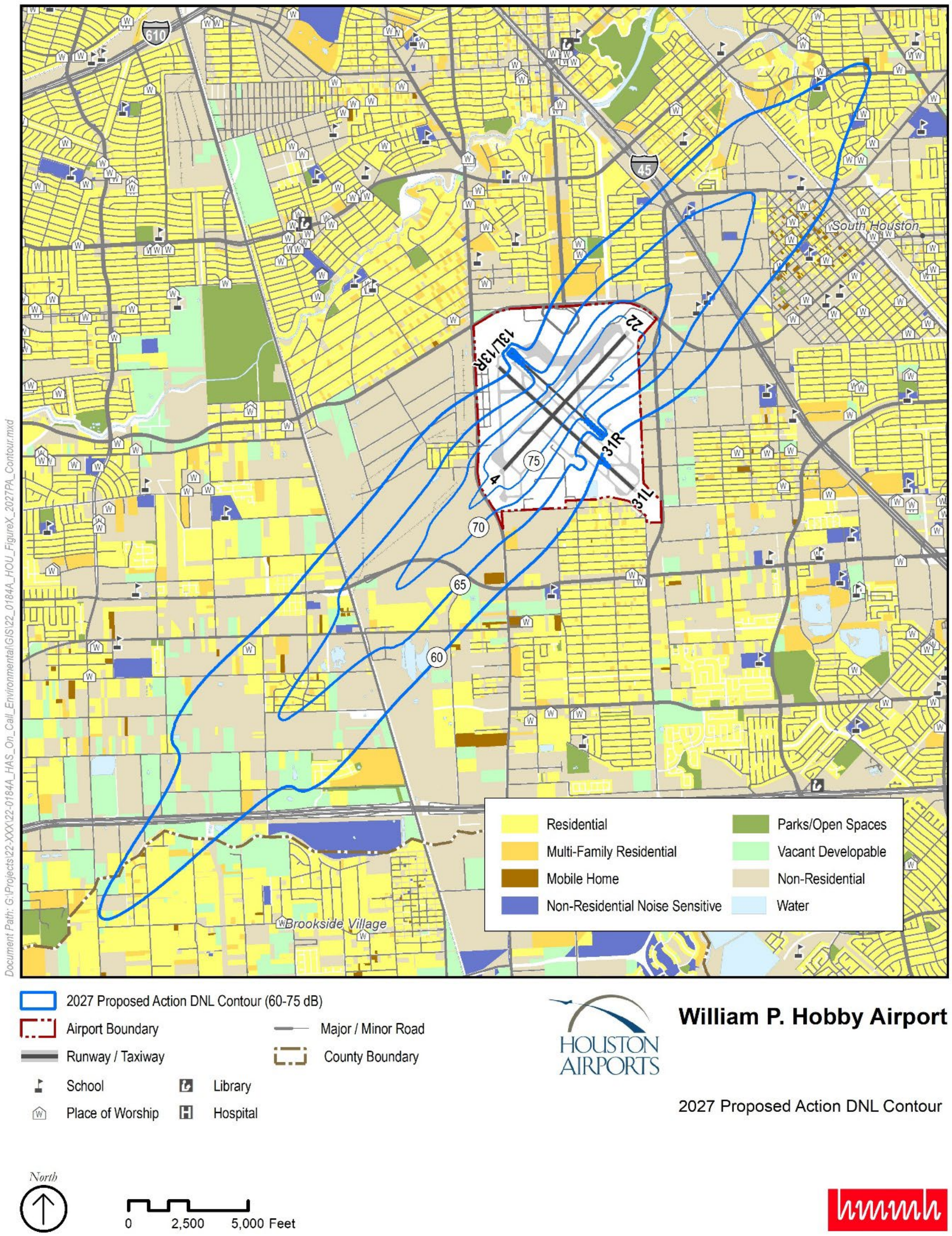

Figure 9. 2027 Proposed Action Noise Contours

3.10.2.3 No Action and Proposed Action Comparison

The 2027 Proposed Action DNL 65 dB contour is larger than the No Action DNL 65 dB contour primarily along the extended Runway 4-22 centerline northeast and southwest of the airport. The 2027 Proposed Action DNL 65 dB contour is smaller than the No Action DNL 65 dB contour primarily along the extended Runway 13R-31L centerline northwest and southeast of the airport. This results in an increase in population and housing unit counts and a decrease in acreage. As shown in **Table 12**, the number of people exposed to a DNL 65 dB or greater noise level increases by 734 people with an increase of 217 housing units and a decrease in area of 92 acres. **Figure 10** provides a comparison of the DNL 65 dB contours for each of the 2027 alternatives.

Table 12. Comparison of Future 2027 Noise Contours Population, Housing, and Area

Source: HMMH, 2024; U.S. Census Bureau, 2020

Alternative	DNL (dB) Noise Contour	Population Census	Housing Units	Area (acres)
No Action	DNL 65-70 dB	1,228	456	1,427.88
	DNL 70-75 dB	23	6	445.06
	DNL 75+ dB	0	0	350.06
	Total	1,251	462	2,223.00
Proposed Action	DNL 65-70 dB	1,970	674	1,409.23
	DNL 70-75 dB	15	5	439.46
	DNL 75+ dB	0	0	282.15
	Total	1,985	679	2,130.84
Difference (Proposed Action – No Action Alternative)	DNL 65-70 dB	742	218	-18.65
	DNL 70-75 dB	-8	-1	-5.60
	DNL 75+ dB	0	0	-67.91
	Total	734	217	-92.16

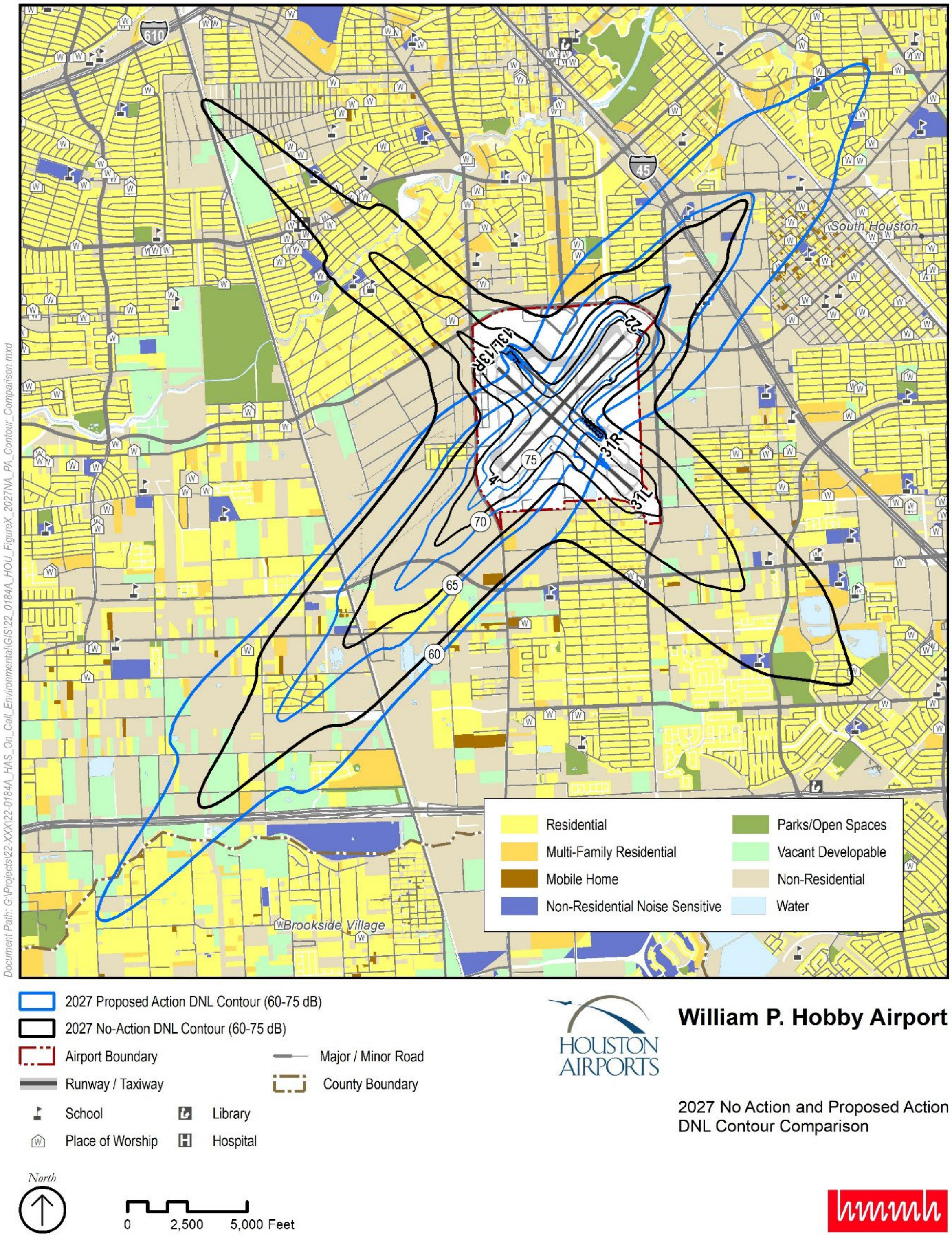

Figure 10. 2027 No Action and Proposed Action Noise Contours Comparison

A grid evaluation was used to determine any significant changes within the 65 DNL contour. FAA considers a 1.5 dB change in noise within the Proposed Action 65 DNL over noise sensitive land use as a significant change in noise.[19] **Figure 11** displays the changes in noise levels between the No Action scenario and Proposed Action scenario in the study area. The red grid points along Runway 4-22 represent areas of 1.5 dB increase in the Proposed Action scenario. The green grid points along Runway 13R-31L represent areas of 1.5 dB decrease in the Proposed Action scenario.

The evaluation shows that multiple noise sensitive land uses northeast and southwest of airport, would experience a temporary significant increase in noise of DNL 1.5 dB or more, at or above 65 DNL noise exposure in the 2027 Proposed Action scenario when compared to the 2027 No Action scenario.

The change in noise and areas of significant impacts would be temporary as the proposed project will not alter runway thresholds or future use of Runway 13R-31L, and runway use is expected to return to No Action conditions once Runway 13R-31L reopens.

HMMH also evaluated the modeling grid covering the noise study area to evaluate any reportable change (+/-3 dB) between the 60 DNL and 65 DNL. **Figure 11** shows that the orange grid points northeast of Runway 4-22 along the extended centerline of Runway 4-22 would experience a 3dB or greater increase between the 60 DNL and 65 DNL. The blue grid points northwest and southeast of Runway 13R-31L along the extended centerline of Runway 13R-31L identify where there would be 3 dB or greater decrease between the 60 DNL and 65 DNL in the 2027 Proposed Action as compared to the 2027 No Action.

[19] FAA 2023 Desk Reference and FAA 1050.1F

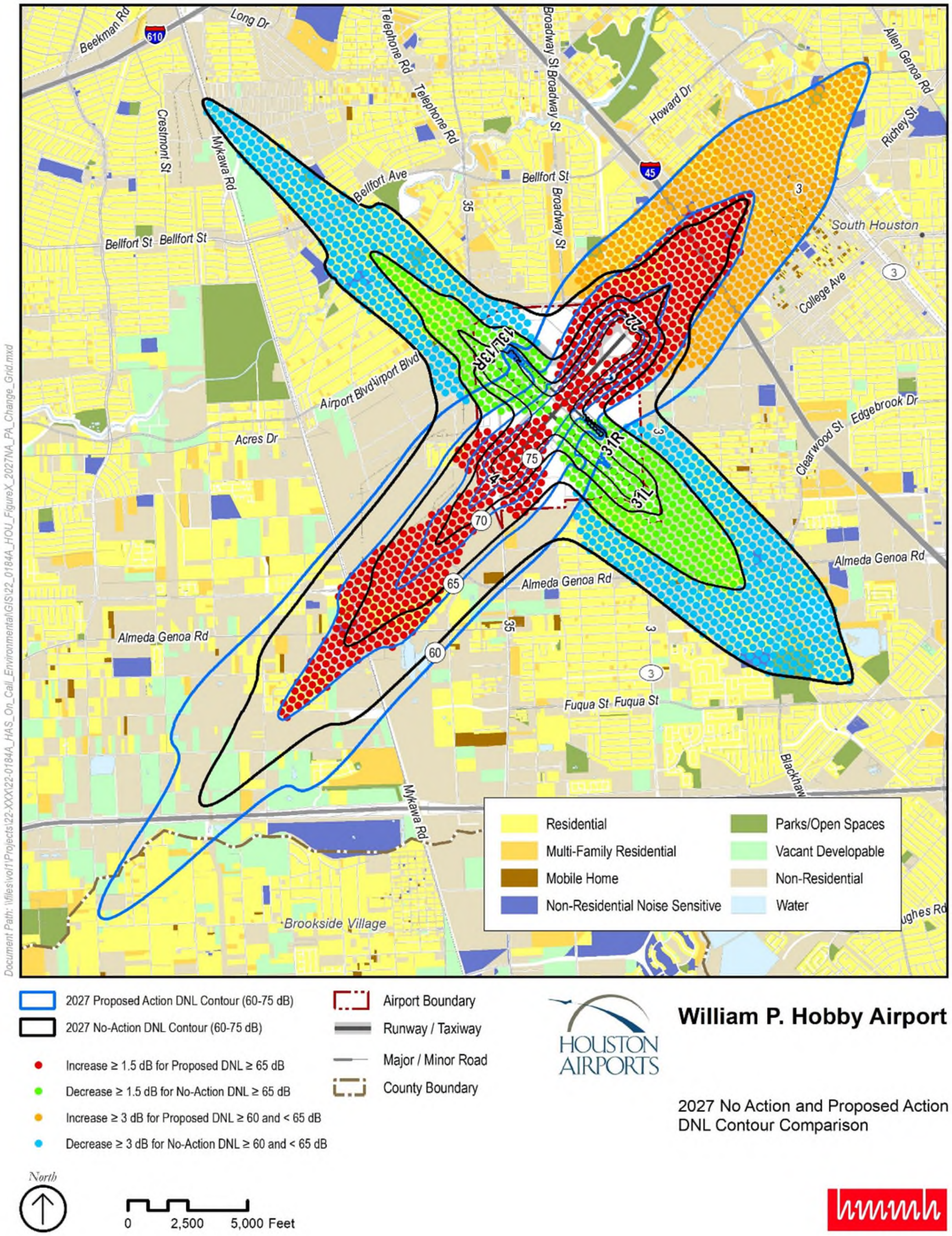

Figure 11. 2027 No Action and Proposed Action Noise Contours Comparison with Grid Evaluation

3.10.3 Mitigation and Minimization

The Proposed Action Alternative results in two areas of temporary noise increase greater than 1.5 dB or more. This is considered an elevated noise impact by FAA since the Proposed Action Alternative results in noise-sensitive areas experiencing an increase of 1.5 dB at or above the day-night average sound level of 65 dB noise exposure when compared to the no action alternative for the same time frame.

The first area where there is a temporary noise increase is located northeast of Runway 4-22 and extends over single-family and multi-family residential land uses. The second area where there is a temporary noise increase is located southwest of Runway 4-22 and extends over single-family, multi-family, and mobile home residential land use. The Proposed Action Alternative would cause short-term, temporary elevated noise levels during the construction period of approximately 26 months. After construction is over, the noise levels and associated contours would return to the existing condition which is equivalent to the No Action Alternative.

Because the Proposed Action Alternative is short-term in nature, no long-term mitigation is required. HAS plans to communicate the temporary noise increases through meeting with community leaders, city council members, and city managers, and by conducting community outreach specific to the affected residents. Notification of impacted communities will be done at least three to six months in advance of the Proposed Action's construction start date. HAS plans to provide an information leaflet of notification to residents prior to the start of the Proposed Action Alternative. The leaflets would describe the Proposed Action Preferred Alternative, the potential timeframe, and the temporary noise impacts due to the full closure of Runway 13R-31L. Along with the project information and its temporary effects, the affected residents will be informed of the significant benefits this runway reconstruction project will yield to the community.

HAS will inform community members of the temporary noise impacts in advance of any project work or changes caused by the runway closure. HAS will respond in a timely manner to request for information related to the proposed runway closure. The implementation of standard applicable engineering controls and best management practices will also reduce any construction noise increases.

3.11 Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks

Statutes related to socioeconomic impacts include the Uniform Relocation Assistance and Real Property Acquisitions Policy Act of 1970. A socioeconomic analysis evaluates how elements of the human environment such as population, employment, housing, and public services might be affected by the Proposed Action. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, is intended to identify, address, and avoid disproportionately high and adverse human or environmental impacts on specific populations. This requires the fair treatment of people of all races, cultures, and income levels, and ensures that no group of people should shoulder a disproportionate share of impacts of a given project. Executive Order (E.O.) 14096, Revitalizing Our Nation's Commitment to Environmental Justice for All, was enacted on April 21, 2023. E.O. 14096 on environmental justice does not rescind E.O. 12898, which has been in effect since February 11, 1994, and is currently implemented through DOT Order 5610.2C. This implementation will continue until further guidance is provided regarding the implementation of the new E.O. 14096 on environmental justice. Pursuant to Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, federal agencies are directed, as appropriate and consistent with the agency's mission, to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children.

Airport activity can impact the growth, movement, and development patterns of communities. In this section, socioeconomic conditions are evaluated to determine the potential impacts of the Proposed Action.

3.11.1 Affected Environment

Race and poverty characteristics for Harris County and Census Tracts in the immediate vicinity of the Proposed Action area are provided in **Tables 13 and 14**. Harris County is used as a Reference Community for comparison purposes. The Census Tracts surrounding the Proposed Action area include Census Tracts 3332.03, 3332.04, 3333.02, 3335.01, 3336, 3337, 9800. As shown in **Table 13**, of the seven Census Tracts, populations self-identifying as "Hispanic or Latino" make up most of the population.

Table 13. Race and Ethnicity

Geography	Total Population	White	Black or African American	Some Other Race or Races[1]	Hispanic or Latino
Census Tract 3332.03	2,163	9.3%	20.2%	4.6%	65.9%
Census Tract 3332.04	1,280	3.1%	37.9%	2.8%	56.2%
Census Tract 3333.02	3,661	6.0%	5.5%	4.4%	84.1%
Census Tract 3335.01	3,443	3.7%	16.1%	2.7%	77.5%
Census Tract 3336	3,215	19.3%	8.7%	2.8%	69.3%
Census Tract 3337	3,442	6.4%	6.2%	4.5%	82.8%
Census Tract 9800	20	25.0%	35.0%	15.0%	25.0%
Harris County	4,731,145	37.7%	18.7%	10.7%	43.0%

Source: U.S. Census Bureau, 2020 Census, Race and Ethnicity
Note:
1. Includes American Indian, Asian, Native Hawaiian or Other Pacific Islander, and Two or More Races or Some Other Race

As shown in **Table 14**, all but one of the Census Tracts identified have a low-income population greater than Harris County, but none have low-income populations greater than 50 percent.

Table 14. Income and Poverty

Geography	Total Households	Percent of Families of Four Below Poverty Level ($25,000)
Census Tract 3332.03	938	22.4%
Census Tract 3332.04	733	39.6%
Census Tract 3333.02	968	9.5%
Census Tract 3335.01	1,238	44.0%
Census Tract 3336	1,132	17.8%
Census Tract 3337	925	19.3%
Census Tract 9800	9	33.3%
Harris County	1,635,749	18.1%

Source: U.S. Census Bureau, 2020 American Community Survey, Income and Poverty

3.11.2 Environmental Consequences

The FAA has not established a significance threshold for socioeconomics, but there are factors to consider when analyzing the context and magnitude of potential impacts. These include whether the Proposed Action has the potential to:

- Induce substantial economic growth in an area,
- Disrupt or divide the physical arrangement of an established community,
- Cause extensive relocation,
- Disrupt traffic patterns and reduce the level of service of roads serving a surrounding community, and/or
- Substantially change a community's tax base.

In most cases, the significance of environmental justice impacts is dependent on the significance of impacts in other environmental categories that may affect environmental justice populations. These categories can include noise, air and water quality, and Section 4(f) impacts, among others.

In most cases, the significance of impacts to children's environmental health and safety is also dependent on the significance of impacts in other environmental categories. The FAA has not established a significance threshold for this category but requires consideration of whether the Proposed Action will lead to disproportionate health or safety risks to children.

3.11.2.1 No Action Alternative

No construction would occur under the No Action Alternative; therefore, no socioeconomic impacts, impacts on environmental justice populations, or risks to children's environmental health and safety would occur.

3.11.2.2 Proposed Action

Socioeconomic Impacts

The Proposed Action would occur entirely within the HOU property boundary on an active airfield. No land would be acquired to construct the Proposed Action. No residences or businesses would be displaced. There would be no loss in the community tax base. Construction activities would not result in the disruption of established communities or orderly planned developments adjacent to or in the vicinity of the Airport. Local traffic patterns would not be affected by the Proposed Action.

Environmental Justice

The Proposed Action would result in temporary elevated noise impacts during the construction period that would result from all aircraft operations being moved from Runway 13R-31L to Runway 4-22. Construction is expected to last for approximately 26 months. During this period, residents may notice a change in aircraft arrival and departure patterns and an increase in noise levels. Once construction is over, operations would return to existing conditions, and noise conditions would return to normal.

No significant indirect impacts associated with air emissions are expected to occur as a result of the Proposed Action.

<u>*Children's Health and Safety*</u>

The Proposed Action would not have any significant impacts with regards to air quality, water quality, or hazardous materials. Therefore, the Proposed Action would not result in any disproportionate health or safety risks to children.

3.11.3 Mitigation and Minimization

As part of mitigation for temporary noise impacts during construction, HAS would notify affected residents of the potential to experience changes in noise levels. Because the area surrounding HOU has high Hispanic or Latino populations, HAS should consider including materials that have been translated to Spanish to ensure the potential changes in noise are clearly communicated to the Spanish-speaking population.

3.12 Water Resources

3.12.1 Surface Water and Groundwater

Actions that impact water resources can have environmental and legal consequences. The Clean Water Act (CWA) was established to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The CWA allows states to adopt water quality standards; Texas has done so under the TCEQ Water Quality Certification Program. So-called "impaired waters" are any bodies of water that do not meet water quality standards or fully support the water body's beneficial use. Section 303(d) of the CWA requires states to assess and list impaired waters and establish priority ranking by considering the water's uses and pollutant levels. Projects occurring near impaired waters require additional best management practices (BMPs) to avoid and minimize further impacts.

Several other regulations exist to protect water resources including those that offer special protection to drinking water supplies and those that require establishment of spill response plans. In addition, consultation is needed with the U.S. Army Corps of Engineers (USACE) when bodies of water are controlled, altered, diverted, or drained. Several activities conducted at airports have the potential to impact water resources such as construction and fuel/hydraulic spills. If not properly controlled, runoff from these activities can impact the water quality of drainage waterways at airports. The TCEQ is responsible for administering the Texas Pollutant Discharge Elimination System (TPDES) program to regulate discharges of pollutants.

3.12.1.1 Affected Environment

The Proposed Action area lies within the Sims Bayou watershed (Hydrologic Unit Code 1204010405). There are no lakes, rivers, or streams located within the Proposed Action area. Existing surface water conveyance (sheet flow, ditches, canals, etc.) on-site consists of stormwater contributions from off-site developed areas and on-site land uses. Stormwater runoff on-site consists of sheet flow into upland-cut drainage ditches with discharge ultimately into Sims Bayou approximately 1.2-miles north of HOU. Most of the airfield drains to a ditch that begins at Airport Boulevard between Broadway Street and Monroe Road and flows north to Sims Bayou.

Groundwater in Harris County is entirely within the Gulf Coast Aquifer, which is found throughout the eastern Gulf coast of Texas including Louisiana, Mississippi, Alabama, and Georgia. The aquifer is used for municipal, industrial, and irrigation purposes. Groundwater within the aquifer meets USEPA drinking water quality standards. According to the Texas Water Development Board, there are no registered groundwater wells within the Proposed Action area.[20] Furthermore, there are no designated Sole Source Aquifers within the Houston region. A Sole Source Aquifer designation is applied by the USEPA to protect drinking water supplies in areas with few or no alternative sources to the groundwater resource.[21]

HOU is a permittee under the General Industrial Stormwater Permit (General Permit) issued by the TCEQ under the National Pollutant Discharge Elimination System (NPDES). The General Permit satisfies the stormwater discharge provisions of the Federal CWA. The TCEQ sets the NPDES permit rules, which require projects meet certain measures for water quality and volume discharge. One requirement of the General Permit is to develop a Stormwater Pollution Prevention Plan (SWPPP). This plan would contain benchmarking requirements, methods, and management practices to prevent contaminated runoff from entering surface and groundwater. The SWPPP would describe pollution prevention steps associated with activities like pavement deicing, pavement maintenance, and equipment fueling that have the potential to impact stormwater. An SWPPP has been prepared for stormwater discharges associated with aviation activities at HOU. It includes the elements necessary for compliance with the General Permit administered by the TCEQ under the TPDES program.

A NPDES permit for construction activity is required for activities disturbing one acre or more of soil. Permittees are required to control runoff from construction sites and develop a construction SWPPP that includes erosion prevention and sediment control BMPs.

3.12.1.2 Environmental Consequences

No Action Alternative

No development would occur under the No Action Alternative; therefore, no impacts to water quality would occur.

Proposed Action

A significant impact to water quality exists if the Proposed Action would either exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or contaminate public drinking water supply such that public health may be adversely affected. The Proposed Action is not expected to exceed water quality standards nor contaminate public drinking water supply, thus there would be no significant impact to water quality.

Prior to construction, the developer will submit a Construction General Permit Notice of Intent to the TCEQ. This Notice of Intent will include a SWPPP, which includes a site plan to manage stormwater, identification of appropriate erosion and sediment controls and stormwater BMPs, maintenance and inspection schedule, recordkeeping, and identification of stormwater discharge areas.

Types of pollutants typically associated with large-scale aviation activity include fuel (aviation gasoline and Jet-A fuel), oil and grease, solvents, and paint. Studies have shown that aircraft movements on runways and taxiways are not a substantial source of pollutants, such as oil and grease, on airfield pavements. The Proposed Action would not introduce new or higher levels of pollutants such as petroleum organics, suspended solids, dissolved solids, and metals to surface waters, when compared to the No Action Alternative.

[20] See https://www3.twdb.texas.gov/apps/WaterDataInteractive/GroundwaterDataViewer
[21] See https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=9ebb047ba3ec41ada1877155fe31356b

3.12.1.3 Mitigation and Minimization

The contractor will install entrance and exit controls, silt fencing, berms, stabilization measures, and spill prevention and clean up BMPs. All runoff from construction will be contained on-site with no discharge off site to waters of the state for the design storm events.

3.12.2 Wetlands

For regulatory purposes under the CWA, the term “wetlands” means areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Areas covered with water for such a short time that there is no effect on moist-soil vegetation are not considered wetlands, nor are the waters of streams, reservoirs, and deep lakes. Wetlands provide many benefits to the human, biological, and hydrological environment, including habitat for fish and wildlife, water quality improvement, flood storage, and opportunities for recreation. Wetlands addressed in this section include jurisdictional wetlands, non-jurisdictional wetlands, and other “Waters of the U.S.” designated under Section 404 of the CWA. A water of the U.S. (WOTUS) is a jurisdictional surface water or wetland under the CWA. The USACE has the lead regulatory responsibility for review and permitting of federal jurisdictional WOTUS impacts.

Executive Order 11990, Protection of Wetlands, directs Federal agencies to “take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency’s responsibilities.” DOT Order 5660.1A, Preservation of the Nation’s Wetlands, contains policies and procedures for implementing the Executive Order and assuring the protection and preservation of wetlands. Agencies are required to make a finding that there is no practicable alternative before taking action that would impact a wetland (7 CFR 650.3).

3.12.2.1 Affected Environment

A site visit was conducted November 16, 2022, to confirm the presence or absence of wetlands within the Proposed Action area. The project is approximately 1.2 miles south of Sims Bayou, the nearest WOTUS. No wetlands are located within the Proposed Action area.

3.12.2.2 Environmental Consequences

No Action Alternative

No wetlands occur within the Proposed Action Area; therefore, there would be no impacts to jurisdictional wetlands or WOTUS under the No Action Alternative. No mitigation is proposed or required.

Proposed Action

No wetlands occur within the Proposed Action area; therefore, there would be no impacts to jurisdictional wetlands or WOTUS. No mitigation is proposed or required.

3.12.3 Floodplains

The Federal Emergency Management Agency (FEMA) identifies flood hazard areas that are depicted on Flood Insurance Rate Maps (FIRMs). A floodplain is defined as the lowlands and relatively flat areas adjoining inland and coastal waters including flood-prone areas of offshore islands, at a minimum, that are prone to the 100-year flood. The 100-year flood is a flood having a 1 percent chance of occurring in any given year. The 100-year floodplain is considered the base floodplain. FEMA defines floodplain management as the operation of a community program of corrective and preventive measures for reducing flood damage. Flood hazard mapping constitutes an integral part of floodplain management. In order to differentiate between differing levels of flood hazard, FEMA created an array of zones corresponding to a location's actual flood risk. Flood hazard areas identified on FIRMs are defined as Special Flood Hazard Areas (SFHA). SFHAs are assigned with various zone designations signifying their individual characteristics.

Executive Order 11988, *Floodplain Management*, directs Federal agencies "to take actions to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by the floodplains." Department of Transportation Order 5650.2, Floodplain Management and Protection, and FAA Orders 1050.1F and 5050.4B contain policies and procedures for implementing the Executive Order and evaluating potential floodplain impacts. Agencies are required to make a finding that there is no practicable alternative before taking action that would encroach on a base floodplain based on a 100-year flood (7 CFR 650.25).

3.12.3.1 Affected Environment

No SFHAs are located within the Proposed Action area. According to the most recent FEMA FIRM Panel No. 48201C0895N (effective 5/2/2019), the Proposed Action area is located within Zone X, SFHAs with low flood risk, and Zone AE, SFHAs with high flood risk (see **Figure 12**).

3.12.3.2 Environmental Consequences

FAA Order 1050.1F considers there to be a significant impact to floodplains if the action would cause notable adverse impacts on natural and beneficial floodplain values.

<u>*No Action Alternative*</u>

No development on the Proposed Action area would occur under the No Action Alternative. Therefore, no encroachment impacts to the 100-year floodplains would occur.

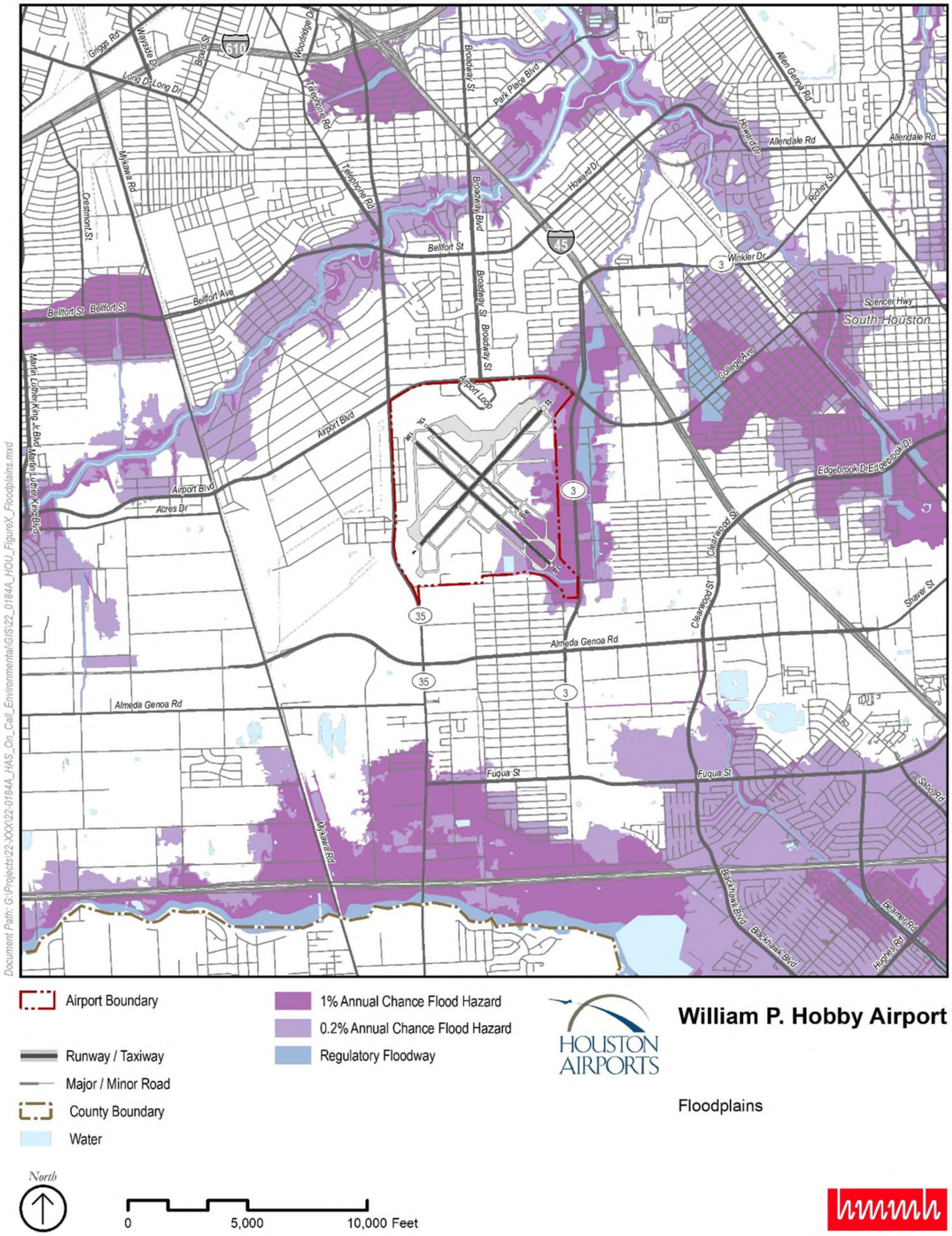

Figure 12. Floodplains

Proposed Action

The Proposed Action does not have the potential to exceed significance thresholds for floodplains, as it is of a replace-in-kind nature.

3.12.3.3 Mitigation and Minimization

No mitigation is required or recommended.

3.13 Cumulative Impacts

A cumulative impact is an impact that is created because of the combination of an alternative evaluated together with other past, present, and reasonably foreseeable projects causing related impacts. These impacts can occur when the incremental impact of the Proposed Action, when combined with the effects of the other projects, are cumulatively considered. Cumulative Analysis Guidance from the CEQ notes that the focus of NEPA analyses is forward-looking (they focus on the impact of a project) and that review of past actions is required to the extent that this review informs agency decision-making regarding the Proposed Action. Present actions are any other actions that are occurring in the same general time frame as the proposal. Reasonably foreseeable future actions are actions that may affect projected impacts of a proposal and are not remote or speculative.

3.13.1 Transportation Improvements in the Vicinity of the Project Area

The organization charged with developing long-range transportation plans for the region is the Houston-Galveston Area Council (H-GAC), in partnership with the TxDOT. The H-GAC 2040 Regional Transportation Plan is a long-range transportation plan that provides a 20-year transportation roadmap for the Houston area. This plan identifies highway and transit projects expected to be completed by 2040. Projects in the vicinity of the project area are shown in **Table 15.**

Table 15. Transportation Projects in Proximity to HOU

Project Name and Type	Project Status	Distance from HOU
Interstate Highway 45 from Interstate Highway 10 to Nyack Drive (landscape development)	Underway	Less than 1 mile west of HOU
State Highway 3 from Interstate Highway 45 to Galveston Road (surfacing/roadway restoration)	Underway	Approximately 1 mile northeast of HOU
State Highway 35 from Interstate Highway 45 South to State Highway Loop 8 (surfacing/roadway restoration)	Construction expected to begin within next four years	Less than 1 mile west of HOU
Interstate Highway 45 from State Highway Loop 8 South to Almeda Genoa Road (surfacing/roadway restoration)	Construction expected to begin within next four years	Approximately 2 miles southeast of HOU

Source: TxDOT Project Tracker, 2024. (https://apps3.txdot.gov/apps-cq/project_tracker/)

3.13.2 HAS Projects at HOU

Other airport projects currently underway or proposed at HOU are shown in **Table 16**.

Table 16. Other Airport Projects at HOU

Name	Location	Status
PN209A – Restroom Renovations, Phase 2	East Concourse	Construction underway; expected completion second quarter 2025
PN208B – Restroom Renovations, Phase 3	Main Terminal	Construction underway; expected completion fourth quarter 2025
PN669 – Rehabilitate & Expand ARFF Station 81	South of HOU central airfield	Construction underway; expected completion second quarter 2026
PN775B TSA-HPD Bunker & K-9 Facility	South of Airport on Telephone Road	Construction underway; expected completion second quarter 2025
PN770 – Non-Standard Taxiway	Airfield	Construction underway; expected completion early 2025
PN950 – HOU Sewer Line Replacement	Central Concourse	Project expected to bid in November 2024 with expected construction first quarter 2025
West Concourse Expansion Project	West Concourse	Construction underway; expected completion second quarter 2027
PN1057 – Runway 4-22 Shoulder and Electrical Improvements	Airfield	Design underway; expected to bid by first quarter 2025; construction expected in 2025
PN773 – Taxiway M Rehabilitation	Airfield	Design underway; construction expected to begin in 2026

Source: HAS Staff Communication, 2024

3.13.3 Cumulative Environmental Consequences

The cumulative impact analysis considers the environmental impacts of the Proposed Action combined with environmental impacts of the past, present, and reasonably foreseeable projects and actions. Impacts of the Proposed Action when considered with past or future actions do not constitute a significant impact that cannot be mitigated.

The Proposed Action would not change aircraft operations or fleet mix at HOU. However, it would result in temporary construction emissions from operation of construction equipment. When considered in addition to other cumulative projects with a moderate to low potential to result in air quality or climate impacts, the Proposed Action would not lead to significant cumulative climate impacts.

All future actions will be subject to avoidance and minimization studies and will undergo agency review and permitting as required. Every effort will be made to avoid or minimize impacts where feasible. No significant cumulative impacts or cumulative potential effects are associated with the Proposed Action.

4.0 PUBLIC INVOLVEMENT

The Draft EA will be made available for public review and comment for a period of 30 days. A public Notice of Availability will be published in the *Houston Chronicle*. Electronic copies of the Draft EA and supporting materials will be available online at: www.fly2houston.com.

The Draft EA will also be made available for in-person review at the Houston Airport System Infrastructure Division Office, 111 Standifer Street, Humble, Texas 77338.

The public involvement process is inclusive of all residents and population groups in the project area and does not exclude any persons based on income, race, color, religion, national origin, age, or disability.

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5.0 LIST OF PREPARERS

The following sections list the agencies, firms, and individuals that were primarily responsible for preparing this EA.

5.1 Federal Aviation Administration

The FAA is the lead agency for the preparation of this EA. Responsibility for review and approval of this EA rests with the FAA. The following FAA Staff Members were involved in the preparation of this EA:

- **Sana Drissi:** Environmental Protection Specialist, Southwest Region, Texas Airports District Office, FAA

5.2 Principal Preparers

The Houston Airport System (HAS) is responsible for the preparation of this EA. The following HAS representatives were involved in the preparation of this EA:

- **Kim Tourloukis:** Environmental Project Manager, 30 years of experience, responsible for coordinating and managing NEPA analyses for HAS
- **Mark deLorimier:** Environmental Project Manager, 45 years of experience, responsible for coordinating and managing NEPA analyses for HAS
- **Karen Korir:** Director – Planning and Capital Development, 20 years of experience, responsible for overseeing planning, airport spatial information services, capital programming, and environmental and sustainability for HAS
- **Mark Wooten:** Deputy Assistant Director – Environmental, 18 years of experience, oversees HAS environmental team responsible for regulatory compliance.

HAS was supported by a consultant team consisting of Freese & Nichols (FNI) and Harris Miller Miller & Hanson Inc. (HMMH) who contributed to the development of this EA. The following consultant representatives participated in the preparation of this EA:

- **Robert Chambers (FNI):** Principal-in-Charge, 30 years of experience, responsible for team management, coordination with HAS and FAA, and quality assurance
- **Brynn Putnam (FNI):** Project Manager, 6 years of experience, responsible for coordination with HAS and FAA, as well as project scheduling and preparing the Biological Resources and Water Resources sections of the EA
- **Missi Shumer (HMMH):** Principal Consultant – NEPA/Federal Programs, 24 years of experience, responsible for overall production of the EA, assisted with coordination with HAS and FAA
- **Scott Polzin, PMP, MCRP (HMMH):** Principal Consultant – NEPA, 27 years of experience, responsible for conducting QA/QC review of EA
- **Michael Hamilton (HMMH):** Senior Geographic Information Systems Analyst, 30 years of experience, prepared figures and graphics for the EA
- **Erin Greenfield (HMMH):** Technical Editor, 18 years of experience, edited EA and assisted with graphics

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APPENDIX A

Air Quality

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William P. Hobby Airport
Runway 13R-31L Runway Reconstruction
Environmental Assessment

Air Quality Analysis Technical Report

HMMH Report No. 22-0184
January 2025

Prepared for:

Houston Airports

Prepared by:

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1 Introduction

Harris Miller Miller & Hanson is supporting Houston Airports on an analysis of the construction emissions associated with the Runway 13R-31L reconstruction project at William P. Hobby Airport (HOU). The construction emissions were compared to EPA *de minimis* thresholds for General Conformity Applicability. The project includes work to rehabilitate Runway 13R-31L along with taxiways H, L, K, M1, M3, F, Q, and portions of M and N.

The Proposed Action is not anticipated to affect operation levels, as the Airport can accommodate the growth regardless of airfield conditions. The Project will change runway utilizations, which could result in changes in emissions surrounding the airport environment.

This Air Quality Analysis Technical Report discusses the potential for air quality and GHG emissions and climate impacts from the Proposed Action associated with the construction and demolition activities and aircraft operations for the No-Action and Build Alternative. This discussion includes the methodology and assumptions used to develop the emission inventory.

Comparing the inventory of air pollutant emissions associated with each year of activity to the General Conformity *de minimis* thresholds for significance is the basis for evaluating the potential for significant impacts under NEPA for those pollutants designated by the United States Environmental Protection Agency (US EPA) as attainment.

Section 2 of this report presents the affected environment, including standards, attainment status, and monitoring data.

Section 3 presents the environmental consequences associated with the Proposed Action.

Section 4 includes the GHG emissions and climate impacts for construction activities associated with the Proposed Action.

Additionally, **Attachment A** includes air emissions spreadsheet calculations.

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2 Affected Environment

Under NEPA, federal agencies must consider the impact of their actions on the environment compared to a No-Action Alternative. According to Federal Aviation Administration (FAA), NEPA implementing guidance (FAA Order 1050.1F and FAA Order 5050.4B), impacts to air quality must be considered as part of the environmental analysis under NEPA. Potential effects of the Proposed Action are evaluated against the National Ambient Air Quality Standards (NAAQS), as promulgated by the US EPA under the federal Clean Air Act (CAA).

2.1 National Ambient Air Quality Standards

Under the NAAQS, the US EPA currently regulates six criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM), and lead (Pb). PM is divided into two particle size categories: coarse particles with a diameter less than 10 micrometers (PM_{10}) and fine particles with a diameter of less than 2.5 micrometers ($PM_{2.5}$). The NAAQS are expressed in terms of pollutant concentration measured (or averaged) over a defined period of time and are two-tiered. The first tier (the "primary standard") is intended to protect public health; the second tier (the "secondary standard") is intended to protect public welfare and prevent further degradation of the environment. **Table 1** shows the NAAQS primary and secondary standards for the criteria pollutants.

Section 176(c) of the CAA states that federal agencies cannot engage, support, or provide financial assistance for licensing, permitting, or approving any project that could cause or contribute to the severity and/or number of violations of the NAAQS, or could inhibit the expeditious attainment of these standards.

The standards in **Table 1** apply to the concentration of a pollutant in outdoor ambient air. If the air quality in a geographic area is equal to or better than the national standard, the US EPA will typically designate the region as an "attainment area." An area where air quality does not meet the national standard is typically designated by the US EPA as a "nonattainment area." Once the air quality in a nonattainment area improves to the point where it meets the standards and the additional requirements outlined in the CAA, the US EPA can re-designate the area to attainment upon approval of a Maintenance Plan, and these areas are then referred to as "maintenance areas."

Each state is required to prepare a State Implementation Plan (SIP) that outlines measures that regions within the state will implement to attain the applicable air quality standard in nonattainment areas for applicable criteria air pollutant, and to maintain compliance with the applicable air quality standard in maintenance areas. The status and severity of pollutant concentrations in a particular area will impact the types of measures a state must take to reach attainment with the NAAQS. The US EPA must review and approve each state's SIP to ensure the proposed measures are sufficient to either attain or maintain compliance with the NAAQS within a set period of time.

The Clean Air Act Amendments (CAAA) of 1990 require states to make recommendations to the US EPA regarding the attainment status of all areas within their borders when the US EPA finalizes an update to any NAAQS. Under its CAAA authority, the US EPA further classifies nonattainment areas for some pollutants— such as O_3—based on the severity of the NAAQS violation as marginal, moderate, serious, severe, and extreme. To further improve the nation's air quality, the US EPA lowered the O_3 standard in

2015 to 0.070 parts per million (ppm). Similarly in February 2024, the US EPA strengthened the primary annual $PM_{2.5}$ standard to 9 micrograms per cubic meter (μg/m^3) of air from 12 μg/m^3.[1]

Table 1. National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standards	Secondary Standards
CO	8-Hour	9 ppm	None
	1-hour	35 ppm	None
Pb	Rolling 3Month Average	0.15 μg/m^3	Same as Primary
NO_2	Annual Arithmetic Mean	0.053 ppm (100 μg/m^3)	Same as Primary
	1-hour	0.100 ppm [Note 2]	None
O_3	8-hour (2015 standard) [Note 4]	0.070 ppm	Same as Primary
$PM_{2.5}$	Annual Arithmetic Mean	9 μg/m^3 [Note 5]	12 μg/m^3
	24-hour	35 μg/m^3	Same as Primary
PM_{10}	24-hour	150 μg/m^3 [Note 1]	Same as Primary
SO_2	1-hour	75 parts per billion (ppb) [Note 3]	None
	3-hour	None	0.5 ppm

μg/m^3 = micrograms per cubic meter
ppb = parts per billion
ppm = parts per million

Notes:

1. For PM_{10}, the 24-hour standard is not to be exceeded more than once per year on average over three years. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or are less than the standard.
2. To attain this standard, the three-year average of the 98th percentile of the daily maximum one-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).
3. Final rule signed June 2, 2010. To attain this standard, the three-year average of the 99th percentile of the daily maximum one-hour average at each monitor within an area must not exceed 75 ppb.
4. US EPA updated the NAAQS for O_3 to strengthen the primary eight-hour standard to 0.07 ppm on October 1, 2015. An area will meet the standard if the fourth-highest maximum daily eight-hour O_3 concentration per year, averaged over three years is equal to or less than 70 ppb.
5. US EPA strengthened the annual PM2.5 standard to 9 μg/m3 on February 7, 2024 (see https://www.epa.gov/newsreleases/epa-finalizes-stronger-standards-harmful-soot-pollution-significantly-increasing).

Source: US EPA NAAQS, https://www.epa.gov/criteria-air-pollutants/naaqs-table

2.2 Attainment Status

Air quality in the Houston-Galveston-Brazoria area (including Harris County) is currently designated by the EPA Greenbook as being in attainment for all criteria pollutants except for the 2008 and 2015 8-hour ozone standard, which is designated by the EPA as nonattainment.[2] It should be noted that the EPA recently reclassified the Houston-Galveston-Brazoria area, including Harris County, for the 2008 ozone standard from serious to severe[3] and the 2015 ozone standard from marginal to moderate.[4] This redesignation will determine the *de minimis* thresholds used for General Conformity Applicability as

[1] US EPA 40 Code of Federal Regulations (CFR) Parts 50, 53, and 58, https://www.federalregister.gov/documents/2024/03/06/2024-02637/reconsideration-of-the-national-ambient-air-quality-standards-for-particulate-matter. Accessed September 2024

[2] https://www3.epa.gov/airquality/greenbook/anayo_tx.html

[3] https://www.epa.gov/system/files/documents/2022-09/Fact%20Sheet%20NFRM%202008%20Ozone%20Determinations%20final_1.pdf

[4] https://www.epa.gov/system/files/documents/2022-09/Fact%20Sheet%20NFRM%202015%20Ozone%20Determinations%20final_0.pdf

discussed below. Because the Houston-Galveston-Brazoria area is designated as nonattainment for some pollutants, the General Conformity Rule applies to this Proposed Action.

2.3 General Conformity Rule

The General Conformity Rule[5] defines a federal action as any activity engaged in by a department, agency, or instrumentality of the Federal Government, or any activity that a department, agency, or instrumentality of the Federal Government supports in any way, provides financial assistance for, licenses, permits, or approves. General Conformity is defined as demonstrating that a project or action conforms to the SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards. Federally funded and approved actions at airports are subject to the US EPA's General Conformity regulations. The General Conformity Rule applies to all federal actions except for certain highway and transit programs which must instead comply with the Transportation Conformity Plans.[6]

The General Conformity Rule includes annual emissions thresholds for nonattainment and maintenance areas that trigger the need for a General Conformity determination and defines projects that are typically excluded from General Conformity requirements. Since Harris County is located in a US EPA-designated nonattainment area for 2008 and 2015 O_3 standards, the General Conformity requirements apply to the Proposed Action. In addition, the EPA *de minimis* thresholds were used to determine significant impacts under NEPA for those pollutants that are designated attainment with the NAAQS by US EPA in Harris County.

[5] Revisions to the General Conformity Rule are codified under 40 CFR Parts 51 and 93, Subpart W, Revisions to the General Conformity Regulations, Final Rule (April 2010).

[6] 40 CFR Part 93, Subpart A.

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3 Environmental Consequences

Potential air quality impacts associated with construction and demolition activity and aircraft operational sources associated with the Proposed Action are discussed in this section. The Proposed Action would not induce changes in aircraft operations counts, fleet mix or additional vehicle trips compared to the No-Action. However, aircraft operations associated with taxi operations during takeoff and landings will change during construction of the Proposed Action. Therefore, aircraft taxi operations changes were evaluated during the construction years of the Proposed Action.

3.1 Construction Emissions Methodology

This section documents the methods used to calculate emissions of CO, volatile organic compounds (VOCs), NO_x, SO_2, PM_{10}, $PM_{2.5}$, and GHGs from construction and demolition-related sources associated with the Proposed Action. This analysis develops emissions inventories pursuant to NEPA as well as determining whether emissions associated with the Proposed Action would exceed applicable US EPA *de minimis* thresholds.

Estimates of construction-related emissions were developed for the Proposed Action using standard industry methodologies and techniques including the FAA Aviation Emissions and Air Quality Handbook Version 4 (FAA Handbook Version 4) and associated US EPA guidance, Motor Vehicle Emission Simulator (MOVES4.0.1 latest available edition) and Texas Commission on Environmental Quality (TCEQ) guidance for NONROAD emission factors (TexN2.2) for both on-road and nonroad source emission factors, respectively. These techniques are described in more detail in the following sections. Construction activities associated with the Proposed Action were estimated for the Proposed Action for each construction year (2026 and 2027).

3.1.1 Demolition and Construction Activities

The goal of the reconstruction of Runway 13R-31L is to improve airfield safety and replace deteriorated infrastructure, while not causing additional long-term regional airspace conflicts. The Runway 13R-31L reconstruction would include the following activities:

- Full reconstruction of the Runway 13R-31L pavement.
- Taxiway improvements
- Improved grading, drainage, shoulders, and pavement markings.
- Improve utilities, lighting, signage, and NAVAIDs. The utility work will include replacing/re-aligning of FAA utilities and equipment.

Construction emissions were not estimated for the No-Action Alternative because no construction activity would be associated with the No-Action Alternative. The construction associated with the Proposed Action would result in short-term changes in air emissions from sources such as exhaust from nonroad construction equipment such as:

- Milling and paving,
- Site clearing,

- Grading,
- Demolition, and
- Runway marking and lighting.

On-road vehicles include those associated with:

- Transport and delivery of supplies,
- Materials and equipment to and from the site, and
- Construction worker trips.

Additionally, fugitive dust emissions sources include:

- Site preparation,
- Equipment movement on unpaved and paved roads, and
- Evaporative emissions from the application of asphalt paving.

Demolition and construction activities associated with the Proposed Action are expected to occur over a 26-month period beginning August of 2026 and completed around September of 2028. **Table 2** presents the primary components of the Proposed Action, including area estimates, preliminary costs, and anticipated start and end dates of construction. These estimates were used for deriving construction equipment schedules with the Airport Cooperative Research Board's (ACRP's) Airport Construction Emissions Inventory Tool (ACEIT).[7]

[7] ACRP, 2014 https://crp.trb.org/acrp0267/acrp-report-102-guidance-for-estimating-airport-construction-emissions/

Table 2. Proposed Action Construction and Demolition Activities

Project Action Component	Preliminary Costs	Estimate Area (Square Feet)	Construction Start	Construction End
Runway Reconstruction 13R-31L (Demolition)	$11,690,000	1,399,850	4/15/2026	12/31/2027
Runway Reconstruction 13R-31L (Reconstruction)	$67,573,000	1,399,850	4/15/2026	12/31/2027
Taxiway H Reconstruction	$970,500	20,100	5/01/2027	9/15/2027
Taxiway H Demolition	$168,000	20,100	5/01/2027	9/15/2027
Taxiway M1 Reconstruction	$5,221,000	108,150	9/15/2026	1/15/2027
Taxiway M1 Demolition	$610,000	73,000	9/15/2026	1/15/2027
Taxiway L Reconstruction	$1,972,000	40,850	1/15/2027	4/30/2027
Taxiway L Demolition	$341,000	40,850	1/15/2027	4/30/2027
Taxiway K Reconstruction	$1,516,000	31,400	5/01/2026	9/15/2026
Taxiway K Demolition	$262,000	31,400	5/01/2026	9/15/2026
Taxiway F Reconstruction (Mill and Overlay)	$2,500,000	44,400	4/15/2026	3/15/2027
Taxiway Q Demolition	$290,000	34,625	1/1/2027	12/31/2027
Taxiway Q Reconstruction	$1,672,000	34,625	1/1/2027	12/31/2027
Taxiway M3 Demolition	$618,000	74,000	1/1/2027	12/31/2027
Taxiway M3 Reconstruction	$5,163,000	106,950	1/1/2027	12/31/2027
Taxiway M and N Demolition	$652,000	78,125	1/1/2027	12/31/2027
Taxiway M and N Reconstruction	$3,772,000	78,125	1/1/2027	12/31/2027

Notes: Information provided by HOU Airports, 10/9/2024.

The ACRP ACEIT model[8] was used to estimate the construction *schedule of equipment only* for each project component based on the preliminary project dimensions and project costs for each activity consistent with the FAA Handbook Version 4 guidance.[9] The model has the ability to generate construction schedules (i.e., equipment type and hours) for a variety of standard airport construction projects including the associated activity types and the equipment used for this project.

[8] ACRP, Guidance for Estimating Airport Construction Emissions, http://onlinepubs.trb.org/onlinepubs/acrp/docs/ACRP02-33_FR.pdf.

[9] FAA Aviation Emissions and Air Quality Handbook Version 4, Section 5.2.1, https://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/files/airquality_handbook_version_4.pdf

ACEIT can also produce emission factors for nonroad and on-road construction equipment, as well as for fugitive emission sources using US EPA and industry standard models and methodologies. However, the current version of ACEIT includes an older version of the US EPA's MOVES emission model, MOVES2010a and NONROADs, which have both been updated over the years. Consistent with the recent FAA Handbook Version 4, emission factors were generated outside of ACEIT using the current version of MOVES4 *and* TCEQ guidance for NONROAD emission factors (TexN2.2)[10] to develop on-road and nonroad emission factors for Harris County.[11] These emission factors were applied to estimates of vehicle miles traveled (VMT) and construction equipment (hours, horsepower, load factor), respectively, for each construction activity and year. Spreadsheet calculations for construction are presented in **Attachment A**.

3.1.2 Off-Road Construction Equipment

As discussed above, off-road equipment emission factors for each construction year using the TCEQ TexN2.2 model and incorporates county-level data representative of Harris County, was used to estimate emissions for both criteria pollutants/precursors and GHGs. Emission factors in grams per horsepower hour (hp-hr) for each nonroad equipment type were applied to the equipment size (in hp), load factor, and anticipated activity levels (in hours per year) of expected equipment use, as generated in the construction equipment inventory by ACEIT.

The annual emissions for off-road construction equipment were computed using the following equation:

Off-road Vehicle Construction emissions (tons per year) = emission factor (grams per hp-hr) x size (hp) x load factor x hours per year x (1 pound/453.6 grams) x (1 ton/2,000 pounds)

3.1.3 On-Road Construction Passenger/Truck Delivery Vehicles

VMT data for each on-road employee trip and truck delivery vehicles were derived from round trip distances and the number of employee hours from the activity-specific construction schedule in ACEIT. It is assumed that all on-road equipment would use gasoline for passenger vehicles and diesel fuel for truck deliveries. Emission factors in grams per mile (g/mile) for each on-road vehicle type were applied to the anticipated VMT. Similar to the way emissions are estimated for nonroad equipment, the MOVES4 model uses US EPA vehicle default data representative of Harris County for both criteria pollutants/precursors and GHGs to estimate emissions factors in g/mile. A round-trip distance of 30 miles was assumed for employee trips and 40 miles was assumed for material delivery trips.

The annual emissions for on-road passenger/delivery vehicles were computed for each year using the following equation:

On-road construction vehicles emissions (tons per year) = emission factor (g/mile) x annual VMT x (1 pound/453.6 grams) x (1 ton/2,000 pounds)

[10] https://www.tceq.texas.gov/downloads/air-quality/research/reports/emissions-inventory/5822111300fy2021-20210423-erg-texn2-update.pdf

[11] Construction emissions used in MOVES4 NONROAD assumed a blend of Tier 1, Tier 2, Tier 3, and Tier 4 for Harris County based on US EPA phasing ratios of older equipment in future years and does not reflect the primary use of either Tier 1 thru Tier 4 engines. MOVES emission factors are specific to Harris County as generated within MOVES for each year.

3.1.4 Fugitive Dust Emissions

Fugitive dust emissions from site preparation and land clearing, equipment movement on unpaved and paved areas, along with evaporative emissions from asphalt paving activities were estimated using US EPA emission factors and methodologies. These are all included in the total construction emissions.

3.2 Summary of Construction-Related Emissions

Construction-related emissions of criteria pollutants using the methodology discussed above during the 2026 and 2027 construction years under the Proposed Action are summarized in **Table 3**. Pb emissions are included and are expected to be zero as fuel for the construction and vehicles is expected to be ultra-low diesel fuel and gasoline, neither of which contain lead. The air emissions spreadsheets are included in **Attachment A**.

Table 3. Construction Criteria Pollutant Emission Inventory – Proposed Action for Each Construction Year

Construction Year	Relevant Criteria Pollutant Emissions (tons per year)						
	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC	Lead
2026	9.32	5.90	0.036	2.36	0.38	1.20	0
2027	28.06	9.05	0.065	3.91	0.60	4.99	0

Notes:
1. Following standard industry practice, O_3 was evaluated by evaluating emissions of VOC and NOx, which are precursors in the formation of O_3.

Source: HMMH, 2024 and information provided by HOU 10/9/2024.

3.3 Aircraft and Stationary Operational Emissions

As discussed above, implementation of the Proposed Action would not increase the number of aircraft or change the fleet mix compared to the No-Action Alternative; however, runway redistribution of aircraft will occur during construction from Runway 31R-13L to Runway 4-22. Taxi times were assumed to not change during construction and are based on the AEDT default values for both the Proposed and No Action. Therefore, emission changes from aircraft operations during construction of the Proposed Action were quantified for the 2027 construction year using the Aviation Environmental Design Tool (AEDT) model. To satisfy NEPA requirements, the operational emission changes of the No-Action Alternative and the Proposed Action along with concurrent construction emissions were compared to General Conformity *de minimis* levels for significance.

For the Proposed Action, the runway configuration and redistribution of aircraft are summarized as follows:

Proposed Action:

- Any aircraft that would normally depart from or land at Runway 13R would use Runway 4 instead. Any aircraft that would normally depart from or land at Runway 31L would use Runway 22 instead. Operations that use Runway 13L/31R would remain the same in the Proposed Action and No Action.
- No changes to taxi times compared to the No-Action Alternative.

The AEDT was run using the same set of model inputs that were used for the noise calculations in the Noise Technical Report (see **Appendix C** of the EA).

The aircraft operational emissions also include emissions from the ground support equipment (GSE) and auxiliary power units (APUs) associated with the No-Action Alternative and the Proposed Action.
The AEDT estimates emissions of the criteria pollutants of CO, NO_X, VOCs, SO_X, PM_{10}, and $PM_{2.5}$, which are primarily emitted through the combustion of fuel by mobile sources and from large industrial facilities. Pb emissions from aircraft utilizing aviation gasoline (Avgas) were also estimated. The air quality analysis estimates emissions from the following sources:

- **Aircraft engines:** Aircraft engines typically represent the largest category of on-airport sources of emissions, which occur during takeoff, landing, taxiing, and idling on taxiways and aircraft apron areas.
- **APUs:** APUs are small aircraft engines, incorporated into an aircraft's airframe and fueled by jet fuel, which are used while aircraft are on the ground. APUs can be used to provide electricity and heated/cooled air while passengers are enplaning or deplaning, during cargo operations, cleaning, and/or minor maintenance.
- **GSE:** GSE is categorized as off-road equipment and encompasses all equipment that is needed to service aircraft during ground operations and primarily includes baggage tractors and belt loaders. Additional GSE types include catering trucks, pushback tractors, lavatory trucks, potable water trucks, airline support staff vehicles, ground power units, and fueling trucks.
- **Avgas:** General aviation aircraft utilize Avgas which contains leaded fuel. Pb emissions were estimated externally using EPA's Pb emissions calculation procedures as referenced in *Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2011 National Emissions Inventory*.[12]

In AEDT, the operating modes are defined somewhat differently than in previous airport air quality models. The modes of interest for air quality impacts include:

- Startup
- Climb Taxi (the increment of this mode was previously referred to as Taxi Out)
- Climb Below Mixing Height (the increment of this mode was previously referred to as Climbout and includes takeoff)
- Descend Below Mixing Height (previously referred to as Approach)
- Descend Taxi (the increment of this mode was previously referred to as Taxi In)

The takeoff/climb out and approach time-in-mode is based on an annual average mixing height, assumed to be 3,000 feet, per the AEDT default value.

3.3.1 Aircraft Operations

The forecast developed for the Domestic Redevelopment Program (DRP) was used as the basis for this EA. The EA forecast was compared to the FAA Terminal Area Forecast (TAF) released in January of 2024 and while higher than the 2023 TAF, the forecast was within five percent of the total forecast operations and within 10 percent for commercial operations which is within FAA guidelines. Therefore, the interpolated DRP EA forecast was used for the future 2027 operational levels in this EA. The interpolated

[12] US EPA, Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2011 National Emissions Inventory, https://nepis.epa.gov/Exe/ZyPDF.cgi/P100LFGL.PDF?Dockey=P100LFGL.PDF

DRP EA forecast for 2027 is used for the 2027 No Action and Proposed action as there are no anticipated operational changes as a result of the Proposed Action.

3.3.2 Aircraft Emission Factors

The aircraft engine emission factors are included in the AEDT and are based on the most recent version of the International Civil Aviation Organization (ICAO) Engine Emissions Databank. Therefore, through AEDT, the ICAO emission factors are used to estimate emissions from aircraft engines. Currently, the latest version of AEDT (Version 3f) does not estimate lead emissions. Therefore, Pb emissions were estimated in a separate analysis outside of AEDT using EPA's Pb emissions calculation procedures as referenced in *Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2011 National Emissions Inventory*.[13]

3.3.3 Auxiliary Power Units

APUs are small utility engines incorporated into the airframe of an aircraft that operate on jet fuel and are used to provide power for lights and navigational equipment and heated/cooled air to the passenger areas of the aircraft while it is parked on the ground. Emissions of criteria pollutants and GHGs from APUs were estimated using the FAA's recommended APU time for each aircraft operation being modeled for both the No-Action and the Proposed Action. For this analysis, aircraft ground operations were modeled using AEDT's 26-minute default APU time, or 13 minutes per arrival and 13 minutes per departure.

3.3.4 Ground Support Equipment

GSE at airports includes baggage tractors, belt loaders, aircraft pushback tractors, catering trucks, lavatory trucks and other off-road equipment that provides services to aircraft while they are on the ground being loaded with passengers and cargo. GSE emissions were estimated within AEDT using default GSE equipment for each aircraft type for each year of analysis.

3.3.5 Summary of Operational Emissions

Table 4 provides the 2027 aircraft operational emissions for the No-Action and Proposed Action as calculated by AEDT. The table also includes Pb emissions utilizing Avgas.

The emissions presented in **Table 4** are the total of the of the aircraft modes including climb and descent below the mixing height, which includes taxi-in and taxi-out, along with GSE and APU. The individual mode contribution to these totals is included in **Attachment A** for each pollutant. GHG emissions for the operational activities are presented in **Section 4**.

As shown in **Table 4**, changes in emissions for the Proposed Action are primarily attributed to the runway redistribution of aircraft during construction from Runway 13R-31L to Runway 4-22. More specifically, the changes in emissions primarily occur during landing and takeoff modes. As shown in the tables the emission changes are very slight during landing and takeoff modes for all criteria pollutants

[13] US EPA, Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2011 National Emissions Inventory, https://nepis.epa.gov/Exe/ZyPDF.cgi/P100LFGL.PDF?Dockey=P100LFGL.PDF

between the No Action and Proposed Action. The main contributor to the difference in emissions between the Proposed Acfion and No Acfion condifions is the difference in runway end elevafions between Runway 13R-31L and Runway 4-22 (Runway 13R-31L having a lower elevafion than Runway 4-22). While minor, runway end elevafion does play a part in AEDT's emissions calculafions (usually the higher the runway end elevafion, the lower the emissions for most pollutants compared to lower elevafion runway ends at the same airport). This slight change in runway end elevafions contributes to the AEDT's calculafion of most aircrafts climb and descent below the mixing height.

Table 4. Operational Criteria Pollutant Emissions Inventory (in TPY) of the 2027 Proposed Action and the No-Action During Construction

Activity	Relevant Criteria Pollutant Emissions (tons per year) Note 1						
	CO	VOC[1]	NO_x [1]	SO_2	PM_{10}	$PM_{2.5}$	Pb [2]
2027 No Action Alternative							
Climb and Descent below the Mixing Height[3]	131.87	46.94	572.11	45.56	3.829	3.829	0.024180
Taxi In/Taxi Out	405.63	88.05	54.47	18.84	1.305	1.305	0
APU	37.88	2.25	31.25	4.87	4.059	4.059	0
GSE	341.04	9.19	8.84	0.07	0.465	0.427	0
Total 2027 No Action Alternative	**916.41**	**146.42**	**666.67**	**69.35**	**9.66**	**9.62**	**0.024180**
2027 Proposed Action							
Climb and Descent below the Mixing Height[3]	131.96	46.94	571.14	45.49	3.823	3.823	0.024182
Taxi In/Taxi Out	405.63	88.05	54.47	18.84	1.305	1.305	0
APU	37.88	2.25	31.25	4.87	4.059	4.059	0
GSE	341.04	9.19	8.84	0.07	0.465	0.427	0
Total 2027 Proposed Action	**916.51**	**146.42**	**665.69**	**69.28**	**9.65**	**9.61**	**0.024182**

APU = Auxiliary Power Units
GAV = Ground Access Vehicles
GSE = Ground Support Equipment

Notes:

1. Following standard industry practice, O_3 was evaluated by evaluating emissions of VOC and NOx, which are precursors in the formation of O_3.
2. Pb emissions were estimated externally using EPA's Pb emissions calculation procedures as referenced in Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2011 National Emissions Inventory.
3. Criteria pollutant emissions were estimated for aircraft operations below the mixing height (3,000 feet) for departure and approach.

Source: HMMH, October 2024

3.3.6 Significance Thresholds

As provided in FAA Order 1050.1F, an action would cause a significant air quality impact if pollutant concentrations would exceed one or more of the NAAQS established by the US EPA under the CAA, for any of the time periods analyzed, or would increase the frequency or severity of any such existing violations. Additionally, the CAA requires federal agencies such as the FAA to ensure their actions conform to the appropriate SIP. Conformity requires that a project or action adheres to the SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards. As stated in **Section 2.3,** the General Conformity Rule applies to the Proposed Action.

If General Conformity applies, an applicability analysis is performed to determine if a General Conformity Determination is required to demonstrate that a project or action conforms to the approved SIP(s). A conformity determination is required if the total direct and indirect pollutant emissions resulting from a project are above the *de minimis* emissions threshold levels specified in the conformity regulations.[14] The *de minimis* thresholds represent emission quantities of a NAAQS-regulated pollutant, or its applicable precursors, over which a proposed action in a nonattainment or maintenance area may cause or contribute to a new or continued violation of the NAAQS. A conformity determination is not required if the differences in emissions between the Proposed Action and the No-Action Alternatives are below the applicable *de minimis* emission threshold levels, or if the Proposed Action is exempt or included in the FAA list of "presumed to conform activities."

As stated in **Section 2.2**, HOU is located in Harris County, which is currently designated by the US EPA Greenbook as being in nonattainment with the 2008 (severe) and 2015 (moderate) 8-hour O_3 standard.[15] The remaining criteria pollutants, SO_2, CO, PM_{10}, $PM_{2.5}$ and Pb are designated attainment with the NAAQS. Because the Houston-Galveston-Brazoria is designated non attainment for some pollutants, the General Conformity Rule applies to the Proposed Action.

Federal US EPA *de minimis* emission thresholds for nonattainment areas relevant to Harris County are listed in **Table 5**. As noted in the table, pollutants designated as attainment do not have US EPA *de minimis* thresholds; therefore, as a conservative assumption, the maintenance *de minimis* thresholds were used to determine significant impacts under NEPA for attainment pollutants.

[14] US Environmental Protection Agency, General Conformity *De Minimis* Tables, https://www.epa.gov/general-conformity/de-minimis-tables. Accessed August 2024

[15] US EPA Green Book, https://www3.epa.gov/airquality/greenbook/anayo_tx.html. Accessed September 2024

Table 5. General Conformity US EPA *De Minimis* pollutant Emission Thresholds

Pollutants	Attainment Status (Severity)	Pollutants	Threshold (tons per year)
CO	**Attainment** Note 2	CO	**100**
O_3 Note 1	**Serious**	NO_X	**25**
O_3 Note 1	**Serious**	VOC	**25**
$PM_{2.5}$	**Attainment** Note 2	$PM_{2.5}$	**100**
PM_{10}	**Attainment** Note 2	PM_{10}	**100**
SO_2	**Attainment** Note 2	SO_2	**100**
Pb	**Attainment** Note 2	Pb	**25**

Notes:
1. Following standard industry practice, O_3 was evaluated by evaluating emissions of VOC and NOx, which are precursors in the formation of O_3.
2. Pollutants designated as attainment, no *de minimis* threshold exists for attainment pollutants. As a conservative approach, the *de minimis* threshold for maintenance was assumed for determining significance under NEPA.

Source: US EPA *De Minimis* Tables https://www.epa.gov/general-conformity/de-minimis-tables, US EPA, 2024

3.3.7 Construction and Operations Emission Impacts

Table 6 presents the construction emissions associated with demolition and construction of the Proposed Action and the net Aircraft Operation emissions (Proposed Action minus No-Action) for the construction year periods compared with the appropriate US EPA *de minimis* thresholds.

As discussed above, demolition and construction activities associated with the Proposed Action are expected to begin in 2026 and be completed in 2027. Similarly for aircraft operations, representative years were also evaluated for periods during the construction for Alternative 2027 which represents the worst case construction year. The corresponding construction and net operational emissions from **Table 3** and **Table 4** were added together to get a total net increase in emissions for each year and compared to the appropriate *de minimis* thresholds.

As shown in **Table 6**, the total emissions each representative year for construction and net aircraft emissions would be below established *de minimis* thresholds for all pollutants. Therefore, a General Conformity determination is not required for the construction and demolition activities for the Proposed Action. Additionally, in accordance with the FAA 1050.1 Desk Reference,[16] the Proposed Action can be determined to "not cause a significant air quality impact, since it is unlikely the pollutant concentration analyzed would exceed a NAAQS." No significant adverse air quality impacts would be expected to result from construction of the Proposed Action.

[16] FAA 1050.1 Desk Reference, https://www.faa.gov/about/office_org/headquarters_offices/apl/environ_policy_guidance/policy/faa_nepa_order/desk_ref. Accessed August 2024

Table 6. Construction and Net Operational Emissions for the Proposed Action for Each Year Compared to US EPA *De Minimis* Thresholds

Construction Year	Relevant Criteria Pollutant Emissions (tons per year)						
	CO[1]	NOx	SO_2[1]	PM_{10}[1]	$PM_{2.5}$[1]	VOC	Lead[1]
***2026* Construction Emissions**	9.32	5.90	0.036	2.36	0.38	1.20	0
US EPA de minimis Threshold	***100***	***25***	***100***	***100***	***100***	***25***	***25***
Emissions below de minimis thresholds?	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***
2027 Construction Emissions	28.06	9.05	0.065	3.91	0.60	4.99	0
***2027 Net Aircraft* Operational Emissions Delta *(Proposed Action minus No Action)*[3]**	0.09	-0.97	-0.07	-0.01	-0.01	0.0	0.000002
2027 Total Emissions (Construction + Net Operational)	28.15	8.08	-0.005	3.90	0.59	4.99	0.000002
US EPA de minimis Threshold	***100***	***25***	***100***	***100***	***100***	***25***	***25***
Emissions below de minimis thresholds?	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***

Notes:

1. General Conformity does not apply for these pollutants in the HOU area because the area is designated attainment/unclassifiable for these NAAQS. The General Conformity *de minimis* threshold for maintenance area were conservativity used to determine significance under NEPA for these pollutants.
2. Pb emissions for construction emissions were not estimated since the fuel use for these sources are gasoline and diesel which do not contain Pb.
3. Net Aircraft emissions from Table 4 Total Proposed Action Aircraft minus Total Proposed No Action Aircraft.

Source: HMMH, October 2024

3.3.8 No-Action Alternative

The No-Action Alternative assumes that the Proposed Action would not be implemented, and air quality would remain unchanged for the construction years. Therefore, no additional air quality impacts would occur as a result of choosing the No-Action Alternative.

3.3.9 Mitigation

As indicated in **Section 3.3.7**, air quality impacts associated with construction or operation of the Proposed Action would not be significant; therefore, no mitigation measures are required for construction or operational emissions. However, HOU is committed to best management practices and reasonably available control measures to further minimize air emissions. Some examples may include but not limited to:

- Construction sequencing or phasing.
- Require the use of equipment that meets Tier IV emission standards.
- Minimization of exposed soils at any given time during construction activities.

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4 Greenhouse Gases

Climate change is a global phenomenon that can have local impacts.[17] Scientific measurements show that Earth's climate is warming, with concurrent impacts including warmer air temperatures, increased sea level rise, increased storm activity, and an increased intensity in precipitation events. Increasing concentrations of GHG emissions in the atmosphere affect global climate.[18,19] GHG emissions result from anthropogenic sources, including the combustion of fossil fuels. GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), O_3, and fluorinated gases.[20] CO_2 is the most important anthropogenic GHG because it is a long-lived gas that remains in the atmosphere for up to 100 years. Anthropogenic sources of GHG emissions include the combustion of fossil fuels. Scientific measurements show that Earth's climate is warming, with concurrent impacts including warmer air temperatures, increased sea level rise, increased storm activity, and an increased intensity in precipitation events.

The Earth's global temperature has risen by 1.5°F over the past century and is projected to continue to rise.[21] Small changes in the global temperature over time can translate into large and potentially dangerous shifts in climate and weather on a global scale and even at the local level. Many states have seen changes in rainfall, resulting in more floods, droughts, or intense rain, as well as more frequent and severe heat waves.[22]

In terms of U.S. contributions, the U.S. 2021 Aviation Climate Action Plan establishes a goal of "Net-Zero GHG Emissions from the U.S. Aviation Sector by 2050."[23] Importantly, actions are underway within the United States and by other nations to reduce aviation's contribution of GHGs. Such actions, which are in varying degrees of development, include new aircraft technologies to reduce emissions and improve fuel efficiency, renewable alternative fuels with lower carbon footprints, more efficient air traffic management, FAA airport-reduction programs, market-based measures, and environmental regulations, including an aircraft CO_2 standard.

[17] As explained by the US EPA, "greenhouse gases, once emitted, become well mixed in the atmosphere, meaning U.S. emissions can affect not only the U.S. population and environment but other regions of the world as well; likewise, emissions in other countries can affect the United States." U.S. Environmental Protection Agency, Climate Change Division, Office of Atmospheric Programs, Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the CAA 2-3, 2009, https://www.epa.gov/ghgemissions/technical-support-document-endangerment-and-cause-or-contribute-findings-greenhouse.

[18] Global warming potentials are based on the latest Intergovernmental Panel on Climate Change (IPCC), Sixth Assessment Report (AR6), March 2021. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_07_Supplementary_Material.pdf.

[19] US Global Change Research Program, Global Climate Change Impacts in the United States, 2009, http://www.globalchange.gov/what-we-do/assessment/previous-assessments/global-climate-change-impacts-in-the-us-2009.

[20] US Environmental Protection Agency, Overview of Greenhouse Gases, http://www3.epa.gov/climatechange/ghgemissions/gases.html.

[21] Air Quality Help, DAF Air Emission Guides, https://www.aqhelp.com/AQdocs.html.

[22] Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide – Fundamentals Volume 1 of 2, https://aqhelp.com/Documents/FINAL%20-%20AF%20AQ%20EIAP%20Guide%20Vol%201%20-%202019.pdf.

[23] United States, 2021 Aviation Climate Action Plan, December 2021, https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf

4.1 Regulatory Framework

Research has shown that there is a direct link between fuel combustion and GHG emissions. Therefore, sources that require fuel or power at an airport are the primary sources that would generate GHGs including construction emissions.

While U.S. aviation has seen increased traffic in terms of passengers over the past 30 years, aviation's share of U.S. CO_2 emissions has remained relatively constant. In 2019, civil aviation's share of U.S. CO_2 emissions was about 2.7 percent of total domestic emissions.[24] Aircraft in the national air space are operating much more efficiently, moving more passengers using the same amount of energy. In 2018, the U.S. aviation sector carried about 32 percent more passengers than in the year 2000, while using almost the same amount of fuel (and emissions), due in large part as result of the fuel efficiency improvements of the fleet over time. Today's fleet of aircraft has an average fuel efficiency of 57.5 passenger-miles per gallon of fuel.[25]

The most recent report by the Intergovernmental Panel on Climate Change (IPCC) was used for calculating Global Warming Potential (GWP) to account for the influence of future warming on the carbon cycle.[26] The GWP indicator is a way to compare the global warming impacts of different gases, by converting each gas amount to a carbon dioxide equivalent (CO_2e). GWPs provide a common unit of measure, which allows for consistency when estimating emissions of these different gases. CO_2 has a GWP of one because it is the gas used as the reference point. CH_4 does not last as long in the atmosphere as CO_2; however, it absorbs much more energy. In comparison, one ton of CH_4 has 29.8 times more heat-capturing potential than one ton of CO_2. The amount of CH_4 emissions would be multiplied by 29.8 to determine its CO_2e value. N_2O lasts in the atmosphere far longer than CO_2. The amount of N_2O emissions would be multiplied by 273 to determine its CO_2e value.

Although no federal standards have been set for GHG emissions, it is well established that GHG emissions can affect climate. The Council on Environmental Quality (CEQ) recently released interim guidance on GHG and climate impacts for NEPA and is currently in the comment period but can be used for new NEPA projects.[27] The recently issued interim guidance to assist agencies in analyzing GHG and climate change effects of their proposed actions under the NEPA.[28] This interim GHG guidance, effective upon publication, builds upon and updates CEQ's 2016 *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews ("2016 GHG Guidance"),* highlighting best practices for analysis grounded in science and agency experience.[29] CEQ issued this guidance to provide for greater clarity and more consistency in how agencies address climate change in NEPA reviews.

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[24] US EPA, "Inventory of U.S. Greenhouse Gas Emissions and Sinks," available at: www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks.

[25] US, "United States Efforts to Address Aviation's Climate Impact," A40-WP/531, ICAO 40th General Assembly, Executive Committee, available at: www.icao.int/Meetings/a40/Documents/WP/wp_531_en.pdf.

[26] https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_07_Supplementary_Material.pdf.

[27] https://www.federalregister.gov/documents/2023/01/09/2023-00158/national-environmental-policy-act-guidance-on-consideration-of-greenhouse-gas-emissions-and-climate.

[28] Federal Register: National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change

[29] CEQ, Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews, 81 FR 51866 (Aug. 8, 2016), https://ceq.doe.gov/docs/ceq-

The scientific community is continuing its efforts to better understand the impact of aviation emissions on the global atmosphere. In particular, the FAA is leading and participating in a number of initiatives intended to clarify the role that aviation plays in GHG emissions and climate. For example, the FAA, with support from the U.S. Global Change Research Program (GCRP)[30] and its participating federal agencies (i.e., NASA, NOAA, US EPA, DOT, and DOE)[31] has developed the Aviation Climate Change Research Initiative (ACCRI)[32] in an effort to advance scientific understanding of the regional and global climate impacts of aircraft emissions. This effort also seeks to quantify uncertainties for current and projected aviation scenarios under changing atmospheric conditions.[33] The FAA also funded the Partnership for Air Transportation Noise & Emissions Reduction (PARTNER) and subsequently the Center of Excellence for Alternative Jet Fuels and Environment (ASCENT) research initiatives to quantify the effects of aircraft exhaust and contrails on global and U.S. climate and atmospheric composition. Similar research topics are being examined at the international level by the ICAO.[34]

There are no formal standards for GHG emissions; however, on January 9, 2023, the CEQ issued interim guidance for public comment for establishing uniform practices for assessing the effects of GHG and climate change effects of proposed federal projects pursuant to NEPA. The 2023 Interim Guidance provided guidance for preparing a GHG analyses, including when and how GHGs should be quantified, the contextualization of GHGs, analysis of reasonable alternatives, mitigation of GHG emissions, and engagement with environmental justice communities. On May 1, 2024, CEQ issued its final rule (Phase 2 Rule) updating its NEPA implementing regulations. The Phase 2 Rule reaffirms that environmental documents should include analysis of "[w]here applicable, climate change-related effects, including, where feasible, quantification of greenhouse gas emissions, from the proposed action and alternatives and the effects of climate change on the proposed action and alternatives" (see 40 Code of Federal Regulations [CFR] §1502.16(a)(6)).[35]

Furthermore, per FAA Order 1050.1F, the discussion of potential climate impacts should be documented in a separate section of the NEPA document, distinct from air quality.[36] Where the proposed action or alternative(s) would result in an increase in GHG emissions, the emissions should be assessed either qualitatively or quantitatively. The guidance recommends consideration of (1) the potential effects of a proposed action or its alternatives on climate change as indicated by its GHG emissions and (2) the implications of climate change for the environmental effects of a proposed action or alternatives. The

regulations-and-guidance/nepa_final_ghg_guidance.pdf. On April 5, 2017, CEQ withdrew the final 2016 guidance, as directed by E.O. 13783. 82 FR 16576 (Apr. 5, 2017). On June 26, 2019, CEQ issued draft GHG guidance. 84 FR 30097 (June 26, 2019). CEQ rescinded this draft guidance on February 19, 2021, pursuant to E.O. 13990. 86 FR 10252 (Feb. 19, 2021). In addition, on April 20, 2022, CEQ issued a Final Rule for its "Phase 1" NEPA rulemaking. 87 FR 23453. CEQ will be proceeding with updates to the NEPA regulations as set forth in the 2022 Regulatory Agenda.

30 U.S. Global Change Research Program, http://www.globalchange.gov/about

31 National Aeronautics and Space Administration (NASA) at http://www.nasa.gov/, National Oceanic and Atmospheric Administration (NOAA) at http://www.noaa.gov/, and Department of Energy (DOE) at http://energy.gov/.

32 FAA, Aviation Climate Change Research Initiative, https://www.faa.gov/sites/faa.gov/files/about/office_org/headquarters_offices/apl/ACCRI_Report_final.pdf.

33 Nathan Brown, et. al. The U.S. Strategy for Tackling Aviation Climate Impacts, 2010, 27 th International Congress of the Aeronautical Sciences.

34 Lourdes Q. Maurice and David S. Lee. Chapter 5: Aviation Impacts on Climate. Final Report of the International Civil Aviation Organization (ICAO) Committee on Aviation and Environmental Protection (CAEP) Workshop, October 29 th - November 2nd 2007, Montreal.

35 89 Fed. Reg. 35494 (May 1, 2024).

36 https://www.faa.gov/sites/faa.gov/files/about/office_org/headquarters_offices/apl/3-climate.pdf.

overall reduction of aviation related GHG emissions impacts on climate is a goal, but it is not a regulatory mandate.

4.2 Affected Environment

The Houston Airport System (HAS) conducted a baseline greenhouse gas inventory in August of 2018 as part of the Sustainable Management Plan for the Houston Airport System[37]. The inventory included both the George Bush Intercontinental Airport (IAH) and HOU. The goal of the goals of the SMP "is not only promote energy, waste, water, and greenhouse gas reductions, but also focus on enhancing our sustainable operations in the areas of design, assets and infrastructure, and procurement."

Developing a GHG emissions baseline is a core component of sustainability planning, and tracking GHG emissions can be accomplished in tandem with other sustainability initiatives around energy use and solid waste. Emissions are reported by ownership and control of the emissions source:

• Scope 1 emissions are those generated and controlled by the airport operator, such as onsite electricity generation and operation of airport vehicles.

• Scope 2 emissions are those generated offsite from activities controlled by the airport operator, such as the offsite generation of electricity or solid waste disposal.

• Scope 3 emissions are generated and controlled by airport tenants and other stakeholders, and include emissions from aircraft as well as tenant and passenger vehicles.

Scope 1 and 2 emissions, which align with data collected for other sustainability categories and reflect activities directly controlled by HAS, were quantified and included in the baseline study. Scope 3 emissions are not directly controlled by HAS and were not quantified.

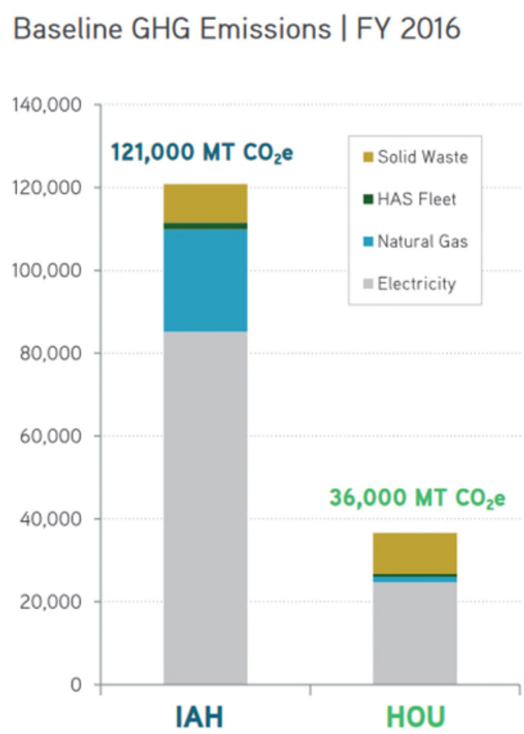
Figure 1 below presents the baseline GHG emissions for 2016 for both IAH and HOU airports reported as metric tons of CO2 equivalent (MT CO2e). IAH and HOU reported 121,000 MT CO2e and 36,000 MT CO2e, respectively for Scope 1 and Scope 2 emissions.

It should be mentioned that HOU airports is committed to carbon neutrality by 2030 and as part of that commitment George Bush Intercontinental and William P. Hobby airports have successfully met all the necessary requirements to upgrade to Level 2 Reduction of the *Airport Carbon Accreditation.*[38]

[37] https://cdn.fly2houston.com/cdn/ff/C1SAXEK4MSaX0ZIzcFIiCQO4r-Ol4uDfVV_fslgoVeE/1673963675/public/2023-01/HAS%20SMP%20Report_August-2018_w-sig-page.pdf

[38] https://www.airportcarbonaccreditation.org/houston-airport-system-airports-achieve-level-2-reduction/

Figure 1 Baseline GHG Emissions for HOU and IAH FY 2016



Source: https://cdn.fly2houston.com/cdn/ff/C1SAXEK4MSaX0ZIzcFIiCQO4r-Ol4uDfVV_fslgoVeE/1673963675/public/2023-01/HAS%20SMP%20Report_August-2018_w-sig-page.pdf

4.3 Analysis Methodology

For this analysis, GHG emissions associated with the Proposed Action were prepared for CO_2, CH_4, and N_2O and presented as CO_2e in metric tons per year relevant to their GWP. The CO_2 equivalent is estimated by taking the mass equivalent of each pollutant (tons per year), multiplying by the GWP equivalent of each pollutant, and then adding them together. For example, CO_2 is 1 GWP, CH_4 is 29.8 GWP, and N_2O is 273 GWP, according to the IPCC Sixth Assessment Report.[39]

In general, FAA's GHG emissions inventory procedures are intended to accomplish the following:

- Identify and characterize the types and sources of GHGs to include in an emissions inventory.
- Apply appropriate and consistent methods for calculating GHG emission inventories.
- Aid in the integration of GHG inventories into larger regional, national, and global inventories.
- Clarify the specific makeup and percent contribution of applicant-generated GHGs, by source and emission type.
- Provide necessary inputs for contextualizing GHG emissions and climate effects using the social costs of greenhouse gas emissions (SC-GHG) methodology. This contextualization method

[39] https://erce.energy/erceipccsixthassessment/.

translates the metric tons of emissions for a project into a monetary value that describes the net social costs of increasing GHG emissions as well as the net social benefits of reducing such emissions.

4.4 Environmental Consequences of Proposed Action

Table 7 presents the annual GHG emissions for construction activities associated with the Proposed Action for years of 2026 and 2027, respectively. **Table 8** presents the annual GHG emissions for aircraft operations during the 2027 construction period (representative worst-case construction year) for the No Action and Proposed Action.

In summary, while there are no significance thresholds established for climate impacts, GHGs associated with the Proposed Action have been calculated in accordance with the latest FAA guidelines (1050.1F) for climate impacts in a NEPA document[40, 41] and are included in the emission spreadsheets in **Attachment A**. As ongoing scientific research works to improve the understanding of construction and aviation's relationship to climate change, FAA guidance will evolve if new federal requirements are established. Given the low percentage of overall emissions generated by the Proposed Action, the increase in construction and/or emissions would not be substantial on a state, national, or global scale.

Table 7. GHG Emissions Associated with Construction/Demolition for Proposed Action for Each Construction Year

Construction Year	Relevant Greenhouse Gase Emissions (metric tons per year)			
	CO_2	N_2O	CH_4	CO_{2e}
2026	5,104	0.055	0.018	5,119
2027	10,413	0.090	0.059	10,439

Notes:
1. Construction emissions derived from ACEIT, MOVES, and TEX2.2 consistent with FAA Emission and Air Quality Handbook Version 4.
2. GWP values derived from IPCC Sixth Assessment Report were used in the calculations of CO_2e.
3. Emissions presented in the table include the GWP for each pollutant.
Source: HMMH, 2024

[40] 1050.1F Desk Reference, https://www.faa.gov/about/office_org/headquarters_offices/apl/environ_policy_guidance/policy/faa_nepa_order/desk_ref/media/3-climate.pdf.

[41] FAA Aviation Emissions and Air Quality Handbook Version 4, Accessed August 2024. https://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/files/airquality_handbook_version_4.pdf

Table 8. GHG Emissions Associated with Aircraft Operations for the 2027 Construction Year No-Action and Proposed Action

Activity	Relevant Greenhouse Gase Emissions (metric tons per year)			
	CO_2	N_2O	CH_4	CO_{2e}
2027 No Action				
Aircraft Operations	243,228	6.800	0.160	245,089
2027 Proposed Action				
Aircraft Operations	243,096	6.796	0.160	244,956
Delta (Proposed Action – No-Action)	**-132**	**-0.004**	**0.00**	**-134**

Notes:
1. Emissions in the table include the GWP for each pollutant.
2. Aircraft GHG emissions were derived from AEDT full flight fuel burn consistent with FAA AQ Handbook Version 4 and includes all aircraft modes, GSE and APUs.
3. GSE GHG emissions were calculated externally using TEXN2.2 NONROAD emission factors and were added to the aircraft GHG totals.
4. GWP values for aircraft derived from IPC 6th Assessment Report were used in the calculation of CO_2e.

Source: HMMH, October 2024

4.5 Social Costs

The CEQ's Interim *Guidance on Consideration of Greenhouse Gas Emissions and Climate Change* provides directions to better assess and disclose climate impacts. The interim guidance recommends contextualizing GHG emissions by developing the social cost of carbon dioxide equivalents (SC-CO_2e) for proposed actions. This is consistent with the FAA Handbook Version 4, which also includes contextualizing GHG emissions and climate effects using the SC-GHG. This contextualization method translates the metric tons of emissions for a project into a monetary value that describes the net social costs of increasing GHG emissions as well as the net social benefits of reducing such emissions.

SC-CO_2e is an estimate of the economic costs of emitting one additional ton of carbon dioxide into the atmosphere, and thus the benefits of reducing emissions. It provides a monetary measure (in U.S. dollars) of the future damages associated with specified quantities of GHG resulting from the Proposed Action (e.g., changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services). To provide a contextualized monetary measure of the three main GHGs, the SC-GHG was calculated for the CO2e, CH_4, and N_2O emissions for the Proposed Action (construction and net operations), summarized in **Table 9**. These costs were calculated using the Interagency Working Group (IWG) 2021 *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990*.[42]

[42] United States Government, Technical Support Document, https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

Table 9. Proposed Action Estimated Social Cost of Carbon Dioxide Equivalents (SC-CO2e) in U.S. Dollars by IWG Average Discount Rates for Construction and Net Operations Activity

Year	CO_2	CH4	N2O	Total
Construction - Build Alternative 1 (2026)				
5%	$88,810	$15	$384	$89,209
3%	$291,949	$32	$1,175	$293,155
2.5%	$429,757	$41	$1,680	$431,478
3% 95th Percentile	$880,950	$83	$3,031	$884,065
Construction - Build Alternative 1 (2027)				
5%	$185,351	$50	$647	$186,048
3%	$608,119	$107	$1,958	$610,183
2.5%	$889,270	$136	$2,802	$892,208
3% 95th Percentile	$1,834,771	$280	$5,065	$1,840,115
Net Operations - 2027				
5%	$-2,350	$0	$-29	$-2,378
3%	$-7,709	$0	$-87	$-7,796
2.5%	$-11,273	$0	$-125	$-11,398
3% 95th Percentile	$-23,258	$0	$-226	$-23,484

Notes:
Construction emissions from Table 7 were used to estimate social costs by pollutant for each construction year.
Net Operations emissions from Table 8 were used to estimate social costs by pollutant for Net Operations 2027 year.
Source: United States Government, Technical Support Document, https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

The SC-GHGs were calculated using the IWG average discount rates: 5 percent, 3 percent, 2.5 percent and the 95th percentile damage estimate using the 3-percent discount rate interpolated between 2025, 2030, 2035, and 2040 to get the years between reflective of the construction and operations period for each Alternative. The 5 percent, 3 percent, and 2.5 percent discount rates reflect the average damages from the multiple simulations at each of the three discount rates. The 95th percentile of damages estimated by applying the 3-percent discount rate reflect higher-than-expected economic impacts from climate change and the associated future economic effects; this is a low probability and high damage scenario that represents an upper bound of damages within the 3-percent discount rate model.

The calculations of social costs for the four discount rates (5 percent, 3 percent, 2.5 percent, and 95th percentile of the 3 percent) were completed for GHG construction emissions for the representative construction and operations representative years. The term “discount rate” refers to the reduction or discount in value per year as a future cost or benefit is adjusted to be comparable with a current cost or benefit from a proposed project. For this analysis, all three discount rates were used to estimate a range of global social costs from the increase in GHG emissions from the Proposed Action.

The social cost of GHG total equivalents for construction is estimated to range from $89,209 to $884,065 in 2026 and $186,048 and $1,840,115 in 2027. Similarly for the net operations changes, GHG total equivalents are estimated to range from $-2,378 to $-23,484 for 2027 due to an expected slight reduction in GHG emissions from the runway redistribution of aircraft during construction. This range in costs represents the potential social costs associated with adding GHGs to the atmosphere each year. It includes the value of all climate change impacts, including but not limited to changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services.

It should be noted that the foregoing social costs are estimates only and are subject to change depending on a variety of factors. They are provided for disclosure and context, but such estimated costs may not actually result.

4.6 No-Action Alternative

The No-Action Alternative assumes that the Proposed Action is not implemented, and air quality would remain unchanged for the construction years. Therefore, no additional air quality impacts would occur as a result of choosing the No-Action Alternative.

4.7 Climate Assessment

To evaluate the effects of climate change on a proposed action, two subjective qualitative assessments are performed: (1) the impact of climate change on a proposed action and (2) the impact of climate change on the action's environmental impacts to address the latest CEQ guidance on GHG and climate.

The following state and local impacts were discussed for addressing the potential impacts on climate change from the Proposed Action.

4.8 State and Local Impacts

The US EPA has developed state specific factsheets regarding climate change impacts. The US EPA factsheet for Texas is presented in **Figure 1** and shows the potential state and local impacts as follows:

- Rising Seas and Retreating Shores
- Rainstorms and Tornadoes
- Water Resources
- Coastal Storms, Homes, and Infrastructure
- Agriculture
- Hot Weather, Air Pollution and Human Health
- Wildfire and Landscape Change

EPA United States Environmental Protection Agency

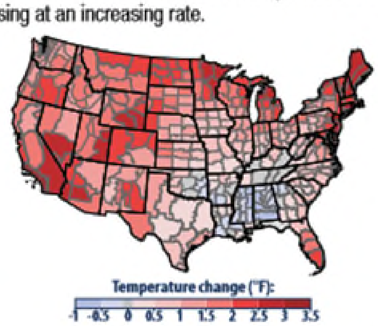
August 2016
EPA 430-F-16-045

What Climate Change Means for Texas

Texas's climate is changing. Most of the state has warmed between one-half and one degree (F) in the past century. In the eastern two-thirds of the state, average annual rainfall is increasing, yet the soil is becoming drier. Rainstorms are becoming more intense, and floods are becoming more severe. Along much of the coast, the sea is rising almost two inches per decade. In the coming decades, storms are likely to become more severe, deserts may expand, and summers are likely to become increasingly hot and dry, creating problems for agriculture and possibly human health.

Our climate is changing because the earth is warming. People have increased the amount of carbon dioxide in the air by 40 percent since the late 1700s. Other heat-trapping greenhouse gases are also increasing. These gases have warmed the surface and lower atmosphere of our planet about one degree during the last 50 years. Evaporation increases as the atmosphere warms, which increases humidity, average rainfall, and the frequency of heavy rainstorms in many places—but contributes to drought in others.

Greenhouse gases are also changing the world's oceans and ice cover. Carbon dioxide reacts with water to form carbonic acid, so the oceans are becoming more acidic. The surface of the ocean has warmed about one degree during the last 80 years. Warming is causing snow to melt earlier in spring, and mountain glaciers are retreating. Even the great ice sheets on Greenland and Antarctica are shrinking. Thus the sea is rising at an increasing rate.



Rising temperatures in the last century. The western part of Texas has warmed twice as much as the eastern part. Source: EPA, Climate Change Indicators in the United States.

Rising Seas and Retreating Shores

Sea level is rising more rapidly along the Texas coast than the rise caused by climate change alone, because the land is sinking, largely because of ground water pumping. If the oceans and atmosphere continue to warm, sea level is likely to rise two to five feet in the next century along much of the Texas coast.

Rising sea level submerges wetlands and dry land, erodes beaches, and exacerbates coastal flooding. Many types of birds and fish depend on tidal wetlands. Shore erosion can eliminate public access along the beach, especially where development is immediately inland.

Coastal Storms, Homes, and Infrastructure

Tropical storms and hurricanes have become more intense during the past 20 years. Although warming oceans provide these storms with more potential energy, scientists are not sure whether the recent intensification reflects a long-term trend. Nevertheless, hurricane wind speeds and rainfall rates are likely to increase as the climate continues to warm.

An eroded beach on North Padre Island impairs public access along the shore. © James G. Titus; used by permission.

Whether or not storms become more intense, coastal homes and infrastructure will flood more often as sea level rises, because storm surges will become higher as well. The rising sea is likely to increase flood insurance rates, while more frequent storms could increase the deductible for wind damage in homeowner insurance policies. Many cities, roads, railways, ports, airports, and oil and gas facilities along the Gulf Coast are vulnerable to the combined impacts of storms and sea level rise. People may move from vulnerable coastal communities and stress the infrastructure of the communities that receive them.

Rainstorms and Tornadoes

Changing the climate is also likely to increase inland flooding. During the last 50 years, the amount of rain falling during the wettest four days of the year has increased about 15 percent in the Great Plains. Over the next several decades, the amount of rainfall during the wettest days of the year is likely to continue to increase, which would increase flooding.

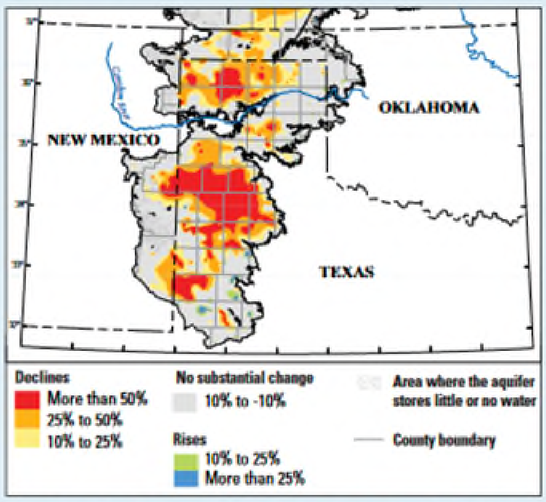
Scientists do not know how the frequency and severity of tornadoes will change. Rising concentrations of greenhouse gases tend to increase humidity, and thus, atmospheric instability, which would encourage tornadoes. But wind shear is likely to decrease, which would discourage tornadoes. Research is ongoing to learn whether tornadoes will be more or less frequent in the future.

Figure 1. US EPA Climate Change Impacts for Texas (Page 1 of 2)

Water Resources

Despite the increase in heavy storms, changing climate is likely to make water less available overall. As warmer temperatures increase evaporation and water use by plants, soils are likely to continue to become drier. Average rainfall is likely to decrease during winter, spring, and summer. Seventy years from now, the longest period without rain each year is likely to be at least three days longer than it is today. Increased evaporation and decreased rainfall are both likely to reduce the average flow of rivers and streams.

Drier soils will increase the need for farmers to irrigate their crops, but sufficient water might not be available. Approximately 14 percent of the farmland in Texas is irrigated; in the Panhandle and the plains to the south, most irrigation water is ground water from the High Plains Aquifer System. As a result, this aquifer is becoming depleted. Since the 1950s, the amount of water stored in the aquifer has declined by more than 50 percent in some parts of the state.



Percent depletion of ground water in the High Plains Aquifer, 1950–2013. Source: USGS.

Agriculture

Increasing droughts and higher temperatures are likely to interfere with Texas's farms and cattle ranches. Hot weather causes cows to eat less, grow more slowly, and produce less milk, and it can threaten their health. Reduced water availability would create challenges for ranchers, as well as farmers who irrigate crops. Yields would decline by about 50 percent in fields that can no longer be irrigated.

Wildfires and Landscape Change

Higher temperatures and drought are likely to increase the severity, frequency, and extent of wildfires, which could harm property, livelihoods, and human health. On average, more than 1 percent of the land in Texas has burned each decade since 1984. Wildfire smoke pollutes the air and can increase medical visits for respiratory and heart problems.

The combination of more fires and drier conditions may expand deserts and otherwise change parts of the Texas landscape. Many plants and animals living in arid lands are already near the limits of what they can tolerate. A warmer and drier climate would generally extend the Chihuahuan desert to higher elevations and expand its geographic range. In some cases, native vegetation may persist and delay or prevent expansion of the desert. In other cases, fires or livestock grazing may accelerate the conversion of grassland to desert in response to the changing climate. For similar reasons, some forests may change to desert or grassland.

The 2011 drought contributed to widespread wildfires in Texas, like this one behind the McDonald Observatory near Fort Davis. Credit: Frank Cianciolo, McDonald Observatory.

Hot Weather, Air Pollution, and Human Health

Hot days can be unhealthy—even dangerous. Seventy years from now, Texas is likely to have three or four times as many days per year above 100°F as it has today. Certain people are especially vulnerable, including children, the elderly, the sick, and the poor. High air temperatures can cause heat stroke and dehydration and affect people's cardiovascular and nervous systems.

Warmer air can also increase the formation of ground-level ozone, a key component of smog. Ozone has a variety of health effects, aggravates lung diseases such as asthma, and increases the risk of premature death from heart or lung disease. EPA and the Texas Commission on Environmental Quality have been working to reduce ozone concentrations. As the climate changes, continued progress toward clean air will be more difficult.

The sources of information about climate and the impacts of climate change in this publication are: the national climate assessments by the U.S. Global Change Research Program, synthesis and assessment products by the U.S. Climate Change Science Program, assessment reports by the Intergovernmental Panel on Climate Change, and EPA's *Climate Change Indicators in the United States*. Mention of a particular season, location, species, or any other aspect of an impact does not imply anything about the likelihood or importance of aspects that are not mentioned. For more information about climate change science, impacts, responses, and what you can do, visit EPA's Climate Change website at www.epa.gov/climatechange.

Figure 1. US EPA Climate Change Impacts for Texas (Page 2 of 2)

Source: https://aqhelp.com/Documents/CCFactSheets/climate-change-TX_AUG2016.pdf

4.9 Potential Climate Impacts

As stated earlier, there are no defined significance thresholds for aviation GHG emissions, nor has FAA identified any factors to consider in making a significance determination for GHG emissions. Any increases in GHG emissions from construction and aircraft operations associated with the Proposed Action would be temporary and essential for implementation of the Proposed Action.

Increases in construction and operational emissions compared to the No-Action Alternative would be temporary, but necessary for the proposed improvements at HOU. However, the increases would comprise a small portion of the HOU 2016 GHG emissions of 36,000 MT CO2e, the US-based emissions of 6,348 MMT CO2e, and even less than the 49 gigatons of CO2e global GHG emissions.[43,44] Based on all this information, no significant impact on GHGs or climate is expected as a result of the Proposed Action.

It should be noted that for this EA, the best available science, data, and rationale for the GHG analysis is based on the interim guidance. The FAA's guidance/policy will evolve and change going into the future.

4.10 Mitigation Measures

The FAA is developing policies for the aviation industry to reduce GHG and climate impacts including the Aviation Action Plan and the Net Zero Sustainable Aviation System including the Aviation Action Plan, Net Zero Sustainable Aviation System as well as a commitment to a sustainable transportation system which includes:

- Increase the Production of Sustainable Aviation Fuels,
- Eliminate Aviation Gasoline Lead Emissions by the End of 2030,
- Develop New Aircraft and Engine Technologies,
- Increase Operations Efficiency;
- Reduce Airport Emissions and Improve Fuel Efficiency; and
- Continue to increase the electric GSE fleet.

These are general mitigation measures the FAA is developing for the industry and may not be specific to HOU for this EA.

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43 https://www.epa.gov/system/files/documents/2023-02/US-GHG-Inventory-2023-Main-Text.pdf

44 IPCC, *AR4 Climate Change 2007 Synthesis Report*, http://ipcc.ch/publications_and_data/ar4/syr/en/contents.html.

Attachment A. Air Emissions Spreadsheet Calculations

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Airport Construction Emissions Inventory Tool (ACEIT)
Version 1.0
Run Date & Time: 10/16/2024 6:23:17 PM

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STUDY

Study Name

HOU Runway Reconstruction

Study Description

2026 Construction Schedule

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EMISSIONS INVENTORY - DETAILS:

Non-Road Sources
Units for Non-Greenhouse Gases Emission: Short Ton
Units for Greenhouse Gases (CO2, CH4, and N2O) Emission: Metric Ton

											MOVES4 Emission Factors (g/hp-hr)							NONROAD Emissions (TPY)						
											3	5	8	6	7	10	2							
Scenario ID	Year	Project	Construction Activity	Equipment	MOVES Equipment	MOVES Lookup	Fuel	HP Average	Load Factor	Hours of Activity	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CO (tpy)	NOx (tpy)	SO2 (tpy)	PM10 (tpy)	PM2.5 (tpy)	VOC (tpy)	CO2 Exhaust (tpy)
1	2026	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	599.9	0.27978	0.769437	0.001242	0.062596	0.060718	0.005805	536.6805	0.019103	0.052535	8.48E-05	0.004273867	0.004145642	0.000396	36.64302
1	2026	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	599.9	0.217	0.621885	0.00123	0.052694	0.051113	0.004104	536.7251	0.014816	0.042461	8.4E-05	0.003597794	0.003489861	0.00028	36.64686
1	2026	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1199.8	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.084859	0.219086	0.000575	0.015103998	0.014650877	0.001519	251.2988
2	2026	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	83.236125	0.636813	1.656267	0.001327	0.113743	0.110331	0.014346	536.4588	0.006023	0.015661	1.26E-05	0.00107754	0.001045214	0.000136	5.082119
2	2026	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	299.7812043	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.021203	0.05474	0.000144	0.003773875	0.003660656	0.00038	62.78885
2	2026	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	166.47225	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.007412	0.019796	1.82E-05	0.001736211	0.001684125	0.000151	7.409093
2	2026	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	83.236125	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.005887	0.015199	3.99E-05	0.00104784	0.001016405	0.000105	17.43372
2	2026	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	83.236125	1.319266	2.086465	0.001463	0.207566	0.201339	0.0166	596.7267	0.007142	0.01129	7.92E-06	0.001123609	0.00108993	8.99E-05	3.224089
2	2026	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	83.236125	0.189623	2.545734	0.001529	0.017191	0.016675	0.005621	696.8406	0.000274	0.003679	2.21E-06	2.48429E-05	2.40976E-05	8.12E-06	1.005662
2	2026	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	106.54224	1.508373	3.769059	0.001826	0.171998	0.166838	0.039634	596.1343	0.002613	0.006529	3.16E-06	0.00029795	0.000289011	6.87E-05	1.030945
2	2026	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	133.1778	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.008136	0.021729	2E-05	0.001905795	0.001848621	0.000165	8.132772
2	2026	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	133.1778	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.009419	0.024318	6.38E-05	0.001676544	0.001626247	0.000169	27.89396
2	2026	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	133.1778	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.009419	0.024318	6.38E-05	0.001676544	0.001626247	0.000169	27.89396
2	2026	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	133.1778	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.005929	0.015836	1.46E-05	0.001388969	0.0013473	0.000121	5.927274
2	2026	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	133.1778	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.009419	0.024318	6.38E-05	0.001676544	0.001626247	0.000169	27.89396
2	2026	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	1199.8	0.369725	2.617622	0.001339	0.0379	0.036763	0.012341	595.8266	0.01154	0.081702	4.18E-05	0.001182965	0.001147476	0.000385	18.59719
2	2026	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1199.8	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.084859	0.219086	0.000575	0.015103998	0.014650877	0.001519	251.2988
2	2026	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	1199.8	0.217	0.621885	0.00123	0.052694	0.051113	0.004104	536.7251	0.029632	0.084921	0.000168	0.007195589	0.006979721	0.00056	73.29213
2	2026	Rehabilitate Runway	Concrete Demolition	Hydraulic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	1199.8	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.073292	0.195755	0.00018	0.017169323	0.016654239	0.001491	73.26822
2	2026	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	1199.8	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.053416	0.142669	0.000131	0.012513235	0.012137836	0.001087	53.39867
2	2026	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1199.8	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.084859	0.219086	0.000575	0.015103998	0.014650877	0.001519	251.2988
2	2026	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	221.9632	1.335432	2.015587	0.001466	0.211614	0.205266	0.014694	595.7777	0.01405	0.021206	1.54E-05	0.00222639	0.002159599	0.000155	6.268182
2	2026	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	221.9632	0.369725	2.617622	0.001339	0.0379	0.036763	0.012341	595.8266	0.002135	0.015115	7.73E-06	0.000218849	0.000212283	7.13E-05	3.440492
2	2026	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	924.8466667	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.065412	0.168878	0.000443	0.011642675	0.011293306	0.001171	193.7061
2	2026	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	443.9264	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.019764	0.052788	4.86E-05	0.004629901	0.004491003	0.000402	19.7575
2	2026	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	665.8896	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.047097	0.121592	0.000319	0.008382726	0.008131244	0.000843	139.4699
2	2026	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	221.9632	0.832607	1.51298	0.001612	0.160808	0.155984	0.024344	625.9137	0.021034	0.038222	3.82E-05	0.004062432	0.003940559	0.000615	15.81219
2	2026	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	221.9632	0.636813	1.656267	0.001327	0.113743	0.110331	0.014346	536.4588	0.016062	0.041816	3.35E-05	0.002873442	0.002787239	0.000362	13.55233
2	2026	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	221.9632	1.508373	3.769059	0.001826	0.171998	0.166838	0.039634	596.1343	0.005444	0.013602	6.59E-06	0.000620729	0.000602107	0.000143	2.147823
2	2026	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2160	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.152772	0.394419	0.001035	0.027191726	0.026375976	0.002735	452.4097
2	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	44.3928	0.27978	0.769437	0.001242	0.062596	0.060718	0.005805	536.6805	0.001414	0.003888	6.28E-06	0.000316267	0.000306779	2.93E-05	2.711596
2	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	147.976	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.010468	0.027021	7.09E-05	0.001862835	0.00180696	0.000187	30.99341
2	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	44.3928	0.217	0.621885	0.00123	0.052694	0.051113	0.004104	536.7251	0.001096	0.003142	6.22E-06	0.000266237	0.00025825	2.07E-05	2.711821
2	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	44.3928	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.00314	0.008106	2.13E-05	0.00055885	0.000542085	5.62E-05	9.298024
2	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	44.3928	1.319266	2.086465	0.001463	0.207566	0.201339	0.0166	596.7267	0.003809	0.006021	4.22E-06	0.000599277	0.000581299	4.79E-05	1.719559
2	2026	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	20.86666667	0.27978	0.769437	0.001242	0.062596	0.060718	0.005805	536.6805	0.000665	0.001829	2.95E-06	0.000148661	0.000144206	1.38E-05	1.276041
2	2026	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	14.674	0.27978	0.769437	0.001242	0.062596	0.060718	0.005805	536.6805	0.000467	0.001286	2.07E-06	0.000104542	0.000101405	9.69E-06	0.896316
2	2026	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	14.674	0.366632	1.036474	0.001282	0.067703	0.065672	0.009305	536.5681	0.001049	0.002966	3.67E-06	0.000193837	0.000188022	2.66E-05	1.536275
2	2026	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	14.674	1.319266	2.086465	0.001463	0.207566	0.201339	0.0166	596.7267	0.001259	0.00199	1.4E-06	0.00019809	0.000192149	1.58E-05	0.568631
2	2026	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	1.4674	1.031015	2.187512	0.001093	0.152232	0.147666	0.016368	536.4036	0.000591	0.001253	7.57E-07	8.71592E-05	8.45441E-05	9.37E-06	0.30715
2	2026	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.4674	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.000104	0.000268	7.03E-07	1.84728E-05	1.79186E-05	1.86E-06	0.307345
2	2026	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	81.32	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.005752	0.014849	3.9E-05	0.001023718	0.000993007	0.000103	17.03239
2	2026	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	81.32	0.832607	1.51298	0.001612	0.160808	0.155984	0.024344	625.9137	0.007706	0.014003	1.4E-05	0.001488341	0.001443691	0.000225	5.793065
2	2026	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	81.32	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.00362	0.00967	8.89E-06	0.000848122	0.000822676	7.36E-05	3.619267
2	2026	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	81.32	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.005752	0.014849	3.9E-05	0.001023718	0.000993007	0.000103	17.03239
2	2026	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	81.32	0.189623	2.545734	0.001529	0.017191	0.016675	0.005621	696.8406	0.000268	0.003594	2.16E-06	2.4271E-05	2.35429E-05	7.94E-06	0.982413
2	2026	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	81.32	1.809311	2.086539	0.001678	0.258497	0.250742	0.031154	696.1905	0.003405	0.003928	3.16E-06	0.000486607	0.000472009	5.86E-05	1.308661
2	2026	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1371.2	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.096982	0.250383	0.000657	0.017261712	0.01674386	0.001737	287.1964
2	2026	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	1371.2	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.061047	0.16305	0.00015	0.01430094	0.013871812	0.001242	61.02728
2	2026	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1371.2	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.096982	0.250383	0.000657	0.017261712	0.01674386	0.001737	287.1964
2	2026	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	17.14	0.369725	2.617622	0.001339	0.0379	0.036763	0.012341	595.8266	0.000165	0.001167	5.97E-07	1.68996E-05	1.63926E-05	5.5E-06	0.265674
2	2026	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	17.14	1.335432	2.015587	0.001466	0.211614	0.205266	0.014694	595.7777	0.001085	0.001638	1.19E-06	0.000171922	0.000166764	1.19E-05	0.484027
2	2026	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	17.14	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.001212	0.00313	8.21E-06	0.000215771	0.000209296	2.17E-05	3.589965
2	2026	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	17.14	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.000763	0.002038	1.87E-06	0.000178761	0.000173396	1.55E-05	0.762841
2	2026	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	17.14	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.001212	0.00313	8.21E-06	0.000215771	0.000209296	2.17E-05	3.589965
2	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	12	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.000534	0.001427	1.31E-06	0.000125153	0.000121399	1.09E-05	0.534078
2	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	24	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.001697	0.004382	1.15E-05	0.00030213	0.000293066	3.04E-05	5.026774
2	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	12	2.471076	4.180276	0.001822	0.240231	0.233024	0.092625	593.7689	0.000155	0.000262	1.14E-07	1.60307E-05	1.46798E-05	5.79E-06	0.037151
2	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	12	1.809311	2.086539	0.001678	0.258497	0.250742	0.031154	696.1905	0.000503	0.00058	4.66E-07	7.18063E-05	6.96521E-05	8.65E-06	0.193113
2	2026	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	140.1871579	0.27978	0.769437	0.001242	0.062596	0.060718	0.005805	536.6805	0.004464	0.012277	1.98E-05	0.000998733	0.000968771	9.26E-05	8.562898
2	2026	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	986.5022222	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.069773	0.180137	0.000473	0.012418843	0.012046277	0.001249	206.6218
2	2026	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	140.1871579	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.009915	0.025598	6.72E-05	0.001764783	0.001711839	0.000178	29.36205
2	2026	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	136.5926154	1.319266	2.086465	0.001463	0.207566	0.201339	0.0166	596.7267	0.01172	0.018526	1.3E-05	0.001843921	0.001788603	0.000147	5.292158
2	2026	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	32.60933333	0.27978	0.769437	0.001242	0.062596	0.060718	0.005805	536.6805	0.001038	0.002856	4.61E-06	0.000232318	0.000225349	2.15E-05	1.991839
2	2026	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	32.60933333	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.002306	0.005955	1.56E-05	0.000410511	0.000398196	4.13E-05	6.82999
2	2026	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	32.60933333	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.002306	0.005955	1.56E-05	0.000410511	0.000398196	4.13E-05	6.82999
3	2026	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	12.001875	0.636813	1.656267	0.001327	0.113743	0.110331	0.014346	536.4588	0.000869	0.002261	1.81E-06	0.000155371	0.00015071	1.96E-05	0.732794
3	2026	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	43.22566123	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.003057	0.007893	2.07E-05	0.000544158	0.000527833	5.47E-05	9.053568
3	2026	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	24.00375	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.001069	0.002854	2.63E-06	0.000250346	0.000242835	2.17E-05	1.068322
3	2026	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	12.001875	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.000849	0.002192	5.75E-06	0.000151089	0.000146556	1.52E-05	2.51378
3	2026	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	12.001875	1.319266	2.086465	0.001463	0.207566	0.201339	0.0166	596.7267	0.00103	0.001628	1.14E-06	0.000162018	0.000157158	1.3E-05	0.465002
3	2026	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	12.001875	0.189623	2.545734	0.001529	0.017191	0.016675	0.005621	696.8406	3.96E-05	0.00053	3.19E-07	3.58212E-06	3.47466E-06	1.17E-06	0.144993
3	2026	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	15.3624	1.508373	3.769059	0.001826	0.171998	0.166838	0.039634	596.1343	0.000377	0.000941	4.56E-07	4.29616E-05	4.16727E-05	9.9E-06	0.149653
3	2026	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	19.203	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.001173	0.003133	2.88E-06	0.000274798	0.000266554	2.39E-05	1.17267
3	2026	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	19.203	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.001368	0.003506	9.2E-06	0.000241742	0.00023449	2.43E-05	4.022048
3	2026	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	19.203	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.001368	0.003506	9.2E-06	0.000241742	0.00023449	2.43E-05	4.022048
3	2026	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	19.203	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.000855	0.002283	2.1E-06	0.000200276	0.000194268	1.74E-05	0.854658
3	2026	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	19.203	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.001368	0.003506	9.2E-06	0.000241742	0.00023449	2.43E-05	4.022048
3	2026	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	173	0.369725	2.617622	0.001339	0.0379	0.036763	0.012341	595.8266	0.001664	0.011781	6.03E-06	0.000170573	0.000165455	5.55E-05	2.681541
3	2026	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	173	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.012236	0.03159	8.29E-05	0.002177866	0.00211252	0.000219	36.23466
3	2026	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	173	0.217	0.621885	0.00123	0.052694	0.051113	0.004104	536.7251	0.004273	0.012245	2.42E-05	0.001037534	0.001006408	8.08E-05	10.56804
3	2026	Rehabilitate Runway	Concrete Demolition	Hydraulic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	173	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.010568	0.028226	2.6E-05	0.002475667	0.002401386	0.000215	10.5646
3	2026	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	173	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.007702	0.020572	1.89E-05	0.001804292	0.001750163	0.000157	7.69962
3	2026	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	173	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.012236	0.03159	8.29E-05	0.002177866	0.00211252	0.000219	36.23466
3	2026	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	32.0048	1.335432	2.015587	0.001466	0.211614	0.205266	0.014694	595.7777	0.002026	0.003058	2.22E-06	0.000321022	0.000311392	2.23E-05	0.903804
3	2026	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	32.0048	0.369725	2.617622	0.001339	0.0379	0.036763	0.012341	595.8266	0.000308	0.002179	1.11E-06	3.15557E-05	3.06091E-05	1.03E-05	0.496082
3	2026	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	133.3533333	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.009432	0.02435	6.39E-05	0.001678753	0.001628391	0.000169	27.93071
3	2026	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	64.0096	0.536726	1.433534	0.001319	0.125733	0.121961	0.010918	536.55	0.00285	0.007611	7E-06	0.000667584	0.000647556	5.8E-05	2.848842
3	2026	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	96.0144	0.181251	0.467944	0.001228	0.032261	0.031293	0.003245	536.7454	0.006791	0.017532	4.6E-05	0.001208703	0.001172441	0.00012	20.11011
3	2026	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	32.0048	0.832607	1.51298	0.001612	0.160808	0.155984	0.024344	625.9137	0.003033	0.005511	5.51E-06	0.000585761	0.000568188	8.87E-05	2.279964
3	2026	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	32.0048	0.636813	1.656267	0.001327	0.113743	0.110331	0.014346	536.4588	0.002316	0.006029	4.83E-06	0.000414321	0.000401891	5.23E-05	1.954108

3	2026	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	32.0048	1.509373	3.768059	0.001826	0.171996	0.166838	0.039634	596.1343	0.000786	0.001961	9.5E-07	8.96027E-05	8.69176E-05	2.06E-05	0.309691
3	2026	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	960	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.067809	0.175297	0.00046	0.012095212	0.011732656	0.001216	201.071
3	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	6.4008	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	0.000204	0.000561	9.05E-07	4.56011E-05	4.42331E-05	4.23E-06	0.390973
3	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	21.336	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.001609	0.003696	1.02E-05	0.000269594	0.000260536	2.7E-05	4.468602
3	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	6.4008	0.217	0.621686	0.00123	0.052694	0.051113	0.004104	536.7251	0.000156	0.000453	8.95E-07	3.83676E-05	3.72369E-05	2.99E-06	0.391005
3	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	6.4008	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000453	0.001169	3.07E-06	8.05782E-05	7.81608E-05	8.11E-06	1.340641
3	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	6.4008	1.319265	2.086466	0.001463	0.207566	0.201339	0.0166	596.7267	0.000549	0.000868	6.09E-07	8.64071E-05	8.38149E-05	6.91E-06	0.247993
3	2026	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	3.012236294	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	9.59E-05	0.000264	4.26E-07	2.148E-05	2.08162E-05	1.99E-06	0.183993
3	2026	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.1368	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	6.8E-05	0.000187	3.02E-07	1.52232E-05	1.47666E-05	1.41E-06	0.13052
3	2026	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	2.1368	0.388632	1.036474	0.001292	0.067703	0.065672	0.008806	536.6681	0.000153	0.000432	5.35E-07	2.82282E-05	2.73796E-05	3.69E-06	0.22371
3	2026	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	2.1368	1.319265	2.086466	0.001463	0.207566	0.201339	0.0166	596.7267	0.000183	0.00029	2.03E-07	2.88456E-05	2.79802E-05	2.31E-06	0.082789
3	2026	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.21368	1.031815	2.187512	0.001393	0.152232	0.147665	0.015366	536.4038	6.6E-05	0.000182	1.16E-07	1.26934E-05	1.23126E-05	1.36E-06	0.044727
3	2026	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.21368	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	1.51E-05	3.9E-05	1.02E-07	2.68997E-06	2.60927E-06	2.71E-07	0.044755
3	2026	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	12.86666667	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.00091	0.002349	6.16E-06	0.000161976	0.000157116	1.63E-05	2.694909
3	2026	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	12.86666667	0.832607	1.51298	0.001512	0.160808	0.155984	0.024344	626.9137	0.001219	0.002216	2.21E-06	0.000235489	0.000228426	3.56E-05	0.918694
3	2026	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	12.86666667	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.000573	0.00153	1.41E-06	0.000134192	0.000130166	1.17E-05	0.57266
3	2026	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	12.86666667	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.00091	0.002349	6.16E-06	0.000161976	0.000157116	1.63E-05	2.694909
3	2026	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	12.86666667	0.189623	2.545734	0.001529	0.017191	0.016675	0.005621	696.8406	4.23E-05	0.000569	3.42E-07	3.84023E-06	3.72502E-06	1.26E-06	0.15544
3	2026	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	12.86666667	1.809311	2.088639	0.001678	0.258497	0.250742	0.031154	696.1906	0.000539	0.000621	5E-07	7.69923E-05	7.46826E-05	9.28E-06	0.20706
3	2026	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	197.7142857	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.013984	0.036103	9.47E-05	0.002488978	0.002414309	0.00025	41.41184
3	2026	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	197.7142857	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.008802	0.02351	2.16E-05	0.002062048	0.002000198	0.000179	8.799666
3	2026	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	197.7142857	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.013984	0.036103	9.47E-05	0.002488978	0.002414309	0.00025	41.41184
3	2026	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	2.471428571	0.359725	2.617622	0.001339	0.0379	0.036763	0.012341	596.8285	2.39E-05	0.000188	8.61E-08	2.43676E-06	2.36366E-06	7.93E-07	0.038308
3	2026	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	2.471428571	1.335432	2.015587	0.001466	0.211614	0.205266	0.014694	595.7777	0.000156	0.000236	1.72E-07	2.47695E-05	2.40456E-05	1.72E-06	0.069792
3	2026	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.471428571	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000176	0.000451	1.18E-06	3.11122E-05	3.01789E-05	3.13E-06	0.517688
3	2026	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	2.471428571	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.00011	0.000294	2.7E-07	2.57756E-05	2.50023E-05	2.24E-06	0.109996
3	2026	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.471428571	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000176	0.000451	1.18E-06	3.11122E-05	3.01789E-05	3.13E-06	0.517688
3	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	1.6	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	7.12E-05	0.00019	1.75E-07	1.66871E-05	1.61865E-05	1.45E-06	0.07121
3	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	3.2	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000226	0.000584	1.53E-06	4.0284E-05	3.90755E-05	4.05E-06	0.670237
3	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	1.6	2.471076	4.180276	0.001622	0.240231	0.233024	0.092525	593.7639	2.06E-05	3.49E-05	1.52E-08	2.00409E-06	1.94397E-06	7.72E-07	0.004953
3	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	1.6	1.809311	2.088639	0.001678	0.258497	0.250742	0.031154	696.1906	6.7E-05	7.73E-05	6.22E-08	9.57417E-06	9.28694E-06	1.15E-06	0.025748
3	2026	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	20.21368421	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	0.000644	0.00177	2.86E-06	0.000144006	0.000139689	1.34E-05	1.23469
3	2026	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	142.2444444	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.010051	0.025974	6.82E-05	0.001790682	0.001736961	0.00018	29.79296
3	2026	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	20.21368421	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.00143	0.003691	9.69E-06	0.000254486	0.000246631	2.56E-05	4.233734
3	2026	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	19.68636462	1.319265	2.086466	0.001463	0.207566	0.201339	0.0166	596.7267	0.00169	0.002671	1.87E-06	0.000265876	0.0002579	2.13E-05	0.76308
3	2026	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	4.748	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	0.000151	0.000416	6.71E-07	3.38281E-05	3.28113E-05	3.14E-06	0.290017
3	2026	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.748	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000336	0.000867	2.27E-06	5.97714E-05	5.79783E-05	6.01E-06	0.994463
3	2026	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.748	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000336	0.000867	2.27E-06	5.97714E-05	5.79783E-05	6.01E-06	0.994463
4	2026	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	58.4	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	0.00186	0.005114	8.26E-06	0.000416056	0.000403576	3.86E-05	3.567182
4	2026	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	58.4	0.217	0.621686	0.00123	0.052694	0.051113	0.004104	536.7251	0.001442	0.004134	8.19E-06	0.000350243	0.000339736	2.73E-05	3.567478
4	2026	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	116.8	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.008251	0.021326	5.6E-05	0.001470356	0.001426256	0.000143	24.45363
5	2026	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	4.35675	0.635813	1.665267	0.001327	0.113743	0.110331	0.014346	536.4688	0.000315	0.000821	6.56E-07	5.64007E-05	5.47086E-05	7.11E-06	0.266009
5	2026	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	15.69116406	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.00111	0.002865	7.52E-06	0.000197532	0.000191606	1.99E-05	3.28649
5	2026	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	8.7135	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.000386	0.001036	9.53E-07	9.09789E-05	8.81606E-05	7.89E-06	0.387607
5	2026	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.35675	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000306	0.000796	2.09E-06	5.48481E-05	5.32007E-05	5.52E-06	0.912517
5	2026	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	4.35675	1.319265	2.086466	0.001463	0.207566	0.201339	0.0166	596.7267	0.000374	0.000591	4.15E-07	5.88136E-05	5.70492E-05	4.7E-06	0.168796
5	2026	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	4.35675	0.189623	2.545734	0.001529	0.017191	0.016675	0.005621	696.8406	1.43E-05	0.000193	1.16E-07	1.30033E-06	1.26132E-06	4.26E-07	0.052633
5	2026	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	5.57864	1.509373	3.768059	0.001826	0.171996	0.166838	0.039634	596.1343	0.000137	0.000342	1.66E-07	1.56963E-05	1.51274E-05	3.59E-06	0.053962
5	2026	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	6.9708	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.000426	0.001137	1.05E-06	9.97632E-05	9.67606E-05	8.66E-06	0.425686
5	2026	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	6.9708	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000493	0.001273	3.34E-06	8.77637E-05	8.51211E-05	8.83E-06	1.460027
5	2026	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	6.9708	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000493	0.001273	3.34E-06	8.77637E-05	8.51211E-05	8.83E-06	1.460027
5	2026	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	6.9708	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.00031	0.000829	7.62E-07	7.27015E-05	7.05204E-05	6.31E-06	0.310246
5	2026	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	6.9708	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000493	0.001273	3.34E-06	8.77637E-05	8.51211E-05	8.83E-06	1.460027
5	2026	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	62.8	0.359725	2.617622	0.001339	0.0379	0.036763	0.012341	596.8285	0.000604	0.004776	2.19E-06	6.19186E-05	6.00613E-05	2.02E-05	0.973415
5	2026	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	62.8	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.004442	0.011467	3.01E-05	0.000790574	0.000766857	7.96E-05	13.15339
5	2026	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	62.8	0.217	0.621686	0.00123	0.052694	0.051113	0.004104	536.7251	0.001551	0.004446	8.79E-06	0.000376631	0.000365332	2.93E-05	3.836261
5	2026	Rehabilitate Runway	Concrete Demolition	Hydralic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	62.8	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.003836	0.010246	9.42E-06	0.000898678	0.000871717	7.8E-05	3.835009
5	2026	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	62.8	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.002796	0.007468	6.87E-06	0.000654956	0.000635319	5.69E-05	2.796007
5	2026	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	62.8	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.004442	0.011467	3.01E-05	0.000790574	0.000766857	7.96E-05	13.15339
5	2026	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	11.6184	1.335432	2.015587	0.001466	0.211614	0.205266	0.014694	595.7777	0.000736	0.00111	8.07E-07	0.000116536	0.000113042	8.09E-06	0.328099
5	2026	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	11.6184	0.359725	2.617622	0.001339	0.0379	0.036763	0.012341	596.8285	0.000112	0.000791	4.05E-07	1.14554E-05	1.11117E-05	3.73E-06	0.180088
5	2026	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	48.41	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.003424	0.00884	2.32E-05	0.000609422	0.000591139	6.13E-05	10.13942
5	2026	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	23.2368	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.001035	0.002763	2.54E-06	0.000242347	0.000235076	2.1E-05	1.034188
5	2026	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	34.8552	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.002456	0.006365	1.67E-05	0.000438784	0.00042562	4.41E-05	7.300384
5	2026	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	11.6184	0.832607	1.51298	0.001512	0.160808	0.155984	0.024344	626.9137	0.001101	0.002001	2E-06	0.000212648	0.000206264	3.22E-05	0.82767
5	2026	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	11.6184	0.635813	1.665267	0.001327	0.113743	0.110331	0.014346	536.4688	0.000841	0.002199	1.75E-06	0.000150407	0.000145895	1.9E-05	0.709381
5	2026	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	11.6184	1.509373	3.768059	0.001826	0.171996	0.166838	0.039634	596.1343	0.000286	0.000712	3.45E-07	3.24913E-05	3.15166E-05	7.49E-06	0.112424
5	2026	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1200	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.084673	0.219122	0.000575	0.015106515	0.01465332	0.00152	251.3387
5	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.324	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	7.4E-05	0.000204	3.29E-07	1.65658E-05	1.60601E-05	1.54E-06	0.141964
5	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	7.745666667	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000548	0.001415	3.71E-06	9.78295E-05	9.48958E-05	9.81E-06	1.622631
5	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	2.324	0.217	0.621686	0.00123	0.052694	0.051113	0.004104	536.7251	5.73E-05	0.000164	3.25E-07	1.38577E-05	1.34419E-05	1.09E-06	0.141966
5	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.324	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000164	0.000424	1.11E-06	2.92643E-05	2.83864E-05	2.94E-06	0.486789
5	2026	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	2.324	1.319265	2.086466	0.001463	0.207566	0.201339	0.0166	596.7267	0.000199	0.000315	2.21E-07	3.13727E-05	3.04316E-05	2.51E-06	0.090041
5	2026	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.093490196	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	3.48E-05	9.56E-05	1.55E-07	7.79033E-06	7.55662E-06	7.22E-07	0.066792
5	2026	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.7812	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	2.52E-05	6.92E-05	1.12E-07	5.60672E-06	5.45765E-06	5.23E-07	0.048329
5	2026	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	0.7812	0.388632	1.036474	0.001292	0.067703	0.065672	0.008806	536.6681	6.85E-05	0.00018	1.98E-07	1.04514E-05	1.01379E-05	1.4E-06	0.082684
5	2026	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	0.7812	1.319265	2.086466	0.001463	0.207566	0.201339	0.0166	596.7267	6.79E-05	0.000107	7.53E-08	1.06607E-05	1.03409E-05	8.54E-07	0.030654
5	2026	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.07812	1.031815	2.187512	0.001393	0.152232	0.147665	0.015366	536.4038	3.15E-05	6.76E-05	4.3E-08	4.70608E-06	4.56518E-06	5.05E-07	0.016581
5	2026	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.07812	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	5.6E-06	1.44E-05	3.79E-08	9.96622E-07	9.66742E-07	1E-07	0.016572
5	2026	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.52	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000396	0.001031	2.64E-06	6.95E-05	6.74805E-05	6.98E-06	1.156189
5	2026	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	5.52	0.832607	1.51298	0.001512	0.160808	0.155984	0.024344	626.9137	0.000523	0.000951	9.5E-07	0.000101029	9.79977E-05	1.53E-05	0.393233
5	2026	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	5.52	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.000246	0.000656	6.04E-07	5.75706E-05	5.5843E-05	5E-06	0.245676
5	2026	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.52	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000396	0.001031	2.64E-06	6.95E-05	6.74805E-05	6.98E-06	1.156189
5	2026	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	5.52	0.189623	2.545734	0.001529	0.017191	0.016675	0.005621	696.8406	1.82E-05	0.000244	1.47E-07	1.64759E-06	1.5982E-06	5.38E-07	0.066686
5	2026	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	5.52	1.809311	2.088639	0.001678	0.258497	0.250742	0.031154	696.1906	0.000211	0.000267	1.96E-07	3.02005E-05	2.92955E-05	3.64E-06	0.081332
5	2026	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	71.77142857	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.005076	0.013106	3.44E-05	0.000903515	0.000876408	9.09E-05	15.03246
5	2026	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	71.77142857	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.003196	0.008534	7.85E-06	0.000748526	0.000726079	6.5E-05	3.194293
5	2026	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	71.77142857	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.005076	0.013106	3.44E-05	0.000903515	0.000876408	9.09E-05	15.03246
5	2026	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	0.897142857	0.359725	2.617622	0.001339	0.0379	0.036763	0.012341	596.8285	8.62E-06	6.11E-05	3.13E-08	8.84566E-07	8.58016E-07	2.88E-07	0.013906
5	2026	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	0.897142857	1.335432	2.015587	0.001466	0.211614	0.205266	0.014694	595.7777	5.68E-05	8.57E-05	6.23E-08	9.98748E-06	8.72795E-06	6.25E-07	0.025335
5	2026	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.897142857	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	6.35E-05	0.000164	4.3E-07	1.12939E-05	1.09551E-05	1.14E-06	0.187906
5	2026	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.897142857	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	3.99E-05	0.000107	9.81E-08	9.35658E-06	9.07599E-06	8.12E-07	0.039929
5	2026	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.897142857	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	6.35E-05	0.000164	4.3E-07	1.12939E-05	1.09551E-05	1.14E-06	0.187906
5	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.8	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	3.56E-05	9.51E-05	8.75E-08	8.34356E-06	8.09324E-06	7.25E-07	0.035605
5	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.6	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000113	0.000292	7.67E-07	2.0142E-05	1.95378E-05	2.03E-06	0.335118
5	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	0.8	2.471076	4.180276	0.001622	0.240231	0.233024	0.092525	593.7639	1.03E-05	1.74E-05	7.6E-09	1.00205E-06	9.71984E-07	3.86E-07	0.002477
5	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.8	1.809311	2.088639	0.001678	0.258497	0.250742	0.031154	696.1906	3.35E-05	3.86E-05	3.11E-08	4.78708E-06	4.64347E-06	5.77E-07	0.012874
5	2026	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	7.337684211	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	0.000234	0.000643	1.04E-06	5.22757E-05	5.07075E-05	4.85E-06	0.4482
5	2026	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	51.63656566	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.003649	0.009429	2.47E-05	0.000650076	0.000630577	6.54E-05	10.81681
5	2026	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	7.337684211	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000519	0.00134	3.52E-06	9.23745E-05	8.96033E-05	9.29E-06	1.53667
5	2026	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	7.145636462	1.319265	2.086466	0.001463	0.207566	0.201339	0.0166	596.7267	0.000613	0.00097	6.8E-07	9.65091E-05	9.36138E-05	7.72E-06	0.277022
5	2026	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.768666667	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	5.6E-05	0.000154	2.49E-07	1.25995E-05	1.22215E-05	1.16E-06	0.107423
5	2026	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.768666667	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000124	0.000321	8.42E-07	2.21594E-05	2.14756E-05	2.23E-06	0.368361
5	2026	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.768666667	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000124	0.000321	8.42E-07	2.21594E-05	2.14756E-05	2.23E-06	0.368361
6	2026	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	31.4	0.27979	0.769437	0.001242	0.062596	0.060718	0.005806	536.6806	0.001	0.00275	4.44E-06	0.000223702	0.000216993	2.07E-05	1.917971
6	2026	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	31.4	0.217	0.621686	0.00123	0.052694	0.051113	0.004104	536.7251	0.000776	0.002222	4.4E-06	0.000188316	0.000182666	1.47E-05	1.91813
6	2026	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	62.8	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.004442	0.011467	3.01E-05	0.000790574	0.000766857	7.96E-05	13.15339
7	2026	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	4.620375	0.635813	1.665267	0.001327	0.113743	0.110331	0.014346	536.4688	0.000334	0.000871	6.96E-07	5.98134E-05	5.80195E-05	7.54E-06	0.282105
7	2026	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	16.64063626	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.001177	0.003039	7.97E-06	0.000209486	0.0002032	2.11E-05	3.485562
7	2026	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	9.24075	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.00041	0.001097	1.01E-06	9.62758E-05	9.34646E-05	8.37E-06	0.411273
7	2026	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.620375	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000327	0.000844	2.21E-06	5.81643E-05	5.64199E-05	5.85E-06	0.967733
7	2026	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	4.620375	1.319265	2.086466	0.001463	0.207566	0.201339	0.0166	596.7267	0.000396	0.000627	4.4E-07	6.23724E-05	6.05012E-05	4.99E-06	0.179012
7	2026	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	4.620375	0.189623	2.545734	0.001529	0.017191	0.016675	0.005621	696.8406	1.52E-05	0.000204	1.23E-07	1.37901E-06	1.33764E-06	4.51E-07	0.055816
7	2026	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	5.91488	1.509373	3.768059	0.001826	0.171996	0.166838	0.039634	596.1343	0.000146	0.000363	1.76E-07	1.66563E-05	1.60662E-05	3.81E-06	0.057287
7	2026	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	7.3926	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.000452	0.001206	1.11E-06	0.000105799	0.000102618	9.18E-06	0.451444
7	2026	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	7.3926	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000523	0.00135	3.54E-06	9.30637E-05	9.02718E-05	9.36E-06	1.548372
7	2026	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	7.3926	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000523	0.00135	3.54E-06	9.30637E-05	9.02718E-05	9.36E-06	1.548372
7	2026	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	7.3926	0.536726	1.433534	0.001319	0.125733	0.121961	0.010916	536.55	0.000329	0.000879	8.09E-07	7.71036E-05	7.47911E-05	6.69E-06	0.329019
7	2026	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	7.3926	0.181251	0.467944	0.001229	0.032261	0.031293	0.003246	536.7454	0.000523	0.00135	3.54E-06	9.30637E-05	9.02718E-05	9.36E-06	1.548372

7	2026	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	66.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	66.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	66.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Demolition	Hydraulic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	66.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	66.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	66.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	19.3205	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	19.3205	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	61.2088687	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	24.5418	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	96.9624	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	12.3205	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	12.3205	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	12.3205	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2800	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Excavation (Cut & Fill) (Assume 50% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.454	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Excavation (Cut & Fill) (Assume 50% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	63.3333333	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Excavation (Cut & Fill) (Assume 50% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	2.454	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Excavation (Cut & Fill) (Assume 50% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.454	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Excavation (Cut & Fill) (Assume 50% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	2.454	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Excavation and Topsoil Stripping	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.3378	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	0.3378	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	0.3378	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.36878	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Hydroseeding	Off Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.36878	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.77333333	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	0.77333333	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.77333333	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.77333333	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	0.77333333	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Lighting	Tractors/Loaders/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.77333333	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	76.1142857	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	76.1142857	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	76.1142857	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	0.30142857	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.42	0.30142857	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.30142857	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.30142857	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.30142857	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	0.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loaders/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	54.76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2026	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.79813E-05	9.50229E-05	9.06E-03	1.629066
7	2026	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	7.502153846	1.519285	2.036465	0.001483	0.207566	0.201339	0.0166	595.7967	0.000651	0.001025	7.22E-07	0.000102365	9.9864E-05	3.19E-03	0.293764
7	2026	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.881333333	0.27976	0.789427	0.001242	0.082696	0.080716	0.006806	538.6806	5.93E-05	0.000163	2.83E-07	1.32807E-05	1.29828E-06	1.28E-03	0.112694
7	2026	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.881333333	0.161251	0.457944	0.001226	0.032261	0.031293	0.003246	538.7464	0.000132	0.00034	8.92E-07	2.54319E-05	2.27289E-05	2.36E-03	0.388054
7	2026	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.881333333	0.161251	0.457944	0.001226	0.032261	0.031293	0.003246	538.7464	0.000132	0.00034	8.92E-07	2.54319E-05	2.27289E-05	2.36E-03	0.388054
																	TOTAL (TPY)	1.885141	4.834573	0.010487	0.355878156	0.34579179	0.035378	4.643

On Road Sources
Units for Non-Greenhouse Gases Emission: Short Ton
Units for Greenhouse Gases (CO2, CH4, and N2O) Emission: Metric Ton

Scenario ID	Year	Project	Equipment	Equipment Category	MOVES Lookup	On road Activity	On road Activity	Fuel	oadway Typ	nd Trip Distance (m	ce for fugit	ber of Vehi	es Or SH*1	er of Projec	roject Leng	roject Widt	roject Are	(Building	ht (Buildin	mber of Tr	VMT	Activity Rate	MOVES Emission Factors (g/mile) CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O	MOVES ONROAD Emissions (tpy) CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O
1	2026	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	9		193	6999	100	--	--	--	--	--	138311	0.119011768	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.163699	0.214848	0.000425	0.02577	0.007802	0.015851	129.5122	0.002088	0.016872
1	2026	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted A	30	--	65.11	65.11	193	--	--	--	--	--	--	--	319067	1.005863269	3.181861	0.070517	0.00181	0.050966	0.008367	0.089657	340.8004	0.006044	0.001768	1.119189	0.024803	0.000637	0.017926	0.002943	0.031493	119.8714	0.002129	0.000618
2	2026	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	1		193	6999	100	--	--	--	--	--	6704	0.011258368	2.059386	3.375093	0.005476	0.262604	0.073969	0.13689	1636.418	0.016793	0.223673	0.019759	0.03239	5.26E-05	0.002519	0.00071	0.001332	15.89111	0.00016	0.002146
2	2026	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	6	9		193	6999	100	--	--	--	--	--	138727	0.122141469	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.170657	0.226577	0.000453	0.026817	0.008115	0.016687	124.774	0.002173	0.017567
2	2026	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	1		193	6999	100	--	--	--	--	--	12331	0.011848597	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.01616	0.019973	4.02E-05	0.002386	0.000722	0.00147	11.97962	0.000193	0.001561
2	2026	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	6	0		193	6999	100	--	--	--	--	--	73868	0.006513206	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.090064	0.110941	0.000242	0.014136	0.00438	0.00882	71.87972	0.001169	0.009354
2	2026	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted A	30	--	65	65	193	--	--	--	--	--	--	--	364770	1.147344243	3.181861	0.070517	0.00181	0.050966	0.008367	0.089657	340.8004	0.006044	0.001768	1.279697	0.026364	0.000729	0.020433	0.003354	0.036002	137.0332	0.002324	0.000706
3	2026	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	1		66	686	100	--	--	--	--	--	1266	0.003267368	2.059386	3.375093	0.005476	0.262604	0.073969	0.13689	1636.418	0.016793	0.223673	0.003649	0.00467	7.58E-06	0.000358	0.000102	0.000192	2.252447	2.3E-06	0.000309
3	2026	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	6	3		66	686	100	--	--	--	--	--	20008	0.017804068	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.024093	0.032237	6.02E-05	0.003838	0.001171	0.002284	19.48302	0.000318	0.002582
3	2026	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	1		66	686	100	--	--	--	--	--	1775	0.003198723	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.002186	0.002866	5.6E-06	0.000341	0.000104	0.000212	1.727336	2.78E-05	0.000225
3	2026	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	2		66	686	100	--	--	--	--	--	10686	0.010377984	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.013118	0.017193	3.48E-05	0.002047	0.000624	0.001272	10.36402	0.000167	0.00136
3	2026	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted A	30	--	63	65	66	--	--	--	--	--	--	--	162540	0.511251008	3.181861	0.070517	0.00181	0.050966	0.008367	0.089657	340.8004	0.006044	0.001768	0.570094	0.012806	0.000324	0.009131	0.001499	0.018042	61.06142	0.001441	0.000316
4	2026	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	2		66	614	100	--	--	--	--	--	12976	0.011570067	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.015968	0.020816	4.24E-05	0.00249	0.00076	0.001547	12.59818	0.000203	0.001642
4	2026	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted A	30	--	5.368	5.368	66	--	--	--	--	--	--	--	13849	0.043580922	3.181861	0.070517	0.00181	0.050966	0.008367	0.089657	340.8004	0.006044	0.001768	0.048674	0.001077	2.76E-05	0.000778	0.000128	0.001287	5.202866	0.000123	2.69E-05
5	2026	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	1		109	314	100	--	--	--	--	--	456	0.003920164	2.059386	3.375093	0.005476	0.262604	0.073969	0.13689	1636.418	0.016793	0.223673	0.001036	0.001697	2.75E-06	0.000132	3.72E-05	6.90E-05	0.822062	8.44E-06	0.000112
5	2026	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	6	1		109	314	100	--	--	--	--	--	7261	0.006850968	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.008927	0.011702	2.37E-05	0.001392	0.000425	0.000866	7.054099	0.000114	0.000919
5	2026	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	1		109	314	100	--	--	--	--	--	645	0.005330029	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.000793	0.00104	2.11E-06	0.000124	3.77E-05	7.69E-05	0.626821	1.01E-05	8.16E-05
5	2026	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	6	1		109	314	100	--	--	--	--	--	8673	0.004336705	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.004792	0.006242	1.20E-05	0.000748	0.000227	0.000462	3.76254	6.07E-05	0.00049
5	2026	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted A	30	--	63	63	109	--	--	--	--	--	--	--	204120	0.642037198	3.181861	0.070517	0.00181	0.050966	0.008367	0.089657	340.8004	0.006044	0.001768	0.715932	0.015867	0.000407	0.011467	0.001882	0.020146	76.98178	0.00181	0.000396
6	2026	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	6	1		109	314	100	--	--	--	--	--	6976	0.006572579	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.008679	0.011246	2.28E-05	0.001339	0.000408	0.000832	6.779168	0.000109	0.000883
6	2026	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted A	30	--	8	8	109	--	--	--	--	--	--	--	9720	0.0805732	3.181861	0.070517	0.00181	0.050966	0.008367	0.089657	340.8004	0.006044	0.001768	0.034092	0.000755	1.94E-05	0.000546	8.96E-05	0.000959	3.651518	8.62E-05	1.88E-05
7	2026	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	1		193	339	100	--	--	--	--	--	463	0.005150563	2.059386	3.375093	0.005476	0.262604	0.073969	0.13689	1636.418	0.016793	0.223673	0.001095	0.001797	2.92E-06	0.00014	3.94E-05	7.3E-05	0.870727	1E-05	0.000119
7	2026	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	6	1		193	339	100	--	--	--	--	--	7701	0.009935598	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.009456	0.012411	2.51E-05	0.001479	0.000451	0.000918	7.481561	0.000121	0.000976
7	2026	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	1		193	339	100	--	--	--	--	--	606	0.005331063	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.000842	0.001104	2.24E-06	0.000131	4.01E-05	8.17E-05	0.665481	1.07E-05	8.67E-05
7	2026	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted A	40	5	1		193	339	100	--	--	--	--	--	4107	0.007245153	1.115829	1.482089	0.002961	0.174064	0.068096	0.10614	581.8301	0.014206	0.114811	0.005049	0.006618	1.34E-05	0.000789	0.00024	0.00049	3.989872	6.43E-05	0.00052
7	2026	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted A	30	--	63	65	193	--	--	--	--	--	--	--	364770	1.147344243	3.181861	0.070517	0.00181	0.050966	0.008367	0.089657	340.8004	0.006044	0.001768	1.279697	0.026364	0.000729	0.020433	0.003354	0.036002	137.0332	0.002324	0.000706
																															TOTAL (TPY)	5.696248	0.863616	0.004366	0.167466	0.03982	0.39564	952.5156	0.016797	0.060628

Fugitive Sources
Units for Non-Greenhouse Gases Emission: Short Ton

Scenario ID	Year	Project	Fugitive Source Type	Number of Months	CO	NOx	SO2	PM10	VOC
1	2026	Demolition - Asphalt	Material Movement (Paved Roads)	9	0	0	0	0.0403	0
1	2026	Demolition - Asphalt	Material Movement (Unpaved Roads)	9	0	0	0	0.1292	0
1	2026	Demolition - Asphalt	Soil Handling	9	0	0	0	0.1696	0
1	2026	Demolition - Asphalt	Unstabilized Land and Wind Erosion	9	0	0	0	1.8169E-07	0
2	2026	Rehabilitate Runway	Asphalt Drying	9	0	0	0	0	0.72675
2	2026	Rehabilitate Runway	Asphalt Storage and Batching	9	1.4515	0.08066	0.0167	0.0964	0.04485
2	2026	Rehabilitate Runway	Concrete Mixing/Batching	9	0	0	0	0.6185	0
2	2026	Rehabilitate Runway	Material Movement (Paved Roads)	9	0	0	0	0.07185	0
2	2026	Rehabilitate Runway	Material Movement (Unpaved Roads)	9	0	0	0	0.22745	0
2	2026	Rehabilitate Runway	Soil Handling	9	0	0	0	0.1696	0
2	2026	Rehabilitate Runway	Unstabilized Land and Wind Erosion	9	0	0	0	1.0155E-07	0
3	2026	Rehabilitate Runway	Asphalt Drying	4	0	0	0	0	0.10494
3	2026	Rehabilitate Runway	Asphalt Storage and Batching	4	0.2093	0.01806	0.0024046	0.01435	0.0066
3	2026	Rehabilitate Runway	Concrete Mixing/Batching	4	0	0	0	0.074	0
3	2026	Rehabilitate Runway	Material Movement (Paved Roads)	4	0	0	0	0.01836	0
3	2026	Rehabilitate Runway	Material Movement (Unpaved Roads)	4	0	0	0	0.04835	0
3	2026	Rehabilitate Runway	Soil Handling	4	0	0	0	0.0240	0
3	2026	Rehabilitate Runway	Unstabilized Land and Wind Erosion	4	0	0	0	1.1686E-08	0
4	2026	Demolition - Asphalt	Material Movement (Paved Roads)	4	0	0	0	0.0080915	0
4	2026	Demolition - Asphalt	Material Movement (Unpaved Roads)	4	0	0	0	0.0126	0
4	2026	Demolition - Asphalt	Soil Handling	4	0	0	0	0.01665	0
4	2026	Demolition - Asphalt	Unstabilized Land and Wind Erosion	4	0	0	0	7.565E-09	0
5	2026	Rehabilitate Runway	Asphalt Drying	5	0	0	0	0	0.03818
5	2026	Rehabilitate Runway	Asphalt Storage and Batching	5	0.0759b	0.004743b	0.000673	0.0052	0.002252
5	2026	Rehabilitate Runway	Concrete Mixing/Batching	5	0	0	0	0.02658	0
5	2026	Rehabilitate Runway	Material Movement (Paved Roads)	5	0	0	0	0.01005	0
5	2026	Rehabilitate Runway	Material Movement (Unpaved Roads)	5	0	0	0	0.03045	0
5	2026	Rehabilitate Runway	Soil Handling	5	0	0	0	0.0080	0
5	2026	Rehabilitate Runway	Unstabilized Land and Wind Erosion	5	0	0	0	5.28E-09	0

6	2026	Demolition - Asphalt	Material Movement (Paved Roads)	5	0	0	0	0.0025065	0
6	2026	Demolition - Asphalt	Material Movement (Unpaved Roads)	5	0	0	0	0.00796	0
6	2026	Demolition - Asphalt	Soil Handling	5	0	0	0	0.0089	0
6	2026	Demolition - Asphalt	Unstabilized Land and Wind Erosion	5	0	0	0	5.28E-09	0
7	2026	Rehabilitate Runway	Asphalt Drying	9	0	0	0	0	0.04028
7	2026	Rehabilitate Runway	Asphalt Storage and Batching	9	0.08056	0.00505	0.0009256	0.0056	0.002496
7	2026	Rehabilitate Runway	Concrete Mixing/Batching	9	0	0	0	0.0286	0
7	2026	Rehabilitate Runway	Material Movement (Paved Roads)	9	0	0	0	0.0179	0
7	2026	Rehabilitate Runway	Material Movement (Unpaved Roads)	9	0	0	0	0.05375	0
7	2026	Rehabilitate Runway	Soil Handling	9	0	0	0	0.00945	0
7	2026	Rehabilitate Runway	Unstabilized Land and Wind Erosion	9	0	0	0	1.0075E-08	0
				TOTAL (TPY)	*1.8173*	*0.1134935*	*0.020903*	*1.840498*	*0.968426*

Total Construction Emissions										
Construction Source	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O	CO2e
NONROAD	1.8931413	4.924673295	0.010687399	0.355878156	0.345201786	0.035378438	4,643	--	--	--
ONROAD	5.606246	0.853514625	0.004356283	0.15745492	0.039620183	0.195539619	982.8193113	0.019797049	0.05052833	--
FUGITIVE	1.8173	0.1134935	0.020903	1.840498	--	0.968428	--	--	--	--
TOTAL (TPY)	*9.32*	*5.90*	*0.036*	*2.36*	*0.38*	*1.20*	*5,104*	*0.01796*	*0.05491*	*5,119*

Airport Construction Emissions Inventory Tool (ACEIT)
Version 1.0
Run Date & Time: 10/15/2024 5:35:40 PM

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STUDY

Study Name

HOU Reconstruction

Study Description

2027 Construction Schedule

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EMISSIONS INVENTORY - SUMMARY
EMISSIONS INVENTORY - DETAILS:

Non-Road Sources
Units for Non-Greenhouse Gases Emission: Short Ton
Units for Greenhouse Gases (CO2, CH4, and N2O) Emission: Metric Ton

											MOVES4 Emission Factors (g-hp-hr)							NONROAD Emissions (TPY)						
											3	5	8	6	7	10	2							
ScenarioID	Year	Project	Construction Activity	Equipment	MOVES Equipment	MOVES Lookup	Fuel	HP Average	Load Factor	Hours of Activity	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CO (tpy)	NOx (tpy)	SO2(tpy)	PM10 (tpy)	PM2.5 (tpy)	VOC (tpy)	CO2 Exhaust (tpy)
1	2027	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	799.9	0.248663	0.683303	0.001233	0.055063	0.053411	0.006147	536.6974	0.022636	0.062208	0.000112	0.005013	0.004863	0.000469	48.96094
1	2027	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	799.9	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7406	0.016922	0.048519	0.000111	0.004103	0.003979	0.000318	48.95486
1	2027	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1599.8	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.092373	0.246007	0.00076	0.016816	0.016311	0.001743	335.0836
2	2027	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	110.986125	0.588652	1.532636	0.001316	0.105062	0.10191	0.013209	536.4884	0.007434	0.01935	1.66E-05	0.001327	0.001287	0.000167	6.776815
2	2027	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	399.7249297	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.02306	0.061457	0.00019	0.004202	0.004075	0.000436	83.72375
2	2027	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	221.97225	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.009652	0.023744	2.4E-05	0.002046	0.001985	0.000176	9.879847
2	2027	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	110.986125	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.005406	0.017067	5.27E-05	0.001167	0.001132	0.000121	23.24642
2	2027	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	110.986125	1.186575	1.96241	0.001447	0.186594	0.180996	0.014949	595.7594	0.008568	0.014165	1.04E-05	0.001347	0.001306	0.000108	4.300366
2	2027	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	110.986125	0.189648	2.545753	0.001529	0.017197	0.016681	0.005622	595.8403	0.000365	0.004905	2.95E-06	3.31E-05	3.21E-05	1.08E-05	1.340804
2	2027	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	142.06224	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	595.1399	0.003463	0.008699	4.22E-06	0.000395	0.000383	9.1E-05	1.374663
2	2027	Rehabilitate Runway	Cold Milling	ColdPlaner	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	177.5778	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.009497	0.026263	2.63E-05	0.002246	0.002179	0.000193	10.84485
2	2027	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	177.5778	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.010253	0.027307	8.44E-05	0.001867	0.001811	0.000193	37.19428
2	2027	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	177.5778	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.010253	0.027307	8.44E-05	0.001867	0.001811	0.000193	37.19428
2	2027	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	177.5778	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.006922	0.018996	1.92E-05	0.001637	0.001588	0.000141	7.903677
2	2027	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	177.5778	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.010253	0.027307	8.44E-05	0.001867	0.001811	0.000193	37.19428
2	2027	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	1599.8	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	595.8413	0.014331	0.107911	5.54E-05	0.00137	0.001329	0.00049	24.7979
2	2027	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1599.8	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.092373	0.246007	0.00076	0.016816	0.016311	0.001743	335.0836
2	2027	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	1599.8	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7406	0.033845	0.097037	0.000222	0.008206	0.007959	0.000637	97.72973
2	2027	Rehabilitate Runway	Concrete Demolition	Hydralic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	1599.8	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.08556	0.234801	0.000237	0.020236	0.019631	0.00174	97.7014
2	2027	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	1599.8	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.062357	0.171126	0.000173	0.01475	0.014307	0.001268	71.2061
2	2027	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1599.8	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.092373	0.246007	0.00076	0.016816	0.016311	0.001743	335.0836
2	2027	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	295.9632	1.175069	1.884261	0.001446	0.187573	0.181946	0.012868	595.8249	0.016484	0.026433	2.03E-05	0.002631	0.002552	0.000181	8.358657
2	2027	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	295.9632	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	595.8413	0.002651	0.019964	1.02E-05	0.000254	0.000246	9.06E-05	4.587614
2	2027	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1233.18	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.071204	0.189631	0.000586	0.012962	0.012573	0.001344	258.2938
2	2027	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	591.9264	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.023072	0.063317	6.39E-05	0.005457	0.005294	0.000469	26.34628
2	2027	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	887.8896	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.051267	0.136534	0.000422	0.009333	0.009053	0.000967	185.9715
2	2027	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	295.9632	0.783896	1.384715	0.001501	0.147389	0.142967	0.022153	625.9706	0.026732	0.046644	5.06E-05	0.004966	0.004816	0.000746	21.08671
2	2027	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	295.9632	0.588652	1.532636	0.001316	0.105062	0.10191	0.013209	536.4884	0.019925	0.051827	4.45E-05	0.003559	0.003453	0.000445	18.07162
2	2027	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	295.9632	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	595.1399	0.007214	0.018124	8.79E-06	0.000823	0.000798	0.00019	2.863883
2	2027	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2680	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.168291	0.442888	0.001369	0.030272	0.029364	0.003138	603.2259
2	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	59.1928	0.248663	0.683303	0.001233	0.055063	0.053411	0.006147	536.6974	0.001675	0.004603	8.31E-06	0.000371	0.00036	3.47E-05	3.615722
2	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	197.3093333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.011393	0.030341	9.38E-05	0.002074	0.002012	0.000215	41.32712
2	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	59.1928	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7406	0.001252	0.00359	8.22E-06	0.000304	0.000294	2.36E-05	3.616012
2	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	59.1928	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.003416	0.009102	2.81E-05	0.000622	0.000604	6.45E-05	12.39813
2	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	59.1928	1.186575	1.96241	0.001447	0.186594	0.180996	0.014949	595.7594	0.004565	0.007556	5.57E-06	0.000718	0.000697	5.75E-05	2.293637
2	2027	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	27.85637265	0.248663	0.683303	0.001233	0.055063	0.053411	0.006147	536.6974	0.000786	0.002166	3.91E-06	0.000176	0.000169	1.63E-05	1.701612
2	2027	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	19.558	0.248663	0.683303	0.001233	0.055063	0.053411	0.006147	536.6974	0.000664	0.001521	2.76E-06	0.000123	0.000119	1.16E-05	1.194677
2	2027	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	19.558	0.333081	0.938166	0.001272	0.061293	0.059454	0.008455	536.5102	0.001271	0.00358	4.86E-06	0.000234	0.000227	3.23E-05	2.047685
2	2027	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	19.558	1.186575	1.96241	0.001447	0.186594	0.180996	0.014949	595.7594	0.001506	0.002496	1.84E-06	0.000237	0.00023	1.9E-05	0.757812
2	2027	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	1.9658	0.959281	2.034659	0.00138	0.142517	0.138242	0.016249	536.433	0.000732	0.001553	1.05E-06	0.000109	0.000105	1.16E-05	0.409402
2	2027	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.9658	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000113	0.000301	9.29E-07	2.06E-05	1.99E-05	2.13E-06	0.409649
2	2027	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	107.9866667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.006235	0.016605	5.13E-05	0.001135	0.001101	0.000118	22.61818
2	2027	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	107.9866667	0.783896	1.384715	0.001501	0.147389	0.142967	0.022153	625.9706	0.009389	0.017019	1.84E-05	0.001811	0.001757	0.000272	7.693441
2	2027	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	107.9866667	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.004209	0.011551	1.17E-05	0.000996	0.000966	8.56E-05	4.806419
2	2027	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	107.9866667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.006235	0.016605	5.13E-05	0.001135	0.001101	0.000118	22.61818
2	2027	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	107.9866667	0.189648	2.545753	0.001529	0.017197	0.016681	0.005622	595.8403	0.000355	0.004773	2.87E-06	3.22E-05	3.13E-05	1.05E-05	1.304568
2	2027	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	107.9866667	1.653392	1.964	0.001666	0.235696	0.228625	0.028239	595.2563	0.004133	0.00491	4.16E-06	0.000589	0.000572	7.06E-05	1.73799
2	2027	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1828.342857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.105669	0.281151	0.000869	0.019218	0.018641	0.001992	382.9527
2	2027	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	1828.342857	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.071266	0.195573	0.000197	0.016857	0.016351	0.001449	81.3784
2	2027	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1828.342857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.105669	0.281151	0.000869	0.019218	0.018641	0.001992	382.9527
2	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	22.85428571	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	595.8413	0.000205	0.001542	7.91E-07	1.96E-05	1.9E-05	6.99E-06	0.354256
2	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	22.85428571	1.175069	1.884261	0.001446	0.187573	0.181946	0.012868	595.8249	0.001273	0.002041	1.57E-06	0.000203	0.000197	1.39E-05	0.645446
2	2027	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	22.85428571	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.00132	0.003514	1.09E-05	0.00024	0.000233	2.49E-05	4.786908
2	2027	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	22.85428571	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.000891	0.002445	2.47E-06	0.000211	0.000204	1.81E-05	1.01723
2	2027	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	22.85428571	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.00132	0.003514	1.09E-05	0.00024	0.000233	2.49E-05	4.786908
2	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	16.4	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.000639	0.001754	1.77E-06	0.000151	0.000147	1.3E-05	0.729964
2	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	32.8	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001894	0.005044	1.56E-05	0.000345	0.000334	3.57E-05	6.870072
2	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	16.4	2.463459	4.101293	0.001822	0.238996	0.231825	0.092723	593.7537	0.000211	0.000358	1.56E-07	2.04E-05	1.98E-05	7.93E-06	0.050772
2	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	16.4	1.653392	1.964	0.001666	0.235696	0.228625	0.028239	595.2563	0.000628	0.000746	6.32E-07	8.95E-05	8.69E-05	1.07E-05	0.26395
2	2027	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	186.924	0.248663	0.683303	0.001233	0.055063	0.053411	0.006147	536.6974	0.00629	0.014637	2.62E-05	0.001171	0.001136	0.00011	11.41803
2	2027	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1315.391111	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.075951	0.202272	0.000625	0.013826	0.013411	0.001433	275.5132
2	2027	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	186.924	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.010793	0.028744	8.88E-05	0.001966	0.001906	0.000204	39.16187
2	2027	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	182.1310769	1.186575	1.96241	0.001447	0.186594	0.180996	0.014949	595.7594	0.014046	0.023245	1.71E-05	0.00221	0.002144	0.000177	7.067012
2	2027	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	43.46266667	0.248663	0.683303	0.001233	0.055063	0.053411	0.006147	536.6974	0.00123	0.00338	6.1E-06	0.000272	0.000264	2.56E-05	2.654865
2	2027	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	43.46266667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.00251	0.006683	2.07E-05	0.000457	0.000443	4.74E-05	9.103404
2	2027	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	43.46266667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.00251	0.006683	2.07E-05	0.000457	0.000443	4.74E-05	9.103404
3	2027	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	2.788875	0.588652	1.532636	0.001316	0.105062	0.10191	0.013209	536.4884	0.000187	0.000486	4.18E-07	3.33E-05	3.23E-05	4.19E-06	0.170289
3	2027	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	10.0443444	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.00058	0.001545	4.77E-06	0.000106	0.000102	1.09E-05	2.103822
3	2027	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	6.57776	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.000217	0.000597	6.02E-07	5.14E-05	4.99E-05	4.42E-06	0.248262
3	2027	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.788875	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000161	0.000429	1.33E-06	2.93E-05	2.84E-05	3.04E-06	0.584139
3	2027	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	2.788875	1.186575	1.96241	0.001447	0.186594	0.180996	0.014949	595.7594	0.000215	0.000355	2.62E-07	3.38E-05	3.28E-05	2.71E-06	0.10805
3	2027	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	2.788875	0.189648	2.545753	0.001529	0.017197	0.016681	0.005622	595.8403	9.18E-06	0.000123	7.4E-08	8.33E-07	8.08E-07	2.72E-07	0.033692
3	2027	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	3.56976	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	595.1399	8.7E-06	0.000219	1.06E-07	9.92E-06	9.63E-06	2.29E-06	0.034543
3	2027	Rehabilitate Runway	Cold Milling	ColdPlaner	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	4.4622	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.000239	0.000655	6.61E-07	5.64E-05	5.48E-05	4.85E-06	0.272511
3	2027	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.4622	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000258	0.000686	2.12E-06	4.69E-05	4.55E-05	4.86E-06	0.934623
3	2027	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.4622	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000258	0.000686	2.12E-06	4.69E-05	4.55E-05	4.86E-06	0.934623
3	2027	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	4.4622	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.000174	0.000477	4.82E-07	4.11E-05	3.99E-05	3.54E-06	0.19861
3	2027	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.4622	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000258	0.000686	2.12E-06	4.69E-05	4.55E-05	4.86E-06	0.934623
3	2027	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	40.2	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	595.8413	0.00036	0.002712	1.39E-06	3.44E-05	3.34E-05	1.23E-05	0.623125
3	2027	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	40.2	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002321	0.006182	1.91E-05	0.000423	0.00041	4.38E-05	8.420028
3	2027	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	40.2	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7406	0.00085	0.002438	5.59E-06	0.000206	0.0002	1.6E-05	2.455766
3	2027	Rehabilitate Runway	Concrete Demolition	Hydralic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	40.2	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.00215	0.0059	5.95E-06	0.000509	0.000493	4.37E-05	2.455054
3	2027	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	40.2	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.001567	0.0043	4.34E-06	0.000371	0.00036	3.19E-05	1.789277
3	2027	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	40.2	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002321	0.006182	1.91E-05	0.000423	0.00041	4.38E-05	8.420028
3	2027	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	7.4368	1.175069	1.884261	0.001446	0.187573	0.181946	0.012868	595.8249	0.000414	0.000664	5.1E-07	6.61E-06	6.41E-06	4.64E-06	0.210029
3	2027	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	7.4368	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	595.8413	6.66E-05	0.000502	2.57E-07	6.37E-06	6.18E-06	2.28E-06	0.115275
3	2027	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	30.98666667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001789	0.004765	1.47E-05	0.000326	0.000316	3.38E-05	6.490263
3	2027	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	14.8736	0.469901	1.29955	0.001301	0.111147	0.107813	0.009554	536.5849	0.00058	0.001591	1.6E-06	0.000137	0.000133	1.18E-05	0.662015
3	2027	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	22.3104	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001288	0.003431	1.06E-05	0.000235	0.000227	2.43E-05	4.67299
3	2027	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	7.4368	0.783896	1.384715	0.001501	0.147389	0.142967	0.022153	625.9706	0.000647	0.00117	1.27E-06	0.000125	0.000121	1.88E-05	0.52983

3	2027	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	7.4368	0.588552	1.532636	0.001316	0.105062	0.10191	0.013209	536.4084	0.000496	0.001297	1.11E-06	8.69E-05	8.43E-05	1.12E-05	0.454091
3	2027	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	7.4368	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	0.000181	0.000455	2.21E-07	2.07E-05	2.01E-05	4.77E-06	0.071962
3	2027	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1200	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.06829	0.184528	0.00057	0.012613	0.012236	0.001307	251.2941
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.4872	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	4.21E-05	0.000116	2.09E-07	9.34E-06	9.07E-06	8.71E-07	0.090644
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.967333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000286	0.000762	2.30E-06	5.21E-05	5.05E-05	5.4E-06	1.03633
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	1.4872	0.186379	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	3.15E-05	9.02E-05	2.07E-07	7.63E-06	7.4E-06	5.92E-07	0.090861
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.4872	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	8.59E-05	0.000229	7.07E-07	1.56E-05	1.52E-05	1.62E-06	0.311499
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	1.4872	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000116	0.00019	1.4E-07	1.8E-05	1.75E-05	1.45E-06	0.057624
3	2027	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.699921569	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	1.90E-05	5.44E-05	9.82E-08	4.39E-06	4.25E-06	4.1E-07	0.042754
3	2027	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.5153	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	1.46E-05	4.01E-05	7.23E-08	3.23E-06	3.13E-06	3.02E-07	0.031476
3	2027	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	0.5153	0.333081	0.938168	0.001272	0.061293	0.059454	0.008455	536.8102	3.35E-05	9.43E-05	1.28E-07	6.16E-06	5.98E-06	8.5E-07	0.053961
3	2027	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	0.5153	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	3.97E-05	6.58E-05	4.86E-08	6.25E-06	6.07E-06	5.01E-07	0.019966
3	2027	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.05153	0.959281	2.034569	0.00138	0.142617	0.138242	0.015249	536.433	1.92E-05	4.09E-05	2.77E-08	2.87E-06	2.78E-06	3.07E-07	0.010787
3	2027	Rehabilitate Runway	Hydroseeding	Off Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.05153	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	2.98E-06	7.92E-06	2.45E-08	5.42E-07	5.25E-07	5.61E-08	0.010798
3	2027	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.013333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000232	0.000617	1.91E-06	4.22E-05	4.09E-05	4.37E-06	0.840606
3	2027	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	4.013333333	0.763896	1.364715	0.001501	0.147369	0.142957	0.022153	625.9705	0.000349	0.000633	6.86E-07	6.73E-05	6.53E-05	1.01E-05	0.285927
3	2027	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	4.013333333	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.000166	0.000429	4.33E-07	3.7E-05	3.59E-05	3.19E-06	0.179631
3	2027	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.013333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000232	0.000617	1.91E-06	4.22E-05	4.09E-05	4.37E-06	0.840606
3	2027	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	4.013333333	0.189648	2.545763	0.001529	0.017197	0.016681	0.005622	696.8403	1.32E-05	0.000177	1.07E-07	1.2E-06	1.16E-06	3.92E-07	0.048484
3	2027	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	4.013333333	1.653392	1.964	0.001666	0.235696	0.228625	0.028239	696.2663	0.000154	0.000182	1.55E-07	2.19E-05	2.12E-05	2.62E-06	0.064693
3	2027	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	45.94285714	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002663	0.007085	2.19E-05	0.000483	0.000468	5.01E-05	9.622889
3	2027	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	45.94285714	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.001791	0.004914	4.96E-06	0.000424	0.000411	3.64E-05	2.044688
3	2027	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	45.94285714	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002663	0.007085	2.19E-05	0.000483	0.000468	5.01E-05	9.622889
3	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	0.574285714	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	596.8413	5.14E-05	3.87E-05	1.99E-08	4.92E-07	4.77E-07	1.76E-07	0.008902
3	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	0.574285714	1.175069	1.884261	0.001446	0.187673	0.181946	0.012868	596.8249	3.2E-05	5.13E-05	3.94E-08	5.11E-06	4.96E-06	3.5E-07	0.016219
3	2027	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.574285714	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	3.32E-05	8.83E-05	2.73E-07	6.04E-06	5.86E-06	6.26E-07	0.120286
3	2027	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.574285714	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	2.24E-05	6.14E-05	6.2E-08	5.29E-06	5.14E-06	4.55E-07	0.025561
3	2027	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.574285714	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	3.32E-05	8.83E-05	2.73E-07	6.04E-06	5.86E-06	6.26E-07	0.120286
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.4	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	1.56E-05	4.28E-05	4.32E-08	3.69E-06	3.58E-06	3.17E-07	0.017804
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.6	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	4.62E-05	0.000123	3.8E-07	8.41E-06	8.16E-06	8.72E-07	0.167563
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	0.4	2.463459	4.181293	0.001822	0.238996	0.231825	0.092723	596.7637	5.14E-06	8.72E-06	3.8E-09	4.98E-07	4.83E-07	1.93E-07	0.001238
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.4	1.653392	1.964	0.001666	0.235696	0.228625	0.028239	696.2663	1.53E-05	1.82E-05	1.54E-08	2.19E-06	2.12E-06	2.61E-07	0.006438
3	2027	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	4.697052632	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	0.000133	0.000365	6.59E-07	2.94E-05	2.86E-05	2.75E-06	0.286914
3	2027	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	33.05333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001909	0.005083	1.57E-05	0.000347	0.000337	3.6E-05	6.923134
3	2027	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.697052632	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000271	0.000722	2.23E-06	4.94E-05	4.79E-05	5.12E-06	0.983614
3	2027	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	4.676216395	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000353	0.000584	4.31E-07	5.55E-05	5.38E-05	4.45E-06	0.17783
3	2027	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.145333333	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	3.24E-05	8.91E-05	1.61E-07	7.16E-06	6.96E-06	6.71E-07	0.069961
3	2027	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.145333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	6.61E-05	0.000176	5.44E-07	1.2E-05	1.17E-05	1.25E-06	0.239694
3	2027	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.145333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	6.61E-05	0.000176	5.44E-07	1.2E-05	1.17E-05	1.25E-06	0.239694
4	2027	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	20.1	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	0.000669	0.001582	2.82E-06	0.000126	0.000122	1.19E-05	1.227786
4	2027	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	20.1	0.186379	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.000425	0.001219	2.79E-06	0.000103	1E-04	8E-06	1.227683
4	2027	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	40.2	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002321	0.006182	1.91E-05	0.000423	0.00041	4.38E-05	8.420028
5	2027	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	2.997	0.588552	1.532636	0.001316	0.105062	0.10191	0.013209	536.4084	0.000201	0.000523	4.49E-07	3.50E-05	3.40E-05	4.51E-06	0.182997
5	2027	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	10.79292234	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000623	0.00166	5.13E-06	0.000113	0.00011	1.18E-05	2.260824
5	2027	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	5.994	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.000234	0.000641	6.47E-07	5.53E-05	5.36E-05	4.75E-06	0.266709
5	2027	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.997	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000173	0.000461	1.42E-06	3.15E-05	3.06E-05	3.27E-06	0.627732
5	2027	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	2.997	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000231	0.000383	2.82E-07	3.64E-05	3.53E-05	2.91E-06	0.116124
5	2027	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	2.997	0.189648	2.545763	0.001529	0.017197	0.016681	0.005622	696.8403	9.86E-06	0.000132	7.96E-08	8.96E-07	8.69E-07	2.93E-07	0.036206
5	2027	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	3.63616	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	9.35E-05	0.000236	1.14E-07	1.07E-05	1.03E-05	2.46E-06	0.037121
5	2027	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	4.7952	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.000256	0.000704	7.1E-07	6.07E-05	5.88E-05	5.21E-06	0.292848
5	2027	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.7952	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000277	0.000737	2.28E-06	5.04E-05	4.89E-05	5.22E-06	1.004371
5	2027	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.7952	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000277	0.000737	2.28E-06	5.04E-05	4.89E-05	5.22E-06	1.004371
5	2027	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	4.7952	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.000187	0.000513	5.17E-07	4.42E-05	4.29E-05	3.8E-06	0.213431
5	2027	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.7952	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000277	0.000737	2.28E-06	5.04E-05	4.89E-05	5.22E-06	1.004371
5	2027	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	43.2	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	596.8413	0.000387	0.002914	1.5E-06	3.7E-05	3.59E-05	1.32E-05	0.669627
5	2027	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	43.2	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002494	0.006643	2.05E-05	0.000454	0.00044	4.71E-05	9.048388
5	2027	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	43.2	0.186379	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.000914	0.00262	6E-06	0.000222	0.000215	1.72E-05	2.639032
5	2027	Rehabilitate Runway	Concrete Demolition	Hydralic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	43.2	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.00231	0.00634	6.4E-06	0.000546	0.00053	4.7E-05	2.638257
5	2027	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	43.2	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.001684	0.004621	4.66E-06	0.000399	0.000386	3.42E-05	1.922806
5	2027	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	43.2	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002494	0.006643	2.05E-05	0.000454	0.00044	4.71E-05	9.048388
5	2027	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	7.992	1.175069	1.884261	0.001446	0.187673	0.181946	0.012868	596.8249	0.000446	0.000714	5.49E-07	7.11E-05	6.89E-05	4.87E-06	0.225709
5	2027	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	7.992	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	596.8413	7.16E-05	0.000539	2.77E-07	6.85E-06	6.64E-06	2.45E-06	0.123881
5	2027	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	33.3	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001923	0.005121	1.58E-05	0.00035	0.00034	3.63E-05	6.974799
5	2027	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	15.984	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.000623	0.00171	1.72E-06	0.000147	0.000143	1.27E-05	0.711436
5	2027	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	23.976	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001384	0.003687	1.14E-05	0.000252	0.000244	2.61E-05	5.021866
5	2027	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	7.992	0.763896	1.364715	0.001501	0.147369	0.142957	0.022153	625.9705	0.000696	0.00126	1.37E-06	0.000134	0.00013	2.02E-05	0.569386
5	2027	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	7.992	0.588552	1.532636	0.001316	0.105062	0.10191	0.013209	536.4084	0.000536	0.001394	1.2E-06	9.56E-05	9.27E-05	1.2E-05	0.487992
5	2027	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	7.992	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	0.000196	0.000489	2.37E-07	2.22E-05	2.15E-05	5.12E-06	0.077334
5	2027	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	240	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.013658	0.036906	0.000114	0.002523	0.002447	0.000261	50.25882
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.5984	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	4.52E-05	0.000124	2.24E-07	1E-05	9.72E-06	9.36E-07	0.097636
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.328	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000308	0.000819	2.53E-06	5.6E-05	5.43E-05	5.81E-06	1.115968
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	1.5984	0.186379	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	3.38E-05	9.7E-05	2.22E-07	8.2E-06	7.96E-06	6.36E-07	0.097644
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.5984	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	9.23E-05	0.000246	7.6E-07	1.68E-05	1.63E-05	1.74E-06	0.33479
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	1.5984	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000123	0.000204	1.5E-07	1.94E-05	1.88E-05	1.55E-06	0.061933
5	2027	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.752156863	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	2.13E-05	5.85E-05	1.06E-07	4.71E-06	4.57E-06	4.41E-07	0.045945
5	2027	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.5519	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	1.56E-05	4.29E-05	7.75E-08	3.46E-06	3.36E-06	3.23E-07	0.033712
5	2027	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	0.5519	0.333081	0.938168	0.001272	0.061293	0.059454	0.008455	536.8102	3.59E-05	0.000101	1.37E-07	6.6E-06	6.4E-06	9.1E-07	0.057783
5	2027	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	0.5519	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	4.25E-05	7.04E-05	5.19E-08	6.7E-06	6.5E-06	5.37E-07	0.021384
5	2027	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.05519	0.959281	2.034569	0.00138	0.142617	0.138242	0.015249	536.433	2.07E-05	4.36E-05	2.97E-08	3.07E-06	2.98E-06	3.26E-07	0.011553
5	2027	Rehabilitate Runway	Hydroseeding	Off Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.05519	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	3.19E-06	8.49E-06	2.62E-08	5.8E-07	5.63E-07	6.01E-08	0.01166
5	2027	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.213333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000243	0.000648	2E-06	4.43E-05	4.3E-05	4.59E-06	0.882497
5	2027	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	4.213333333	0.763896	1.364715	0.001501	0.147369	0.142957	0.022153	625.9705	0.000366	0.000664	7.2E-07	7.07E-05	6.86E-05	1.06E-05	0.300176
5	2027	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	4.213333333	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.000164	0.000451	4.55E-07	3.89E-05	3.77E-05	3.34E-06	0.187633
5	2027	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.213333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000243	0.000648	2E-06	4.43E-05	4.3E-05	4.59E-06	0.882497
5	2027	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	4.213333333	0.189648	2.545763	0.001529	0.017197	0.016681	0.005622	696.8403	1.39E-05	0.000186	1.12E-07	1.26E-06	1.22E-06	4.11E-07	0.050901
5	2027	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	4.213333333	1.653392	1.964	0.001666	0.235696	0.228625	0.028239	696.2663	0.000161	0.000192	1.62E-07	2.3E-05	2.23E-05	2.76E-06	0.067811
5	2027	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	49.37142857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002851	0.007592	2.35E-05	0.000519	0.000503	5.38E-05	10.34101
5	2027	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	49.37142857	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.001924	0.005281	5.33E-06	0.000456	0.000442	3.91E-05	2.197492
5	2027	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	49.37142857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002851	0.007592	2.35E-05	0.000519	0.000503	5.38E-05	10.34101
5	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	0.617142857	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	596.8413	5.53E-05	4.16E-05	2.14E-08	5.29E-07	5.13E-07	1.89E-07	0.009566
5	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	0.617142857	1.175069	1.884261	0.001446	0.187673	0.181946	0.012868	596.8249	3.44E-05	5.51E-05	4.23E-08	5.49E-06	5.32E-06	3.76E-07	0.017429
5	2027	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.617142857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	3.56E-05	9.49E-05	2.93E-07	6.49E-06	6.29E-06	6.72E-07	0.129263
5	2027	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.617142857	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	2.41E-05	6.6E-05	6.66E-08	5.69E-06	5.52E-06	4.89E-07	0.027469
5	2027	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.617142857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	3.56E-05	9.49E-05	2.93E-07	6.49E-06	6.29E-06	6.72E-07	0.129263
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.4	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	1.56E-05	4.28E-05	4.32E-08	3.69E-06	3.58E-06	3.17E-07	0.017804
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.6	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	4.62E-05	0.000123	3.8E-07	8.41E-06	8.16E-06	8.72E-07	0.167563
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	0.4	2.463459	4.181293	0.001822	0.238996	0.231825	0.092723	596.7637	5.14E-06	8.72E-06	3.8E-09	4.98E-07	4.83E-07	1.93E-07	0.001238
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.4	1.653392	1.964	0.001666	0.235696	0.228625	0.028239	696.2663	1.53E-05	1.82E-05	1.54E-08	2.18E-06	2.12E-06	2.61E-07	0.005436
5	2027	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	5.047578947	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	0.000143	0.000393	7.08E-07	3.16E-05	3.07E-05	2.96E-06	0.308326
5	2027	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	35.52	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.002051	0.005462	1.69E-05	0.000373	0.000362	3.87E-05	7.439786
5	2027	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.047578947	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000291	0.000776	2.4E-06	5.31E-05	5.15E-05	5.5E-06	1.057233
5	2027	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	4.918163946	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000379	0.000629	4.62E-07	5.97E-05	5.79E-05	4.79E-06	0.190663
5	2027	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.226666667	0.248563	0.563303	0.001233	0.055063	0.053411	0.005147	536.6974	3.47E-05	9.54E-05	1.72E-07	7.69E-06	7.46E-06	7.19E-07	0.074929
5	2027	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.226666667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	7.08E-05	0.000189	5.83E-07	1.29E-05	1.25E-05	1.34E-06	0.25693
5	2027	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.226666667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	7.08E-05	0.000189	5.83E-07	1.29E-05	1.25E-05	1.34E-06	0.25693
1	2027	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	5.674976	0.588552	1.532636	0.001316	0.105062	0.10191	0.013209	536.4084	0.00038	0.00099	8.5E-07	6.79E-05	6.59E-05	8.53E-06	0.345609
1	2027	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	20.43349184	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.00118	0.003143	9.71E-06	0.000215	0.000208	2.23E-05	4.280912
1	2027	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	11.34976	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.000442	0.001214	1.22E-06	0.000105	0.000102	8.99E-06	0.50517
1	2027	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.674976	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000328	0.000873	2.7E-06	5.96E-05	5.78E-05	6.18E-06	1.188622
1	2027	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	5.674976	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000438	0.000724	5.34E-07	6.89E-05	6.68E-05	5.52E-06	0.219884
1	2027	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	5.674976	0.189648	2.545763	0.001529	0.017197	0.016681	0.005622	696.8403	1.87E-05	0.000251	1.51E-07	1.69E-06	1.64E-06	5.54E-07	0.068557
1	2027	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	7.26384	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	0.000177	0.000445	2.16E-07	2.02E-05	1.96E-05	4.66E-06	0.070288
1	2027	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	9.0798	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.000486	0.001333	1.34E-06	0.000115	0.000111	9.87E-06	0.554513
1	2027	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	9.0798	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000524	0.001396	4.32E-06	9.54E-05	9.26E-05	9.89E-06	1.901796
1	2027	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	9.0798	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000524	0.001396	4.32E-06	9.54E-05	9.26E-05	9.89E-06	1.901796
1	2027	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	9.0798	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	536.5849	0.000354	0.000971	9.8E-07	8.37E-05	8.12E-05	7.2E-06	0.404136
1	2027	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	9.0798	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000524	0.001396	4.32E-06	9.54E-05	9.26E-05	9.89E-06	1.901796
1	2027	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	81.8	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	596.8413	0.000733	0.005518	2.83E-06	7.01E-05	6.8E-05	2.5E-05	1.267961
1	2027	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	81.8	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.004723	0.012579	3.89E-05	0.00086	0.000834	8.91E-05	17.13329

1	2027	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	81.8	0.186079	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.001751	0.004952	1.14E-05	0.00042	0.000407	3.26E-05	4.997057
1	2027	Rehabilitate Runway	Concrete Demolition	Hydralic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	81.8	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.004376	0.012006	1.21E-05	0.001035	0.001004	8.80E-05	4.996608
1	2027	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	81.8	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.003188	0.00875	8.83E-06	0.000754	0.000732	6.48E-05	3.640667
1	2027	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	81.8	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.004723	0.012579	3.89E-05	0.00086	0.000834	8.91E-05	17.13329
1	2027	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	960	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.05543	0.147623	0.000456	0.010091	0.009788	0.001046	201.0793
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	3.0264	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	8.57E-05	0.000236	4.25E-07	1.9E-05	1.84E-05	1.77E-06	0.184864
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	10.088	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000582	0.001551	4.79E-06	0.000106	0.000103	1.1E-05	2.112966
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	3.0264	0.186079	0.532936	0.001221	0.045063	0.042711	0.003497	536.7405	6.4E-05	0.000184	4.21E-07	1.55E-05	1.51E-05	1.2E-06	0.184679
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	3.0264	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000175	0.000465	1.44E-06	3.10E-05	3.09E-05	3.3E-06	0.63389
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	3.0264	1.186678	1.96241	0.001447	0.186694	0.180996	0.014949	696.7694	0.000233	0.000388	2.86E-07	3.67E-05	3.56E-05	2.94E-06	0.117264
1	2027	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.424213725	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	4.03E-05	0.000111	2E-07	8.93E-06	8.66E-06	8.34E-07	0.087003
1	2027	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.0232	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	2.9E-05	7.96E-05	1.44E-07	6.41E-06	6.22E-06	5.99E-07	0.062501
1	2027	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	1.0232	0.333081	0.938160	0.001272	0.061293	0.059454	0.008455	536.8102	6.65E-05	0.000187	2.54E-07	1.22E-05	1.19E-05	1.69E-06	0.107127
1	2027	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	1.0232	1.186678	1.96241	0.001447	0.186694	0.180996	0.014949	696.7694	7.83E-05	0.000131	9.62E-08	1.24E-05	1.2E-05	9.96E-07	0.039646
1	2027	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.10232	0.959281	2.034569	0.00138	0.142617	0.138242	0.015249	536.433	3.82E-05	8.12E-05	5.51E-08	5.69E-06	5.52E-06	6.09E-07	0.021419
1	2027	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.10232	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	5.91E-06	1.57E-05	4.86E-08	1.08E-06	1.04E-06	1.11E-07	0.021431
1	2027	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	6.796666667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000392	0.001044	3.23E-06	7.13E-05	6.92E-05	7.39E-06	1.421491
1	2027	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	6.796666667	0.763896	1.384715	0.001501	0.147389	0.142967	0.022153	625.9705	0.00069	0.00107	1.16E-06	0.000114	0.00011	1.71E-05	0.483812
1	2027	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	6.796666667	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.000266	0.000728	7.32E-07	6.26E-05	6.07E-05	5.36E-06	0.30207
1	2027	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	6.796666667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000392	0.001044	3.23E-06	7.13E-05	6.92E-05	7.39E-06	1.421491
1	2027	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	6.796666667	0.180648	2.545763	0.001529	0.017197	0.016681	0.005622	696.8403	2.22E-05	0.0003	1.8E-07	2.03E-06	1.97E-06	6.62E-07	0.081989
1	2027	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	6.796666667	1.653392	1.964	0.001666	0.236696	0.229625	0.028239	696.2653	0.00026	0.000309	2.62E-07	3.7E-05	3.59E-05	4.44E-06	0.109228
1	2027	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	93.48571429	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.005398	0.014376	4.44E-05	0.000993	0.000963	0.000102	19.5809
1	2027	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	93.48571429	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.003644	0.01	1.01E-05	0.000862	0.000836	7.41E-05	4.160991
1	2027	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	93.48571429	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.005398	0.014376	4.44E-05	0.000993	0.000963	0.000102	19.5809
1	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	1.168571429	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	596.8413	1.05E-05	7.88E-05	4.05E-08	1E-06	9.71E-07	3.58E-07	0.018114
1	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.48	1.168571429	1.175059	1.884261	0.001446	0.187573	0.181946	0.012868	596.8249	6.51E-05	0.000104	8.01E-08	1.04E-05	1.01E-05	7.13E-07	0.033008
1	2027	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.168571429	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	6.75E-05	0.00018	5.55E-07	1.23E-05	1.19E-05	1.27E-06	0.244761
1	2027	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	1.168571429	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	4.55E-05	0.000125	1.26E-07	1.08E-05	1.05E-05	9.26E-07	0.052012
1	2027	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.168571429	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	6.75E-05	0.00018	5.55E-07	1.23E-05	1.19E-05	1.27E-06	0.244761
1	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.8	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	3.12E-05	8.56E-05	8.63E-08	7.38E-06	7.15E-06	6.34E-07	0.035608
1	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.6	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	9.24E-05	0.000246	7.6E-07	1.68E-05	1.63E-05	1.74E-06	0.335126
1	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	0.8	2.463459	4.161293	0.001822	0.238996	0.231825	0.092723	593.7637	1.03E-05	1.74E-05	7.6E-09	9.97E-07	9.67E-07	3.87E-07	0.002477
1	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.8	1.653392	1.964	0.001666	0.236696	0.229625	0.028239	696.2653	3.08E-05	3.64E-05	3.09E-08	4.38E-06	4.23E-06	5.23E-07	0.012676
1	2027	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	9.557684211	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	0.00027	0.000743	1.34E-06	5.99E-05	5.81E-05	5.6E-06	0.58382
1	2027	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	67.26777778	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.003883	0.010342	3.2E-05	0.000707	0.000686	7.33E-05	14.08787
1	2027	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	9.557684211	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000552	0.00147	4.54E-06	0.0001	9.74E-05	1.04E-05	2.00169
1	2027	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	9.312615385	1.186678	1.96241	0.001447	0.186694	0.180996	0.014949	696.7694	0.000718	0.001189	8.78E-07	0.000113	0.00011	9.06E-06	0.360636
1	2027	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.273333333	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	6.43E-05	0.000177	3.19E-07	1.42E-05	1.38E-05	1.33E-06	0.138864
1	2027	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.273333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000131	0.00035	1.08E-06	2.39E-05	2.32E-05	2.48E-06	0.476157
1	2027	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.273333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000131	0.00035	1.08E-06	2.39E-05	2.32E-05	2.48E-06	0.476157
2	2027	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	40.9	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	0.001158	0.003181	5.74E-06	0.000256	0.000249	2.4E-05	2.498528
2	2027	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	40.9	0.186079	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.000886	0.002481	5.68E-06	0.00021	0.000203	1.63E-05	2.490520
2	2027	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	81.8	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.004723	0.012579	3.89E-05	0.00086	0.000834	8.91E-05	17.13329
3	2027	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	1.640126	0.588652	1.532636	0.001316	0.105062	0.10191	0.013209	536.4884	0.000103	0.000269	2.31E-07	1.84E-05	1.79E-05	2.32E-06	0.09404
3	2027	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.546876759	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.00032	0.000853	2.64E-06	5.83E-05	5.65E-05	6.04E-06	1.161612
3	2027	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	3.08026	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.00012	0.000329	3.32E-07	2.84E-05	2.75E-05	2.44E-06	0.1371
3	2027	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.640126	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	8.89E-05	0.000237	7.32E-07	1.62E-05	1.57E-05	1.69E-06	0.322684
3	2027	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	1.640126	1.186678	1.96241	0.001447	0.186694	0.180996	0.014949	696.7694	0.000119	0.000197	1.45E-07	1.87E-05	1.81E-05	1.5E-06	0.059676
3	2027	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	1.640126	0.180648	2.545763	0.001529	0.017197	0.016681	0.005622	696.8403	5.07E-06	6.81E-05	4.09E-08	4.6E-07	4.46E-07	1.5E-07	0.018606
3	2027	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	1.97136	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	4.81E-05	0.000121	5.86E-08	5.49E-06	5.32E-06	1.26E-06	0.019076
3	2027	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	2.4642	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.000132	0.000362	3.65E-07	3.12E-05	3.02E-05	2.66E-06	0.150491
3	2027	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.4642	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000142	0.000379	1.17E-06	2.59E-05	2.51E-05	2.68E-06	0.518136
3	2027	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.4642	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000142	0.000379	1.17E-06	2.59E-05	2.51E-05	2.68E-06	0.518136
3	2027	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	2.4642	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	9.6E-05	0.000264	2.66E-07	2.27E-05	2.2E-05	1.96E-06	0.10969
3	2027	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.4642	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000142	0.000379	1.17E-06	2.59E-05	2.51E-05	2.68E-06	0.518136
3	2027	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	22.2	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	596.8413	0.000199	0.001497	7.69E-07	1.9E-05	1.84E-05	6.79E-06	0.344114
3	2027	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	22.2	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001282	0.003414	1.05E-05	0.000233	0.000226	2.42E-05	4.648666
3	2027	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	22.2	0.186079	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.00047	0.001347	3.09E-06	0.000114	0.00011	8.84E-06	1.356169
3	2027	Rehabilitate Runway	Concrete Demolition	Hydralic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	22.2	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.001187	0.003258	3.29E-06	0.000281	0.000272	2.41E-05	1.355776
3	2027	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	22.2	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.000865	0.002375	2.4E-06	0.000205	0.000199	1.76E-05	0.988108
3	2027	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	22.2	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001282	0.003414	1.05E-05	0.000233	0.000226	2.42E-05	4.648666
3	2027	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.48	4.1072	1.175059	1.884261	0.001446	0.187573	0.181946	0.012868	596.8249	0.000229	0.000367	2.82E-07	3.65E-05	3.54E-05	2.51E-06	0.115996
3	2027	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	4.1072	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	596.8413	3.68E-05	0.000277	1.42E-07	3.52E-06	3.41E-06	1.26E-06	0.063664
3	2027	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	17.11333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000988	0.002632	8.13E-06	0.00018	0.000174	1.86E-05	3.584446
3	2027	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	8.2144	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.00032	0.000879	8.86E-07	7.57E-05	7.35E-05	6.51E-06	0.365618
3	2027	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	12.3216	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000711	0.001895	5.86E-06	0.00013	0.000126	1.34E-05	2.580801
3	2027	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	4.1072	0.763896	1.384715	0.001501	0.147389	0.142967	0.022153	625.9705	0.000367	0.000647	7.02E-07	6.89E-05	6.68E-05	1.04E-05	0.292616
3	2027	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	4.1072	0.588652	1.532636	0.001316	0.105062	0.10191	0.013209	536.4884	0.000275	0.000716	6.15E-07	4.91E-05	4.76E-05	6.17E-06	0.250786
3	2027	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	4.1072	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	0.0001	0.000252	1.22E-07	1.14E-05	1.11E-05	2.63E-06	0.039743
3	2027	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	720	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.041573	0.110717	0.000342	0.007568	0.007341	0.000784	150.8066
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.8216	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	2.32E-05	6.39E-05	1.15E-07	5.16E-06	4.99E-06	4.81E-07	0.050186
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.736666667	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000158	0.000421	1.3E-06	2.88E-05	2.79E-05	2.98E-06	0.573623
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	0.8216	0.186079	0.532936	0.001221	0.045063	0.042711	0.003497	536.7405	1.74E-05	4.99E-05	1.14E-07	4.21E-06	4.09E-06	3.27E-07	0.05019
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.8216	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	4.74E-05	0.000126	3.9E-07	8.64E-06	8.38E-06	8.96E-07	0.172087
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	0.8216	1.186678	1.96241	0.001447	0.186694	0.180996	0.014949	696.7694	6.34E-05	0.000105	7.72E-08	9.97E-06	9.67E-06	7.98E-07	0.031834
3	2027	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.306509804	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	1.09E-05	3.01E-05	5.43E-08	2.42E-06	2.35E-06	2.26E-07	0.023609
3	2027	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.2955	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	8.36E-06	2.3E-05	4.15E-08	1.85E-06	1.8E-06	1.73E-07	0.01805
3	2027	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	0.2955	0.333081	0.938160	0.001272	0.061293	0.059454	0.008455	536.8102	1.92E-05	5.41E-05	7.34E-08	3.53E-06	3.43E-06	4.87E-07	0.030936
3	2027	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	0.2955	1.186678	1.96241	0.001447	0.186694	0.180996	0.014949	696.7694	2.26E-05	3.77E-05	2.79E-08	3.59E-06	3.48E-06	2.87E-07	0.01145
3	2027	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.02955	0.959281	2.034569	0.00138	0.142617	0.138242	0.015249	536.433	1.11E-05	2.35E-05	1.59E-08	1.64E-06	1.59E-06	1.76E-07	0.006186
3	2027	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.02955	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	1.71E-06	4.54E-06	1.4E-08	3.11E-07	3.01E-07	3.22E-08	0.006189
3	2027	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.813333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000162	0.000433	1.34E-06	2.96E-05	2.87E-05	3.07E-06	0.588282
3	2027	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	2.813333333	0.763896	1.384715	0.001501	0.147389	0.142967	0.022153	625.9705	0.000246	0.000443	4.81E-07	4.72E-05	4.58E-05	7.09E-06	0.200484
3	2027	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	2.813333333	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.00011	0.000301	3.04E-07	2.59E-05	2.52E-05	2.22E-06	0.12522
3	2027	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.813333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000162	0.000433	1.34E-06	2.96E-05	2.87E-05	3.07E-06	0.588282
3	2027	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	2.813333333	0.180648	2.545763	0.001529	0.017197	0.016681	0.005622	696.8403	9.2E-06	0.000124	7.47E-08	8.4E-07	8.15E-07	2.75E-07	0.033937
3	2027	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	2.813333333	1.653392	1.964	0.001666	0.236696	0.229625	0.028239	696.2653	0.000108	0.000128	1.08E-07	1.53E-05	1.49E-05	1.84E-06	0.045279
3	2027	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	25.37142857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001465	0.003901	1.21E-05	0.000267	0.000259	2.76E-05	5.314132
3	2027	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	25.37142857	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.000989	0.002714	2.74E-06	0.000234	0.000227	2.01E-05	1.129256
3	2027	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	25.37142857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001465	0.003901	1.21E-05	0.000267	0.000259	2.76E-05	5.314132
3	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	0.317142857	0.344343	2.592871	0.001331	0.032928	0.031941	0.011763	596.8413	2.84E-06	2.14E-05	1.1E-08	2.72E-07	2.64E-07	9.7E-08	0.004916
3	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.48	0.317142857	1.175059	1.884261	0.001446	0.187573	0.181946	0.012868	596.8249	1.77E-05	2.83E-05	2.17E-08	2.82E-06	2.74E-06	1.93E-07	0.008957
3	2027	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.317142857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	1.83E-05	4.89E-05	1.51E-07	3.33E-06	3.23E-06	3.46E-07	0.066427
3	2027	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.317142857	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	1.24E-05	3.39E-05	3.42E-08	2.93E-06	2.84E-06	2.51E-07	0.014116
3	2027	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.317142857	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	1.83E-05	4.89E-05	1.51E-07	3.33E-06	3.23E-06	3.46E-07	0.066427
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.4	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	1.56E-05	4.28E-05	4.31E-08	3.69E-06	3.58E-06	3.17E-07	0.017804
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.8	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	4.62E-05	0.000123	3.8E-07	8.41E-06	8.15E-06	8.72E-07	0.167563
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	0.4	2.463459	4.161293	0.001822	0.238996	0.231825	0.092723	593.7637	5.14E-06	8.7E-06	3.8E-09	4.99E-07	4.83E-07	1.94E-07	0.001238
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.4	1.653392	1.964	0.001666	0.236696	0.229625	0.028239	696.2653	1.53E-05	1.82E-05	1.54E-08	2.19E-06	2.12E-06	2.61E-07	0.006338
3	2027	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.558894737	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	7.23E-05	0.000199	3.59E-07	1.6E-05	1.56E-05	1.5E-06	0.156305
3	2027	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	18.26333333	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.001054	0.002807	8.67E-06	0.000192	0.000186	1.99E-05	3.823223
3	2027	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.558894737	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000148	0.000394	1.22E-06	2.68E-05	2.6E-05	2.78E-06	0.5359
3	2027	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	2.527304615	1.186678	1.96241	0.001447	0.186694	0.180996	0.014949	696.7694	0.000195	0.000323	2.38E-07	3.07E-05	2.98E-05	2.46E-06	0.097926
3	2027	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.666	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	1.88E-05	5.19E-05	9.35E-08	4.15E-06	4.03E-06	3.9E-07	0.040671
3	2027	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.666	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	3.85E-05	0.000102	3.16E-07	6.92E-06	6.8E-06	7.26E-07	0.13949
3	2027	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.666	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	3.85E-05	0.000102	3.16E-07	6.92E-06	6.8E-06	7.26E-07	0.13949
4	2027	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	34.8	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.6974	0.000985	0.002706	4.88E-06	0.000217	0.000212	2.04E-05	2.126
4	2027	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	34.8	0.186079	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.000752	0.002108	4.83E-06	0.000178	0.000173	1.38E-05	2.11567
4	2027	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	69.6	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.004019	0.010702	3.31E-05	0.000731	0.000709	7.58E-05	14.5776
5	2027	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	4.60075	0.588652	1.532636	0.001316	0.105062	0.10191	0.013209	536.4884	0.000289	0.000755	6.48E-07	5.16E-05	5.02E-05	6.51E-06	0.2638
5	2027	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	15.56026449	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000898	0.002392	7.38E-06	0.000163	0.000158	1.69E-05	3.258
5	2027	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	9.2015	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.000358	0.000983	9.92E-07	8.44E-05	8.21E-05	7.29E-06	0.4095
5	2027	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4.60075	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000249	0.000665	2.05E-06	4.54E-05	4.4E-05	4.71E-06	0.9052
5	2027	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	4.60075	1.186678	1.96241	0.001447	0.186694	0.180996	0.014949	696.7694	0.000334	0.000553	4.07E-07	5.26E-05	5.1E-05	4.21E-06	0.1674
5	2027	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	4.60075	0.180648	2.545763	0.001529	0.017197	0.016681	0.005622	696.8403	1.42E-05	0.000191	1.15E-07	1.29E-06	1.25E-06	4.21E-07	0.052241
5	2027	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	5.14488	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	0.000126	0.000316	1.53E-07	1.43E-05	1.39E-05	3.3E-06	0.04984
5	2027	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	7.6812	0.469901	1.28955	0.001301	0.111147	0.107813	0.009654	536.5849	0.000411	0.001127	1.14E-06	9.72E-05	9.43E-05	8.45E-06	0.469
5	2027	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	7.6812	0.147968	0.394069	0.001218	0.026936	0.026128	0.002792	536.7569	0.000444	0.001181	3.65E-06	7.97E-05	7.73E-05	8.37E-06	1.603864

5	2027	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	7.6812	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000444	0.001181	3.65E-06	8.07E-05	7.83E-05	8.37E-06	1.608654
5	2027	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	7.6812	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.000299	0.000822	8.29E-07	7.08E-05	6.87E-05	6.09E-06	0.341886
5	2027	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	7.6812	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000444	0.001181	3.65E-06	8.07E-05	7.83E-05	8.37E-06	1.608654
5	2027	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	89.2	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	0.00062	0.004682	2.4E-06	5.93E-05	5.75E-05	2.12E-05	1.072643
5	2027	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	89.2	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.003996	0.010641	3.29E-05	0.000727	0.000706	7.54E-05	14.49416
5	2027	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	89.2	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.001464	0.004197	9.62E-06	0.000355	0.000344	2.76E-05	4.227339
5	2027	Rehabilitate Runway	Concrete Demolition	Hydrolic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	89.2	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.003701	0.010156	1.02E-05	0.000875	0.000849	7.52E-05	4.225114
5	2027	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	89.2	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.002697	0.007402	7.47E-06	0.000638	0.000619	5.48E-05	3.080049
5	2027	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	89.2	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.003996	0.010641	3.29E-05	0.000727	0.000706	7.54E-05	14.49416
5	2027	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	12.8024	1.175059	1.864261	0.001446	0.167573	0.161946	0.012668	596.8249	0.000713	0.001143	8.79E-07	0.000114	0.00011	7.61E-06	0.361664
5	2027	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	12.8024	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	0.000116	0.000864	4.43E-07	1.1E-05	1.06E-05	3.92E-06	0.198446
5	2027	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	53.34333333	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.00308	0.008203	2.54E-05	0.000561	0.000544	5.81E-05	11.17294
5	2027	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	25.6048	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.000998	0.002739	2.76E-06	0.000236	0.000229	2.03E-05	1.139664
5	2027	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	38.4072	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.002218	0.005906	1.83E-05	0.000404	0.000392	4.18E-05	8.044619
5	2027	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	12.8024	0.763896	1.364715	0.001601	0.147389	0.142967	0.022153	626.9705	0.001113	0.002019	2.19E-06	0.000215	0.000208	3.23E-05	0.912099
5	2027	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	12.8024	0.588652	1.532636	0.001315	0.105062	0.10191	0.013209	536.4884	0.000658	0.002233	1.92E-06	0.000153	0.000148	1.92E-05	0.781715
5	2027	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	12.8024	1.499225	3.766303	0.001928	0.170969	0.16584	0.039416	596.1399	0.000312	0.000784	3.8E-07	3.56E-05	3.45E-05	8.2E-06	0.123682
5	2027	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2880	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.166291	0.442868	0.001369	0.030272	0.029364	0.003138	603.2259
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.6808	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	7.25E-05	0.000199	3.59E-07	1.6E-05	1.56E-05	1.5E-06	0.156423
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	8.536	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000493	0.001313	4.06E-06	8.97E-05	8.7E-05	9.3E-06	1.787884
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	2.6808	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	5.42E-05	0.000155	3.56E-07	1.31E-05	1.27E-05	1.02E-06	0.156436
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.6808	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000148	0.000394	1.22E-06	2.69E-05	2.61E-05	2.79E-06	0.536868
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	2.6808	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000197	0.000327	2.41E-07	3.11E-05	3.01E-05	2.49E-06	0.098923
5	2027	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.204862745	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	3.41E-05	9.37E-05	1.69E-07	7.55E-06	7.32E-06	7.06E-07	0.073696
5	2027	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.8694	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	2.46E-05	6.76E-05	1.22E-07	5.46E-06	5.29E-06	5.09E-07	0.053106
5	2027	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	0.8694	0.333081	0.938168	0.001272	0.061293	0.059454	0.008456	536.8102	5.66E-05	0.000159	2.16E-07	1.04E-05	1.01E-05	1.43E-06	0.091026
5	2027	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	0.8694	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	6.4E-05	0.000106	8.19E-08	1.06E-05	1.02E-05	8.46E-07	0.033687
5	2027	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.08694	0.959281	2.034559	0.00138	0.142617	0.138242	0.015249	536.433	3.25E-05	6.9E-05	4.68E-08	4.84E-06	4.68E-06	5.17E-07	0.018199
5	2027	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.08694	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	5.02E-06	1.34E-05	4.13E-08	9.14E-07	8.86E-07	9.47E-08	0.01821
5	2027	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.946666667	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000343	0.000914	2.83E-06	6.25E-05	6.06E-05	6.48E-06	1.24555
5	2027	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	5.946666667	0.763896	1.364715	0.001601	0.147389	0.142967	0.022153	626.9705	0.000517	0.000937	1.02E-06	9.96E-05	9.66E-05	1.5E-05	0.423666
5	2027	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	5.946666667	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.000232	0.000636	6.42E-07	5.48E-05	5.32E-05	4.71E-06	0.264682
5	2027	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.946666667	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000343	0.000914	2.83E-06	6.25E-05	6.06E-05	6.48E-06	1.24555
5	2027	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	5.946666667	0.108543	2.545763	0.001529	0.017197	0.016681	0.005622	596.3403	1.96E-05	0.000263	1.58E-07	1.78E-06	1.72E-06	5.8E-07	0.071641
5	2027	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	5.946666667	1.653392	1.964	0.001666	0.236696	0.228625	0.028239	596.2663	0.000228	0.00027	2.29E-07	3.24E-05	3.15E-05	3.89E-06	0.096709
5	2027	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	79.08571429	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.004666	0.012161	3.78E-05	0.000831	0.000806	8.62E-05	16.56477
5	2027	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	79.08571429	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.003083	0.00845	8.53E-06	0.000729	0.000707	6.27E-05	3.520056
5	2027	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	79.08571429	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.004666	0.012161	3.78E-05	0.000831	0.000806	8.62E-05	16.56477
5	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	0.988571429	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	8.86E-06	6.67E-05	3.42E-08	8.47E-07	8.21E-07	3.03E-07	0.015323
5	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	0.988571429	1.175059	1.864261	0.001446	0.167573	0.161946	0.012668	596.8249	5.51E-05	8.83E-05	6.79E-08	8.79E-06	8.53E-06	6.03E-07	0.027919
5	2027	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.988571429	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	5.71E-05	0.000152	4.7E-07	1.04E-05	1.01E-05	1.08E-06	0.20706
5	2027	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.988571429	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	3.86E-05	0.000106	1.07E-07	9.11E-06	8.84E-06	7.83E-07	0.044001
5	2027	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.988571429	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	5.71E-05	0.000152	4.7E-07	1.04E-05	1.01E-05	1.08E-06	0.20706
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.8	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	3.12E-05	8.56E-05	8.62E-08	7.38E-06	7.15E-06	6.34E-07	0.035608
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.6	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	9.24E-05	0.000246	7.6E-07	1.68E-05	1.63E-05	1.74E-06	0.335126
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	0.8	2.463459	4.161293	0.001822	0.238996	0.231825	0.092723	593.7637	1.03E-05	1.74E-05	7.6E-09	9.97E-07	9.67E-07	3.87E-07	0.002477
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.8	1.653392	1.964	0.001666	0.236696	0.228625	0.028239	596.2663	3.06E-05	3.64E-05	3.09E-08	4.36E-06	4.23E-06	5.23E-07	0.012676
5	2027	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	8.095478684	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	0.000229	0.000629	1.13E-06	5.07E-05	4.92E-05	4.74E-06	0.492892
5	2027	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	56.89777778	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.003266	0.008749	2.7E-05	0.000598	0.00058	6.2E-05	11.91743
5	2027	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	8.095478684	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000467	0.001243	3.84E-06	8.5E-05	8.24E-05	8.81E-06	1.69563
5	2027	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	7.878153846	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000608	0.001005	7.41E-07	9.56E-05	9.27E-05	7.66E-06	0.305254
5	2027	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.932	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	5.47E-05	0.00015	2.71E-07	1.21E-05	1.17E-05	1.13E-06	0.118014
5	2027	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.932	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000112	0.000297	9.18E-07	2.03E-05	1.97E-05	2.11E-06	0.404664
5	2027	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.932	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000112	0.000297	9.18E-07	2.03E-05	1.97E-05	2.11E-06	0.404664
6	2027	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	74	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	0.002094	0.005755	1.04E-05	0.000464	0.00045	4.33E-05	4.520202
6	2027	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	74	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.001566	0.004469	1.02E-05	0.00038	0.000368	2.96E-05	4.520666
6	2027	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	148	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.008646	0.022759	7.03E-05	0.001556	0.001509	0.000161	30.99941
1	2027	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	14.84826	0.588652	1.532636	0.001315	0.105062	0.10191	0.013209	536.4884	0.000994	0.00259	2.22E-06	0.000178	0.000172	2.23E-05	0.905612
1	2027	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	53.46969908	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.003087	0.008222	2.54E-05	0.000562	0.000545	5.83E-05	11.19946
1	2027	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	29.5925	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.001157	0.003175	3.2E-06	0.000274	0.000266	2.38E-05	1.321596
1	2027	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	14.84826	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000857	0.002283	7.06E-06	0.000156	0.000151	1.62E-05	3.103698
1	2027	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	14.84826	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.001146	0.001896	1.4E-06	0.00018	0.000175	1.44E-05	0.575246
1	2027	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	14.84826	0.108543	2.545763	0.001529	0.017197	0.016681	0.005622	596.3403	4.89E-05	0.000656	3.94E-07	4.43E-06	4.3E-06	1.46E-06	0.179566
1	2027	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	19.0032	1.499225	3.766303	0.001928	0.170969	0.16584	0.039416	596.1399	0.000463	0.001164	5.64E-07	5.28E-05	5.12E-05	1.22E-05	0.183684
1	2027	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	23.754	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.00127	0.003486	3.52E-06	0.0003	0.000291	2.58E-05	1.450681
1	2027	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	23.754	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.001372	0.003653	1.13E-05	0.00025	0.000242	2.59E-05	4.975367
1	2027	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	23.754	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.001372	0.003653	1.13E-05	0.00025	0.000242	2.59E-05	4.975367
1	2027	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	23.754	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.000926	0.002541	2.56E-06	0.000219	0.000212	1.86E-05	1.057276
1	2027	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	23.754	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.001372	0.003653	1.13E-05	0.00025	0.000242	2.59E-05	4.975367
1	2027	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	214	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	0.001917	0.014435	7.41E-06	0.000183	0.000178	6.55E-05	3.317133
1	2027	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	214	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.012366	0.032908	0.000102	0.002249	0.002182	0.000233	44.82303
1	2027	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	214	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.004627	0.01298	2.97E-05	0.001098	0.001066	8.52E-05	13.07298
1	2027	Rehabilitate Runway	Concrete Demolition	Hydrolic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	214	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.011445	0.031409	3.17E-05	0.002707	0.002626	0.000233	13.0692
1	2027	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	214	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.008341	0.022891	2.31E-05	0.001973	0.001914	0.00017	9.525007
1	2027	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	214	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.012366	0.032908	0.000102	0.002249	0.002182	0.000233	44.82303
1	2027	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2880	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.166291	0.442868	0.001369	0.030272	0.029364	0.003138	603.2259
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	7.9164	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	0.000224	0.000616	1.11E-06	4.96E-05	4.81E-05	4.64E-06	0.483686
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	26.39466667	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.001624	0.004059	1.25E-05	0.000277	0.000269	2.88E-05	5.528463
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	7.9164	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.000168	0.00048	1.1E-06	4.06E-05	3.94E-05	3.15E-06	0.483726
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	7.9164	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000457	0.001219	3.76E-06	8.32E-05	8.07E-05	8.63E-06	1.659636
1	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	7.9164	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000611	0.001011	7.45E-07	9.61E-05	9.32E-05	7.7E-06	0.306613
1	2027	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	3.726117647	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	0.000105	0.00029	5.23E-07	2.34E-05	2.27E-05	2.18E-06	0.227605
1	2027	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.6374	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	7.46E-05	0.000205	3.7E-07	1.66E-05	1.6E-05	1.54E-06	0.161102
1	2027	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	2.6374	0.333081	0.938168	0.001272	0.061293	0.059454	0.008456	536.8102	0.000171	0.000483	6.55E-07	3.16E-05	3.06E-05	4.36E-06	0.276131
1	2027	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	2.6374	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.000203	0.000337	2.48E-07	3.2E-05	3.1E-05	2.56E-06	0.102191
1	2027	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.26374	0.959281	2.034559	0.00138	0.142617	0.138242	0.015249	536.433	9.87E-05	0.000209	1.42E-07	1.47E-05	1.42E-05	1.57E-06	0.055208
1	2027	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.26374	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	1.52E-05	4.06E-05	1.25E-07	2.77E-06	2.69E-06	2.87E-07	0.055241
1	2027	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	15.6	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000901	0.002399	7.41E-06	0.000164	0.000159	1.7E-05	3.267473
1	2027	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	15.6	0.763896	1.364715	0.001601	0.147389	0.142967	0.022153	626.9705	0.001356	0.002459	2.66E-06	0.000262	0.000254	3.93E-05	1.111412
1	2027	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	15.6	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.000608	0.001669	1.68E-06	0.000144	0.00014	1.24E-05	0.694346
1	2027	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	15.6	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000901	0.002399	7.41E-06	0.000164	0.000159	1.7E-05	3.267473
1	2027	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	15.6	0.108543	2.545763	0.001529	0.017197	0.016681	0.005622	596.3403	5.13E-05	0.000689	4.14E-07	4.66E-06	4.52E-06	1.52E-06	0.188461
1	2027	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	15.6	1.653392	1.964	0.001666	0.236696	0.228625	0.028239	596.2663	0.000597	0.000709	6.01E-07	8.51E-05	8.26E-05	1.02E-05	0.251074
1	2027	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	244.5714286	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.014122	0.037609	0.000116	0.002571	0.002494	0.000266	51.22632
1	2027	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	244.5714286	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.009683	0.026161	2.64E-05	0.002256	0.002187	0.000194	10.88572
1	2027	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	244.5714286	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.014122	0.037609	0.000116	0.002571	0.002494	0.000266	51.22632
1	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	3.057142857	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	2.74E-05	0.000206	1.06E-07	2.62E-06	2.54E-06	9.36E-07	0.047388
1	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	3.057142857	1.175059	1.864261	0.001446	0.167573	0.161946	0.012668	596.8249	0.00017	0.000273	2.1E-07	2.72E-05	2.64E-05	1.86E-06	0.086339
1	2027	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	3.057142857	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000177	0.00047	1.45E-06	3.21E-05	3.12E-05	3.33E-06	0.640329
1	2027	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	3.057142857	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.000119	0.000327	3.3E-07	2.82E-05	2.73E-05	2.42E-06	0.136072
1	2027	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	3.057142857	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000177	0.00047	1.45E-06	3.21E-05	3.12E-05	3.33E-06	0.640329
1	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	2	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	7.8E-05	0.000214	2.16E-07	1.84E-05	1.79E-05	1.59E-06	0.089019
1	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	4	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000231	0.000615	1.9E-06	4.2E-05	4.08E-05	4.36E-06	0.837814
1	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	2	2.463459	4.161293	0.001822	0.238996	0.231825	0.092723	593.7637	2.57E-05	4.36E-05	1.9E-08	2.49E-06	2.42E-06	9.67E-07	0.006192
1	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	2	1.653392	1.964	0.001666	0.236696	0.228625	0.028239	596.2663	7.65E-05	9.09E-05	7.71E-08	1.09E-05	1.06E-05	1.31E-06	0.032189
1	2027	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	25.00421053	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	0.000708	0.001945	3.51E-06	0.000157	0.000152	1.46E-05	1.527362
1	2027	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	175.9555556	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.01016	0.027057	8.36E-05	0.001849	0.001794	0.000192	36.85449
1	2027	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	25.00421053	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.001444	0.003845	1.19E-05	0.000263	0.000255	2.72E-05	5.237217
1	2027	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	24.36307692	1.186676	1.96241	0.001447	0.186694	0.180996	0.014949	596.7694	0.001679	0.003109	2.29E-06	0.000295	0.000287	2.37E-05	0.943993
1	2027	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	5.861333333	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	0.000166	0.000456	9.23E-07	3.67E-05	3.56E-05	3.43E-06	0.358033
1	2027	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.861333333	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000338	0.000901	2.79E-06	6.16E-05	5.98E-05	6.39E-06	1.227676
1	2027	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.861333333	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000338	0.000901	2.79E-06	6.16E-05	5.98E-05	6.39E-06	1.227676
2	2027	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	39.1	0.248563	0.683303	0.001233	0.055063	0.053411	0.005147	536.8974	0.001107	0.003041	5.49E-06	0.000245	0.000238	2.29E-05	2.388377
2	2027	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	39.1	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	536.7405	0.000827	0.002372	5.43E-06	0.000201	0.000196	1.56E-05	2.382669
2	2027	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	78.2	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.004516	0.012025	3.72E-05	0.000822	0.000797	8.52E-05	16.37926
3	2027	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	5.425125	0.588652	1.532636	0.001315	0.105062	0.10191	0.013209	536.4884	0.000363	0.000946	8.13E-07	6.49E-05	6.29E-05	8.16E-06	0.331258
3	2027	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	19.53099931	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.001128	0.003005	9.29E-06	0.000205	0.000199	2.13E-05	4.09251
3	2027	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	10.85025	0.469901	1.28965	0.001301	0.111147	0.107813	0.009664	536.5849	0.000493	0.001161	1.17E-06	0.0001	9.7E-05	8.6E-06	0.482988
3	2027	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.425125	0.147968	0.394069	0.001213	0.026936	0.026123	0.002792	536.7569	0.000313	0.000834	2.58E-06	5.7E-05	5.53E-05	5.91E-06	1.138311

3	2027	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	5.426126	1.186675	1.96241	0.001447	0.166694	0.160996	0.014949	596.7594	0.000418	0.000692	5.1E-07	5.58E-05	5.38E-05	5.27E-06	0.210207
3	2027	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	5.426126	0.188648	2.545753	0.001529	0.017197	0.016681	0.005622	696.8403	1.79E-05	0.00024	1.44E-07	1.62E-06	1.57E-06	5.29E-07	0.06654
3	2027	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	5.94416	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	0.000169	0.000425	2.06E-07	1.93E-05	1.87E-05	4.45E-06	0.067196
3	2027	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	8.6802	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.000464	0.001274	1.29E-06	0.00011	0.000107	9.44E-06	0.530109
3	2027	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	8.6802	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000501	0.001336	4.13E-06	9.12E-05	8.85E-05	9.46E-06	1.818096
3	2027	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	8.6802	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000501	0.001335	4.13E-06	9.12E-05	8.85E-05	9.46E-06	1.818096
3	2027	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	8.6802	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.000338	0.000928	9.37E-07	8E-05	7.75E-05	6.88E-06	0.38636
3	2027	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	8.6802	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000501	0.001336	4.13E-06	9.12E-05	8.85E-05	9.46E-06	1.818096
3	2027	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	79.2	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	0.000701	0.005275	2.71E-06	6.7E-05	6.5E-05	2.39E-05	1.212149
3	2027	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	79.2	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.004616	0.012025	3.72E-05	0.000822	0.000797	8.62E-05	18.37926
3	2027	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	79.2	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	636.7405	0.001654	0.004743	1.09E-05	0.000401	0.000389	3.11E-05	4.777137
3	2027	Rehabilitate Runway	Concrete Demolition	Hydralic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	79.2	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.004182	0.011477	1.16E-05	0.000989	0.00096	8.5E-05	4.775763
3	2027	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	79.2	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.003048	0.008365	8.44E-06	0.000721	0.000699	6.2E-05	3.480633
3	2027	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	79.2	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.004616	0.012025	3.72E-05	0.000822	0.000797	8.62E-05	18.37926
3	2027	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	14.4672	1.175059	1.864261	0.001446	0.167673	0.161946	0.012668	596.8249	0.000606	0.001292	9.92E-07	0.000129	0.000125	8.82E-06	0.402681
3	2027	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	14.4672	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	0.00013	0.000975	5.01E-07	1.24E-05	1.2E-05	4.43E-06	0.224251
3	2027	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	80.26	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.003481	0.009289	2.88E-05	0.000634	0.000616	6.67E-05	12.62686
3	2027	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	29.9344	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.001128	0.003096	3.12E-06	0.000267	0.000259	2.29E-05	1.287867
3	2027	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	43.4016	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.002606	0.006874	2.08E-05	0.000456	0.000443	4.73E-05	9.090614
3	2027	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	14.4672	0.762896	1.384716	0.001501	0.147389	0.142967	0.022163	626.9706	0.001268	0.00228	2.47E-06	0.000243	0.000236	3.65E-05	1.030706
3	2027	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	14.4672	0.588652	1.532636	0.001316	0.105062	0.10191	0.013209	636.4884	0.000969	0.002524	2.17E-06	0.000173	0.000168	2.17E-05	0.982368
3	2027	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	14.4672	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	0.000363	0.000886	4.3E-07	4.02E-05	3.9E-05	9.27E-06	0.139992
3	2027	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2980	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.166291	0.442988	0.001369	0.030272	0.029364	0.003138	603.2269
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.8936	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	8.13E-05	0.000225	4.06E-07	1.81E-05	1.76E-05	1.7E-06	0.176752
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	9.646333333	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000667	0.001483	4.59E-06	0.000101	9.82E-05	1.05E-05	2.020248
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	2.8936	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	636.7405	6.12E-05	0.000176	4.02E-07	1.48E-05	1.44E-05	1.15E-06	0.176786
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.8936	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000167	0.000446	1.38E-06	3.04E-05	2.95E-05	3.16E-06	0.606074
3	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	2.8936	1.186675	1.96241	0.001447	0.166694	0.160996	0.014949	596.7594	0.000223	0.000369	2.72E-07	3.51E-05	3.41E-05	2.81E-06	0.112118
3	2027	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.361568627	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	3.85E-05	0.000106	1.91E-07	8.53E-06	8.29E-06	7.99E-07	0.08317
3	2027	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.9792	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	2.77E-05	7.62E-05	1.37E-07	6.14E-06	5.96E-06	5.74E-07	0.059813
3	2027	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	0.9792	0.383081	0.988168	0.001272	0.061293	0.059454	0.008466	636.6102	6.38E-05	0.000179	2.43E-07	1.17E-05	1.14E-05	1.62E-06	0.10262
3	2027	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	0.9792	1.186675	1.96241	0.001447	0.166694	0.160996	0.014949	596.7594	7.55E-05	0.000125	9.21E-08	1.19E-05	1.15E-05	9.52E-07	0.037941
3	2027	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.09792	0.969281	2.034689	0.00138	0.142517	0.138242	0.015249	636.433	3.67E-05	7.77E-05	5.27E-08	5.46E-06	5.28E-06	5.83E-07	0.020497
3	2027	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.09792	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	5.66E-06	1.51E-05	4.66E-08	1.03E-06	9.98E-07	1.07E-07	0.02051
3	2027	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.546666667	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000378	0.001007	3.11E-06	6.88E-05	6.67E-05	7.13E-06	1.371222
3	2027	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	5.546666667	0.762896	1.384716	0.001501	0.147389	0.142967	0.022163	626.9706	0.000669	0.001032	1.12E-06	0.00011	0.000107	1.66E-05	0.468413
3	2027	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	5.546666667	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.000255	0.0007	7.06E-07	6.04E-05	5.85E-05	5.19E-06	0.291388
3	2027	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.546666667	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000378	0.001007	3.11E-06	6.88E-05	6.67E-05	7.13E-06	1.371222
3	2027	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	5.546666667	0.188648	2.545753	0.001529	0.017197	0.016681	0.005622	696.8403	2.15E-05	0.000289	1.74E-07	1.96E-06	1.9E-06	6.39E-07	0.079089
3	2027	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	5.546666667	1.653392	1.964	0.001666	0.236696	0.229625	0.028239	696.2663	0.000261	0.00029	2.52E-07	3.57E-05	3.46E-05	4.26E-06	0.105366
3	2027	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	89.37142857	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.00516	0.013743	4.25E-05	0.000939	0.000911	9.74E-05	18.71915
3	2027	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	89.37142857	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.003484	0.00966	9.64E-06	0.000824	0.000799	7.08E-05	3.977867
3	2027	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	89.37142857	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.00516	0.013743	4.25E-05	0.000939	0.000911	9.74E-05	18.71915
3	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	1.117142857	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	1E-06	7.64E-06	3.87E-09	9.67E-07	9.28E-07	3.42E-07	0.017316
3	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	1.117142857	1.175059	1.864261	0.001446	0.167673	0.161946	0.012668	596.8249	6.22E-05	9.86E-05	7.66E-08	9.93E-06	9.63E-06	6.81E-07	0.03155
3	2027	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.117142857	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	6.45E-05	0.000172	5.31E-07	1.17E-05	1.14E-05	1.22E-06	0.233969
3	2027	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	1.117142857	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	4.35E-05	0.000119	1.21E-07	1.03E-05	9.99E-06	8.86E-07	0.049723
3	2027	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.117142857	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	6.45E-05	0.000172	5.31E-07	1.17E-05	1.14E-05	1.22E-06	0.233969
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.6	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	3.12E-05	8.56E-05	8.63E-08	7.38E-06	7.15E-06	6.34E-07	0.035600
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.6	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	9.24E-05	0.000246	7.6E-07	1.68E-05	1.63E-05	1.74E-06	0.336125
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	0.6	2.463459	4.161293	0.001822	0.238996	0.231825	0.092723	693.7637	1.03E-05	1.74E-05	7.6E-09	9.97E-07	9.67E-07	3.87E-07	0.002477
3	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.8	1.653392	1.964	0.001666	0.236696	0.229625	0.028239	696.2663	3.06E-05	3.64E-05	3.09E-08	4.38E-06	4.23E-06	5.23E-07	0.012876
3	2027	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	9.137062832	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	0.000269	0.000711	1.29E-06	5.73E-05	5.55E-05	5.36E-06	0.568126
3	2027	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	64.29777778	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.003713	0.009887	3.06E-05	0.000676	0.000656	7.01E-05	13.46768
3	2027	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	9.137062832	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000528	0.001405	4.34E-06	9.6E-05	9.32E-05	9.96E-06	1.913767
3	2027	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	9.902769231	1.186675	1.96241	0.001447	0.166694	0.160996	0.014949	596.7594	0.000667	0.00113	8.38E-07	0.000108	0.000106	8.66E-06	0.344995
3	2027	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.176	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	6.15E-05	0.000163	3.05E-07	1.36E-05	1.32E-05	1.27E-06	0.132919
3	2027	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.176	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000126	0.000335	1.03E-06	2.29E-05	2.22E-05	2.37E-06	0.455771
3	2027	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.176	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000126	0.000335	1.03E-06	2.29E-05	2.22E-05	2.37E-06	0.455771
4	2027	Demolition - Asphalt	Asphalt Demolition	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	39.1	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	0.001107	0.00304	5.49E-06	0.000245	0.000238	2.29E-05	2.388377
4	2027	Demolition - Asphalt	Asphalt Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	39.1	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	636.7405	0.000827	0.002372	5.49E-06	0.000201	0.000195	1.56E-05	2.388699
4	2027	Demolition - Asphalt	Asphalt Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	79.2	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.004616	0.012025	3.72E-05	0.000822	0.000797	8.62E-05	18.37926
5	2027	Rehabilitate Runway	Asphalt Placement	Asphalt Paver	Pavers	Pavers175	Diesel	175	0.59	5.426126	0.588652	1.532636	0.001316	0.105062	0.10191	0.013209	636.4884	0.000363	0.000946	8.13E-07	6.49E-05	6.29E-05	8.16E-06	0.331358
5	2027	Rehabilitate Runway	Asphalt Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	18.55399931	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.001126	0.003005	9.29E-06	0.000206	0.000199	2.13E-05	4.09261
5	2027	Rehabilitate Runway	Asphalt Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	10.85025	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.000423	0.001161	1.17E-05	0.0001	9.7E-05	8.6E-06	0.482988
5	2027	Rehabilitate Runway	Asphalt Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.426126	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000313	0.000834	2.58E-06	5.7E-06	5.53E-05	5.91E-06	1.135811
5	2027	Rehabilitate Runway	Asphalt Placement	Roller	Rollers	Rollers100	Diesel	100	0.59	5.426126	1.186675	1.96241	0.001447	0.166694	0.160996	0.014949	596.7594	0.000418	0.000692	5.1E-07	5.58E-05	5.38E-05	5.27E-06	0.210207
5	2027	Rehabilitate Runway	Asphalt Placement	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	5.426126	0.188648	2.545753	0.001529	0.017197	0.016681	0.005622	696.8403	1.79E-05	0.00024	1.44E-07	1.62E-06	1.57E-06	5.29E-07	0.06654
5	2027	Rehabilitate Runway	Asphalt Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	5.94416	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	0.000169	0.000425	2.06E-07	1.93E-05	1.87E-05	4.45E-06	0.067196
5	2027	Rehabilitate Runway	Cold Milling	Cold Planer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	8.6802	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.000464	0.001274	1.29E-06	0.00011	0.000107	9.44E-06	0.530109
5	2027	Rehabilitate Runway	Cold Milling	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	8.6802	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000501	0.001336	4.13E-06	9.12E-05	8.85E-05	9.46E-06	1.818096
5	2027	Rehabilitate Runway	Cold Milling	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	8.6802	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000501	0.001335	4.13E-06	9.12E-05	8.85E-05	9.46E-06	1.818096
5	2027	Rehabilitate Runway	Cold Milling	Sweepers	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	8.6802	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.000338	0.000928	9.37E-07	8E-05	7.75E-05	6.88E-06	0.38636
5	2027	Rehabilitate Runway	Cold Milling	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	8.6802	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000501	0.001336	4.13E-06	9.12E-05	8.85E-05	9.46E-06	1.818096
5	2027	Rehabilitate Runway	Concrete Demolition	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	79.2	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	0.000701	0.005275	2.71E-06	6.7E-05	6.5E-05	2.39E-05	1.212149
5	2027	Rehabilitate Runway	Concrete Demolition	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	79.2	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.004616	0.012025	3.72E-05	0.000822	0.000797	8.62E-05	18.37926
5	2027	Rehabilitate Runway	Concrete Demolition	Excavator	Excavators	Excavators175	Diesel	175	0.59	79.2	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	636.7405	0.001654	0.004743	1.09E-05	0.000401	0.000389	3.11E-05	4.777137
5	2027	Rehabilitate Runway	Concrete Demolition	Hydralic Hammer	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.59	79.2	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.004182	0.011477	1.16E-05	0.000989	0.00096	8.5E-05	4.775763
5	2027	Rehabilitate Runway	Concrete Demolition	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	79.2	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.003048	0.008365	8.44E-06	0.000721	0.000699	6.2E-05	3.480633
5	2027	Rehabilitate Runway	Concrete Demolition	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	79.2	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.004616	0.012025	3.72E-05	0.000822	0.000797	8.62E-05	18.37926
5	2027	Rehabilitate Runway	Concrete Placement	Air Compressor	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	14.4672	1.175059	1.864261	0.001446	0.167673	0.161946	0.012668	596.8249	0.000606	0.001292	9.92E-07	0.000129	0.000125	8.82E-06	0.402681
5	2027	Rehabilitate Runway	Concrete Placement	Concrete Saws	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	14.4672	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	0.00013	0.000975	5.01E-07	1.24E-05	1.2E-05	4.43E-06	0.224251
5	2027	Rehabilitate Runway	Concrete Placement	Concrete Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	80.26	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.003481	0.009289	2.88E-05	0.000634	0.000616	6.67E-05	12.62686
5	2027	Rehabilitate Runway	Concrete Placement	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	29.9344	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.001128	0.003096	3.12E-06	0.000267	0.000259	2.29E-05	1.287867
5	2027	Rehabilitate Runway	Concrete Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	43.4016	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.002606	0.006874	2.08E-05	0.000456	0.000443	4.73E-05	9.090614
5	2027	Rehabilitate Runway	Concrete Placement	Rubber Tired Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	14.4672	0.762896	1.384716	0.001501	0.147389	0.142967	0.022163	626.9706	0.001268	0.00228	2.47E-06	0.000243	0.000236	3.65E-05	1.030706
5	2027	Rehabilitate Runway	Concrete Placement	Slip Form Paver	Pavers	Pavers175	Diesel	175	0.59	14.4672	0.588652	1.532636	0.001316	0.105062	0.10191	0.013209	636.4884	0.000969	0.002524	2.17E-06	0.000173	0.000168	2.17E-05	0.982368
5	2027	Rehabilitate Runway	Concrete Placement	Surfacing Equipment (Grooving)	Other Construction Equipment	Other Construction Equipment25	Diesel	25	0.59	14.4672	1.499225	3.766303	0.001826	0.170969	0.16584	0.039416	596.1399	0.000363	0.000886	4.3E-07	4.02E-05	3.9E-05	9.27E-06	0.139992
5	2027	Rehabilitate Runway	Dust Control	Water Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2980	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.166291	0.442988	0.001369	0.030272	0.029364	0.003138	603.2269
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	2.8936	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	8.13E-05	0.000225	4.06E-07	1.81E-05	1.76E-05	1.7E-06	0.176752
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	9.646333333	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000667	0.001483	4.59E-06	0.000101	9.82E-05	1.05E-05	2.020248
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Excavator	Excavators	Excavators175	Diesel	175	0.59	2.8936	0.186879	0.532936	0.001221	0.045063	0.043711	0.003497	636.7405	6.12E-05	0.000176	4.02E-07	1.48E-05	1.44E-05	1.15E-06	0.176786
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	2.8936	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000167	0.000446	1.38E-06	3.04E-05	2.95E-05	3.16E-06	0.606074
5	2027	Rehabilitate Runway	Excavation (Cut to Fill) (Assume 20% reconstruction)	Roller	Rollers	Rollers100	Diesel	100	0.59	2.8936	1.186675	1.96241	0.001447	0.166694	0.160996	0.014949	596.7594	0.000223	0.000369	2.72E-07	3.51E-05	3.41E-05	2.81E-06	0.112118
5	2027	Rehabilitate Runway	Excavation (Topsoil Stripping)	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	1.361568627	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	3.85E-05	0.000106	1.91E-07	8.53E-06	8.29E-06	7.99E-07	0.08317
5	2027	Rehabilitate Runway	Grading	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	0.9792	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	2.77E-05	7.62E-05	1.37E-07	6.14E-06	5.96E-06	5.74E-07	0.059813
5	2027	Rehabilitate Runway	Grading	Grader	Graders	Graders300	Diesel	300	0.59	0.9792	0.383081	0.988168	0.001272	0.061293	0.059454	0.008466	636.6102	6.38E-05	0.000179	2.43E-07	1.17E-05	1.14E-05	1.62E-06	0.10262
5	2027	Rehabilitate Runway	Grading	Roller	Rollers	Rollers100	Diesel	100	0.59	0.9792	1.186675	1.96241	0.001447	0.166694	0.160996	0.014949	596.7594	7.55E-05	0.000125	9.21E-08	1.19E-05	1.15E-05	9.52E-07	0.037941
5	2027	Rehabilitate Runway	Hydroseeding	Hydroseeder	Other Construction Equipment	Other Construction Equipment600	Diesel	600	0.59	0.09792	0.969281	2.034689	0.00138	0.142517	0.138242	0.015249	636.433	3.67E-05	7.77E-05	5.27E-08	5.46E-06	5.28E-06	5.83E-07	0.020497
5	2027	Rehabilitate Runway	Hydroseeding	Off-Road Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	0.09792	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	5.66E-06	1.51E-05	4.66E-08	1.03E-06	9.98E-07	1.07E-07	0.02051
5	2027	Rehabilitate Runway	Lighting	Dump Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.546666667	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000378	0.001007	3.11E-06	6.88E-05	6.67E-05	7.13E-06	1.371222
5	2027	Rehabilitate Runway	Lighting	Loader	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes175	Diesel	175	0.59	5.546666667	0.762896	1.384716	0.001501	0.147389	0.142967	0.022163	626.9706	0.000669	0.001032	1.12E-06	0.00011	0.000107	1.66E-05	0.468413
5	2027	Rehabilitate Runway	Lighting	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	5.546666667	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.000255	0.0007	7.06E-07	6.04E-05	5.85E-05	5.19E-06	0.291388
5	2027	Rehabilitate Runway	Lighting	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	5.546666667	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.000378	0.001007	3.11E-06	6.88E-05	6.67E-05	7.13E-06	1.371222
5	2027	Rehabilitate Runway	Lighting	Skid Steer Loader	Skid Steer Loaders	Skid Steer Loaders75	Diesel	75	0.21	5.546666667	0.188648	2.545753	0.001529	0.017197	0.016681	0.005622	696.8403	2.15E-05	0.000289	1.74E-07	1.96E-06	1.9E-06	6.39E-07	0.079089
5	2027	Rehabilitate Runway	Lighting	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	5.546666667	1.653392	1.964	0.001666	0.236696	0.229625	0.028239	696.2663	0.000261	0.00029	2.52E-07	3.57E-05	3.46E-05	4.26E-06	0.105366
5	2027	Rehabilitate Runway	Markings	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	89.37142857	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.00516	0.013743	4.25E-05	0.000939	0.000911	9.74E-05	18.71915
5	2027	Rehabilitate Runway	Markings	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	89.37142857	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	0.003484	0.00966	9.64E-06	0.000824	0.000799	7.08E-05	3.977867
5	2027	Rehabilitate Runway	Markings	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	89.37142857	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	0.00516	0.013743	4.25E-05	0.000939	0.000911	9.74E-05	18.71915
5	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Cleaner	Other Construction Equipment	Other Construction Equipment40	Diesel	40	0.59	1.117142857	0.344343	2.592671	0.001331	0.032928	0.031941	0.011763	596.8413	1E-06	7.64E-06	3.87E-09	9.67E-07	9.28E-07	3.42E-07	0.017316
5	2027	Rehabilitate Runway	Sealing Random Cracks	Crack Filler (Trailer Mounted)	Other Construction Equipment	Other Construction Equipment100	Diesel	100	0.43	1.117142857	1.175059	1.864261	0.001446	0.167673	0.161946	0.012668	596.8249	6.22E-05	9.86E-05	7.66E-08	9.93E-06	9.63E-06	6.81E-07	0.03155
5	2027	Rehabilitate Runway	Sealing Random Cracks	Flatbed Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.117142857	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	6.45E-05	0.000172	5.31E-07	1.17E-05	1.14E-05	1.22E-06	0.233969
5	2027	Rehabilitate Runway	Sealing Random Cracks	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	1.117142857	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	4.35E-05	0.000119	1.21E-07	1.03E-05	9.99E-06	8.86E-07	0.049723
5	2027	Rehabilitate Runway	Sealing Random Cracks	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.117142857	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	6.45E-05	0.000172	5.31E-07	1.17E-05	1.14E-05	1.22E-06	0.233969
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Other General Equipment	Other Construction Equipment	Other Construction Equipment175	Diesel	175	0.43	0.6	0.469901	1.28955	0.001301	0.111147	0.107813	0.009664	636.5849	3.12E-05	8.56E-05	8.63E-08	7.38E-06	7.15E-06	6.34E-07	0.035600
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pickup Truck	Off-highway Trucks	Off-highway Trucks600	Diesel	600	0.59	1.6	0.147968	0.394069	0.001218	0.026936	0.026129	0.002792	636.7569	9.24E-05	0.000246	7.6E-07	1.68E-05	1.63E-05	1.74E-06	0.336125
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Pumps	Other Construction Equipment	Other Construction Equipment11	Diesel	11	0.43	0.6	2.463459	4.161293	0.001822	0.238996	0.231825	0.092723	693.7637	1.03E-05	1.74E-05	7.6E-09	9.97E-07	9.67E-07	3.87E-07	0.002477
5	2027	Rehabilitate Runway	Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Tractors/Loaders/Backhoes	Tractors/Loaders/Backhoes100	Diesel	100	0.21	0.8	1.653392	1.964	0.001666	0.236696	0.229625	0.028239	696.2663	3.06E-05	3.64E-05	3.09E-08	4.38E-06	4.23E-06	5.23E-07	0.012876
5	2027	Rehabilitate Runway	Subbase Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers175	Diesel	175	0.59	9.137062832	0.248863	0.683303	0.001233	0.065063	0.063411	0.005147	636.8974	0.000269	0.000711	1.29E-06	5.73E-05	5.55E-05	5.36E-06	0.568126

5	2027	Rehabilitate Runway	Subbase Placement	Dump Truck (12 cy)	Off-highway Trucks	Off-highway Trucks 600	Diesel	600	0.59	64.59777778	0.147966	0.094039	0.001316	0.035958	0.025126	0.010793	536.7589	0.035725	0.029037	3.05E-05	0.000576	0.000556	7.01E-05	13.46739
5	2027	Rehabilitate Runway	Subbase Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks 600	Diesel	600	0.59	0.137802222	0.147966	0.094039	0.001316	0.035958	0.025126	0.010793	536.7589	0.000526	0.000406	4.04E-06	[illegible]	[illegible]	[illegible]	1.918767
5	2027	Rehabilitate Runway	Subbase Placement	Roller	Rollers	Rollers 100	Diesel	100	0.59	[illegible]	1.156079	1.00241	0.001447	0.186804	0.180990	0.014049	596.7814	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	2027	Rehabilitate Runway	Topsoil Placement	Dozer	Crawler Tractor/Dozers	Crawler Tractor/Dozers 175	Diesel	175	0.59	3.176	0.248605	0.063033	0.001228	0.066013	0.054411	0.009147	536.1874	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	2027	Rehabilitate Runway	Topsoil Placement	Dump Truck	Off-highway Trucks	Off-highway Trucks 600	Diesel	600	0.59	3.176	0.147966	0.094039	0.001316	0.035958	0.025126	0.010793	536.7589	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	2027	Rehabilitate Runway	Topsoil Placement	Pickup Truck	Off-highway Trucks	Off-highway Trucks 600	Diesel	600	0.59	3.176	0.147966	0.094039	0.001316	0.035958	0.025126	0.010793	536.7589	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.455771
																	TOTAL (TPY)	2.707877	7.47876	0.019054	0.326974	0.316056	0.953487	8485.64

On-Road Sources
Units for Non-Greenhouse Gases Emission: Short Ton
Units for Greenhouse Gases (CO2, CH4, and N2O) Emission: Metric Ton

ScenarioID	Year	Project	Equipment	Equipment Category	MOVES Lookup	On road Activity	On road Activity	Fuel	Roadway Type	d Trip Distance (m	ce for figh	ber of Veh	es Or SM*	er of Proje	oject Leng	roject Wid	Project Are	(Building I	t (Building	mber of Tr	VMT	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O
																						MOVES Emission Factors (g/mile)									MOVES ONROAD Emissions (tpy)								
[illegible]	2027	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	9	--	256	7899	100	--	--	--	--	--	177756	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.210943	0.256060	0.000568	0.032023	0.009309	0.010842	169.0567	0.002670	0.022326
[illegible]	2027	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	73.48	73.48	256			--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	1.531161	0.040461	0.001116	0.031863	0.005168	0.064045	210.1576	0.004882	0.001085
[illegible]	2027	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	2.000667	3.070271	0.006373	0.254452	0.056853	0.127122	1604.824	0.01826	0.224215749	0.025594	0.039278	6.87E-05	0.003255	0.000867	0.001625	20.52874	0.000234	0.002868
[illegible]	2027	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.219512	0.266572	0.000591	0.034157	0.008867	0.0194	176.8233	0.002787	0.023545
[illegible]	2027	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.019512	0.023673	5.26E-05	0.003035	0.000961	0.001724	15.69724	0.000246	0.002083
[illegible]	2027	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.117073	0.143238	0.000315	0.018217	0.005166	0.010348	92.92537	0.001488	0.012567
[illegible]	2027	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	424.7446	424.7446	256	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	11.16286	0.233362	0.006461	0.184122	0.029817	0.317802	1214.798	0.027981	0.008298
[illegible]	2027	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	2.000667	3.070271	0.006373	0.254452	0.056853	0.127122	1604.824	0.01826	0.224215749	0.000644	0.000068	1.78E-06	8.19E-06	2.10E-06	4.09E-06	0.515491	5.88E-06	7.22E-06
[illegible]	2027	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.005610	0.006749	1.48E-05	0.000868	0.000248	0.000487	4.420503	7E-05	0.000592
[illegible]	2027	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.00049	0.0006	1.32E-06	7.83E-05	2.16E-05	4.33E-05	0.392786	6.22E-06	5.26E-05
[illegible]	2027	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.002942	0.003598	7.81E-06	0.000453	0.00013	0.00026	2.367955	3.73E-05	0.000316
[illegible]	2027	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.632094	0.014022	0.000401	0.011432	0.001861	0.01972	76.42594	0.001734	0.000391
[illegible]	2027	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.005301	0.006456	1.49E-05	0.000825	0.000234	0.000466	4.248362	6.73E-05	0.000568
[illegible]	2027	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.039004	0.000599	1.81E-05	0.000544	8.83E-05	0.000959	3.591711	8.26E-05	1.86E-05
[illegible]	2027	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	2.000667	3.070271	0.006373	0.254452	0.056853	0.127122	1604.824	0.01826	0.224215749	0.00059	0.001069	1.86E-05	8.76E-06	2.31E-06	4.39E-06	0.563586	6.31E-06	7.74E-06
[illegible]	2027	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.006928	0.007262	1.59E-05	0.000922	0.000262	0.000524	4.760519	7.63E-05	0.000828
[illegible]	2027	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.000527	0.000645	1.42E-06	9.2E-05	2.33E-05	4.66E-06	0.422268	6.69E-06	5.65E-05
[illegible]	2027	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.003161	0.003868	8.51E-06	0.000492	0.00014	0.000279	2.58851	4.01E-05	0.000339
[illegible]	2027	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.141186	0.002308	8.16E-06	0.002323	0.000377	0.004017	16.35464	0.000363	7.30E-06
[illegible]	2027	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	2.000667	3.070271	0.006373	0.254452	0.056853	0.127122	1604.824	0.01826	0.224215749	0.001303	0.002007	3.51E-06	0.000166	4.36E-05	8.31E-06	1.048901	1.19E-06	0.000147
[illegible]	2027	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.011224	0.013732	3.02E-05	0.001748	0.000496	0.000992	8.995077	0.00142	0.001204
[illegible]	2027	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.000998	0.001221	2.69E-06	0.000155	4.4E-06	8.82E-06	0.799827	1.27E-06	0.000107
[illegible]	2027	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.006886	0.007323	1.61E-05	0.000951	0.000264	0.000529	4.797121	7.6E-05	0.000642
[illegible]	2027	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.491824	0.010096	0.000278	0.007947	0.001287	0.013709	52.43465	0.001205	0.000272
[illegible]	2027	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.010786	0.013197	2.9E-06	0.001679	0.000476	0.000953	8.544138	0.000137	0.001157
[illegible]	2027	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.032062	0.000869	1.9E-06	0.000542	8.78E-05	0.000936	3.578192	8.22E-06	1.96E-05
[illegible]	2027	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	2.000667	3.070271	0.006373	0.254452	0.056853	0.127122	1604.824	0.01826	0.224215749	0.000365	0.000545	9.54E-07	4.52E-06	1.19E-05	2.26E-06	0.264777	3.24E-06	3.98E-05
[illegible]	2027	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.002046	0.008727	8.2E-06	0.000474	0.000134	0.000269	2.441358	3.87E-06	0.000327
[illegible]	2027	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.000271	0.000331	7.28E-07	4.21E-06	1.19E-06	2.30E-06	0.215841	3.48E-06	2.9E-06
[illegible]	2027	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.001825	0.001968	4.37E-06	0.000253	7.17E-05	0.000144	1.301984	2.06E-05	0.000174
[illegible]	2027	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.41714	0.00874	0.000241	0.00688	0.001114	0.011668	45.38524	0.001044	0.000235
[illegible]	2027	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.009126	0.011164	2.46E-05	0.00142	0.000402	0.000808	7.312861	0.000118	0.000979
[illegible]	2027	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.059869	0.001757	4.86E-05	0.001363	0.000224	0.002365	9.12376	0.00021	4.79E-06
[illegible]	2027	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	2.000667	3.070271	0.006373	0.254452	0.056853	0.127122	1604.824	0.01826	0.224215749	0.001107	0.001699	2.97E-06	0.000141	3.7E-06	7.03E-06	0.88794	1.01E-06	0.000124
[illegible]	2027	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.009406	0.011517	2.56E-05	0.001477	0.000419	0.000839	7.50959	0.000121	0.001018
[illegible]	2027	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.000844	0.001032	2.27E-06	0.000131	3.72E-05	7.46E-06	0.6782	1.07E-06	9.05E-05
[illegible]	2027	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.005064	0.00696	1.36E-05	0.000768	0.000223	0.000443	4.058151	6.43E-06	0.000543
[illegible]	2027	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	1.556724	0.03489	0.000967	0.02731	0.004422	0.047108	180.1842	0.004143	0.000924
[illegible]	2027	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.018514	0.023675	5.26E-05	0.003036	0.000861	0.001725	15.60915	0.000246	0.002063
[illegible]	2027	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.178862	0.003743	0.000103	0.002947	0.000477	0.005083	19.44281	0.000447	0.000101
[illegible]	2027	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	2.000667	3.070271	0.006373	0.254452	0.056853	0.127122	1604.824	0.01826	0.224215749	0.003425	0.005255	9.2E-06	0.000436	0.000115	0.000218	2.746953	3.13E-06	0.000384
[illegible]	2027	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.029364	0.036926	7.9E-06	0.004569	0.001296	0.002596	23.5229	0.000373	0.00216
[illegible]	2027	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.00261	0.003193	7.02E-06	0.000405	0.000115	0.000231	2.09157	3.31E-06	0.00028
[illegible]	2027	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.016661	0.019061	4.21E-05	0.002437	0.000691	0.001384	12.55107	0.000199	0.00168
[illegible]	2027	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	1.402696	0.031273	0.000868	0.024619	0.003987	0.042467	162.4318	0.003736	0.000842
[illegible]	2027	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.010311	0.012618	2.77E-05	0.001604	0.000455	0.000911	8.263716	0.000131	0.001106
[illegible]	2027	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.094246	0.001975	5.45E-05	0.001555	0.000252	0.002681	10.25833	0.000238	5.32E-05
[illegible]	2027	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	2.000667	3.070271	0.006373	0.254452	0.056853	0.127122	1604.824	0.01826	0.224215749	0.00126	0.001919	3.30E-06	0.000159	4.18E-06	7.96E-06	1.002312	1.14E-06	0.00014
[illegible]	2027	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.01075	0.013128	2.89E-05	0.00187	0.000474	0.000943	8.598438	0.000138	0.001151
[illegible]	2027	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.000954	0.001167	2.57E-06	0.000149	4.21E-05	8.43E-06	0.764848	1.21E-06	0.000102
[illegible]	2027	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.005722	0.007001	1.54E-05	0.00089	0.000253	0.000505	4.585387	7.26E-06	0.000614
3	2027	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	1.556724	0.03489	0.000967	0.02731	0.004422	0.047103	180.1842	0.004143	0.000924
4	2027	Demolition - Asphalt	Dump Truck	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.010311	0.012615	2.77E-06	0.001604	0.000466	0.000911	8.263716	0.000131	0.001106
4	2027	Demolition - Asphalt	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	0.078844	0.001662	4.56E-05	0.0013	0.000211	0.002243	8.580199	0.000197	4.45E-06
5	2027	Rehabilitate Runway	Asphalt 18 Wheeler	Combination Short-haul Truck	DieselUrban Unrestricted AccessCombination Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	2.000667	3.070271	0.006373	0.254452	0.056853	0.127122	1604.824	0.01826	0.224215749	0.00126	0.001919	3.36E-06	0.000159	4.18E-06	7.96E-06	1.002312	1.14E-06	0.00014
5	2027	Rehabilitate Runway	Cement Mixer	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.01075	0.013128	2.89E-05	0.00187	0.000474	0.000943	8.599438	0.000138	0.001151
5	2027	Rehabilitate Runway	Dump Truck - Asphalt	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.000954	0.001167	2.57E-06	0.000149	4.21E-05	8.43E-06	0.764848	1.21E-06	0.000102
5	2027	Rehabilitate Runway	Dump Truck Subbase Material	Single Unit Short-haul Truck	DieselUrban Unrestricted AccessSingle Unit Short-haul Truck	Material Delivery	Diesel	Urban Unrestricted Access	40	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	[illegible]	1.076662	1.317156	0.002896	0.167513	0.047507	0.096142	682.776	0.01387	0.115470635	0.006722	0.007001	1.54E-06	0.00089	0.000262	0.000505	4.565387	7.26E-06	0.000514
5	2027	Rehabilitate Runway	Passenger Car	Passenger Car	GasolineUrban Unrestricted AccessPassenger Car	Employee Commute	Gasoline	Urban Unrestricted Access	30	--	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	--	[illegible]	5.080348	0.054539	0.00176	0.050808	0.008228	0.067541	335.219	0.00771	0.001787285	1.556724	0.03489	0.000957	0.02731	0.004423	0.047103	180.1842	0.004143	0.000934
																														TOTAL (TPY)	22.65694	1.456686	0.014794	0.484032	0.093487	0.699496	3616.366	0.054944	0.25938

Fugitive Sources
Units for Non-Greenhouse Gases Emission: Short Ton

ScenarioID	Year	Project	Fugitive Source Type	Number of Months	CO	NOx	SO2	PM10	VOC
1	2027	Demolition - Asphalt	Material Movement (Paved Roads)	12	0	0	0	0.0539	0
1	2027	Demolition - Asphalt	Material Movement (Unpaved Roads)	12	0	0	0	0.1727	0
1	2027	Demolition - Asphalt	Soil Handling	12	0	0	0	0.2264	0
1	2027	Demolition - Asphalt	Unstabilized Land and Wind Erosion	12	0	0	0	8.2275E-07	0
2	2027	Rehabilitate Runway	Asphalt Drying	12	0	0	0	0	0.9762
2	2027	Rehabilitate Runway	Asphalt Storage and Batching	12	1.9054	0.12066	0.0225	0.13255	0.05995
2	2027	Rehabilitate Runway	Concrete Mixing/Batching	12	0	0	0	0.6844	0
2	2027	Rehabilitate Runway	Material Movement (Paved Roads)	12	0	0	0	0.0966	0
2	2027	Rehabilitate Runway	Material Movement (Unpaved Roads)	12	0	0	0	0.304	0
2	2027	Rehabilitate Runway	Soil Handling	12	0	0	0	0.2264	0
2	2027	Rehabilitate Runway	Unstabilized Land and Wind Erosion	12	0	0	0	8.2275E-07	0
3	2027	Rehabilitate Runway	Asphalt Drying	5	0	0	0	0	0.0265
3	2027	Rehabilitate Runway	Asphalt Storage and Batching	5	0.04565	0.0030585	0.0005565	0.0033305	0.001506
3	2027	Rehabilitate Runway	Concrete Mixing/Batching	5	0	0	0	0.0172	0
3	2027	Rehabilitate Runway	Material Movement (Paved Roads)	5	0	0	0	0.01006	0
3	2027	Rehabilitate Runway	Material Movement (Unpaved Roads)	5	0	0	0	0.03015	0
3	2027	Rehabilitate Runway	Soil Handling	5	0	0	0	0.0057	0
3	2027	Rehabilitate Runway	Unstabilized Land and Wind Erosion	5	0	0	0	3.279E-09	0
4	2027	Demolition - Asphalt	Material Movement (Paved Roads)	5	0	0	0	0.0026068	0
4	2027	Demolition - Asphalt	Material Movement (Unpaved Roads)	5	0	0	0	0.00775	0
4	2027	Demolition - Asphalt	Soil Handling	5	0	0	0	0.0057	0
4	2027	Demolition - Asphalt	Unstabilized Land and Wind Erosion	5	0	0	0	3.279E-09	0
5	2027	Rehabilitate Runway	Asphalt Drying	1	0	0	0	0	0.0265
5	2027	Rehabilitate Runway	Asphalt Storage and Batching	1	0.06220	0.003252	0.0006003	0.003673	0.0016185
5	2027	Rehabilitate Runway	Concrete Mixing/Batching	1	0	0	0	0.0180	0
5	2027	Rehabilitate Runway	Material Movement (Paved Roads)	1	0	0	0	0.003571	0
5	2027	Rehabilitate Runway	Material Movement (Unpaved Roads)	1	0	0	0	0.01115	0
5	2027	Rehabilitate Runway	Soil Handling	1	0	0	0	0.0061	0
5	2027	Rehabilitate Runway	Unstabilized Land and Wind Erosion	1	0	0	0	7.26E-10	0
1	2027	Rehabilitate Runway	Asphalt Drying	4	0	0	0	0	0.04962
1	2027	Rehabilitate Runway	Asphalt Storage and Batching	4	0.09696	0.0082	0.001137	0.0065	0.0030645
1	2027	Rehabilitate Runway	Material Movement (Paved Roads)	4	0	0	0	0.01	0
1	2027	Rehabilitate Runway	Material Movement (Unpaved Roads)	4	0	0	0	0.03065	0
1	2027	Rehabilitate Runway	Soil Handling	4	0	0	0	0.0116	0
1	2027	Rehabilitate Runway	Unstabilized Land and Wind Erosion	4	0	0	0	5.6E-09	0
2	2027	Demolition - Asphalt	Material Movement (Paved Roads)	4	0	0	0	0.0038945	0
2	2027	Demolition - Asphalt	Material Movement (Unpaved Roads)	4	0	0	0	0.0125	0

2	2027	Demolition - Asphalt	Soil Handling	4	0	0	0	0.0118	0
2	2027	Demolition - Asphalt	Unstabilized Land and Wind Erosion	4	0	0	0	6.6E-09	0
3	2027	Rehabilitate Runway	Asphalt Drying	3	0	0	0	0	0.01325
3	2027	Rehabilitate Runway	Asphalt Storage and Batching	3	0.02685	0.001677	0.0008086	0.001839	0.0008815
3	2027	Rehabilitate Runway	Concrete Mixing/Batching	3	0	0	0	0.0086	0
3	2027	Rehabilitate Runway	Material Movement (Paved Roads)	3	0	0	0	0.00606	0
3	2027	Rehabilitate Runway	Material Movement (Unpaved Roads)	2	0	0	0	0.0181	0
3	2027	Rehabilitate Runway	Soil Handling	3	0	0	0	0.0031415	0
3	2027	Rehabilitate Runway	Unstabilized Land and Wind Erosion	3	0	0	0	1.1196E-09	0
4	2027	Demolition - Asphalt	Material Movement (Paved Roads)	12	0	0	0	0.006	0
4	2027	Demolition - Asphalt	Material Movement (Unpaved Roads)	12	0	0	0	0.01826	0
4	2027	Demolition - Asphalt	Soil Handling	12	0	0	0	0.0098	0
4	2027	Demolition - Asphalt	Unstabilized Land and Wind Erosion	12	0	0	0	1.398E-06	0
5	2027	Rehabilitate Runway	Asphalt Drying	12	0	0	0	0	0.04187
5	2027	Rehabilitate Runway	Asphalt Storage and Batching	12	0.0637	0.00525	0.000862	0.00575	0.0025825
5	2027	Rehabilitate Runway	Concrete Mixing/Batching	12	0	0	0	0.0295	0
5	2027	Rehabilitate Runway	Material Movement (Paved Roads)	12	0	0	0	0.02396	0
5	2027	Rehabilitate Runway	Material Movement (Unpaved Roads)	12	0	0	0	0.0718	0
5	2027	Rehabilitate Runway	Soil Handling	12	0	0	0	0.0099	0
5	2027	Rehabilitate Runway	Unstabilized Land and Wind Erosion	12	0	0	0	1.396E-06	0
6	2027	Demolition - Asphalt	Material Movement (Paved Roads)	12	0	0	0	0.006	0
6	2027	Demolition - Asphalt	Material Movement (Unpaved Roads)	12	0	0	0	0.01896	0
6	2027	Demolition - Asphalt	Soil Handling	12	0	0	0	0.02096	0
6	2027	Demolition - Asphalt	Unstabilized Land and Wind Erosion	12	0	0	0	2.9065E-08	0
1	2027	Rehabilitate Runway	Asphalt Drying	12	0	0	0	0	0.12906
1	2027	Rehabilitate Runway	Asphalt Storage and Batching	12	0.2609	0.01615	0.0029746	0.01776	0.008
1	2027	Rehabilitate Runway	Material Movement (Paved Roads)	12	0	0	0	0.02396	0
1	2027	Rehabilitate Runway	Material Movement (Unpaved Roads)	12	0	0	0	0.0912	0
1	2027	Rehabilitate Runway	Soil Handling	12	0	0	0	0.0203	0
1	2027	Rehabilitate Runway	Unstabilized Land and Wind Erosion	12	0	0	0	4.317E-06	0
2	2027	Demolition - Asphalt	Material Movement (Paved Roads)	12	0	0	0	0.006	0
2	2027	Demolition - Asphalt	Material Movement (Unpaved Roads)	12	0	0	0	0.01036	0
2	2027	Demolition - Asphalt	Soil Handling	12	0	0	0	0.01106	0
2	2027	Demolition - Asphalt	Unstabilized Land and Wind Erosion	12	0	0	0	1.5776E-08	0
3	2027	Rehabilitate Runway	Asphalt Drying	12	0	0	0	0	1.4605
3	2027	Rehabilitate Runway	Asphalt Storage and Batching	12	0.0948	0.0069	0.001087	0.0066	0.00293
3	2027	Rehabilitate Runway	Concrete Mixing/Batching	12	0	0	0	0.03345	0
3	2027	Rehabilitate Runway	Material Movement (Paved Roads)	12	0	0	0	0.02396	0
3	2027	Rehabilitate Runway	Material Movement (Unpaved Roads)	12	0	0	0	0.0717	0
3	2027	Rehabilitate Runway	Soil Handling	12	0	0	0	0.01106	0
3	2027	Rehabilitate Runway	Unstabilized Land and Wind Erosion	12	0	0	0	1.5776E-08	0
4	2027	Demolition - Asphalt	Material Movement (Paved Roads)	12	0	0	0	0.006	0
4	2027	Demolition - Asphalt	Material Movement (Unpaved Roads)	12	0	0	0	0.01836	0
4	2027	Demolition - Asphalt	Soil Handling	12	0	0	0	0.01106	0
4	2027	Demolition - Asphalt	Unstabilized Land and Wind Erosion	12	0	0	0	1.5776E-08	0
5	2027	Rehabilitate Runway	Asphalt Drying	12	0	0	0	0	1.4605
5	2027	Rehabilitate Runway	Asphalt Storage and Batching	12	0.0948	0.0069	0.001087	0.0066	0.00293
5	2027	Rehabilitate Runway	Concrete Mixing/Batching	12	0	0	0	0.03345	0
5	2027	Rehabilitate Runway	Material Movement (Paved Roads)	12	0	0	0	0.02396	0
5	2027	Rehabilitate Runway	Material Movement (Unpaved Roads)	12	0	0	0	0.0717	0
5	2027	Rehabilitate Runway	Soil Handling	12	0	0	0	0.01106	0
5	2027	Rehabilitate Runway	Unstabilized Land and Wind Erosion	12	0	0	0	1.5776E-08	0
				TOTAL (TPY)	***2.8939***	***0.1682266***	***0.030965***	***2.901962***	***4.247413***

Total Construction Emissions										
Construction Sour	CO	NOx	SO2	PM10	PM2.5	VOC	CO2	CH4	N2O	CO2e
NONROAD	2.757872	7.428780273	0.01928427	0.626874481	0.510098209	0.053482376	8409.682386	--	--	--
ONROAD	22.59604	1.456606007	0.014754187	0.484031326	0.09346608	0.693404709	2018.862480	0.064648839	0.090080098	--
FUGITIVE	2.8939	0.1682266	0.030965	2.901062	--	4.247413	--	--	--	--
TOTAL (TPY)	***28.06***	***9.05***	***0.07***	***3.91***	***0.60***	***4.991306685***	***10412.58456***	***0.059***	***0.089***	***10,439***

2027 No Action Aircraft Emissions

Operation Group	Mode	Fuel (lb)	Distance (mi)	Duration	CO (lb)	THC (lb)	TOG (lb)	VOC (lb)	NMHC (lb)
2027_Allops_C	Startup	0	0	0.00	0.00	151.45	175.11	174.20	175.11
2027_Allops_C	Taxi Out	48,706	0	65.84	1,391.80	263.03	303.89	302.12	303.75
2027_Allops_C	Climb Ground	85,226	217	69.04	1,417.10	418.26	483.36	480.65	483.22
2027_Allops_C	Climb Below 1000 ft AFE	106,140	533	71.68	1,453.40	420.70	486.14	483.38	485.97
2027_Allops_C	Climb Below Mixing Height (3000 ft AFE)	154,790	1,463	79.00	1,539.10	426.46	492.71	489.85	492.48
2027_Allops_C	Climb Below 10000 ft AFE	277,310	5,386	100.95	1,855.10	442.97	511.40	508.12	510.93
2027_Allops_C	Above 10000 ft AFE	3	0	0.01	0.01	0.00	0.00	0.00	0.00
2027_Allops_C	Descend Below 10000 ft AFE	134,000	7,927	24.17	1,846.30	265.00	305.83	303.78	305.48
2027_Allops_C	Descend Below Mixing Height (3000 ft AFE)	111,090	4,265	18.54	1,406.10	217.82	251.44	249.81	251.20
2027_Allops_C	Descend Below 1000 ft AFE	66,316	1,330	12.87	998.83	173.39	200.24	199.01	200.10
2027_Allops_C	Descend Ground	37,859	175	9.77	856.42	159.92	184.76	183.68	184.67
2027_Allops_C	Taxi In	29,075	0	9.29	830.85	157.02	181.41	180.35	181.33
2027_Allops_C	Full Flight	411,320	13,313	125.13	3,701.40	707.97	817.22	811.90	816.41
2027_Allops_C	APU	28,384	N/A	68.11	207.55	10.70	12.37	12.30	12.37
2027_Allops_C	GSE LTO	N/A	N/A	14049:42:0	1,868.70	53.93	56.26	50.36	48.56

Mode	NOx (lb)	SOx (lb)	PMSO (lb)	PMFO (lb)	PM10 (lb)	PM2.5 (lb)	nvPM Mass (lb)	nvPM Number	CO2 (lb)	CH4 (lb)	CO2e (lb)	H2O (lb)
Startup	0.00	0	0.00E+00	0.00	0.00	0.00	N/A	N/A	0.00	N/A	0.00	0.00
Taxi Out	186.88	65	2.38E+00	1.51	4.48	4.48	1	1.20E+19	153,670.00	N/A	153,670.00	60,249.00
Climb Ground	1,065.40	113	4.17E+00	1.89	9.60	9.60	4	2.12E+19	268,890.00	N/A	268,890.00	105,420.00
Climb Below 1000 ft AFE	1,558.30	141	5.19E+00	2.14	12.56	12.56	5	2.66E+19	334,870.00	N/A	334,870.00	131,300.00
Climb Below Mixing Height (3000 ft AFE)	2,621.90	205	7.57E+00	2.58	19.24	19.24	9	3.97E+19	488,350.00	N/A	488,350.00	191,470.00
Climb Below 10000 ft AFE	5,239.00	368	1.20E+01	6.26	38.23	38.23	20	7.87E+19	874,920.00	N/A	874,920.00	343,030.00
Above 10000 ft AFE	0.05	0	1.12E-04	0.00	0.00	0.00	0	101,182,000,000,000.00	9.85	N/A	9.85	3.86
Descend Below 10000 ft AFE	938.03	178	6.26E+00	3.25	10.68	10.68	1	2.79E+19	422,780.00	N/A	422,780.00	165,760.00
Descend Below Mixing Height (3000 ft AFE)	811.39	147	5.43E+00	2.56	8.89	8.89	1	2.21E+19	350,480.00	N/A	350,480.00	137,420.00
Descend Below 1000 ft AFE	468.35	88	3.24E+00	1.66	5.51	5.51	1	1.41E+19	209,230.00	N/A	209,230.00	82,033.00
Descend Ground	203.68	50	1.85E+00	1.02	3.27	3.27	0	8.52E+18	119,440.00	N/A	119,440.00	46,831.00
Taxi In	111.56	39	1.42E+00	0.90	2.67	2.67	0	7.13E+18	91,733.00	N/A	91,733.00	35,966.00
Full Flight	6,177.10	546	1.82E+01	9.50	48.92	48.92	21	1.07E+20	1,297,700	N/A	1,297,700.00	508,800.00
APU	171.22	27	N/A	N/A	22.24	22.24	N/A	N/A	89,551.00	N/A	89,551.00	N/A
GSE LTO	48.45	0	N/A	N/A	2.55	2.34	N/A	N/A	26,303.00	5.56	26,453.00	N/A

Operation Post-Processing	Fuel (lb)	Distance (mi)	Duration	CO (lb)	THC (lb)	TOG (lb)	VOC (lb)	NMHC (lb)
Flight below mixing height	188,099.00	5,728.10	22.41	722.55			257.19	
Taxi	77,781.00	0.00	75.13	2,222.65			482.47	
SUBTOTAL: Aircraft (Flight+taxi)	265,880.00	5,728.10	97.54	2,945.20			739.66	
GSE	N/A	N/A	14049:42:0	1,868.70			50.36	48.56
SUBTOTAL: Aircraft (Flight+taxi+APU)				3,152.75			751.96	0.00
APU	28,384.00	N/A	68.11	207.55			12.30	
TOTAL				5,021.45	0.00	0.00	802.32	48.56

Operation Post-Processing	NOx (lb)	SOx (lb)	PMSO (lb)	PMFO (lb)	PM10 (lb)	PM2.5 (lb)	nvPM Mass (lb)	nvPM Number	CO2 (lb)	CH4 (lb)	CO2e (lb)	H2O (lb)
Flight below mixing height	3,134.85	249.67			20.982	20.982	9	42,668,300,000,000,000,000.00	593,427.00	#VALUE!	593,427.00	232,675.00
Taxi	298.44	103.24			7	7	1	19,084,100,000,000,000,000.00	245,403.00	#VALUE!	245,403.00	96,215.00
SUBTOTAL: Aircraft (Flight+taxi)	3,433.29	352.91			28	28	10	61,752,400,000,000,000,000.00	838,830.00	#VALUE!	838,830.00	328,890.00
GSE	48.45	0.38			2.55	2.34	N/A	N/A	26,303.00	5.56	26,453.00	N/A
SUBTOTAL: Aircraft (Flight+taxi+APU)	3,604.51	379.61			50.37	50.37	#VALUE!	#VALUE!	928,381.00	#VALUE!	928,381.00	#VALUE!
APU	171.22	26.70			22	22	N/A	N/A	89,551.00	N/A	89,551.00	N/A
TOTAL	3,652.96	379.99	0.00	0.00	52.92	52.71	#VALUE!	#VALUE!	954,684.00	#VALUE!	954,834.00	#VALUE!

Year to Day Conversion	365
Pounds To Tons conversion	2,000.00
Pounds to Metric Tons Conversion	2,204.62
Tons to Metric Tons	0.907185

Grey cells denote value utilized in GHG calculations

2027 No Action TOTAL	CO (tons/year)	VOC (tons/year)	NO_x (tons/year)	SO_x (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)
	916.41	146.42	666.67	69.35	9.66	9.62

Operational Mode	Fuel Use (ST)	Day to Year Fuel Burn Conversion	Gallons of AvGas/ Jet A	CO2 (MT)	N2O (MT)	CH4 (MT)	CO2e (MT)
Aircraft	N/A	150,131,800.00	21,949,093.57	214,849	6.79991	0.160302	216,710
GSE				4,355			4,355
TEXN2.2 GSE				13,553			13,553
APU				14,826			14,826
TOTAL				243,228	6.7999	0.1603	245,089

Nitrous Oxide and Methane are calculated externally using FAA AQ handbook Version 4
*** GHG Emissions are calculated based on full flight fuel burn***

Calendar Year	Operational Category	CO (tons/year)	VOC (tons/year)	NO_x (tons/year)	SO_x (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)
2027 No Action Emissions by AEDT Operation Mode	Aircraft	131.87	46.94	572.11	45.56	3.829	3.829
	Taxi In/ Out	405.63	88.05	54.47	18.84	1.305	1.305
	APU	37.88	2.25	31.25	4.87	4.059	4.059
	GSE	341.04	9.19	8.84	0.07	0.465	0.427
	TOTAL	916.41	146.42	666.67	69.35	9.66	9.62

2027 Proposed Action Aircraft Emissions

Operation Group	Mode	Fuel (lb)	Distance (mi)	Duration	CO (lb)	THC (lb)	TOG (lb)	VOC (lb)	NMHC (lb)	NOx (lb)	SOx (lb)	PMSO (lb)	PMFO (lb)
2027_Allops_C	Startup	0	0	0.00	0.00	151.45	175.11	174.20	175.11	0.00	0	0.00E+00	0.00
2027_Allops_C	Taxi Out	48,706	0	41.92	1,391.80	263.03	303.89	302.12	303.75	186.88	65	2.38E+00	1.51
2027_Allops_C	Climb Ground	85,226	217	43.93	1,417.10	418.26	483.36	480.65	483.22	1,065.40	113	4.17E+00	1.89
2027_Allops_C	Climb Below 1000 ft AFE	106,100	531	45.60	1,453.20	420.69	486.13	483.37	485.96	1,557.60	141	5.19E+00	2.14
2027_Allops_C	Climb Below Mixing Height (3000 ft AFE)	154,580	1,457	50.33	1,538.90	426.44	492.69	489.82	492.46	2,617.70	205	7.56E+00	2.58
2027_Allops_C	Climb Below 10000 ft AFE	277,150	5,385	64.48	1,855.00	442.95	511.38	508.10	510.91	5,234.50	368	1.20E+01	6.25
2027_Allops_C	Above 10000 ft AFE	4	0	0.01	0.01	0.00	0.00	0.00	0.00	0.06	0	1.29E-04	0.00
2027_Allops_C	Descend Below 10000 ft AFE	133,910	7,927	14.82	1,846.90	265.01	305.84	303.79	305.49	936.92	178	6.26E+00	3.24
2027_Allops_C	Descend Below Mixing Height (3000 ft AFE)	110,990	4,265	11.35	1,406.80	217.84	251.47	249.84	251.23	810.27	147	5.43E+00	2.56
2027_Allops_C	Descend Below 1000 ft AFE	66,382	1,333	7.89	998.97	173.40	200.26	199.03	200.11	468.94	88	3.25E+00	1.66
2027_Allops_C	Descend Ground	37,859	175	5.96	856.42	159.92	184.76	183.68	184.67	203.68	50	1.85E+00	1.02
2027_Allops_C	Taxi In	29,075	0	5.67	830.85	157.02	181.41	180.35	181.33	111.56	39	1.42E+00	0.90
2027_Allops_C	Full Flight	411,060	13,312	79.31	3,701.90	707.96	817.22	811.89	816.40	6,171.50	546	1.82E+01	9.50
2027_Allops_C	APU	28,384	N/A	41.68	207.55	10.70	12.37	12.30	12.37	171.22	27	N/A	N/A
2027_Allops_C	GSE LTO	N/A	N/A	353.51	1,868.70	53.93	56.26	50.36	48.56	48.45	0	N/A	N/A

Operation Group	Mode	PM10 (lb)	PM2.5 (lb)	nvPM Mass (lb)	nvPM Number	CO2 (lb)	CH4 (lb)	CO2e (lb)	H2O (lb)
2027_Allops_C	Startup	0.00	0.00	N/A	N/A	0.00	N/A	0.00	0.00
2027_Allops_C	Taxi Out	4.48	4.48	1	1.20E+19	153,670.00	N/A	153,670.00	60,249.00
2027_Allops_C	Climb Ground	9.60	9.60	4	2.12E+19	268,890.00	N/A	268,890.00	105,420.00
2027_Allops_C	Climb Below 1000 ft AFE	12.55	12.55	5	2.66E+19	334,730.00	N/A	334,730.00	131,240.00
2027_Allops_C	Climb Below Mixing Height (3000 ft AFE)	19.21	19.21	9	3.96E+19	487,710.00	N/A	487,710.00	191,220.00
2027_Allops_C	Climb Below 10000 ft AFE	38.21	38.21	20	7.87E+19	874,400.00	N/A	874,400.00	342,830.00
2027_Allops_C	Above 10000 ft AFE	0.00	0.00	0	118,452,000,000,000.00	11.27	N/A	11.27	4.42
2027_Allops_C	Descend Below 10000 ft AFE	10.68	10.68	1	2.79E+19	422,500.00	N/A	422,500.00	165,650.00
2027_Allops_C	Descend Below Mixing Height (3000 ft AFE)	8.89	8.89	1	2.20E+19	350,180.00	N/A	350,180.00	137,300.00
2027_Allops_C	Descend Below 1000 ft AFE	5.52	5.52	1	1.41E+19	209,440.00	N/A	209,440.00	82,114.00
2027_Allops_C	Descend Ground	3.27	3.27	0	8.52E+18	119,440.00	N/A	119,440.00	46,831.00
2027_Allops_C	Taxi In	2.67	2.67	0	7.13E+18	91,733.00	N/A	91,733.00	35,966.00
2027_Allops_C	Full Flight	48.89	48.89	21	1.07E+20	1,296,900	N/A	1,296,900.00	508,490.00
2027_Allops_C	APU	22.24	22.24	N/A	N/A	89,551.00	N/A	89,551.00	N/A
2027_Allops_C	GSE LTO	2.55	2.34	N/A	N/A	26,303.00	5.56	26,453.00	N/A

Operation Post-Processing	Fuel (lb)	Distance (mi)	Duration	CO (lb)	THC (lb)	TOG (lb)	VOC (lb)	NMHC (lb)	NOx (lb)	SOx (lb)	PMSO (lb)	PMFO (lb)
Flight below mixing height	187,789.00	5,722.70	14.09	723.05			257.19		3,129.53	249.28		
Taxi	77,781.00	0.00	47.59	2,222.65			482.47		298.44	103.24		
SUBTOTAL: Aircraft (Flight+taxi)	265,570.00	5,722.70	61.68	2,945.70			739.66		3,427.97	352.52		
GSE	N/A	N/A	353.51	1,868.70			50.36	48.56	48.45	0.38		
SUBTOTAL: Aircraft (Flight+taxi+APU)				3,153.25			751.96	0.00	3,599.19	379.22		
APU	28,384.00	N/A	41.68	207.55			12.30		171.22	26.70		
TOTAL				5,021.95	0.00	0.00	802.32	48.56	3,647.64	379.60	0.00	0.00

Operation Post-Processing	PM10 (lb)	PM2.5 (lb)	nvPM Mass (lb)	nvPM Number	CO2 (lb)	CH4 (lb)	CO2e (lb)	H2O (lb)
Flight below mixing height	20.950	20.950	9	42,591,500,000,000,000,000.00	592,487.00	#VALUE!	592,487.00	232,305.00
Taxi	7	7	1	19,084,100,000,000,000,000.00	245,403.00	#VALUE!	245,403.00	96,215.00
SUBTOTAL: Aircraft (Flight+taxi)	28	28	10	61,675,600,000,000,000,000.00	837,890.00	#VALUE!	837,890.00	328,520.00
GSE	2.55	2.34	N/A	N/A	26,303.00	5.56	26,453.00	N/A
SUBTOTAL: Aircraft (Flight+taxi+APU)	50.34	50.34	#VALUE!	#VALUE!	927,441.00	#VALUE!	927,441.00	#VALUE!
APU	22	22	N/A	N/A	89,551.00	N/A	89,551.00	N/A
TOTAL	52.89	52.68	#VALUE!	#VALUE!	953,744.00	#VALUE!	953,894.00	#VALUE!

Year to Day Conversion	365
Pounds To Tons conversion	2,000.00
Pounds to Metric Tons Conversion	2,204.62

Grey cells denote value utilized in GHG calculations

Tons to Metric Tons 0.907185

2027 Proposed Action TOTAL	CO (tons/year)	VOC (tons/year)	NO_x (tons/year)	SO_x (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)
	916.51	146.42	665.69	69.28	9.65	9.61

AEDT Scenario	Fuel Use (ST)	Day to Year Fuel Burn Conversion	Gallons of AvGas/ Jet A	CO2 (MT)	N2O (MT)	CH4 (MT)	CO2e (MT)
Aircraft	N/A	150,036,900.00	21,935,219.30	214,717	6.79561	0.16032	216,577
GSE				4,355			4,355
TEXN2.2 GSE				13,553			13,553
APU				14,826			14,826
TOTAL				243,096	6.796	0.1603	244,956

Nitrous Oxide and Methane are calculated externally using FAA AQ handbook Version 4
*** GHG Emissions are calculated based on full flight fuel burn***

Calendar Year	Operational Category	CO (tons/year)	VOC (tons/year)	NO_x (tons/year)	SO_x (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)
2027 Proposed Action Emissions by AEDT Operation Mode	Aircraft	131.96	46.94	571.14	45.49	3.823	3.823
	Taxi In/ Out	405.63	88.05	54.47	18.84	1.305	1.305
	APU	37.88	2.25	31.25	4.87	4.059	4.059
	GSE	341.04	9.19	8.84	0.07	0.465	0.427
	TOTAL	916.51	146.42	665.69	69.28	9.65	9.61

Proposed Lead Emissions 2027 No Action

Fuel Burn (Below Mixing Height)	10,892		⟶	0.024180	Emissions in Tons /Yr	0.132495	lb/day
LTO COUNT	1656.477562		⟶	0.0127241	Emissions in Tons /Yr	0.069721	lb/day

Operation Group	Mode	Fuel (lb)	Distance (r	Duration	CO (lb)	THC (lb)	TOG (lb)	VOC (lb)	NMHC (lb)	NOx (lb)	SOx (lb)	PMSO (lb)	PMFO (lb)	PM10 (lb)	PM2.5 (lb)	nvPM Mas	nvPM Num	CO2 (lb)	CH4 (lb)	CO2e (lb)	H2O (lb)
2027_Avgas_C	Startup	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	0	N/A	0	0
2027_Avgas_C	Taxi Out	18.293	0	0.5479167	25.458	1.3397	1.3125	1.1182	1.1688	0.006183	0.024282	0.000896	0.007684	0.008579	0.008579	N/A	N/A	57.715	N/A	57.715	22.629
2027_Avgas_C	Climb Ground	20.961	0.64001	0.5653919	29.305	1.3794	1.3514	1.1514	1.2034	0.007085	0.027823	0.001026	0.011476	0.012502	0.012502	N/A	N/A	66.132	N/A	66.132	25.929
2027_Avgas_C	Climb Below 1000 ft AFE	35.932	9.9419	0.6636429	51.074	1.604	1.5714	1.3389	1.3994	0.012172	0.047695	0.001759	0.032757	0.034516	0.034516	N/A	N/A	113.37	N/A	113.37	44.448
2027_Avgas_C	Climb Below Mixing Height (3000 ft AFE)	70.602	35.542	0.8913098	102.8	2.1368	2.0935	1.7836	1.8642	0.024129	0.093714	0.003457	0.076564	0.080021	0.080021	N/A	N/A	222.75	N/A	222.75	87.334
2027_Avgas_C	Climb Below 10000 ft AFE	206.36	144.41	1.7820655	322.55	4.3902	4.3012	3.6646	3.8302	0.07229	0.27392	0.008344	0.080637	0.088981	0.088981	N/A	N/A	651.08	N/A	651.08	255.27
2027_Avgas_C	Above 10000 ft AFE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	0	N/A	0	0
2027_Avgas_C	Descend Below 10000 ft AFE	168.44	98.941	0.4989595	252.63	3.2444	3.1786	2.7081	2.8305	0.058221	0.22358	0.007469	0.079785	0.087254	0.087254	N/A	N/A	531.42	N/A	531.42	208.36
2027_Avgas_C	Descend Below Mixing Height (3000 ft AFE)	108.44	49.672	0.354584	159.32	2.2854	2.2391	1.9077	1.9939	0.037147	0.14394	0.005309	0.077985	0.083294	0.083294	N/A	N/A	342.13	N/A	342.13	134.14
2027_Avgas_C	Descend Below 1000 ft AFE	46.171	16.827	0.2047564	66.456	1.3286	1.3017	1.109	1.1591	0.015671	0.061286	0.002261	0.031118	0.033379	0.033379	N/A	N/A	145.67	N/A	145.67	57.114
2027_Avgas_C	Descend Ground	12.005	0.40389	0.12254	16.761	0.81586	0.79931	0.68101	0.71178	0.004058	0.015935	0.000588	0.005403	0.005991	0.005991	N/A	N/A	37.875	N/A	37.875	14.85
2027_Avgas_C	Taxi In	10.92	0	0.1199306	15.197	0.79972	0.78349	0.66753	0.6977	0.003691	0.014495	0.000535	0.004587	0.005122	0.005122	N/A	N/A	34.454	N/A	34.454	13.508
2027_Avgas_C	Full Flight	374.8	243.35	2.281025	575.18	7.6347	7.4797	6.3727	6.6607	0.13051	0.4975	0.015813	0.16042	0.17624	0.17624	N/A	N/A	1182.5	N/A	1182.5	463.63

65350.33 10891.72

Annualization Conversion	***365***

Proposed Lead Emissions 2027 Proposed Action

Fuel Burn (Below Mixing Height)	10,892		⟶	0.024182	Emissions in Tons /Yr	0.132503934	lb/day
LTO COUNT	1656.477562		⟶	0.01272	Emissions in Tons /Yr	0.069721189	lb/day

Operation Group	Mode	Fuel (lb)	Distance (r	Duration	CO (lb)	THC (lb)	TOG (lb)	VOC (lb)	NMHC (lb)
2027_Avgas_C	Startup	0	0	0	0	0	0	0	0
2027_Avgas_C	Taxi Out	18.293	0	0.3652778	25.458	1.3397	1.3125	1.1182	1.1688
2027_Avgas_C	Climb Ground	20.961	0.64001	0.376925	29.305	1.3794	1.3514	1.1514	1.2034
2027_Avgas_C	Climb Below 1000 ft AFE	35.932	9.9419	0.4424257	51.074	1.604	1.5714	1.3389	1.3994
2027_Avgas_C	Climb Below Mixing Height (3000 ft AFE)	70.584	35.524	0.5941715	102.77	2.1366	2.0932	1.7834	1.864
2027_Avgas_C	Climb Below 10000 ft AFE	206.38	144.42	1.1880725	322.58	4.3905	4.3014	3.6648	3.8304
2027_Avgas_C	Above 10000 ft AFE	0	0	0	0	0	0	0	0
2027_Avgas_C	Descend Below 10000 ft AFE	168.47	98.941	0.3175443	252.67	3.2449	3.1791	2.7086	2.831
2027_Avgas_C	Descend Below Mixing Height (3000 ft AFE)	108.47	49.672	0.2256691	159.36	2.2859	2.2395	1.9081	1.9943
2027_Avgas_C	Descend Below 1000 ft AFE	46.171	16.827	0.1302995	66.456	1.3286	1.3017	1.109	1.1591
2027_Avgas_C	Descend Ground	12.005	0.40389	0.07798	16.761	0.81586	0.79931	0.68101	0.71178
2027_Avgas_C	Taxi In	10.92	0	0.0763194	15.197	0.79972	0.78349	0.66753	0.6977
2027_Avgas_C	Full Flight	374.85	243.36	1.5056168	575.25	7.6354	7.4805	6.3734	6.6614

Operation Group	Mode	NOx (lb)	SOx (lb)	PMSO (lb)	PMFO (lb)	PM10 (lb)	PM2.5 (lb)	nvPM Mas	nvPM Num	CO2 (lb)	CH4 (lb)	CO2e (lb)	H2O (lb)
2027_Avgas_C	Startup	0	0	0	0	0	0	N/A	N/A	0	N/A	0	0
2027_Avgas_C	Taxi Out	0.006183	0.024282	0.000896	0.007684	0.008579	0.008579	N/A	N/A	57.715	N/A	57.715	22.629
2027_Avgas_C	Climb Ground	0.007085	0.027823	0.001026	0.011476	0.012502	0.012502	N/A	N/A	66.132	N/A	66.132	25.929
2027_Avgas_C	Climb Below 1000 ft AFE	0.012172	0.047695	0.001759	0.032757	0.034516	0.034516	N/A	N/A	113.37	N/A	113.37	44.448
2027_Avgas_C	Climb Below Mixing Height (3000 ft AFE)	0.024123	0.093691	0.003456	0.076542	0.079998	0.079998	N/A	N/A	222.69	N/A	222.69	87.313
2027_Avgas_C	Climb Below 10000 ft AFE	0.072295	0.27394	0.008344	0.080616	0.08896	0.08896	N/A	N/A	651.12	N/A	651.12	255.29
2027_Avgas_C	Above 10000 ft AFE	0	0	0	0	0	0	N/A	N/A	0	N/A	0	0
2027_Avgas_C	Descend Below 10000 ft AFE	0.058232	0.22362	0.007471	0.079809	0.087279	0.087279	N/A	N/A	531.52	N/A	531.52	208.4
2027_Avgas_C	Descend Below Mixing Height (3000 ft AFE)	0.037158	0.14398	0.005311	0.078009	0.08332	0.08332	N/A	N/A	342.23	N/A	342.23	134.18
2027_Avgas_C	Descend Below 1000 ft AFE	0.015671	0.061286	0.002261	0.031118	0.033379	0.033379	N/A	N/A	145.67	N/A	145.67	57.114
2027_Avgas_C	Descend Ground	0.004058	0.015935	0.000588	0.005403	0.005991	0.005991	N/A	N/A	37.875	N/A	37.875	14.85
2027_Avgas_C	Taxi In	0.003691	0.014495	0.000535	0.004587	0.005122	0.005122	N/A	N/A	34.454	N/A	34.454	13.508
2027_Avgas_C	Full Flight	0.13053	0.49756	0.015815	0.16042	0.17624	0.17624	N/A	N/A	1182.6	N/A	1182.6	463.69

65354.71 10892.45

Annualization Conversion	***365***

Proposed CH4 Emissions 2027 No Action

Operation Group	Mode	Fuel (lb)	Distance (mi)	Duration	CO (lb)	THC (lb)	TOG (lb)	VOC (lb)	NMHC (lb)	NOx (lb)	SOx (lb)	PMSO (lb)	PMFO (lb)	PM10 (lb)	PM2.5 (lb)	nvPM Mass (lb)	nvPM Number	CO2 (lb)	CH4 (lb)	CO2e (lb)	H2O (lb)
2027_Avgas_C	Startup	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00E+00	0.00	0.00	0.00	N/A	N/A	0.00	N/A	0.00	0.00
2027_Avgas_C	Taxi Out	18	0	0.55	25.46	1.34	1.31	1.12	1.17	0.01	0	8.96E-04	0.01	0.01	0.01	N/A	N/A	57.72	N/A	57.72	22.63
2027_Avgas_C	Climb Ground	21	1	0.57	29.31	1.38	1.35	1.15	1.20	0.01	0	1.03E-03	0.01	0.01	0.01	N/A	N/A	66.13	N/A	66.13	25.93
2027_Avgas_C	Climb Below 1000 ft AFE	36	10	0.66	51.07	1.60	1.57	1.34	1.40	0.01	0	1.76E-03	0.03	0.03	0.03	N/A	N/A	113.37	N/A	113.37	44.45
2027_Avgas_C	Climb Below Mixing Height (3000	71	36	0.89	102.80	2.14	2.09	1.78	1.86	0.02	0	3.46E-03	0.08	0.08	0.08	N/A	N/A	222.75	N/A	222.75	87.33
2027_Avgas_C	Climb Below 10000 ft AFE	206	144	1.78	322.55	4.39	4.30	3.66	3.83	0.07	0	8.34E-03	0.08	0.09	0.09	N/A	N/A	651.08	N/A	651.08	255.27
2027_Avgas_C	Above 10000 ft AFE	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00E+00	0.00	0.00	0.00	N/A	N/A	0.00	N/A	0.00	0.00
2027_Avgas_C	Descend Below 10000 ft AFE	168	99	0.50	252.63	3.24	3.18	2.71	2.83	0.06	0	7.47E-03	0.08	0.09	0.09	N/A	N/A	531.42	N/A	531.42	208.36
2027_Avgas_C	Descend Below Mixing Height (30	108	50	0.35	159.32	2.29	2.24	1.91	1.99	0.04	0	5.31E-03	0.08	0.08	0.08	N/A	N/A	342.13	N/A	342.13	134.14
2027_Avgas_C	Descend Below 1000 ft AFE	46	17	0.20	66.46	1.33	1.30	1.11	1.16	0.02	0	2.26E-03	0.03	0.03	0.03	N/A	N/A	145.67	N/A	145.67	57.11
2027_Avgas_C	Descend Ground	12	0	0.12	16.76	0.82	0.80	0.68	0.71	0.00	0	5.88E-04	0.01	0.01	0.01	N/A	N/A	37.88	N/A	37.88	14.85
2027_Avgas_C	Taxi In	11	0	0.12	15.20	0.80	0.78	0.67	0.70	0.00	0	5.35E-04	0.00	0.01	0.01	N/A	N/A	34.45	N/A	34.45	13.51
2027_Avgas_C	Full Flight	375	243	2.28	575.18	7.63	7.48	6.37	6.66	0.13	0	1.58E-02	0.16	0.18	0.18	N/A	N/A	1,183	N/A	1,182.50	463.63

Year to Day Conversion	365.00
Tons to pounds conversion	2,000.00
Metric tons to pounds conversio	2,204.62

1

Grey cells denote value utilized in GHG calculations

AEDT Scenario	Fuel Use (ST)	Day to Year Conversion	Gallons of AvGas	CO2 (MT)	N2O (MT)	CH4 (MT)	CO2e (MT)
		136,802.00	22,800.33			0.160302	

Proposed CH4 Emissions 2027 Proposed Action

Operation Group	Mode	Fuel (lb)	Distance (mi)	Duration	CO (lb)	THC (lb)	TOG (lb)	VOC (lb)	NMHC (lb)	NOx (lb)	SOx (lb)	PMSO (lb)	PMFO (lb)	PM10 (lb)	PM2.5 (lb)	nvPM Mass (lb)	nvPM Number	CO2 (lb)	CH4 (lb)	CO2e (lb)	H2O (lb)
2027_Avgas_C	Startup	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00E+00	0.00	0.00	0.00	N/A	N/A	0.00	N/A	0.00	0.00
2027_Avgas_C	Taxi Out	18	0	0.37	25.46	1.34	1.31	1.12	1.17	0.01	0	8.96E-04	0.01	0.01	0.01	N/A	N/A	57.72	N/A	57.72	22.63
2027_Avgas_C	Climb Ground	21	1	0.38	29.31	1.38	1.35	1.15	1.20	0.01	0	1.03E-03	0.01	0.01	0.01	N/A	N/A	66.13	N/A	66.13	25.93
2027_Avgas_C	Climb Below 1000 ft AFE	36	10	0.44	51.07	1.60	1.57	1.34	1.40	0.01	0	1.76E-03	0.03	0.03	0.03	N/A	N/A	113.37	N/A	113.37	44.45
2027_Avgas_C	Climb Below Mixing Height (300	71	36	0.59	102.77	2.14	2.09	1.78	1.86	0.02	0	3.46E-03	0.08	0.08	0.08	N/A	N/A	222.69	N/A	222.69	87.31
2027_Avgas_C	Climb Below 10000 ft AFE	206	144	1.19	322.58	4.39	4.30	3.66	3.83	0.07	0	8.34E-03	0.08	0.09	0.09	N/A	N/A	651.12	N/A	651.12	255.29
2027_Avgas_C	Above 10000 ft AFE	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00E+00	0.00	0.00	0.00	N/A	N/A	0.00	N/A	0.00	0.00
2027_Avgas_C	Descend Below 10000 ft AFE	168	99	0.32	252.67	3.24	3.18	2.71	2.83	0.06	0	7.47E-03	0.08	0.09	0.09	N/A	N/A	531.52	N/A	531.52	208.40
2027_Avgas_C	Descend Below Mixing Height (3	108	50	0.23	159.36	2.29	2.24	1.91	1.99	0.04	0	5.31E-03	0.08	0.08	0.08	N/A	N/A	342.23	N/A	342.23	134.18
2027_Avgas_C	Descend Below 1000 ft AFE	46	17	0.13	66.46	1.33	1.30	1.11	1.16	0.02	0	2.26E-03	0.03	0.03	0.03	N/A	N/A	145.67	N/A	145.67	57.11
2027_Avgas_C	Descend Ground	12	0	0.08	16.76	0.82	0.80	0.68	0.71	0.00	0	5.88E-04	0.01	0.01	0.01	N/A	N/A	37.88	N/A	37.88	14.85
2027_Avgas_C	Taxi In	11	0	0.08	15.20	0.80	0.78	0.67	0.70	0.00	0	5.35E-04	0.00	0.01	0.01	N/A	N/A	34.45	N/A	34.45	13.51
2027_Avgas_C	Full Flight	375	243	1.51	575.25	7.64	7.48	6.37	6.66	0.13	0	1.58E-02	0.16	0.18	0.18	N/A	N/A	1,183	N/A	1,182.60	463.69

Year to Day Conversion	365.00
Tons to pounds conversion	2,000.00
Metric tons to pounds conversion	1

Grey cells denote value utilized in GHG calculations

AEDT Scenario	Fuel Use (ST)	Day to Year Conversion	Gallons of AvGas	CO2 (MT)	N2O (MT)	CH4 (MT)	CO2e (MT)
		136,820.25	22,803.38			0.160323	5

2027 No Action GSE GHG Emissions Utilizing TEXN2.2 NONROAD Emission Factors

TEXN2 Lookup	TEXN2 Equip	Duration	Scaled Duration	Duration Hours	HP	Load Factor	CO2 Emission Factor	CO2 Final
Diesel - (None specified. EPA default data used.) - Generator158	Other Construction Equipment175	507.2160966	185133.8753	3085.564588	158	0.82	536.5849441	236.4561405
Diesel - (None specified. EPA default data used.) - Lift115	Other Construction Equipment100	42.26800805	15427.82294	257.1303823	115	0.5	595.8248657	9.710607422
Diesel - ACE 180 - Air Start425	Other Construction Equipment600	1395.139943	509226.0792	8487.101321	425	0.9	536.4329574	1919.609151
Diesel - F250 / F350 - Hydrant Truck235	Off-highway Trucks300	2391.668474	872958.993	14549.31655	235	0.7	536.7932638	1416.191833
Diesel - F250 / F350 - Service Truck235	Off-highway Trucks300	3437.221146	1254585.718	20909.76197	235	0.2	536.7932638	581.5144851
Diesel - F750, Dukes Transportation Services, DART 3000 to 6000 gallon - Fuel Truck175	Off-highway Trucks300	1804.306181	658571.7559	10976.19593	175	0.25	536.7932638	284.1472769
Diesel - Hi-Way / TUG 660 chasis - Catering Truck71	Off-highway Trucks300	273.3595644	99776.241	1662.93735	71	0.53	536.7932638	37.0274408
Diesel - Hi-Way F650 - Cabin Service Truck210	Off-highway Trucks300	3986.114123	1454931.655	24248.86092	210	0.53	536.7932638	1596.982279
Diesel - Hi-Way F650 - Catering Truck210	Off-highway Trucks300	2989.585592	1091198.741	18186.64569	210	0.53	536.7932638	1197.73671
Diesel - Stewart & Stevenson TUG GT-35, Douglas TBL-180 - Aircraft Tractor88	Other Construction Equipment75	1594.445649	581972.662	9699.544367	88	0.8	595.6977812	448.3906092
Diesel - Stewart & Stevenson TUG MC - Aircraft Tractor86	Other Construction Equipment100	391.2238003	142796.6871	2379.944785	86	0.8	595.8248657	107.5425862
Diesel - TLD 1410 - Lavatory Truck56	Off-highway Trucks300	3169.421107	1156838.704	19280.64507	56	0.25	536.7932638	159.7214285
Diesel - TLD, 28 VDC - Ground Power Unit71	Other Construction Equipment75	464.0737573	169386.9214	2823.115357	71	0.75	595.6977812	98.71445497
Diesel - TLD, 400 Hz AC - Ground Power Unit194	Other Construction Equipment175	236.0374581	86153.67219	1435.894536	194	0.75	536.5849441	123.5749809
Electric - Gate Service - Water Service0	NONE	2391.668474	872958.993	14549.31655	0	0.2	N/A	0
Electric - None - Air Conditioner0	NONE	5979.171185	2182397.482	36373.29137	0	0.75	N/A	0
Gasoline - Stewart & Stevenson TUG 660 - Belt Loader107	Other Construction Equipment100	10386.75259	3791164.695	63186.07825	107	0.5	595.8248657	2220.242132
Gasoline - Stewart & Stevenson TUG MA 50 - Baggage Tractor107	Other Construction Equipment100	16166.64424	5900825.149	98347.08581	107	0.55	595.8248657	3801.308524
Gasoline - Taylor Dunn - Cart25	Other Construction Equipment25	42.26800805	15427.82294	257.1303823	25	0.5	595.1398713	2.108574685
Gasoline - TLD - Ground Power Unit107	Other Construction Equipment100	2125.106752	775663.9644	12927.73274	107	0.75	595.8248657	681.3849909
Gasoline - TLD 1410 - Lavatory Truck97	Off-highway Trucks300	194.8612794	71124.36699	1185.406117	97	0.25	536.7932638	17.00953718
							TOTAL (MTPY)	*13552.77577*

2027 Proposed Action GSE GHG Emissions Utilizing TEXN2.2 NONROAD Emission Factors

TEXN2 Lookup	TEXN2 Equip	Duration	Scaled Duration	Duration Hours	HP	Load Factor	CO2 Emission Factor	CO2 Final
Diesel - (None specified. EPA default data used.) - Generator158	Other Construction Equipment175	507.2160966	185133.8753	3085.564588	158	0.82	536.5849441	236.4561405
Diesel - (None specified. EPA default data used.) - Lift115	Other Construction Equipment100	42.26800805	15427.82294	257.1303823	115	0.5	595.8248657	9.710607422
Diesel - ACE 180 - Air Start425	Other Construction Equipment600	1395.139943	509226.0792	8487.101321	425	0.9	536.4329574	1919.609151
Diesel - F250 / F350 - Hydrant Truck235	Off-highway Trucks300	2391.668474	872958.993	14549.31655	235	0.7	536.7932638	1416.191833
Diesel - F250 / F350 - Service Truck235	Off-highway Trucks300	3437.221146	1254585.718	20909.76197	235	0.2	536.7932638	581.5144851
Diesel - F750, Dukes Transportation Services, DART 3000 to 6000 gallon - Fuel Truck175	Off-highway Trucks300	1804.306181	658571.7559	10976.19593	175	0.25	536.7932638	284.1472769
Diesel - Hi-Way / TUG 660 chasis - Catering Truck71	Off-highway Trucks300	273.3595644	99776.241	1662.93735	71	0.53	536.7932638	37.0274408
Diesel - Hi-Way F650 - Cabin Service Truck210	Off-highway Trucks300	3986.114123	1454931.655	24248.86092	210	0.53	536.7932638	1596.982279
Diesel - Hi-Way F650 - Catering Truck210	Off-highway Trucks300	2989.585592	1091198.741	18186.64569	210	0.53	536.7932638	1197.73671
Diesel - Stewart & Stevenson TUG GT-35, Douglas TBL-180 - Aircraft Tractor88	Other Construction Equipment75	1594.445649	581972.662	9699.544367	88	0.8	595.6977812	448.3906092
Diesel - Stewart & Stevenson TUG MC - Aircraft Tractor86	Other Construction Equipment100	391.2238003	142796.6871	2379.944785	86	0.8	595.8248657	107.5425862
Diesel - TLD 1410 - Lavatory Truck56	Off-highway Trucks300	3169.421107	1156838.704	19280.64507	56	0.25	536.7932638	159.7214285
Diesel - TLD, 28 VDC - Ground Power Unit71	Other Construction Equipment75	464.0737573	169386.9214	2823.115357	71	0.75	595.6977812	98.71445497
Diesel - TLD, 400 Hz AC - Ground Power Unit194	Other Construction Equipment175	236.0374581	86153.67219	1435.894536	194	0.75	536.5849441	123.5749809
Electric - Gate Service - Water Service0	NONE	2391.668474	872958.993	14549.31655	0	0.2		
Electric - None - Air Conditioner0	NONE	5979.171185	2182397.482	36373.29137	0	0.75		
Gasoline - Stewart & Stevenson TUG 660 - Belt Loader107	Other Construction Equipment100	10386.75259	3791164.695	63186.07825	107	0.5	595.8248657	2220.242132
Gasoline - Stewart & Stevenson TUG MA 50 - Baggage Tractor107	Other Construction Equipment100	16166.64424	5900825.149	98347.08581	107	0.55	595.8248657	3801.308524
Gasoline - Taylor Dunn - Cart25	Other Construction Equipment25	42.26800805	15427.82294	257.1303823	25	0.5	595.1398713	2.108574685
Gasoline - TLD - Ground Power Unit107	Other Construction Equipment100	2125.106752	775663.9644	12927.73274	107	0.75	595.8248657	681.3849909
Gasoline - TLD 1410 - Lavatory Truck97	Off-highway Trucks300	194.8612794	71124.36699	1185.406117	97	0.25	536.7932638	17.00953718
							TOTAL (MTPY)	*13552.77577*

HOU Runway 13R-31L Rehab GHG Social Costs-Construction Activities

CO2					
Year	CO_2 (metric tons/year) Note 2,3	5%	3%	2.50%	3% 95th Percentile
2023	0	$0.0	$0.0	$0.0	$0.0
2024	0	$0.0	$0.0	$0.0	$0.0
2025	0	0	0	0	0
2026	5104	$88,810	$291,949	$429,757	$880,950
2027	10413	$185,351	$608,119	$889,270	$1,834,771
2028	0	$0	$0	$0	$0
2029	0	$0.0	$0.0	$0.0	$0.0
2030	0	$0.0	$0.0	$0.0	$0.0
2031	0	$0.0	$0.0	$0.0	$0.0

Notes:
1. Construction emissions derived from ACEIT, TEXN2.2 and MOVES
2. Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov)

CH4					
Year	CH4 (metric tons/year) Note 2,3	5%	3%	2.50%	3% 95th Percentile
2023	0	$0.0	$0.0	$0.0	$0.0
2024	0	$0.0	$0.0	$0.0	$0.0
2025	0	0	0	0	0
2026	0.01796	$15	$32	$41	$83
2027	0.0586	$50	$107	$136	$280
2028	0	$0	$0	$0	$0
2029	0	$0.0	$0.0	$0.0	$0.0
2030	0	$0.0	$0.0	$0.0	$0.0
2031	0	$0.0	$0.0	$0.0	$0.0

Notes:
1. Construction emissions derived from ACEIT, TEXN2.2 and MOVES
2. Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov)

N2O					
Year	N2O (metric tons/year) Note 2,3	5%	3%	2.50%	3% 95th Percentile
2023	0	$0.0	$0.0	$0.0	$0.0
2024	0	$0.0	$0.0	$0.0	$0.0
2025	0	0	0	0	0
2026	0.05491	$384	$1,175	$1,680	$3,031
2027	0.0898	$647	$1,958	$2,802	$5,065
2028	0	$0	$0	$0	$0
2029	0	$0.0	$0.0	$0.0	$0.0
2030	0	$0.0	$0.0	$0.0	$0.0
2031	0	$0.0	$0.0	$0.0	$0.0

Notes:
1. Construction emissions derived from ACEIT, TEXN2.2 and MOVES
2. Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov)

Total Costs				
Year	5%	3%	2.50%	3% 95th Percentile
2023	$0.0	$0.0	$0.0	$0.0
2024	$0.0	$0.0	$0.0	$0.0
2025	$0	$0	$0	$0
2026	$89,209	$293,155	$431,478	$884,065
2027	$186,048	$610,183	$892,208	$1,840,115
2028	$0	$0	$0	$0
2029	$0.0	$0.0	$0.0	$0.0
2030	$0.0	$0.0	$0.0	$0.0
2031	$0.0	$0.0	$0.0	$0.0

Notes:
1 Construction emissions derived from ACEIT, TEXN2.2 and MOVES
2. Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov)

HOU Runway 13R-31L Rehab GHG Social Costs-Aircraft

CO2					
Year	CO_2 (metric tons/year) Note 2,3	5%	3%	2.50%	3% 95th Percentile
2023	0	$0.0	$0.0	$0.0	$0.0
2024	0	$0.0	$0.0	$0.0	$0.0
2025	0	0	0	0	0
2026	0	$0	$0	$0	$0
2027	-132	-$2,350	-$7,709	-$11,273	-$23,258
2028	0	$0	$0	$0	$0
2029	0	$0.0	$0.0	$0.0	$0.0
2030	0	$0.0	$0.0	$0.0	$0.0
2031	0	$0.0	$0.0	$0.0	$0.0

Notes:

1. Net Aircraft emissions derived from AEDT and TexN2.2
2. Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov)

CH4					
Year	CH4 (metric tons/year) Note 2,3	5%	3%	2.50%	3% 95th Percentile
2023	0	$0.0	$0.0	$0.0	$0.0
2024	0	$0.0	$0.0	$0.0	$0.0
2025	0	0	0	0	0
2026	0	$0	$0	$0	$0
2027	0	$0	$0	$0	$0
2028	0	$0	$0	$0	$0
2029	0	$0.0	$0.0	$0.0	$0.0
2030	0	$0.0	$0.0	$0.0	$0.0
2031	0	$0.0	$0.0	$0.0	$0.0

Notes:

1. Net Aircraft emissions derived from AEDT and TexN2.2
2. Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov)

N2O					
Year	N2O (metric tons/year) Note 2,3	5%	3%	2.50%	3% 95th Percentile
2023	0	$0.0	$0.0	$0.0	$0.0
2024	0	$0.0	$0.0	$0.0	$0.0
2025	0	0	0	0	0
2026	0	$0	$0	$0	$0
2027	-0.004	-$29	-$87	-$125	-$226
2028	0	$0	$0	$0	$0
2029	0	$0.0	$0.0	$0.0	$0.0
2030	0	$0.0	$0.0	$0.0	$0.0
2031	0	$0.0	$0.0	$0.0	$0.0

Notes:

1. Net Aircraft emissions derived from AEDT and TexN2.2
2. Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov)

Total Costs				
Year	5%	3%	2.50%	3% 95th Percentile
2023	$0.0	$0.0	$0.0	$0.0
2024	$0.0	$0.0	$0.0	$0.0
2025	$0	$0	$0	$0
2026	$0	$0	$0	$0
2027	-$2,378	-$7,796	-$11,398	-$23,484
2028	$0	$0	$0	$0
2029	$0.0	$0.0	$0.0	$0.0
2030	$0.0	$0.0	$0.0	$0.0
2031	$0.0	$0.0	$0.0	$0.0

Notes:

1. Net Aircraft emissions derived from AEDT and TexN2.2
2. Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov)

APPENDIX B

Biological Resources

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal & Central Plains Esfo
17629 El Camino Real, Suite 211
Houston, TX 77058-3051
Phone: (281) 286-8282 Fax: (281) 488-5882

In Reply Refer To: 10/09/2024 16:19:26 UTC
Project Code: 2025-0003871
Project Name: HOU 13R Rehab EA

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The U.S. Fish and Wildlife Service (Service) field offices in Clear Lake, Corpus Christi, Fort Worth, and Alamo, Texas, have combined administratively to form the Texas Coastal Ecological Services Field Office. All project related correspondence should be sent to the field office address listed below responsible for the county in which your project occurs:

Project Leader; U.S. Fish and Wildlife Service; 17629 El Camino Real Ste. 211; Houston, Texas 77058
Angelina, *Austin*, *Brazoria*, *Brazos*, *Chambers, Colorado, Fayette, Fort Bend, Freestone, Galveston, Grimes, Hardin, Harris, Houston, Jasper, Jefferson, Leon, Liberty, Limestone, Madison, Matagorda, Montgomery, Newton, Orange, Polk, Robertson, Sabine, San Augustine, San Jacinto, Trinity, Tyler, Walker, Waller, and Wharton.*

Assistant Field Supervisor, U.S. Fish and Wildlife Service; 4444 Corona Drive, Ste 215; Corpus Christi, Texas 78411
Aransas, Atascosa, Bee, Brooks, Calhoun, De Witt, Dimmit, Duval, Frio, Goliad, Gonzales, Hidalgo, Jackson, Jim Hogg, Jim Wells, Karnes, Kenedy, Kleberg, La Salle, Lavaca, Live Oak, Maverick, McMullen, Nueces, Refugio, San Patricio, Victoria, and Wilson.

U.S. Fish and Wildlife Service; Santa Ana National Wildlife Refuge; Attn: Texas Ecological Services Sub-Office; 3325 Green Jay Road, Alamo, Texas 78516
Cameron, Hidalgo, Starr, Webb, Willacy, and Zapata.

For questions or coordination for projects occurring in counties not listed above, please contact arles@fws.gov.

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: http://www.fws.gov/media/endangered-species-consultation-handbook.

Non-Federal entities may consult under Sections 9 and 10 of the Act. Section 9 and Federal regulations prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR § 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR § 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Should the proposed project have the potential to take listed species, the Service recommends that the applicant develop a Habitat Conservation Plan and obtain a section 10(a)(1)(B) permit. The Habitat Conservation Planning Handbook is available at: https://www.fws.gov/library/collections/habitat-conservation-planning-handbook.

Migratory Birds:
In addition to responsibilities to protect threatened and endangered species under the Act, there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts visit: https://www.fws.gov/program/migratory-birds.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable National Environmental Policy Act (NEPA) documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- Bald & Golden Eagles
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

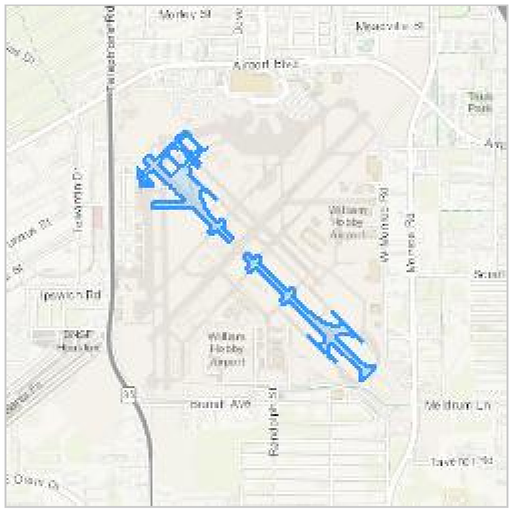
This species list is provided by:

Texas Coastal & Central Plains Esfo
17629 El Camino Real, Suite 211
Houston, TX 77058-3051
(281) 286-8282

PROJECT SUMMARY

Project Code: 2025-0003871
Project Name: HOU 13R Rehab EA
Project Type: Airport - Maintenance/Modification
Project Description: The Houston Airport System proposes to rehabilitate Runway 13R-31L at Houston Hobby Airport. The project will consist of replacing and improving existing exit taxiways including high speed exits.
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@29.6489609,-95.2826194472604,14z



Counties: Harris County, Texas

ENDANGERED SPECIES ACT SPECIES

There is a total of 7 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

BIRDS

NAME	STATUS
Eastern Black Rail *Laterallus jamaicensis ssp. jamaicensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10477	Threatened
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Rufa Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

REPTILES

NAME	STATUS
Alligator Snapping Turtle *Macrochelys temminckii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4658	Proposed Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

BALD & GOLDEN EAGLES

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Jul 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

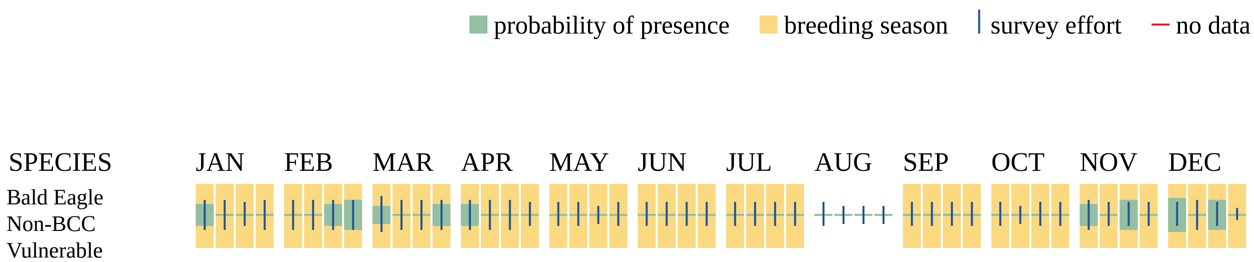
Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

1. The Migratory Birds Treaty Act of 1918.

2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Golden-plover *Pluvialis dominica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10561	Breeds elsewhere
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Jul 31
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9406	Breeds Mar 15 to Aug 25
Dickcissel *Spiza americana* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9453	Breeds May 5 to Aug 31
Forster's Tern *Sterna forsteri* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/11953	Breeds Mar 1 to Aug 15
Least Tern *Sternula antillarum antillarum* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/11919	Breeds Apr 25 to Sep 5
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Painted Bunting *Passerina ciris* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9511	Breeds Apr 25 to Aug 15

NAME	BREEDING SEASON
Prairie Loggerhead Shrike *Lanius ludovicianus excubitorides* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8833	Breeds Feb 1 to Jul 31
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9439	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9398	Breeds May 10 to Sep 10
Swallow-tailed Kite *Elanoides forficatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8938	Breeds Mar 10 to Jun 30
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10669	Breeds Apr 20 to Aug 5

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

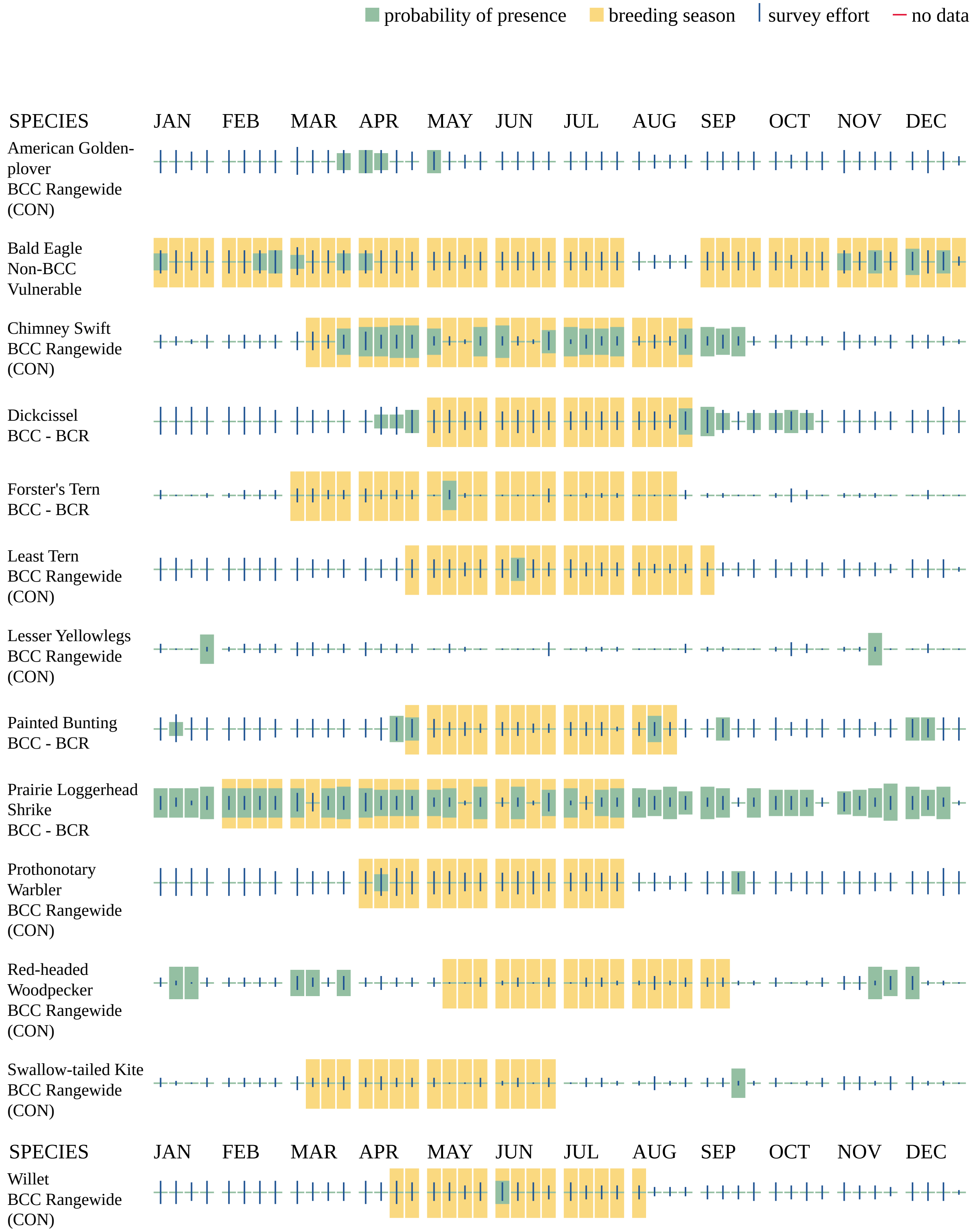
Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.


probability of presence
breeding season
survey effort
no data
SPECIES
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
American Golden-plover
BCC Rangewide (CON)
Bald Eagle
Non-BCC Vulnerable
Chimney Swift
BCC Rangewide (CON)
Dickcissel
BCC - BCR
Forster's Tern
BCC - BCR
Least Tern
BCC Rangewide (CON)
Lesser Yellowlegs
BCC Rangewide (CON)
Painted Bunting
BCC - BCR
Prairie Loggerhead Shrike
BCC - BCR
Prothonotary Warbler
BCC Rangewide (CON)
Red-headed Woodpecker
BCC Rangewide (CON)
Swallow-tailed Kite
BCC Rangewide (CON)
SPECIES
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Willet
BCC Rangewide (CON)

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

THERE ARE NO WETLANDS WITHIN YOUR PROJECT AREA.

IPAC USER CONTACT INFORMATION

Agency:	Houston city
Name:	Brynn Putnam
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Address Line 2:	Suite 500
City:	Houston, Texas 77024
State:	TX
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LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Aviation Administration

Last Update: 8/22/2024

HARRIS COUNTY

AMPHIBIANS

Houston toad *Anaxyrus houstonensis*

Terrestrial and aquatic: Primary terrestrial habitat is forests with deep sandy soils. Juveniles and adults are presumed to move through areas of less suitable soils using riparian corridors. Aquatic habitats can include any water body from a tire rut to a large lake.

Federal Status: E	State Status: E	SGCN: Y
Endemic: Y	Global Rank: G1	State Rank: S1

southern crawfish frog *Lithobates areolatus areolatus*

Terrestrial and aquatic: The terrestial habitat is primarily grassland and can vary from pasture to intact prairie; it can also include small prairies in the middle of large forested areas. Aquatic habitat is any body of water but preferred habitat is ephemeral wetlands.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4T4	State Rank: S3

spotted dusky salamander *Desmognathus conanti*

This species occurs in association with aquatic habitats in forested areas. Small, clear, spring fed streams with sandy substrate bordered with ferns and moss as well as murky, stagnant water bodies in cypress swamps, baygalls, and flood plains in bottomland forests support populations of this species.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S1

Strecker's chorus frog *Pseudacris streckeri*

Terrestrial and aquatic: Wooded floodplains and flats, prairies, cultivated fields and marshes. Likes sandy substrates.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

Woodhouse's toad *Anaxyrus woodhousii*

Terrestrial and aquatic: A wide variety of terrestrial habitats are used by this species, including forests, grasslands, and barrier island sand dunes. Aquatic habitats are equally varied.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

BIRDS

bald eagle *Haliaeetus leucocephalus*

Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Federal Status: DL	State Status:	SGCN: N
Endemic: N	Global Rank: G5	State Rank: S3B,S3N

HARRIS COUNTY

BIRDS

Bank Swallow *Riparia riparia*

Bank Swallows live in low areas along rivers, streams, ocean coasts, and reservoirs. Their territories usually include vertical cliffs or banks where they nest in colonies of 10 to 2,000 nests. Though in the past Bank Swallows were most commonly found around natural bluffs or eroding streamside banks, they now often nest in human-made sites, such as sand and gravel quarries or road cuts. They forage in open areas and avoid places with tree cover.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2B,S4N

black rail *Laterallus jamaicensis*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored inte evaluations to determine potential presence of this species in a specific county. Salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mat of previous years dead grasses; nest usually hidden in marsh grass or at base of Salicornia

Federal Status: T	State Status: T	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S2

black skimmer *Rynchops niger*

Primarily coastal waters, including bays, estuaries, lagoons and mudflats in migration and winter (AOU 1983); also quiet waters of rivers and lakes (Stiles and Skutch 1989). Rest on mudflats, sandbars, beaches.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2B

Brewer's Blackbird *Euphagus cyanocephalus*

Shrubby and bushy areas (especially near water), riparian woodland, aspen parklands, cultivated lands, marshes, and around human habitation; ir migration and winter also in pastures and fields (AOU 1983).

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

Common Grackle *Quiscalus quiscula*

Common Grackles do well in human landscapes, using scattered trees for nesting and open ground for foraging. Typical natural habitats include open woodland, forest edge, grassland, meadows, swamps, marshes, and palmetto hammocks. They are also very common near agricultural fields and feedlots, suburbs, city parks, cemeteries, pine plantations, and hedgerows. Unbroken tracts of forest are the only places where you are unlikely to find Common Grackles.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5B

Common Nighthawk *Chordeiles minor*

Common Nighthawks nest in both rural and urban habitats including coastal sand dunes and beaches, logged forest, recently burned forest, woodland clearings, prairies, plains, sagebrush, grasslands, open forests, and rock outcrops. They also nest on flat gravel rooftops, though less often as gravel roofs are being replaced by smooth, rubberized roofs that provide an unsuitable surface.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S4B

HARRIS COUNTY

BIRDS

Franklin's gull *Leucophaeus pipixcan*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. This species is only a spring and fall migrant throughout Texas. It does not breed in or near Texas. Winter records are unusual consisting of one or a few individuals at a given site (especially along the Gulf coastline). During migration, these gulls fly during daylight hours but often come down to wetlands, lake shore, or islands to roost for the night.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S2N

Henslow's Sparrow *Centronyx henslowii*

Wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G4 State Rank: S2S3N,SXB

Least Tern *Sternula antillarum*

Sand beaches, flats, bays, inlets, lagoons, islands, river sandbars and flat gravel rooftops in urban areas.

Federal Status: DL State Status: SGCN: Y
Endemic: N Global Rank: G4 State Rank: S2B

Loggerhead Shrike *Lanius ludovicianus*

Loggerhead Shrikes inhabit open country with short vegetation and well-spaced shrubs or low trees, particularly those with spines or thorns. They frequent agricultural fields, pastures, old orchards, riparian areas, desert scrublands, savannas, prairies, golf courses, and cemeteries. Loggerhead Shrikes are often seen along mowed roadsides with access to fence lines and utility poles.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G4 State Rank: S4B

Mottled Duck *Anas fulvigula*

Estuaries, ponds, lakes, secondary bays.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G4 State Rank: S4B

mountain plover *Charadrius montanus*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G3 State Rank: S2

HARRIS COUNTY

BIRDS

Northern Bobwhite *Colinus virginianus*

Inhabits a wide variety of vegetation types, particularly early successional stages. Occurs in croplands, grasslands, pastures, fallow fields, grass-brush rangelands, open pinelands, open mixed pine-hardwood forests, and habitat mosaics (Brennan 1999).

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4G5	State Rank: S4B

piping plover *Charadrius melodus*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway. Based on the November 30, 1992 Section 6 Job No. 9.1, Piping Plover and Snowy Plover Winter Habitat Status Survey, algal flats appear to be the highest quality habitat. Some of the most important aspects of algal flats are their relative inaccessibility and their continuous availability throughout all tidal conditions. Sand flats often appear to be preferred over algal flats when both are available, but large portions of sand flats along the Texas coast are available only during low-very low tides and are often completely unavailable during extreme high tides or strong north winds. Beaches appear to serve as a secondary habitat to the flats associated with the primary bays, lagoons, and inter-island passes. Beaches are rarely used on the southern Texas coast, where bayside habitat is always available, and are abandoned as bayside habitats become available on the central and northern coast. However, beaches are probably a vital habitat along the central and northern coast (i.e. north of Padre Island) during periods of extreme high tides that cover the flats. Optimal site characteristics appear to be large in area, sparsely vegetated, continuously available or in close proximity to secondary habitat, and with limited human disturbance.

Federal Status: T	State Status: T	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S2N

reddish egret *Egretta rufescens*

Resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S2B

rufa red knot *Calidris canutus rufa*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore. Bolivar Flats in Galveston County, sandy beaches Mustang Island, few on outer coastal and barrier beaches, tidal mudflats and salt marshes.

Federal Status: T	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4T2	State Rank: S2N

Sanderling *Calidris alba*

Nonbreeding: primarily sandy beaches, less frequently on mud flats and shores of lakes or rivers (AOU 1983) also on exposed reefs (Pratt et al. 1987). Sleeps/loafs on upper beach or on salt pond dike.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

Snowy Plover *Charadrius nivosus*

HARRIS COUNTY

BIRDS

Algal flats appear to be the highest quality habitat. Some of the most important aspects of algal flats are their relative inaccessibility and their continuous availability throughout all tidal conditions. An optimal site characteristic would be large in size. The size of populations appear to be roughly proportional to the total area of suitable habitat used. Formerly an uncommon breeder in the Panhandle; potential migrant; winter along coast.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S3B

Sprague's pipit *Anthus spragueii*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Habitat during migration and in winter consists of pastures and weedy fields (AOU 1983), including grasslands with dense herbaceous vegetation or grassy agricultural fields.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3G4	State Rank: S3N

swallow-tailed kite *Elanoides forficatus*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2B

western burrowing owl *Athene cunicularia hypugaea*

Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows

Federal Status:	State Status:	SGCN: N
Endemic: N	Global Rank: G4T4	State Rank: S2

white-faced ibis *Plegadis chihi*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.

Federal Status:	State Status: T	SGCN: N
Endemic: N	Global Rank: G5	State Rank: S4B

white-tailed hawk *Buteo albicaudatus*

Near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May

Federal Status:	State Status: T	SGCN: N
Endemic: N	Global Rank: G4G5	State Rank: S4B

whooping crane *Grus americana*

HARRIS COUNTY

BIRDS

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.

Federal Status: E	State Status: E	SGCN: Y
Endemic: N	Global Rank: G1	State Rank: S1S2N

Willet *Tringa semipalmata*

Marshes, tidal mudflats, beaches, lake margins, mangroves, tidal channels, river mouths, coastal lagoons, sandy or rocky shores, and, less frequently, open grassland (AOU 1983, Stiles and Skutch 1989).

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5B

Wilson's Warbler *Cardellina pusilla*

Wilson’s warblers key in on forests and scrubby areas along streams to fatten up during migration. During the nonbreeding season they use many types of habitats from lowland thickets near streams to high-elevation cloud forests in Mexico and Central America.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S4

wood stork *Mycteria americana*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers to nest in large tracts of baldcypress (Taxodium distichum) or red mangrove (Rhizophora mangle); forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: SHB,S3N

Yellow Rail *Coturnicops noveboracensis*

BREEDING: Emergent wetlands, grass or sedge marshes and wet meadows in freshwater situations. Some breeding territories in these wet meadows contain firm footing and only a few remnant pools of water (Berkey 1991). These areas can range from damp to 38 cm (15 inches) of water but the average depth used for nesting is 8 to 15 cm (3 to 6 inches) (Savaloja 1981). NON-BREEDING: Grain fields in winter and when migrating. Winters in both freshwater and brackish marshes, as well as in dense, deep grass. During fall migration, will use many open habitats, from rice paddies to dry hayfields.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S3N

yellow-billed cuckoo *Coccyzus americanus*

HARRIS COUNTY

BIRDS

In Texas, the populations of concern are found breeding in riparian areas in the Trans Pecos (know as part of the Western Distinct Population Segment). It is the Western DPS that is on the U.S. ESA threatened list and includes the Texas counties Brewster, Culberson, El Paso, Hudspeth, Jeff Davis, and Presidio. Riparian woodlands below 6,000' in elevation consisting of cottonwoods and willows are prime habitat. This species is a long-distant migrant that summers in Texas, but winters mainly in South America. Breeding birds of the Trans Pecos populations typically arrive on their breeding grounds possibly in late April but the peak arrival time is in May. Threats to preferred habitat include hydrologic changes that don't promote the regeneration of cottonwoods and willows, plus livestock browsing and trampling of sapling trees in sensitive riparian areas.

Federal Status: T	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S4S5B

CRUSTACEANS

Houston burrowing crayfish *Fallicambarus houstonensis*

All species in the genus <i>Fallicambarus </i>are primary burrowers (Guiasu, 2007). It is clearly a primary burrower with 100% of adult and subadult specimens known from excavated burrows. Large numbers of juveniles were collected from Temporary pools (October through February) (Johnson, 2008).

Federal Status:	State Status:	SGCN: Y
Endemic:	Global Rank: G2	State Rank: S3

FISH

alligator gar *Atractosteus spatula*

From the Red River to the Rio Grande (Hubbs et al. 2008); occurs in the Trinity River upstream of Lake Livingston. Found in rivers, streams, lakes, swamps, bayous, bays and estuaries typically in pools and backwater habitats. Floodplains inundated with flood waters provide spawning and nursery habitats.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3G4	State Rank: S4

Atlantic guitarfish *Rhinobatos lentiginosus*

Gulf of Mexico

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: GNR	State Rank: S2S3

Atlantic tarpon *Megalops atlanticus*

Gulf of Mexico

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2S3

black grouper *Mycteroperca bonaci*

Gulf of Mexico

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: GNR	State Rank: S3S4

HARRIS COUNTY

FISH

blacknose shark *Carcharhinus acronotus*
Gulf of Mexico
Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: GNR State Rank: S3

blue marlin *Makaira nigricans*
Gulf of Mexico
Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: GNR State Rank: SNR

Bull Shark *Carcharhinus leucas*
Gulf of Mexico
Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S5

Caribbean sharpnose shark *Rhizoprionodon porosus*
Gulf of Mexico
Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: GNR State Rank: S3

cobia *Rachycentron canadum*
Gulf of Mexico
Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: GNR State Rank: S3S4

dusky shark *Carcharhinus obscurus*
Gulf of Mexico
Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G3 State Rank: S3

Finetooth Shark *Carcharhinus isodon*
Gulf of Mexico
Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: GNR State Rank: SNR

HARRIS COUNTY

FISH

giant manta ray *Manta birostris*

Gulf of Mexico

Federal Status: T | State Status: | SGCN: Y

Endemic: N | Global Rank: G3G4 | State Rank: SNR

great hammerhead *Sphyrna mokarran*

Gulf of Mexico

Federal Status: | State Status: T | SGCN: Y

Endemic: N | Global Rank: G3G4 | State Rank: S2

greater amberjack *Seriola dumerili*

Gulf of Mexico

Federal Status: | State Status: | SGCN: Y

Endemic: N | Global Rank: GNR | State Rank: S3

lemon shark *Negaprion brevirostris*

Gulf of Mexico

Federal Status: | State Status: | SGCN: Y

Endemic: N | Global Rank: G3G4 | State Rank: S1S3

Mississippi silvery minnow *Hybognathus nuchalis*

Found in eastern Texas streams, from the Brazos River eastward and northward to the Red River; found in moderate current; silty, muddy, or rocky substrate. In Texas, adults likely to inhabit smaller tributary streams.

Federal Status: | State Status: | SGCN: Y

Endemic: | Global Rank: G5 | State Rank: S4

oceanic whitetip shark *Carcharhinus longimanus*

Habitat description is not available at this time.

Federal Status: T | State Status: T | SGCN: Y

Endemic: N | Global Rank: GNR | State Rank: S2

Sabine shiner *Notropis sabinae*

Inhabits small streams and large rivers of eastern Texas from San Jacinto drainage northward along the Gulf Coast to the Sabine River Basin; Habitat generalist with affinities for shallow, moving water and rarely found in pools and backwater areas;
closely restricted to substrate of fine, silt free sand in small creeks and rivers having slight to moderate current.

Federal Status: | State Status: | SGCN: Y

Endemic: N | Global Rank: G4 | State Rank: S3

HARRIS COUNTY

FISH

sailfish *Istiophorus platypterus*

Gulf of Mexico

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: GNR State Rank: S3

saltmarsh topminnow *Fundulus jenkinsi*

Occupies estuaries and the edges of saltmarsh habitats along the Gulf coast in salinities of 4-20 ppt in Spartina dominated tidal creeks and wetlands (Peterson & Ross 1991; Peterson & Turner 1994; Lopez et al. 2010; and Griffith 1974). Requires access to small interconnected tidal creeks for feeding and reproduction. Spawning occurs from March to August during high tide events (Robertson Thesis, 2016). Non-migratory.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3 State Rank: S1

sandbar shark *Carcharhinus plumbeus*

Gulf of Mexico

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S3S4

scalloped hammerhead shark *Sphyrna lewini*

Gulf of Mexico

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: SNR

scamp *Mycteroperca phenax*

Gulf of Mexico

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: GNR State Rank: SNR

shortfin mako shark *Isurus oxyrinchus*

Habitat description is not available at this time.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: GNR State Rank: S2

silky shark *Carcharhinus falciformis*

Gulf of Mexico

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3 State Rank: S3

HARRIS COUNTY

FISH

silverband shiner *Notropis shumardi*

In Texas, found from Red River to Lavaca River; Main channel with moderate to swift current velocities and moderate to deep depths; associated with turbid water over silt, sand, and gravel.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S4

smalltail shark *Carcharhinus porosus*

Gulf of Mexico

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: GNR	State Rank: S3

southern flounder *Paralichthys lethostigma*

This is an estuarine-dependent species that inhabits riverine, estuarine and coastal waters, and prefers muddy, sandy, or silty substrates (Reagan and Wingo 1985). Individuals can tolerate wide temperature (~5-35°C) and salinity ranges (0-60 ppt). Southern Flounder spawn in offshore waters of the Gulf of Mexico from October to February (Reagan and Wingo 1985). The oceanic larval stage is pelagic and lasts 30–60 days. Metamorphosing individuals enter estuaries and migrate towards low-salinity headwaters, where settlement occurs (Burke et al. 1991, Walsh et al. 1999). The young fish enter the bays during late winter and early spring, occupying seagrass; some may move further into coastal rivers and bayous. Juveniles remain in estuaries until the onset of sexual maturation (approximately two years), at which time they migrate out of estuaries to join adults on the inner continental shelf. Adult southern flounder leave the bays during the fall for spawning in the Gulf of Mexico. They spawn for the first time when two years old at depths of 50 to 100 feet. Although most of the adults leave the bays and enter the Gulf for spawning during the winter, some remain behind and spend winter in the bays. Those in the Gulf will reenter the bays in the spring. The spring influx is gradual and does not occur with large concentrations that characterize the fall emigration.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

speckled hind *Epinephelus drummondhayi*

Gulf of Mexico

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S3

spinner shark *Carcharhinus brevipinna*

Gulf of Mexico

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: GNR	State Rank: S3

spotted sucker *Minytrema melanops*

Found primarily in east Texas streams from the Red to the Brazos river basins. An isolated, disjunct population occurs in the Llano River near Junction downstream to about Mason; this may be an introduced population. Typically in clear creeks with firm substrates.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

HARRIS COUNTY

FISH

swordfish *Xiphias gladius*

Gulf of Mexico

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

western creek chubsucker *Erimyzon claviformis*

Eastern Texas streams from the Red River to the San Jacinto drainage. Habitat includes silt-, sand-, and gravel-bottomed pools of clear headwaters, creeks, and small rivers; often near vegetation; occasionally in lakes. Spawning occurs in river mouths or pools, riffles, lake outlets, or upstream creeks. Prefers headwaters, but seldom occurs in springs.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2S3

white marlin *Kajikia albida*

Gulf of Mexico

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: GNR	State Rank: S3

INSECTS

American bumblebee *Bombus pensylvanicus*

Habitat description is not available at this time.

Federal Status:	State Status:	SGCN: Y
Endemic:	Global Rank: G3G4	State Rank: SNR

bay skipper *Euphyes bayensis*

Apparently tidal sawgrass marsh only, probably covers same range of salinity as saw grass, nectarivore (butterfly), herbivore (caterpillar), larval foodplant is so far unconfirmed but is probably sawgrass, diurnal; two well separated broods apparently peaking in late May and in September which suggests the larvae may well aestivate in summer and the next brood hibernate

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G2G3	State Rank: S1

MAMMALS

Atlantic spotted dolphin *Stenella frontalis*

Inhabit warm tropical, subtropical, and temperate waters throughout the Atlantic Ocean, including the Gulf of Mexico. Commonly found along the continental shelf and coastal waters that are 65-820 feet deep, usually inside or near 185 m contour (within 250-350 km of coast); occassionally found in deeper waters. Often dive to 30-200 feet preying upon fish, invertebrates, and cephalopods.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S1

HARRIS COUNTY

MAMMALS

big free-tailed bat *Nyctinomops macrotis*

Habitat data sparse but records indicate that species prefers to roost in crevices and cracks in high canyon walls, but will use buildings, as well; reproduction data sparse, gives birth to single offspring late June-early July; females gather in nursery colonies; winter habits undetermined, but may hibernate in the Trans-Pecos; opportunistic insectivore

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S3

Blainville's beaked whale *Mesoplodon densirostris*

Not applicable.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1

blue whale *Balaenoptera musculus*

Inhabits tropical, subtropical, temperate, and subpolar waters worldwide, but are infrequently sighted in the Gulf of Mexico. They migrate seasonally between summer feeding grounds and winter breeeding grounds, but specifics vary. Commonly observed at the surface in open ocean.

Federal Status: E	State Status: E	SGCN: Y
Endemic: N	Global Rank: G3G4	State Rank: SH

bottlenosed dolphin *Tursiops truncatus*

Habitat description is not available at this time.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2

Bryde's whale *Balaenoptera edeni brydei*

Gulf of Mexico

Federal Status:	State Status: E	SGCN: Y
Endemic: N	Global Rank: GNR	State Rank: SNR

clymene dolphin *Stenella clymene*

Habitat description is not available at this time.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1

Cuvier's beaked whale *Ziphius cavirostris*

Inhabit tropical, subtropical, and temperate waters world wide, including the Gulf of Mexico. Commonly found in water over 3,300 feet deep near the continetal shelf near steep slopes or canyons, avoiding coastal areas. Mostly pelagic apparently confined by the 1,00 meter bthymetric contour. frequenly make deep dives to capture prey (squids and fishes).

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1

HARRIS COUNTY

MAMMALS

dwarf sperm whale *Kogia simus*

Inhabits tropical and temperate waters world wide, Commonly found in deep waters near the continental shelf and rarely seen at the surface, but may be more coastal than the pygmy sperm whale (Kogia breviceps). Dives to great depths (1,000 feet) to hunt for squid, fish, and crustaceans. Migration patterns are unknown.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1

eastern spotted skunk *Spilogale putorius*

Generalist; open fields prairies, croplands, fence rows, farmyards, forest edges & woodlands. Prefer wooded, brushy areas & tallgrass prairies. S.p. ssp. interrupta found in wooded areas and tallgrass prairies, preferring rocky canyons and outcrops when such sites are available.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1S3

false killer whale *Pseudorca crassidens*

Inhabit tropical, subtropical, and temperate waters world wide, including the Gulf of Mexico. Commonly found in deep, offshore waters deeper than 3,300 feet, making dives of up to 2,000 meters to catch their prey (fishes and squids). Gulf of Mexico distinct population segment is not well studied.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1

finback whale *Balaenoptera physalus*

Inhabit tropical, subtropical, temperate, and subpolar waters worldwide, but are less common in the tropics preferring cooler water. Commonly found in deep, offshore waters and migrate in the open ocean from the poles (feeding grounds) to warmer waters in the winter to give birth. They feed on krill, squid, and small schooling fish sometimes with other baleen whale species. They are very rare in the Gulf of Mexico and reported sightings are likely vagrants (Witt et al. 2011).

Federal Status: E	State Status: E	SGCN: Y
Endemic: N	Global Rank: G3G4	State Rank: S1

Gervais's beaked whale *Mesoplodon europaeus*

Inhabit tropical, subtropical, and temperate waters of the northern Atlantic Ocean, Gulf of Mexico, and Caribbean. Commonly found in deep water and open ocean where they prey upon squids. They are difficult to distinguish from others in their family (Mesoplodon) and are cryptic and skittish, but the most commonly stranded species on the US southeastern coast. Migration patterns are unknown.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S1

hoary bat *Lasiurus cinereus*

Hoary bats are highly migratory, high-flying bats that have been noted throughout the state. Females are known to migrate to Mexico in the winter, males tend to remain further north and may stay in Texas year-round. Commonly associated with forests (foliage roosting species) but are found in unforested parts of the state and lowland deserts. Tend to be captured over water and large, open flyways.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3G4	State Rank: S3

HARRIS COUNTY

MAMMALS

humpback whale *Megaptera novaeangliae*

Inhabits tropical, subtropical, temperate, and subpolar waters world wide. Migrate up to 5,000 miles between colder water (feeding grounds) and warmer water (calving grounds) each year. They will use both open ocean and coastal waters, sometimes including inshore areas such as bays, and are often found near the surface; however, this species is rare in the Gulf of Mexico. The northwest Atlantic/Gulf of Mexico distinct population segment is not considered at risk of extinction and is not listed as Endangered on the Endangered Species Act.

Federal Status: E	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: SNR

killer whale *Orcinus orca*

Inhabits tropical, subtropical, temperate, and polar waters world wide. In the Gulf of Mexico, they are commonly found in oceanic waters ranging from 256-2,652 meters deep beyond the 1,000 meter isobath and a very rarely found over the continental shelf and may be entirely absent from nearshore waters. May come in contact with pelagic longline fisheries targeting tunas and billfishes.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4G5	State Rank: S1

minke whale *Balaenoptera acutorostrata*

Gulf of Mexico

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S1

mountain lion *Puma concolor*

Generalist; found in a wide range of habitats statewide. Found most frequently in rugged mountains & riparian zones.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2S3

North Atlantic right whale *Eubalaena glacialis*

Inhabits subtropical and temperate waters in the northern Atlantic. Commonly found in coastal waters or clsoe to the continental shelf near the surface. They migrate from feeding grounds in cooler waters (Canada and New England) to warmer waters of the southeast US (South Carolina, Georgia, and Florida) to give birth in the fall/winter - both areas are identified as critical habitat by NOAA-NMFS. Nursery areas are in shallow, coastal waters. This species is very rare in the Gulf of Mexico and the few reported sightings are likely vagrants (Ward-Geiger etal 2011).

Federal Status: E	State Status: E	SGCN: Y
Endemic: N	Global Rank: G1	State Rank: S1

plains spotted skunk *Spilogale interrupta*

Generalist; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1S3

HARRIS COUNTY

MAMMALS

pygmy killer whale *Feresa attenuata*

Inhabit tropical and subtropical waters worldwide, including the Gulf of Mexico. Commonly found in deeper, offshore waters where they dive for their prey (squids and fishes), but may occassionally occur close to shore. They are very rare and migration patterns are unknown.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1

pygmy sperm whale *Kogia breviceps*

Inhabits tropical, subtropical, and temperate waters world wide. Commonly found in deep water over the continental slope and rarely seen at the surface. Dives to great depths (over 1,000 feet) to hunt for squid, fish, and crustaceans.Migration patterns are unknown.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1

Rafinesque's big-eared bat *Corynorhinus rafinesquii*

Historically, lowland pine and hardwood forests with large hollow trees. roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G3G4	State Rank: S2

Rice's whale *Balaenoptera ricei*

Gulf of Mexico

Federal Status: E	State Status: E	SGCN: Y
Endemic: N	Global Rank: G1	State Rank: SNR

roughtoothed dolphin *Steno bredanensis*

Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Records in Texas are only known from strandings. Commonly found in deep, oceanic water over 1,500-2,000 meters deep and ranging in temperature from 17-25 degrees Celsius. May associate with other cetaceans. Prey on squids and fish. No known migration patterns.

Federal Status:	State Status: T	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S1

sei whale *Balaenoptera borealis*

Gulf of Mexico

Federal Status: E	State Status: E	SGCN: Y
Endemic: N	Global Rank: G5?	State Rank: SNR

HARRIS COUNTY

MAMMALS

Seminole bat *Lasiurus seminolus*

Pine-oak and long-leaf pine in east Texas. Habitats include pine, mixed pine-hardwood, and hardwood forests of uplands and bottomlands, particularly pine-dominated forests, including mature pine and pine-hardwood corridors in managed pine forest landscapes (Menzel et al. 1998, 1999, 2000; Carter et al. 2004; Marks and Marks 2006; Perry and Thill 2007; Perry et al. 2007; Hein et al. 2008; Ammerman et al. 2012).

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S3

short-finned pilot whale *Globicephala macrorhynchus*

Inhabit tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Commonly found in deeper waters (>1,000 feet) and continental shelf where they make deep dives to capture squid, but may come closer to shore. Migration patterns unknown.

Federal Status: | State Status: T | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S1

southeastern myotis bat *Myotis austroriparius*

Caves are rare in Texas portion of range; buildings, hollow trees are probably important. Historically, lowland pine and hardwood forests with large hollow trees; associated with ecological communities near water. Roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G4 | State Rank: S3?

sperm whale *Physeter macrocephalus*

Inhabits tropical, subtropical, and temperate waters world wide, avoiding icey waters. Distribution is highly dependent on their food source (squids, sharks, skates, and fish), breeding, and composition of the pod. In general, this species migrates from north to south in the winter and south to north in the summer; however, individuals in tropical and temperate waters don't seem to migrate at all. Routinely dive to catch their prey (2,000-10,000 feet) and generally occupies water at least 3,300 feet deep near ocean trenches.

Federal Status: E | State Status: E | SGCN: Y
Endemic: N | Global Rank: G3G4 | State Rank: S1

spinner dolphin *Stenella longirostris*

Habitat description is not available at this time.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S1

tricolored bat *Perimyotis subflavus*

Forest, woodland and riparian areas are important. Caves are very important to this species.

Federal Status: PE | State Status: | SGCN: Y
Endemic: N | Global Rank: G3G4 | State Rank: S2

HARRIS COUNTY

MAMMALS

West Indian manatee *Trichechus manatus*

Large rivers, brackish water bays, coastal waters. Warm waters of the tropics, in rivers and brackish bays but may also survive in salt water habitats. Very sensitive to cold water temperatures. Rarely occurring as far north as Texas. Gulf and bay system; opportunistic, aquatic herbivore.

Federal Status: T State Status: T SGCN: Y

Endemic: N Global Rank: G2G3 State Rank: S1

MOLLUSKS

Deertoe *Truncilla truncata*

Reported from streams, rivers, lakes, and reservoirs. In riverine habitats primarily occurs in mainchannel habitats such as riffles or runs with moderate to swift current but may occasionally occur in areas with no current. Typically found in sand, gravel, cobble substrates, but sometimes may occur in firm mud or in crevices among large rocks and boulders (Parmalee and Bogan 1998; Williams et al. 2008).

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

Lilliput *Toxolasma parvum*

Reported from small streams, where it may penetrate into the headwaters, to large rivers, oxbows, sloughs, lakes, ponds, canals, borrow pits, and reservoirs. Primarily occurs in still to slow currents in mud and sand substrates (Coker et al. 1921; Read 1954; Neck and Metcalf 1988; Williams et al. 2008; Watters et al. 2009).

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

Louisiana Fatmucket *Lampsilis hydiana*

Reported from streams to rivers, may penetrate into headwaters, oxbows, lakes, canals, and reservoirs. Reported to occur in still to moderate currents in sand, mud, and gravel substrates. In riverine systems it is found primarily in nearshore habitats such as banks, backwaters and oxbows (Howells et al. 1996; Randklev et al. 2013a; Randklev et al. 2014a; Tsakiris and Randklev 2016). It adapts readily to reservoirs and can cope with flow modification stemming from river impoundment (Randklev et al. 2016).

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S4

Louisiana pigtoe *Pleurobema riddellii*

Occurs in small streams to large rivers in slow to moderate currents in substrates of clay, mud, sand, and gravel. Not known from impoundments (Howells 2010f; Randklev et al. 2013b; Troia et al. 2015). [Mussels of Texas 2019]

Federal Status: PT State Status: T SGCN: Y

Endemic: N Global Rank: G1G2 State Rank: S1

HARRIS COUNTY

MOLLUSKS

Mapleleaf *Quadrula quadrula*

Reported from streams to rivers, lakes, and reservoirs. In riverine habitats, it may be found in main-channel habitats such as riffles or runs in sand, gravel, and cobble substrates with moderate to swift currents. May also be found in nearshore habitats such as banks and backwaters to include pools in sand or mud substrates with little to no flow. (Williams et al. 2008; Howells 2016; Haag and Cicerello 2016).

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

Pimpleback *Cyclonaias pustulosa*

Occurs in small streams to large rivers in habitats including riffles and runs with flowing water, also found in nearshore habitats such as banks and backwaters or pools. Can occur in reservoirs but varies based by population. Is often found in substrates comprising of sand, gravel, and cobble but also mud and silt (Howells et al. 1996; Williams et al. 2008; Watters et al. 2009).

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: SNR

sandbank pocketbook *Lampsilis satura*

Occurs in small streams to large rivers in slow to moderate current in sandy mud to sand and gravel substrate. Can occur in a variety of habitats but most common in littoral habitats such as banks or backwaters or in protected areas along point bars (Randklev et al. 2013b; Randklev et al. 2014a; Troia et al. 2015). [Mussels of Texas 2019]

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G2? State Rank: S1

Tapered Pondhorn *Uniomerus declivis*

It likely occurs in streams, rivers, oxbows, marshes, swamps, lakes, canals, ponds, and reservoirs in still to moderate currents in mud, sand, or gravel substrates. Also probably occurs in woody debris such as logjams and exposed roots of riparian trees (Williams et al. 2008).

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: SNR

REPTILES

alligator snapping turtle *Macrochelys temminckii*

Aquatic: Perennial water bodies; rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near running water; sometimes enters brackish coastal waters. Females emerge to lay eggs close to the waters edge.

Federal Status: PT State Status: T SGCN: Y

Endemic: N Global Rank: G3 State Rank: S2

American alligator *Alligator mississippiensis*

Aquatic: Coastal marshes; inland natural rivers, swamps and marshes; manmade impoundments.

Federal Status: SAT State Status: SGCN: N

Endemic: N Global Rank: G5 State Rank: S4

HARRIS COUNTY

REPTILES

Atlantic hawksbill sea turtle *Eretmochelys imbricata*

Inhabit tropical and subtropical waters worldwide, in the Gulf of Mexico, especially Texas. Hatchling and juveniles are found in open, pelagic ocean and closely associated with floating lgae/seagrass mats. Juveniles then migrate to shallower, coastal areas, mainly coral reefs and rocky areas, but also in bays and estuaries near mangroves when reefs are absent; seldom in water lmore than 65 feet deep. They feed on sponges, jellyfish, sea urchins, molluscs, and crustaceans. Nesting occurs from April to November high up on the beach where there is vegetation for cover and little or no sand. Some migrate, but others stay close to foraging areas - females are philopatric.

Federal Status: E | State Status: E | SGCN: Y
Endemic: N | Global Rank: G3 | State Rank: S2

common garter snake *Thamnophis sirtalis*

Terrestrial and aquatic: Habitats used include the grasslands and modified open areas in the vicinity of aquatic features, such as ponds, streams or marshes. Damp soils and debris for cover are thought to be critical.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S2

eastern box turtle *Terrapene carolina*

Terrestrial: Eastern box turtles inhabit forests, fields, forest-brush, and forest-field ecotones. In some areas they move seasonally from fields in spring to forest in summer. They commonly enters pools of shallow water in summer. For shelter, they burrow into loose soil, debris, mud, old stump holes, or under leaf litter. They can successfully hibernate in sites that may experience subfreezing temperatures.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S3

green sea turtle *Chelonia mydas*

Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Adults and juveniles occupy inshore and nearshore areas, including bays and lagoons with reefs and seagrass. They migrate from feeding grounds (open ocean) to nesting grounds (beaches/barrier islands) and some nesting does occur in Texas (April to September). Adults are herbivorous feeding on sea grass and seaweed; juveniles are omnivorous feeding initially on marine invertebrates, then increasingly on sea grasses and seaweeds.

Federal Status: T | State Status: T | SGCN: Y
Endemic: N | Global Rank: G3 | State Rank: S3B,S3N

Kemp's Ridley sea turtle *Lepidochelys kempii*

Inhabits tropical, subtropical, and temperate waters of the northwestern Atlantic Ocean and Gulf of Mexico. Adults are found in coastal waters with muddy or sandy bottoms. Some males migrate between feeding grounds and breeeding grounds, but some don't. Females migrate between feeding and nesting areas, often returning to the same destinations. Nesting in Texas occurs on a smaller scale compared to other areas (i.e. Mexico). Hatchlings are quickly swept out to open water and are rarely found nearshore. Similarly, juveniles often congregate near floating algae/seagrass mats offshore, and move into nearshore, coastal, neritic areas after 1-2 years and remain until they reach maturity. They feed primarily on crabs, but also snails, clams, other crustaceans and plants, juveniles feed on sargassum and its associated fauna; nests April through August.

Federal Status: E | State Status: E | SGCN: Y
Endemic: N | Global Rank: G1 | State Rank: S3

leatherback sea turtle *Dermochelys coriacea*

HARRIS COUNTY

REPTILES

Inhabit tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Nesting is not common in Texas (March to July). Most pelagic of the seaturtles with the longest migration (>10,000 miles) between nesting and foraging sites. Are able to dive to depths of 4,000 feet. They are omnivorous, showing a preference for jellyfish.

Federal Status: E | State Status: E | SGCN: Y
Endemic: N | Global Rank: G2 | State Rank: S1S2

loggerhead sea turtle *Caretta caretta*

Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. They migrate from feeding grounds to nesting beaches/barrier islands and some nesting does occur in Texas (April to September). Beaches that are narrow, steeply sloped, with coarse-grain sand are preffered for nesting. Newly hatched individuals depend on floating alage/seaweed for protection and foraging, which eventually transport them offshore and into open ocean. Juveniles and young adults spend their lives in open ocean, offshore before migrating to coastal areas to breed and nest. Foraging areas for adults include shallow continental shelf waters.

Federal Status: T | State Status: T | SGCN: Y
Endemic: N | Global Rank: G3 | State Rank: S4

prairie skink *Plestiodon septentrionalis*

The prairie skink can occur in any native grassland habitat across the Rolling Plains, Blackland Prairie, Post Oak Savanna and Pineywoods ecoregions.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S2

pygmy rattlesnake *Sistrurus miliarius*

The pygmy rattlesnake occurs in a variety of wooded habitats from bottomland coastal hardwood forests to upland savannas. The species is frequently found in association with standing water.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S2S3

slender glass lizard *Ophisaurus attenuatus*

Terrestrial: Habitats include open grassland, prairie, woodland edge, open woodland, oak savannas, longleaf pine flatwoods, scrubby areas, fallow fields, and areas near streams and ponds, often in habitats with sandy soil.

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S3

smooth softshell *Apalone mutica*

Aquatic: Large rivers and streams; in some areas also found in lakes and impoundments (Ernst and Barbour 1972). Usually in water with sandy or mud bottom and few aquatic plants. Often basks on sand bars and mudflats at edge of water. Eggs are laid in nests dug in high open sandbars and banks close to water, usually within 90 m of water (Fitch and Plummer 1975).

Federal Status: | State Status: | SGCN: Y
Endemic: N | Global Rank: G5 | State Rank: S3

HARRIS COUNTY

REPTILES

Texas diamondback terrapin *Malaclemys terrapin littoralis*

Coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water; burrows into mud when inactive. Bay islands are important habitats. Nests on oyster shell beaches.

Federal Status: State Status: SGCN: Y
Endemic: Y Global Rank: G4T3 State Rank: S2

Texas horned lizard *Phrynosoma cornutum*

Terrestrial: Open habitats with sparse vegetation, including grass, prairie, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive. Occurs to 6000 feet, but largely limited below the pinyon-juniper zone on mountains in the Big Bend area.

Federal Status: State Status: T SGCN: Y
Endemic: N Global Rank: G4G5 State Rank: S3

western box turtle *Terrapene ornata*

Terrestrial: Ornate or western box trutles inhabit prairie grassland, pasture, fields, sandhills, and open woodland. They are essentially terrestrial but sometimes enter slow, shallow streams and creek pools. For shelter, they burrow into soil (e.g., under plants such as yucca) (Converse et al. 2002) or enter burrows made by other species.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5 State Rank: S3

western chicken turtle *Deirochelys reticularia miaria*

Aquatic and terrestrial: This species uses aquatic habitats in the late winter, spring and early summer and then terrestrial habitats the remainder of the year. Preferred aquatic habitats seem to be highly vegetated shallow wetlands with gentle slopes. Specific terrestrial habitats are not well known.

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G5T5 State Rank: S2S3

PLANTS

coastal gay-feather *Liatris bracteata*

Coastal prairie grasslands of various types, from salty prairie on low- lying somewhat saline clay loams to upland prairie on nonsaline clayey to sandy loams; flowering in fall

Federal Status: State Status: SGCN: Y
Endemic: Y Global Rank: G2G3 State Rank: S2S3

corkwood *Leitneria pilosa ssp. pilosa*

Wet or saturated silty soils along brackish or freshwater swamps and ponds and other low, poorly drained sites; flowers in early spring, fruiting as early as May

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G2G3T2 State Rank: S2

HARRIS COUNTY

PLANTS

Correll's false dragon-head *Physostegia correllii*

Wet, silty clay loams on streamsides, in creek beds, irrigation channels and roadside drainage ditches; or seepy, mucky, sometimes gravelly soils along riverbanks or small islands in the Rio Grande; or underlain by Austin Chalk limestone along gently flowing spring-fed creek in central Texas; flowering May-September

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G2	State Rank: S2

giant sharpstem umbrella-sedge *Cyperus cephalanthus*

In Texas on saturated, fine sandy loam soils, along nearly level fringes of deep prairie depressions; also in depressional area within coastal prairie remnant on heavy black clay; in Louisiana, most sites are coastal prairie on poorly drained sites, some on slightly elevated areas surrounded by standing shallow water, and on moderately drained sites; soils include very strongly acid to moderately alkaline silt loams and silty clay loams; flowering/fruiting May-June, August-September, and possibly other times in response to rainfall

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3?Q	State Rank: S1

goldenwave tickseed *Coreopsis intermedia*

In deep sandy soils of sandhills in openings in or along margins of post oak woodlands and pine-oak forests of east Texas; Perennial; Flowering/Fruiting May-Aug

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S3

Houston daisy *Rayjacksonia aurea*

On and around naturally barren or sparsely vegetated saline slick spots or pimple mounds on coastal prairies, usually on sandy to sandy loam soils, occasionally in pastures and on roadsides in similar soil types where mowing may mimic natural prairie disturbance regimes; flowering late September-November (-December)

Federal Status:	State Status: T	SGCN: Y
Endemic: Y	Global Rank: G1	State Rank: S1

Indianola beakrush *Rhynchospora indianolensis*

Locally abundant in cattle pastures in some areas (at least during wet years), possibly becoming a management problem in such sites; Perennial; Flowering/Fruiting April-Nov

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3Q	State Rank: S3

Oklahoma grass pink *Calopogon oklahomensis*

Mesic, acidic, sandy to loamy prairies, pine savannas, oak woodlands, edges of bogs, and frequently mowed meadows (Goldman, Magrath & Catling 2002). Flowering March-July.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G2	State Rank: S1S2

panicled indigobush *Amorpha paniculata*

HARRIS COUNTY

PLANTS

A stout shrub, 3 m (9 ft) tall that grows in acid seep forests, peat bogs, wet floodplain forests, and seasonal wetlands on the edge of Saline Prairies in East Texas. It is distinguished from other Amorpha species by its fuzzy leaflets with prominent raised veins underneath, and the flower panicles, which are 8 to 16 inches long and slender, held above the foliage. Perennial; Flowering May-August.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S3

South Texas false cudweed *Pseudognaphalium austrotexanum*

In sandy grasslands on eroded area above saline flats; along edge of sendero through mesquite woodland and shrub mottes on sandy loam; on gravel and silt bars and flats in scour plain of streams (TEX-LL specimens Carr 23682, 29264, 22647, 27206). Oct-Jan, sometimes in spring.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S3

Texas ladies'-tresses *Spiranthes brevilabris*

Sandy soils in moist prairies, incl. blackland/Fleming prairies, calcareous prairie pockets surrounded by pines, pine-hardwood forest, open pinelands, wetland pine savannahs/flatwoods, and dry to moist fields, meadows, and roadsides. Delicate, nearly ephemeral orchid, producing winter rosettes, flowers Feb-Apr. Historically endemic to SE coastal plain.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G1G2	State Rank: S1

Texas meadow-rue *Thalictrum texanum*

Mostly found in woodlands and woodland margins on soils with a surface layer of sandy loam, but it also occurs on prairie pimple mounds; both on uplands and creek terraces, but perhaps most common on claypan savannas; soils are very moist during its active growing season; flowering/fruiting (January-)February-May, withering by midsummer, foliage reappears in late fall(November) and may persist through the winter

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G2Q	State Rank: S2

Texas prairie dawn *Hymenoxys texana*

In poorly drained, sparsely vegtated areas (slick spots) at the base of mima mounds in open grassland or almost barren areas on slightly saline soils that are sticky when wet and powdery when dry; flowering late February-early April

Federal Status: E	State Status: E	SGCN: Y
Endemic: Y	Global Rank: G2	State Rank: S2

Texas sunnybell *Schoenolirion wrightii*

Rocky barrens in the Post Oak region near College Station, with a few disjunct populations on the Catahoula Formation of southeast Texas; Perennial; Flowering March-April; Fruiting March

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S3

HARRIS COUNTY

PLANTS

Texas tauschia *Tauschia texana*

Occurs in loamy soils in deciduous forests or woodlands on river and stream terraces; Perennial; Flowering/Fruiting Feb-April

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S3

Texas willkommia *Willkommia texana var. texana*

Mostly in sparsely vegetated shortgrass patches within taller prairies on alkaline or saline soils on the Coastal Plain (Carr 2015).

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3G4T3 State Rank: S3

Texas windmill grass *Chloris texensis*

Sandy to sandy loam soils in relatively bare areas in coastal prairie grassland remnants, often on roadsides where regular mowing may mimic natural prairie fire regimes; flowering in fall

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2 State Rank: S2

threeflower broomweed *Thurovia triflora*

Near coast in sparse, low vegetation on a veneer of light colored silt or fine sand over saline clay along drier upper margins of ecotone between between salty prairies and tidal flats; further inland associated with vegetated slick spots on prairie mima mounds; flowering September-November

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2G3 State Rank: S2S3

APPENDIX C

Noise

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TECHNICAL MEMORANDUM

To:	Kim Tourloukis Houston Airport System – Environmental Affairs P.O. Box 60106 Houston, TX 77205-0106
From:	Tyler White, Principal Technical Analyst
Date:	January 2, 2025
Subject:	William P. Hobby Airport (HOU) Runway 13R-31L Rehabilitation 2027 Future Noise Contours
Reference:	HMMH Project Number 22-0184A.002

Harris Miller Miller & Hanson Inc. (HMMH) as a sub-consultant to Freese and Nichols Inc. is assisting the Houston Airport System (HAS) with the National Environmental Policy Act (NEPA) evaluation for the rehabilitation of Runway 13R-31L (the project) at Willam P. Hobby Airport (HOU). The purpose of this memorandum is to summarize the aircraft noise modeling assumptions and results for the proposed project.

1. Aircraft Noise Terminology

Noise is a complex physical quantity. The properties, measurement, and presentation of noise involve specialized terminology that can be difficult to understand. To provide a basic reference on these technical issues, this section introduces fundamentals of noise terminology, the effects of noise on human activity, and noise propagation.

1.1 Introduction to Noise Terminology

Analyses of potential impacts from changes in aircraft noise levels rely largely on a measure of cumulative noise exposure over an entire calendar year, expressed in terms of a metric called the Day-Night Average Sound Level (DNL). However, DNL does not provide an adequate description of noise for many purposes. A variety of measures, which are further described in subsequent sub-sections, are available to address essentially any issue of concern, including:

- Sound Pressure Level, SPL, and the Decibel, dB
- A-Weighted Decibel, dBA
- Maximum A-Weighted Sound Level, L_{max}
- Time Above, TA
- Sound Exposure Level, SEL
- Equivalent A-Weighted Sound Level, L_{eq}
- Day-Night Average Sound Level, DNL

1.1.1 Sound Pressure Level, SPL, and the Decibel, dB

All sounds come from a sound source – a musical instrument, a voice speaking, an airplane passing overhead. It takes energy to produce sound. The sound energy produced by any sound source travels through the air in sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. The ear senses these pressure variations and – with much processing in our brain – translates them into “sound.”

Our ears are sensitive to a wide range of sound pressures. The loudest sounds that we can hear without pain contain about one million times more energy than the quietest sounds we can detect. To allow us to perceive sound over this very wide range, our ear/brain “auditory system” compresses our response in a complex manner, represented by a term called sound pressure level (SPL), which we express in units called decibels (dB).

Mathematically, SPL is a logarithmic quantity based on the ratio of two sound pressures, the numerator being the pressure of the sound source of interest (P_{source}), and the denominator being a reference pressure ($P_{reference}$).[1]

$$\textit{Sound Pressure Level (SPL)} = 20 * Log\left(\frac{P_{source}}{P_{reference}}\right)dB$$

The logarithmic conversion of sound pressure to SPL means that the quietest sound that we can hear (the reference pressure) has a sound pressure level of about 0 dB, while the loudest sounds that we hear without pain have sound pressure levels of about 120 dB. Most sounds in our day-to-day environment have sound pressure levels from about 40 to 100 dB.[2]

Because decibels are logarithmic quantities, we cannot use common arithmetic to combine them. For example, if two sound sources each produce 100 dB operating individually, when they operate simultaneously, they produce 103 dB -- not the 200 dB we might expect. Increasing to four equal sources operating simultaneously will add another three decibels of noise, resulting in a total SPL of 106 dB. For every doubling of the number of equal sources, the SPL goes up another three decibels.

If one noise source is much louder than another is, the louder source "masks" the quieter one and the two sources together produce virtually the same SPL as the louder source alone. For example, a 100 dB and 80 dB sources produce approximately 100 dB of noise when operating together.

Two useful “rules of thumb” related to SPL are worth noting: (1) humans generally perceive a six to 10 dB increase in SPL to be about a doubling of loudness,[3] and (2) changes in SPL of less than about three decibels for an particular sound are not readily detectable outside of a laboratory environment.

1.1.2 A-Weighted Decibel

An important characteristic of sound is its frequency, or "pitch.” This is the per-second oscillation rate of the sound pressure variation at our ear, expressed in units known as Hertz (Hz).

When analyzing the total noise of any source, acousticians often break the noise into frequency components (or bands) to consider the “low,” “medium,” and “high” frequency components. This breakdown is important for two reasons:

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[1] The reference pressure is approximately the quietest sound that a healthy young adult can hear.

[2] The logarithmic ratio used in its calculation means that SPL changes relatively quickly at low sound pressures and more slowly at high pressures. This relationship matches human detection of changes in pressure. We are much more sensitive to changes in level when the SPL is low (for example, hearing a baby crying in a distant bedroom), than we are to changes in level when the SPL is high (for example, when listening to highly amplified music).

[3] A “10 dB per doubling” rule of thumb is the most often used approximation.

- Our ear is better equipped to hear mid and high frequencies and is least sensitive to lower frequencies. Thus, we find mid- and high-frequency noise more annoying.
- Engineering solutions to noise problems differ with frequency content. Low-frequency noise is generally harder to control.

The normal frequency range of hearing for most people extends from a low of about 20 Hz to a high of about 10,000 to 15,000 Hz. Most people respond to sound most readily when the predominant frequency is in the range of normal conversation – typically around 1,000 to 2,000 Hz. The acoustical community has defined several “filters,” which approximate this sensitivity of our ear and thus, help us to judge the relative loudness of various sounds made up of many different frequencies.

The so-called "A" filter (“A weighting”) generally does the best job of matching human response to most environmental noise sources, including natural sounds and sound from common transportation sources. “A-weighted decibels” are abbreviated “dBA.” Because of the correlation with our hearing, the U. S. Environmental Protection Agency (EPA) and nearly every other federal and state agency have adopted A-weighted decibels as the metric for use in describing environmental and transportation noise. **Figure 1** depicts A-weighting adjustments to sound from approximately 20 Hz to 10,000 Hz.

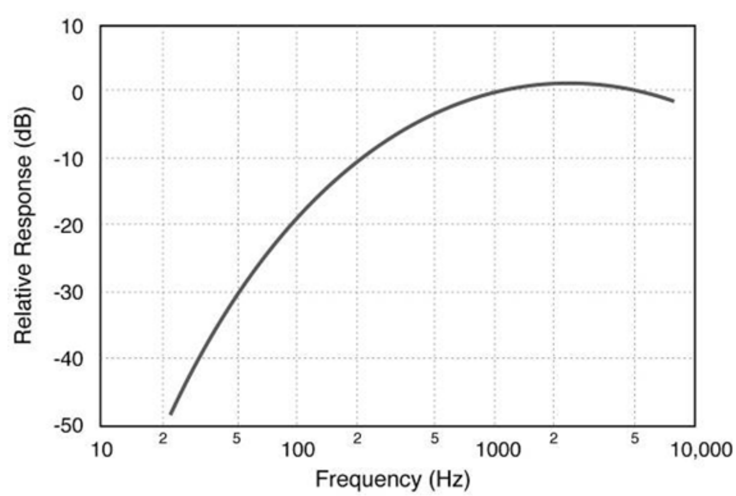

Figure 1. A-Weighting Frequency Response

Source: Extract from Harris, Cyril M., Editor, “Handbook of Acoustical Measurements and Control,” McGraw-Hill, Inc., 1991, pg. 5.13; HMMH

As **Figure 1** shows, A-weighting significantly de-emphasizes noise content at lower and higher frequencies where we do not hear as well, and has little effect, or is nearly "flat,” in for mid-range frequencies between 1,000 and 5,000 Hz. All sound pressure levels presented in this document are A-weighted unless otherwise specified.

Figure 2 depicts representative A-weighted sound levels for a variety of common sounds.

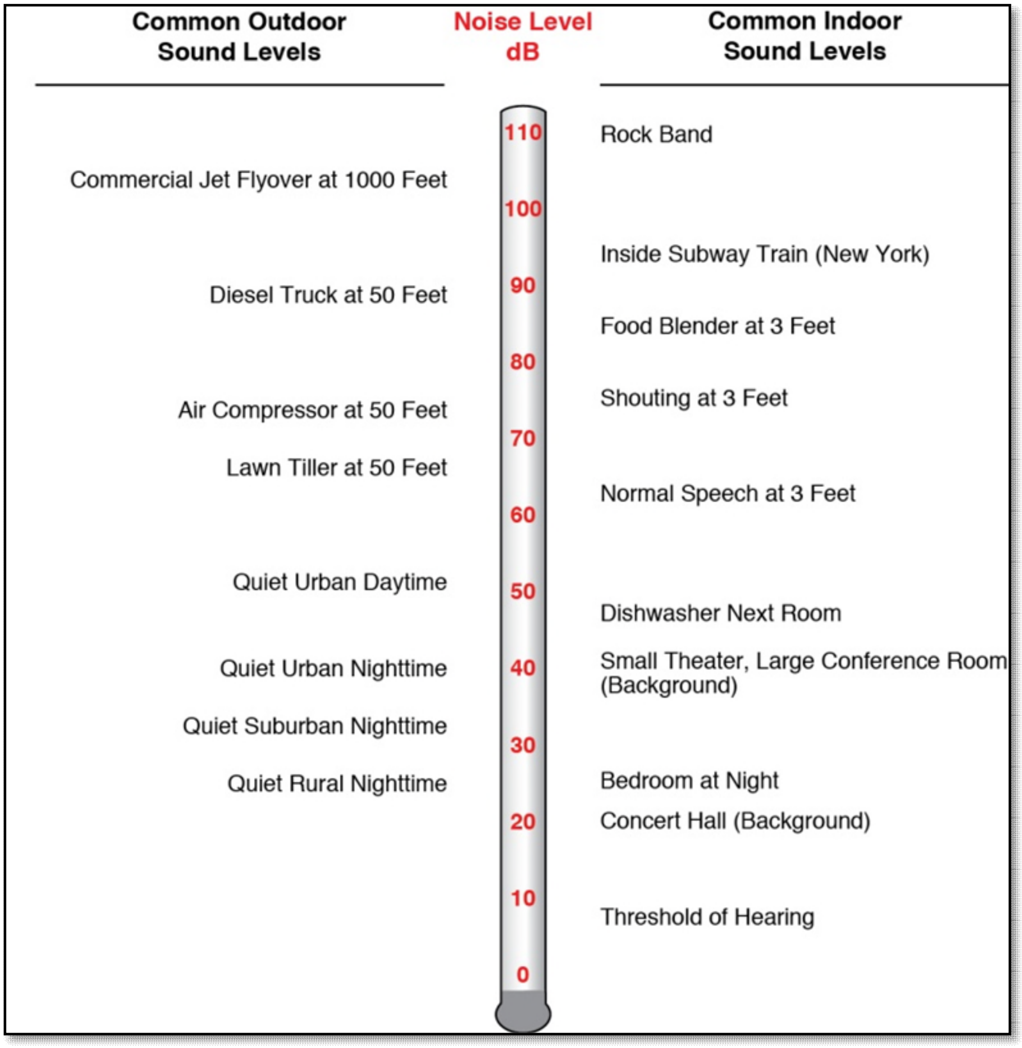

Figure 2. A-Weighted Sound Levels for Common Sounds

Source: HMMH

1.1.3 Maximum A-Weighted Sound Level, L_{max}

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as a car or aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance. The background or "ambient" level continues to vary in the absence of a distinctive source, for example due to birds chirping, insects buzzing, leaves rustling, etc. It is often convenient to describe a particular noise "event" (such as a vehicle passing by, a dog barking, etc.) by its maximum sound level, abbreviated as L_{max}.

Figure 3 depicts this general concept, for a hypothetical noise event with an L_{max} of approximately 102 dB.

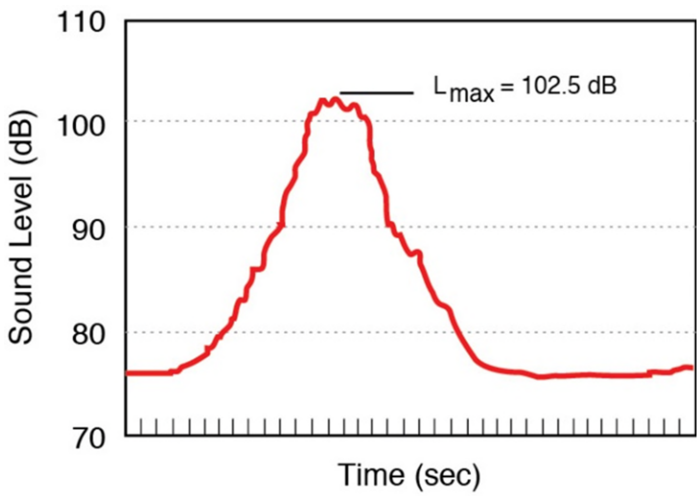

Figure 3. Variation in A-Weighted Sound Level over Time and Maximum Noise Level

Source: HMMH

While the maximum level is easy to understand, it suffers from a serious drawback when used to describe the relative “noisiness” of an event such as an aircraft flyover; i.e., it describes only one dimension of the event and provides no information on the event’s overall, or cumulative, noise exposure. In fact, two events with identical maximum levels may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying. The next section introduces a measure that accounts for this concept of a noise "dose," or the cumulative exposure associated with an individual “noise event” such as an aircraft flyover.

1.1.4 Sound Exposure Level, SEL

The most commonly used measure of cumulative noise exposure for an individual noise event, such as an aircraft flyover, is the Sound Exposure Level, or SEL. SEL is a summation of the A-weighted sound energy over the entire duration of a noise event. SEL expresses the accumulated energy in terms of the one-second-long steady-state sound level that would contain the same amount of energy as the actual time-varying level.

SEL provides a basis for comparing noise events that generally match our impression of their overall “noisiness,” including the effects of both duration and level. The higher the SEL, the more annoying a noise event is likely to be. In simple terms, SEL “compresses” the energy for the noise event into a single second. **Figure 4** depicts this compression, for the same hypothetical event shown in **Figure 3**. Note that the SEL is higher than the L_{max}.

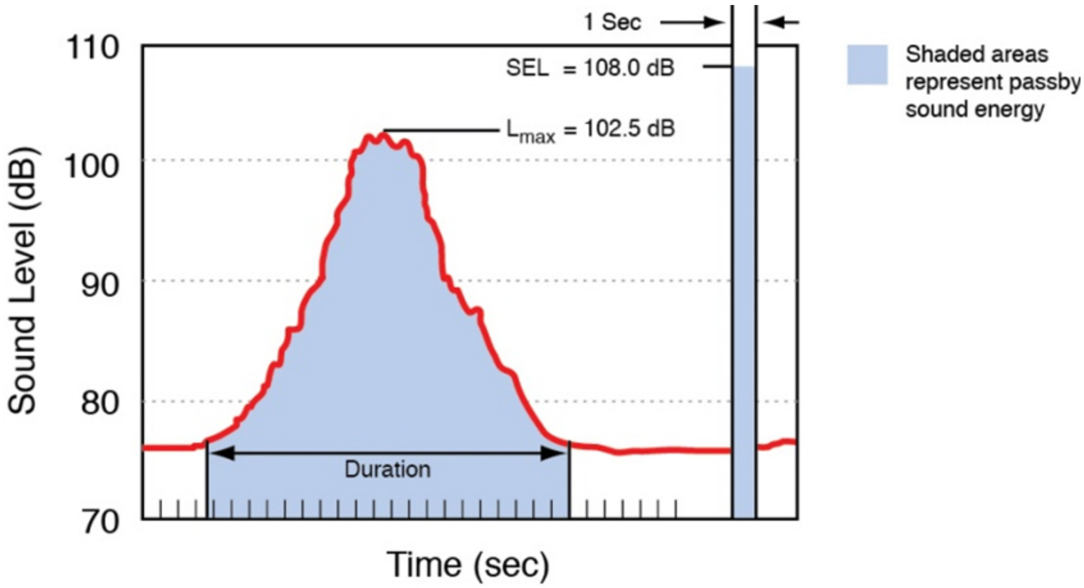

Figure 4. Graphical Depiction of Sound Exposure Level

Source: HMMH

The "compression" of energy into one second means that a given noise event's SEL will almost always will be a higher value than its L_{max}. For most aircraft flyovers, SEL is roughly five to 12 dB higher than L_{max}. Adjustment for duration means that relatively slow and quiet propeller aircraft can have the same or higher SEL than faster, louder jets, which produce shorter duration events.

1.1.5 Equivalent A-Weighted Sound Level, L_{eq}

The Equivalent Sound Level, abbreviated L_{eq}, is a measure of the exposure resulting from the accumulation of sound levels over a particular period of interest; e.g., one hour, an eight-hour school day, nighttime, or a full 24-hour day. L_{eq} plots for consecutive hours can help illustrate how the noise dose rises and falls over a day or how a few loud aircraft significantly affect some hours.

L_{eq} may be thought of as the constant sound level over the period of interest that would contain as much sound energy as the actual varying level. It is a way of assigning a single number to a time-varying sound level. **Figure 5** illustrates this concept for the same hypothetical event shown in **Figure 3** and **Figure 4**. Note that the L_{eq} is lower than either the L_{max} or SEL.

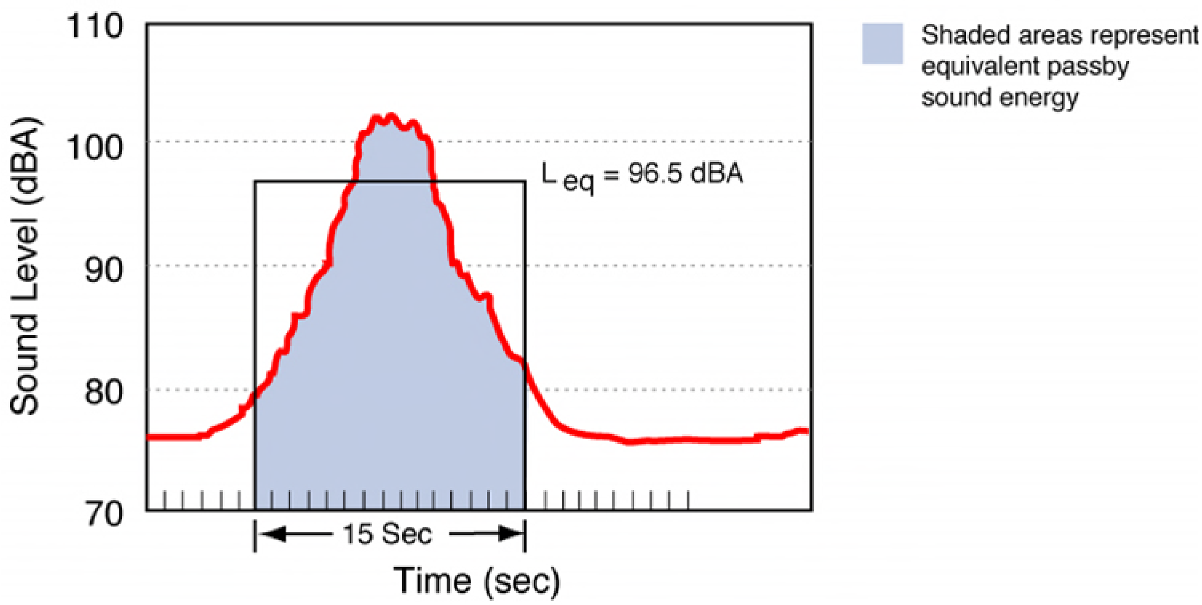

Figure 5. Example of a 15-Second Equivalent Sound Level

Source: HMMH

1.1.6 Day-Night Average Sound Level, DNL or L_{dn}

The FAA requires that airports use a measure of noise exposure that is slightly more complicated than L_{eq} to describe cumulative noise exposure – the Day-Night Average Sound Level, DNL.

The U.S. EPA identified DNL as the most appropriate means of evaluating airport noise based on the following considerations.[4]

- The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods.
- The measure should correlate well with known effects of the noise environment and on individuals and the public.
- The measure should be simple, practical, and accurate. In principle, it should be useful for planning as well as for enforcement or monitoring purposes.
- The required measurement equipment, with standard characteristics, should be commercially available.
- The measure should be closely related to existing methods currently in use.
- The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.
- The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods.

[4] "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," U. S. EPA Report No. 550/9-74-004, March 1974.

Most federal agencies dealing with noise have formally adopted DNL. The Federal Interagency Committee on Noise (FICON) reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated: "There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric."

In 2015, the FAA began a multi-year effort to update the scientific evidence on the relationship between aircraft noise exposure and its effects on communities around airports.[5] This was the most comprehensive study using a single noise survey ever undertaken in the United States, polling communities surrounding 20 airports nationwide. The FAA Reauthorization Act of 2018 under Section 188 and 173, required FAA to complete the evaluation of alternative metrics to the DNL standard within one year. The Section 188 and 173 Report to Congress was delivered on April 14, 2020[6] and concluded that while no single noise metric can cover all situations, DNL provides the most comprehensive way to consider the range of factors influencing exposure to aircraft noise. In addition, use of supplemental metrics is both encouraged and supported to further disclose and aid in the public understanding of community noise impacts. The full study supporting these reports was released in January 2021. If changes are warranted in the use of DNL, which DNL level to assess or the use of supplemental metrics, FAA will propose revised policy and related guidance and regulations, subject to interagency coordination, as well as public review and comment.

In simple terms, DNL is the 24-hour L_{eq} with one adjustment; all noises occurring at night (defined as 10 p.m. through 7 a.m.) are increased by 10 dB, to reflect the added intrusiveness of nighttime noise events when background noise levels decrease. In calculating aircraft exposure, this 10 dB increase is mathematically identical to counting each nighttime aircraft noise event ten times.

DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short periods. Most airport noise studies use computer-generated DNL estimates depicted as equal-exposure noise contours (much as topographic maps have contours of equal elevation).

The annual DNL is mathematically identical to the DNL for the average annual day—i.e., a day on which the number of operations is equal to the annual total divided by 365 (366 in a leap year). **Figure 6** graphically depicts the manner in which the nighttime adjustment applies in calculating DNL. **Figure 7** presents representative outdoor DNL values measured at various U.S. locations.

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[5] Federal Aviation Administration. Press Release – FAA To Re-Evaluate Method for Measuring Effects of Aircraft Noise. https://www.faa.gov/news/press_releases/news_story.cfm?newsId=18774

[6] Federal Aviation Administration. Report to Congress on an evaluation of alternative noise metrics. https://www.faa.gov/about/plans_reports/congress/media/Day-Night_Average_Sound_Levels_COMPLETED_report_w_letters.pdf

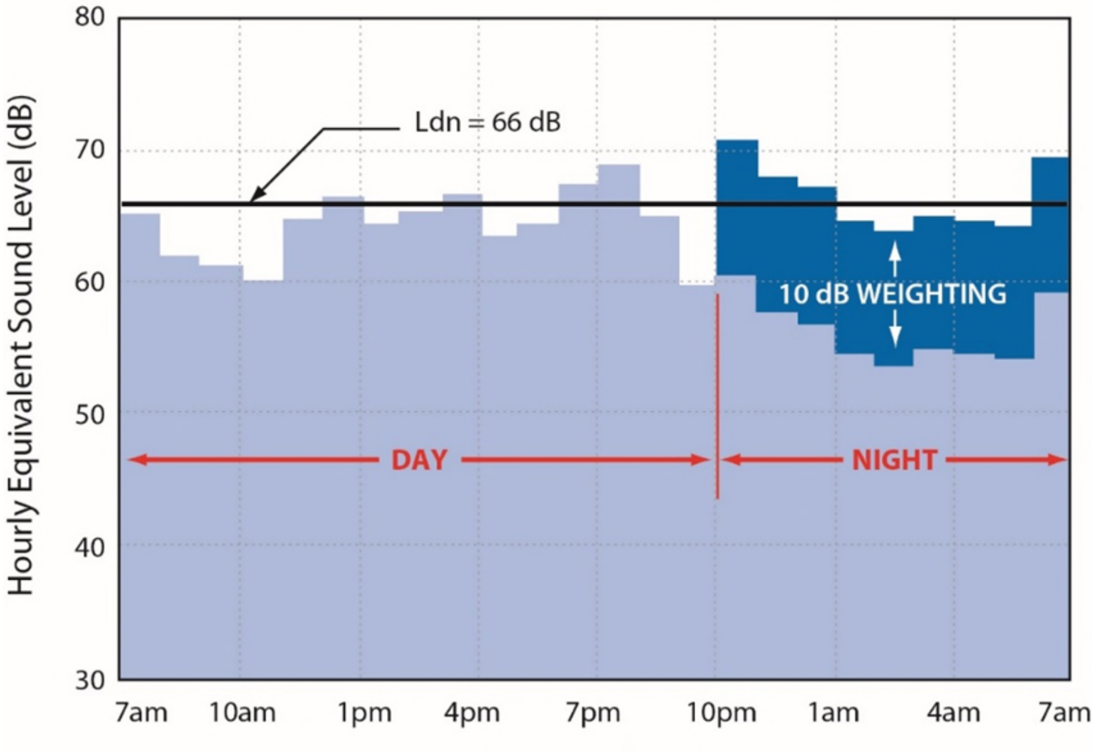


Figure 6. Example of a Day-Night Average Sound Level Calculation

Source: HMMH

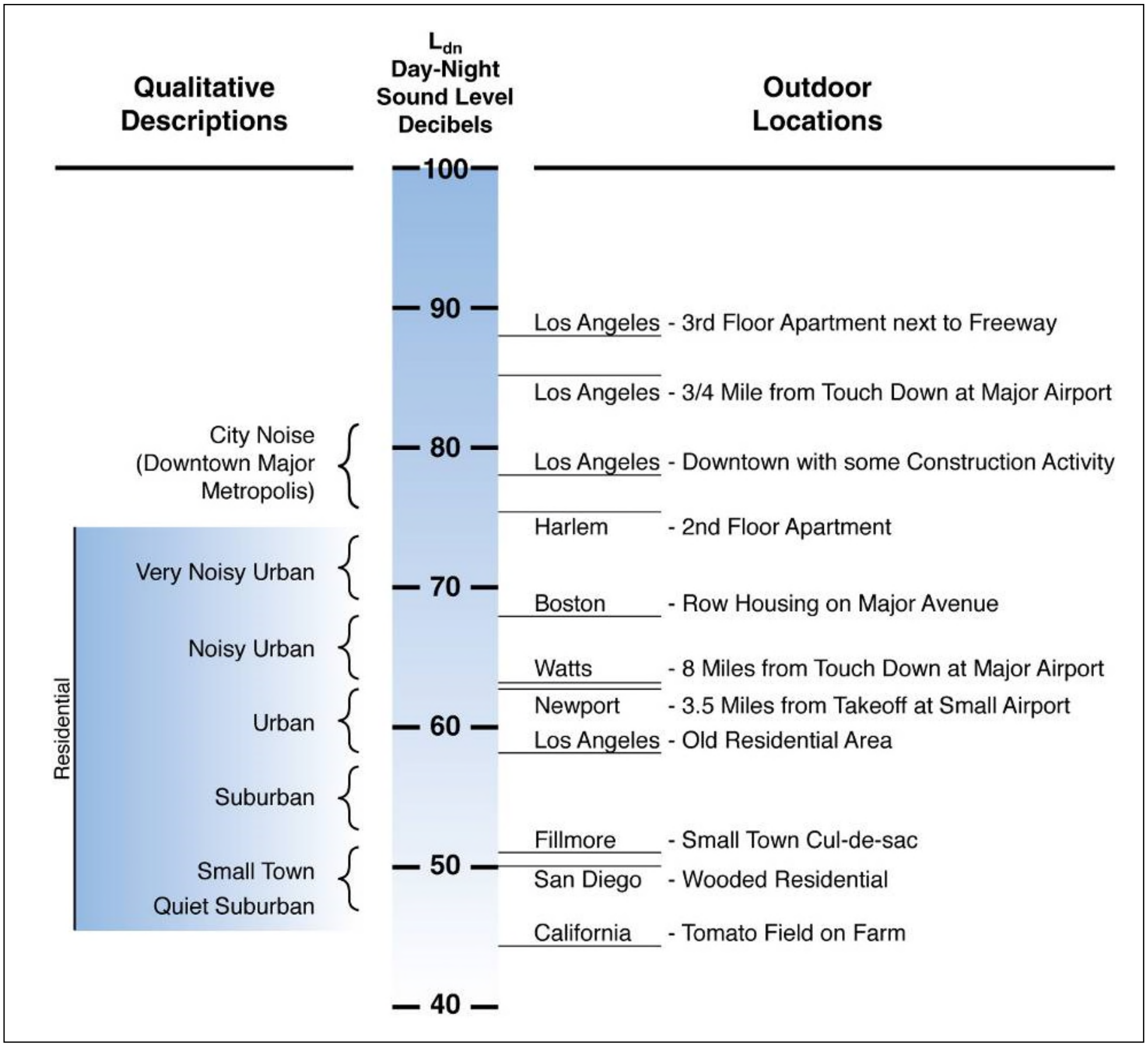


Figure 7. Examples of Measured Day-Night Average Sound Levels, DNL

Source: U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," March 1974, p.14.

1.2 Aircraft Noise Effects on Human Activity

Aircraft noise can be an annoyance and a nuisance. It can interfere with conversation and listening to television, disrupt classroom activities in schools, and disrupt sleep. Relating these effects to specific noise metrics helps in the understanding of how and why people react to their environment.

1.2.1 Speech Interference

One potential effect of aircraft noise is its tendency to "mask" speech, making it difficult to carry on a normal conversation. The sound level of speech decreases as the distance between a talker and listener increases. As the background sound level increases, it becomes harder to hear speech.

Figure 8 presents typical distances between talker and listener for satisfactory outdoor conversations, in the presence of different steady A-weighted background noise levels for raised, normal, and relaxed voice effort. As the background level increases, the talker must raise his/her voice, or the individuals must get closer together to continue talking.

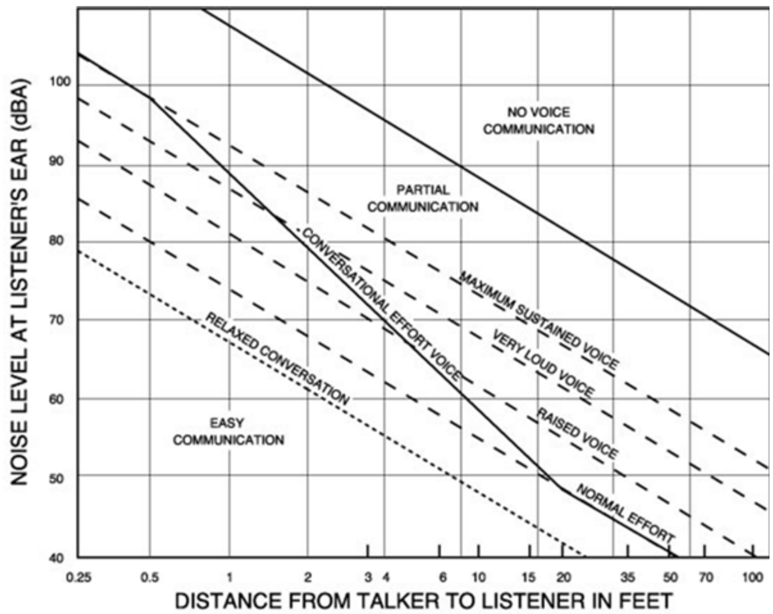


Figure 8. Outdoor Speech Intelligibility

Source: U.S. EPA, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," March 1974, p.D-5.

Satisfactory conversation does not always require hearing every word; 95% intelligibility is acceptable for many conversations. In relaxed conversation, however, we have higher expectations of hearing speech and generally require closer to 100% intelligibility. Any combination of talker-listener distances and background noise that falls below the bottom line in the figure (which roughly represents the upper boundary of 100% intelligibility) represents an ideal environment for outdoor speech communication. Indoor communication is generally acceptable in this region as well.

One implication of the relationships in **Figure 8** is that for typical communication distances of three or four feet, acceptable outdoor conversations can be carried on in a normal voice as long as the background noise outdoors is less than about 65 dB. If the noise exceeds this level, as might occur when an aircraft passes overhead, intelligibility would be lost unless vocal effort were increased or communication distance were decreased.

Indoors, typical distances, voice levels, and intelligibility expectations generally require a background level less than 45 dB. With windows partly open, housing generally provides about 10 to 15 dB of interior-to-exterior noise level reduction. Thus, if the outdoor sound level is 60 dB or less, there is a reasonable chance that the resulting indoor sound level will afford acceptable interior conversation. With windows closed, 24 dB of attenuation is typical.

1.2.2 Sleep Interference

Research on sleep disruption from noise has led to widely varying observations. In part, this is because (1) sleep can be disturbed without awakening, (2) the deeper the sleep the more noise it takes to cause arousal, (3) the tendency to awaken increases with age, and other factors. **Figure 9** shows a summary of findings on the topic.

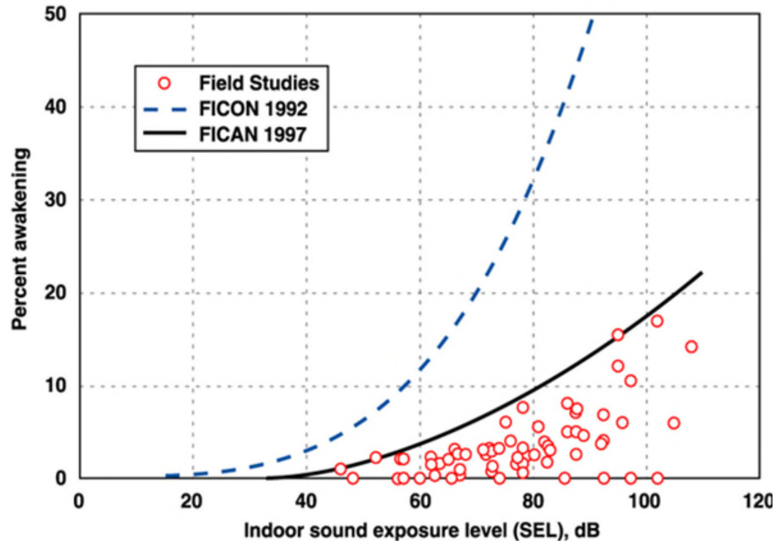


Figure 1. Sleep Interference

Source: Federal Interagency Committee on Aircraft Noise (FICAN), "Effects of Aviation Noise on Awakenings from Sleep," June 1997, pg. 6

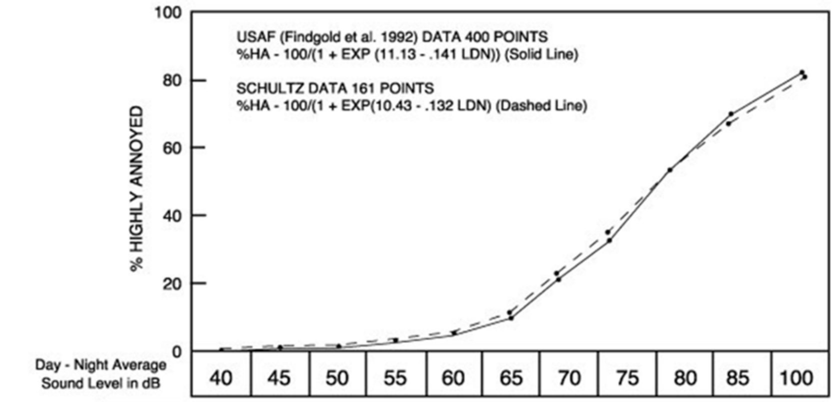
Figure 9 uses indoor SEL as the measure of noise exposure; current research supports the use of this metric in assessing sleep disruption. An indoor SEL of 80 dBA results in a maximum of 10% awakening.[7]

1.2.3 Community Annoyance

Numerous psychoacoustic surveys provide substantial evidence that individual reactions to noise vary widely with noise exposure level. Since the early 1970s, researchers have determined (and subsequently confirmed) that aggregate community response is generally predictable and relates reasonably well to cumulative noise exposure such as DNL. **Figure 10** depicts the widely recognized relationship between environmental noise and the percentage of people "highly annoyed," with annoyance being the key indicator of community response usually cited in this body of research. Separate work by the EPA showed that overall community reaction to a noise environment was also correlated with DNL. **Figure 11** depicts this relationship.

As noted above in the discussion of DNL, the full report on the FAA's recent research, polling communities surrounding 20 airports nationwide, was released in January 2021. At the time of this reporting, the public review and comment period on that research had ended but FAA had not yet issued new guidance.

[7] The awakening data presented in Figure A-9 apply only to individual noise events. The American National Standards Institute (ANSI) has published a standard that provides a method for estimating the number of people awakened at least once from a full night of noise events: ANSI/ASA S12.9-2008 / Part 6, "Quantities and Procedures for Description and Measurement of Environmental Sound – Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes." This method can use the information on single events computed by a program such as the FAA's AEDT, to compute awakenings.



Calculated %HA Points												
	USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
	SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Figure 10. Percentage of People Highly Annoyed

Source: FICON, "Federal Agency Review of Selected Airport Noise Analysis Issues," September 1992

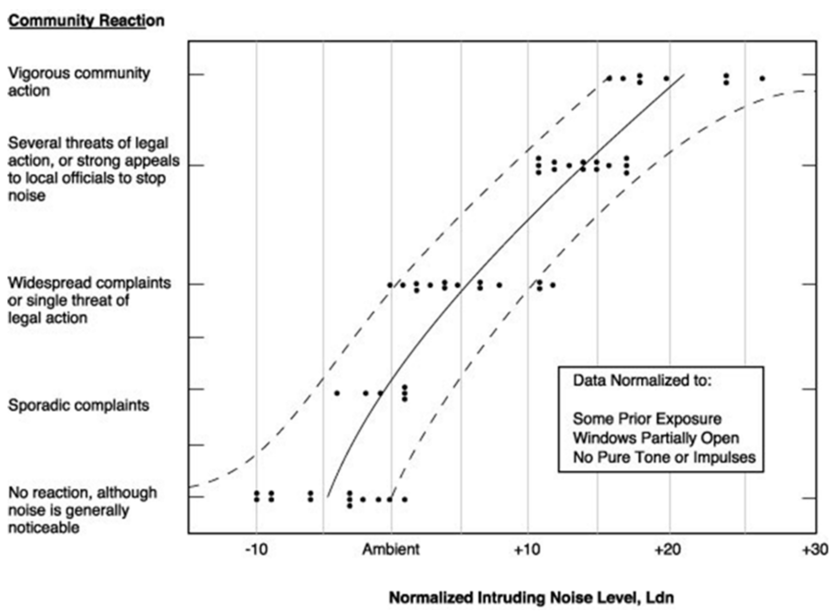


Figure 11. Community Reaction as a Function of Outdoor DNL

Source: Wyle Laboratories, Community Noise, prepared for the U.S. EPA, Office of Noise Abatement and Control, Washington, D.C., December 1971, pg. 63

Data summarized in the figure suggest that little reaction would be expected for intrusive noise levels five decibels below the ambient, while widespread complaints can be expected as intruding noise exceeds background levels by about five decibels. Vigorous action is likely when levels exceed the background by 20 dB.

1.3 Noise Propagation

This section presents information sound-propagation effect due to weather, source-to-listener distance, and vegetation.

1.3.1 Weather-Related Effects

Weather (or atmospheric) conditions that can influence the propagation of sound include humidity, precipitation, temperature, wind, and turbulence (or gustiness). The effect of wind – turbulence in particular – is generally more important than the effects of other factors. Under calm-wind conditions, the importance of temperature (in particular vertical "gradients") can increase, sometimes to very significant levels. Humidity generally has little significance relative to the other effects.

1.3.2 Influence of Humidity and Precipitation

Humidity and precipitation rarely effect sound propagation in a significant manner. Humidity can reduce propagation of high-frequency noise under calm-wind conditions. This is called "Atmospheric absorption." In very cold conditions, listeners often observe that aircraft sound "tinny," because the dry air increases the propagation of high-frequency sound. Rain, snow, and fog also have little, if any, noticeable effect on sound propagation. A substantial body of empirical data supports these conclusions.[8]

1.3.3 Influence of Temperature

The velocity of sound in the atmosphere is dependent on the air temperature.[9] As a result, if the temperature varies at different heights above the ground, sound will travel in curved paths rather than straight lines. During the day, temperature normally decreases with increasing height. Under such "temperature lapse" conditions, the atmosphere refracts ("bends") sound waves upwards and an acoustical shadow zone may exist at some distance from the noise source.

Under some weather conditions, an upper level of warmer air may trap a lower layer of cool air. Such a "temperature inversion" is most common in the evening, at night, and early in the morning when heat absorbed by the ground during the day radiates into the atmosphere.[10] The effect of an inversion is just the opposite of lapse conditions. It causes sound propagating through the atmosphere to refract downward.

The downward refraction caused by temperature inversions often allows sound rays with originally upward-sloping paths to bypass obstructions and ground effects, increasing noise levels at greater distances. This type of effect is most prevalent at night, when temperature inversions are most common and when wind levels often are very low, limiting any confounding factors.[11] Under extreme conditions, one study found that noise from ground-borne aircraft might be amplified 15 to 20 dB by a temperature inversion. In a similar study, noise caused by an aircraft on the ground registered a higher level at an observer location 1.8 miles away than at a second observer location only 0.2 miles from the aircraft.[12]

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[8] Ingard, Uno. "A Review of the Influence of Meteorological Conditions on Sound Propagation," *Journal of the Acoustical Society of America*, Vol. 25, No. 3, May 1953, p. 407.

[9] In dry air, the approximate velocity of sound can be obtained from the relationship:

$c = 331 + 0.6T_c$ (c in meters per second, T_c in degrees Celsius). Pierce, Allan D., *Acoustics: An Introduction to its Physical Principles and Applications.* McGraw-Hill. 1981. p. 29.

[10] Embleton, T.F.W., G.J. Thiessen, and J.E. Piercy, "Propagation in an inversion and reflections at the ground," *Journal of the Acoustical Society of America*, Vol. 59, No. 2, February 1976, p. 278.

[11] Ingard, p. 407.

[12] Dickinson, P.J., "Temperature Inversion Effects on Aircraft Noise Propagation," (Letters to the Editor) *Journal of Sound and Vibration.* Vol. 47, No. 3, 1976, p. 442.

1.3.4 Influence of Wind

Wind has a strong directional component that can lead to significant variation in propagation. In general, receivers that are downwind of a source will experience higher sound levels, and those that are upwind will experience lower sound levels. Wind perpendicular to the source-to-receiver path has no significant effect.

The refraction caused by wind direction and temperature gradients is additive.[13] One study suggests that for frequencies greater than 500 Hz, the combined effects of these two factors tends towards two extreme values: approximately 0 dB in conditions of downward refraction (temperature inversion or downwind propagation) and -20 dB in upward refraction conditions (temperature lapse or upwind propagation). At lower frequencies, the effects of refraction due to wind and temperature gradients are less pronounced.[14]

Wind turbulence (or "gustiness") can also affect sound propagation. Sound levels heard at remote receiver locations will fluctuate with gustiness. In addition, gustiness can cause considerable attenuation of sound due to effects of eddies traveling with the wind. Attenuation due to eddies is essentially the same in all directions, with or against the flow of the wind, and can mask the refractive effects discussed above.[15]

1.3.5 Distance-Related Effects

People often ask how distance from an aircraft to a listener affects sound levels. Changes in distance may be associated with varying terrain, offsets to the side of a flight path, or aircraft altitude. The answer is a bit complex, because distance affects the propagation of sound in several ways.

The principal effect results from the fact that any emitted sound expands in a spherical fashion – like a balloon – as the distance from the source increases, resulting in the sound energy being spread out over a larger volume. With each doubling of distance, spherical spreading reduces instantaneous or maximum level by approximately six decibels and SEL by approximately three decibels.

1.3.6 Vegetation-Related Effects

Sound can be scattered and absorbed as it travels through vegetation. This results in a decrease in sound levels. The literature on the effect of vegetation on sound propagation contains several approaches to calculating its effect. Though these approaches differ in some aspects, they agree on the following:

- The vegetation must be dense and deep enough to block the line of sight
- The noise reduction is greatest at high frequencies and least at low frequencies

The International Standard ISO 9613-2[16] provides a useful example of the types of calculations employed in these methods. Originally developed for industrial noise sources, ISO 9613-2 is well-suited for the evaluation of ground-based aircraft noise sources under favorable meteorological conditions for sound propagation. ISO 9613-2's methodology for calculating sound propagation includes geometric dispersion

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[13] Piercy and Embleton, p. 1412. Note, in addition, as a result of the scalar nature of temperature and the vector nature of wind, the following is true: under lapse conditions, the refractive effects of wind and temperature add in the upwind direction and cancel each other in the downwind direction. Under inversion conditions, the opposite is true.

[14] Piercy and Embleton, p. 1413.

[15] Ingard, pp. 409-410.

[16] International Organization for Standardization, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of calculation, International Standard ISO9613-2, Geneva, Switzerland (15 December 1996).

from acoustical point sources, atmospheric absorption, the effects of areas of hard and soft ground, screening due to barriers, and reflections. The attenuation provided by dense foliage varies by octave band and by distance as shown in **Table 1**.

For propagation through less than 10 m of dense foliage, no attenuation is assumed. For propagation through 10 m to 20 m of dense foliage, the total attenuation is shown in the first row of **Table 1**. For distances between 20 m and 200 m, the total attenuation is computed by multiplying the distance of propagation through dense foliage by the dB/m values shown in the second row of **Table 1**.

Table 1. Dense Foliage Noise Attenuation

Source: ISO 9613-2, Table A.1

Propagation Distance	Nominal Midband Frequency (Hz)							
	63	125	250	500	1,000	2,000	4,000	8,000
10 m to 20 m (dB Attenuation)	0	0	1	1	1	1	2	3
20 m to 200 m (dB/m Attenuation)	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.12

ISO 9613-2 assumes a moderate downwind condition. The equations in the ISO Standard also hold, equivalently, for average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights. In either case, the sound is refracted downward. The radius of this curved path is assumed to be 5 km. With this curved sound path, only portions of the sound path may travel through the dense foliage, as illustrated by **Figure 12**. Thus, the relative locations of the source and receiver, the dimensions of the volume of dense foliage, and the contours of the intervening terrain are essential to the estimation of the noise attenuation.

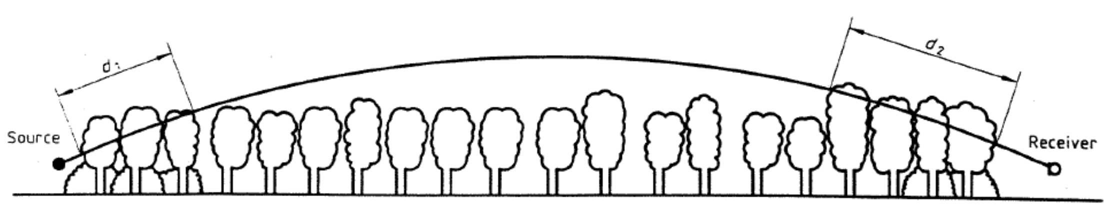

Figure 12. Downward Refracting Sound Path

Source: ISO 9613-2

As illustrated in **Figure 12**, the foliage only provides attenuation if the sound path passes through the foliage. For aircraft in the air, the sound will pass through little, if any foliage. Additionally, either the noise source or receiver must be near the foliage for it to have an effect.

2. Noise and Noise-Compatible Land Use

This section describes the regulations, affected environment, significance threshold(s) pertaining to noise and noise-compatible land use, the methodologies used to determine potential noise effects, and identifies potential noise impacts of the No Action Alternative and the Proposed Action, as well as mitigation measures, if needed.

2.1 Regulatory Setting

2.1.1 Federal Aviation Regulations, Part 36

Federal Aviation Regulations (FAR), Part 36, "Noise Standards: Aircraft Type and Airworthiness Certification," sets noise standards for issuance of new aircraft type certificates. Aircraft are certified as Stage 1 through Stage 5 depending on their noise level, weight, and number of engines. Stage 1 and Stage 2 aircraft, which are the noisiest aircraft, are no longer permitted to operate in the continental U.S. Although aircraft meeting Part 36 standards are noticeably quieter than many of the older aircraft, the regulations make no determination that such aircraft are acceptably quiet for operations at any given airport. Stage 5 aircraft are the newest and quietest aircraft. All aircraft certificated after January 1, 2018, must meet Stage 5 limits, which are a cumulative 7 decibels (dB) below Stage 4 aircraft and 17 dB below Stage 3 aircraft.

2.1.2 Federal Aviation Noise Abatement Policy

The Federal Aviation Noise Abatement Policy establishes the noise abatement authority and responsibilities of the federal government, airport proprietors, state and local governments, air carriers, air travelers, shippers, and airport area residents and prospective residents. It emphasizes that the FAA's role is primarily one of regulating noise and its source (the aircraft), plus supporting local efforts to develop airport noise abatement plans. The FAA gives high priority in the allocation of Airport Development Aid Program (ADAP) funds to projects designated to ensure compatible use of land near airports, but it is the role of state and local governments and airport proprietors to undertake the land use and operational actions necessary to promote compatibility.

2.1.3 Aviation Safety and Noise Abatement Act of 1979

The Aviation Safety and Noise Abatement Act of 1979 establishes funding for noise compatibility planning and sets the requirements by which airport operators can apply for funding. This is also the law by which Congress mandated that the FAA develop and airport community noise metric to be used by all federal agencies assessing or regulating aircraft noise. The result was DNL. Because California already had a well-established airport community noise metric in CNEL, and because CNEL and DNL are so similar, FAA expressly allows CNEL to be used in lieu of DNL in noise assessments performed for California airports. The ACT does not require an airport to develop a noise compatibility program, rather, that is accomplished through the Code of Federal Regulations (CFR) Part 150. CFR Part 150 sets forth standards for airport operators to use when documenting noise exposure around airports and for establishing programs, subject to FAA approval, to reduce noise-related noncompatible land use.

2.1.4 Airport Noise and Capacity Act of 1990

The Airport Noise and Capacity Act of 1990 (ANCA) sets forth several provisions related to the regulation of aircraft activities at airports. One of the most notable aspects of ANCA is that it precludes the local imposition of noise and access restrictions that are not otherwise in accordance with the national noise polity unless the restrictions are "grandfathered" under ANCA, in which case the restrictions are free from the restrictions that ANCA otherwise would impose. ANCA established two broad directives to the FAA: 1) establish a method to review aircraft noise, airport use, or airport access restrictions proposed by airport proprietors; and 2) institute a program to phase-out Stage 2 aircraft over 75,000 pounds by December 21, 1999. ANCA applies to all new local noise restrictions and amendments to existing restrictions proposed after October 1990.

2.1.5 FAA Order 1050.1F, Environmental Impacts: Policies and Procedures

This Order serves as the Federal Aviation Administration's (FAA) policy and procedures for compliance with NEPA and implementing regulations issued by the Council on Environmental Quality (CEQ). The provisions of this Order and the CEQ Regulations apply to actions directly undertaken by the FAA and to actions undertaken by a non-Federal entity where the FAA has authority to condition a permit, license, or other approval. The requirements in this Order apply to, but are not limited to, the following actions: grants, loans, contracts, leases, construction and installation actions, procedural actions, research activities, rulemaking and regulatory actions, certifications, licensing, permits, plans submitted to the FAA by state and local agencies for approval, and legislation proposed by the FAA. Order 1050.1F and the 1050.1F 2020 Desk Reference provides the specific requirements for this EA.

2.1.6 FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions

The Federal Aviation Administration's Office of Airports (ARP) is responsible for identifying major Federal actions involving the Nation's public-use airports. After determining that an airport sponsor is proposing a major Federal action such as this EA, ARP is responsible for analyzing the environmental effects of that action and its alternatives. Order 5050.4B provides instruction on evaluating those environmental effects. Order 5050.4B supplements FAA Order 1050.1F, "Environmental Impacts: Policies and Procedures."

These laws and guidance documents specify the use of DNL—the Day-Night Average Sound Level—as the noise metric used in all FAA aviation noise studies in airport communities. DNL, a cumulative sound level, provides a measure of total sound energy. DNL is a logarithmic average of the sound levels of multiple events at one location over a 24-hour period. A 10-decibel (dB) penalty is added to all sounds occurring during nighttime hours (between 10:00 p.m. and 6:59 a.m.). The 10 dB increase for nighttime events accounts for the added intrusiveness of noise during typical sleeping hours as ambient sound levels during nighttime hours are typically about 10 dB lower than during daytime hours.

For a NEPA noise analysis, the FAA requires that the 24-hour analysis period represent the average annual day (AAD). The AAD reflects the daily aircraft operations averaged over a 365-day period.

Estimates of noise effects resulting from aircraft operations can be interpreted in terms of the probable effects on human activities that typically occur within specific land uses. The FAA has adopted guidelines for evaluating land-use compatibility with noise exposure. In general, most land uses are considered compatible with DNL less than 65 dB, but only certain uses are compatible with DNL greater than or equal to 65 dB.

The noise analysis compares the No Action and Proposed Action Alternative for the future year using the FAA's thresholds of significance. Table 1 defines the significance threshold for changes in noise in accordance with FAA Order 1050.1F. When an action (compared to the No Action Alternative for the same timeframe) would cause noise-sensitive areas to have a DNL greater than or equal to 65 dB and experience a change in noise of at least 1.5 dB, the impact is considered significant. For example, an increase from No Action 65.5 DNL to Proposed Action 67 DNL is considered a significant impact, as is an increase from No Action 63.5 DNL to Proposed Action 65 DNL. **Table 2** also lists FAA-defined reportable changes of noise levels.

Table 2. Aircraft DNL Thresholds and Impact Categories

Source: FAA Order 1050.1F and the 1050.1F 2020 Desk Reference

	DNL 65 dB or Greater	Greater than or equal to DNL 60 dB but less than DNL 65 dB	Greater than or equal to DNL 45 dB but less than DNL 60 dB
Minimum Change in DNL when compared to the higher of the Proposed Action or No Action Alternative DNL	1.5 dB	3.0 dB	5.0 dB
Level of Change	Significant	Reportable	Reportable

In addition to defining significant impacts, FAA Order 1050.1F includes additional reporting requirements, including:

- The location and number of noise-sensitive uses at or above DNL 65 dB
- The disclosure of potentially newly noncompatible land use regardless of whether there is a significant noise impact
- Maps reporting the number of residences or people residing at or above DNL 65 dB for at least the 65 dB, 70 dB, and 75 dB exposure levels

FAA Order 1050.1F states, "Special consideration needs to be given to the evaluation of the significance of noise impacts on noise-sensitive areas within Section 4(f) properties (including, but not limited to, noise-sensitive areas within national parks; national wildlife and waterfowl refuges; and historic sites, including traditional cultural properties) where the land use compatibility guidelines in 14 CFR Part 150 are not relevant to the value, significance, and enjoyment of the area in question." For example, the DNL 65 dB threshold does not adequately address the impacts of noise on visitors to areas within a national park or national wildlife and waterfowl refuge where other noise is very low and a quiet setting is a generally recognized purpose and attribute. Levels of changes for noise-sensitive locations include:

- Significant noise impact: DNL increase of 1.5 dB or more in areas of 65 dB DNL and higher
- Reportable changes:
  - DNL increase of 3 dB or more in areas between 60 and 65 dB DNL
  - DNL increase of 5 dB or more in areas between 45 and 60 dB DNL

2.2 Noise-Compatible Land Use

NEPA requires the review of land uses located in the airport environs to understand the relationship between those land uses and the noise exposure associated with arriving and departing aircraft. This includes delineation of land uses within the 65 DNL and higher aircraft noise exposure contours on the noise contour exhibits and identification of noise-sensitive uses that may be noncompatible with that level of noise exposure. Identification of a noise-sensitive use within the 65 DNL contour does not necessarily mean that the use is either considered noncompatible or that it is eligible for mitigation. Rather, identification merely indicates that the use is generally considered noncompatible but requires further investigation. Factors that influence compatibility and/or eligibility may include but are not limited to previous sound reduction treatments, current interior noise levels, structure condition, ambient and self-generated noise levels, whether a given use is considered temporary or permanent, and the timeframe within which a given structure was constructed.

This chapter provides a description of recommended land uses that are deemed generally compatible under Appendix A of Part 150.

2.2.1 Land Use Compatibility Guidelines

The objective of airport noise compatibility planning is to promote compatible land use in communities surrounding airports. NEPA requires the review of land uses surrounding an airport to determine land use compatibility associated with aircraft activity at the airport.

The FAA has published land use compatibility designations, as set forth in Part 150, Appendix A, Table 1[17] (reproduced here as **Table 3**). As the table indicates, the FAA generally considers all land uses to be compatible with aircraft-related DNL below 65 dB, including residential, hotels, retirement homes, intermediate care facilities, hospitals, nursing homes, schools, preschools, and libraries. These categories are referenced throughout the EA. Institutional or Public land use land use consists of schools, hospitals, nursing homes, churches, auditoriums, concert halls, governmental services, transportation, and parking. While all these uses are compatible with aircraft-related DNL below 65 dB, schools are not compatible above 65 DNL without mitigation and are listed separately in the EA.

[17] Appendix A, Part 150 Table 1 can be found in 14 CFR Part 150, Airport Noise Compatibility Planning

https://www.ecfr.gov/current/title-14/chapter-I/subchapter-I/part-150/appendix-

Appendix%20A%20to%20Part%20150?msclkid=cba3d6bfa60d11ec83ea1e9ed3e3b966

Table 3. Part 150 Land Use Compatibility with Yearly Day-Night Average Sound Levels

Source: FAA Part 150, Appendix A, Table 1, 2007

Land Use	Yearly Day-Night Average Sound Level [DNL] in Decibels (Key and notes on following page)					
Residential Use						
Residential other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home park	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Retail trade–general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Land Use	**Yearly Day-Night Average Sound Level [DNL] in Decibels**					
Manufacturing and Production						
Manufacturing general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

SLUCM = Standard Land Use Coding Manual

Y(Yes): Land use and related structures compatible without restrictions.
N(No): Land use and related structures are not compatible and should be prohibited.
NLR: Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, or 35: Land use and related structures generally compatible; measures to achieve NLR of 25 dBA, 30 dBA, or 35 dBA must be incorporated into design and construction of structure.

<u>Notes for Table 2:</u>

The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise-compatible land uses.

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dBA and 30 dBA should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dBA, thus, the reduction requirements are often stated as 5 dBA, 10 dBA, or 15 dBA over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.

(2) Measures to achieve NLR of 25 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

(3) Measures to achieve NLR of 30 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas or where the normal noise level is low.

(4) Measures to achieve NLR of 35 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

(5) Land use compatible provided special sound reinforcement systems are installed.

(6) Residential buildings require an NLR of 25 dBA

(7) Residential buildings require an NLR of 30 dBA

(8) Residential buildings not permitted

2.2.2 Study Area

To adequately capture the effects of aircraft noise, the noise study area (NSA) must include not only the immediate airport environs, where aircraft flight paths are aligned with the runways, but also other potentially affected areas over which aircraft would fly as they follow any modified flight corridors that join the surrounding airspace. The NSA was developed to encompass an area that would contain at least the lateral extent of the estimated 60 DNL contour resulting from aircraft flight and ground operations contemplated under the Proposed Action, with an adequate buffer to accommodate potential changes in the contour between the No Action and Proposed Action Alternatives. **Figure 13** displays the general extent of the NSA on the land use map. The NSA is approximately 4 Nautical Miles (NMI) to the east and west and 4 NMI to the north and south.

2.2.3 Existing Land Use

HOU is located approximately 6 NMI southeast from downtown Houston.

Existing land use in the study area consists of the HOU property, residential uses, commercial, and industrial land uses, as shown on **Figure 13**. HOU is surrounded to the north and south by residential areas consisting of single-family and multi-family residences and commercial areas. The areas to the west and east are primarily industrial and commercial facilities with areas of residential land use to the west of Runway 4 and east of Runway 31L.

All noise-sensitive sites such as schools, nursing homes, hospitals and places of worship have been identified and are shown on **Figure 13**. Any potential noncompatible land use and the noise-sensitive sites within the study area are evaluated in the EA.

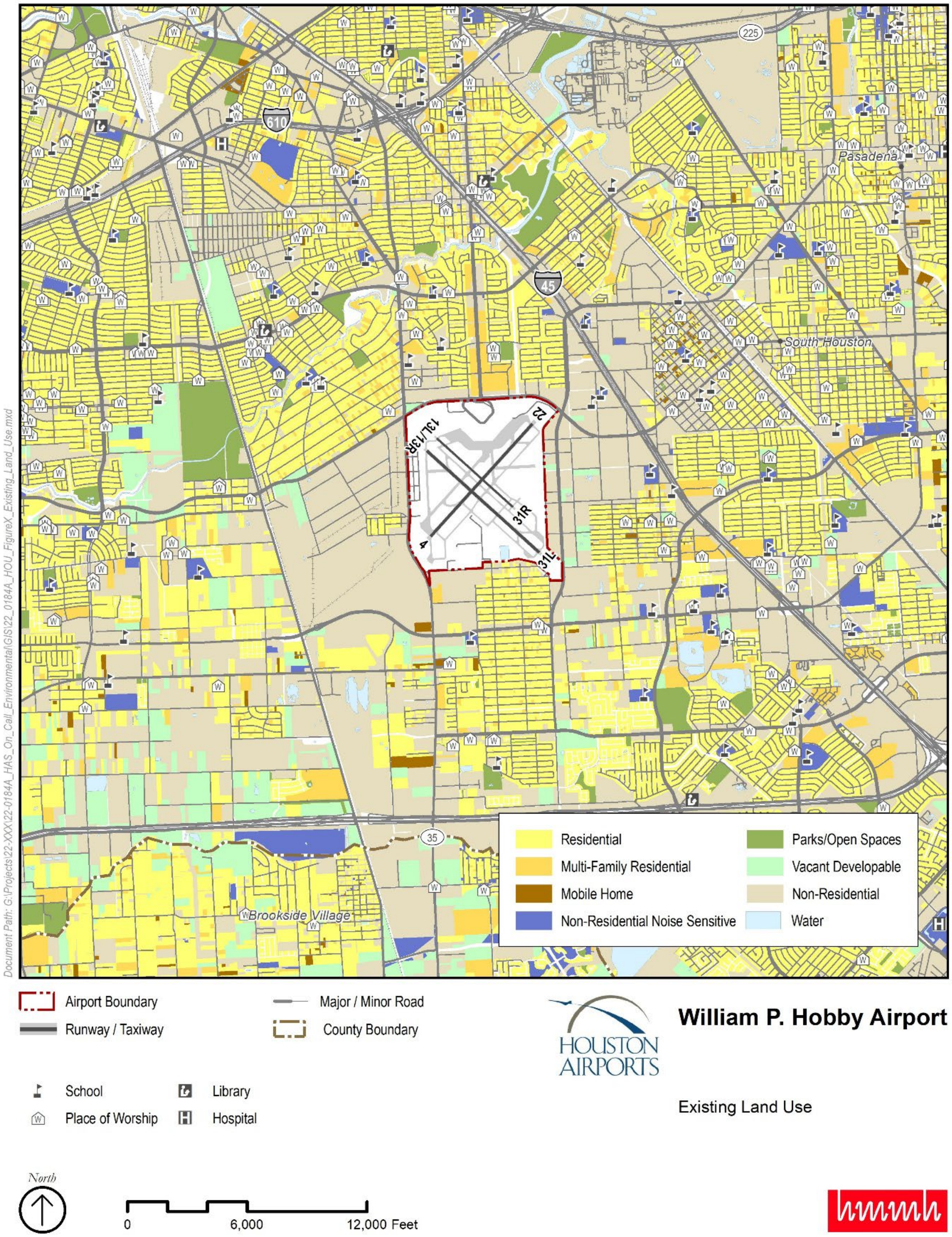

Figure 13. Existing Land Use

3. Modeling Methodology

The following sections present the modeling methodology for the noise analysis for the future no action and future proposed action alternatives.

3.1 Aviation Environmental Design Tool (AEDT)

For an action occurring on, or in the vicinity of a single airport, or as part of an air traffic action, FAA directs the use of the latest version of the Aviation Environmental Design Tool (AEDT) for detailed noise modeling or another model, as approved by FAA. The model must be used to produce DNL 65 dB, DNL 70 dB, and DNL 75 dB contours, and others as needed.

The aircraft noise analysis for the EA uses AEDT Version 3f (released December 13, 2023). All AEDT modeling conducted for this study adheres to "*Guidance on Using the AEDT to Conduct Environmental modeling for FAA Actions Subject to NEPA*" (FAA 2017). AEDT is a combined noise and emission model that uses a database of aircraft noise and performance characteristics. The AEDT predicts ground based DNL values from user input for aircraft types, AAD aircraft operations, airport operating conditions, aircraft performance, and flight patterns. AEDT also calculates air pollutant emissions from aircraft engines for air quality analyses, enables noise and air quality calculations on a regional basis (as opposed to in the immediate airport environment only), and includes updated databases for newer aircraft models.

The noise pattern calculated by the AEDT for an airport is a function of several factors, including: the number of aircraft operations during the period evaluated, the types of aircraft flown, the time of day when they are flown, the way they are flown, how frequently each runway is used for landing and takeoff, and the routes of flight used to and from the runways. Substantial variations in any one of these factors may, when extended over a long period of time, cause marked changes to the noise pattern.

The primary data input categories for the AEDT are:

- Airfield layout, which includes the coordinates of each runway centerline endpoint, runway widths, approach threshold crossing heights, and runway end elevations.
- Meteorological data, which refers to weather conditions affecting sound propagation and aircraft performance. AEDT's database of airports was accessed to obtain annual average daily HOU weather conditions. AEDT's airport database contains 10-year average meteorological data (from 2013 to 2022), which AEDT uses to adjust aircraft performance and sound propagation parameters from standard day conditions.
  - Temperature: 70.95° F
  - Station Pressure: 1014.7 mbar
  - Sea Level Pressure: 1017. 1 mbar
  - Dew point: 61.29° F
  - Relative humidity: 71.62%
- Terrain data, which refers to ground elevations. AEDT uses terrain data to adjust the aircraft-to-ground path length, which is the distance between the modeled location on the ground and the aircraft in flight, making the ground closer to or farther from the aircraft relative to flat-earth

conditions. AEDT does not use terrain data to account for shielding or reflective effects of terrain.

- Specific aircraft types in HOU's fleet mix, defined by airframe and engine type combinations. All aircraft types evaluated for the HOU modeling are in the AEDT database.
- Aircraft flight operations, which are numbers of AAD aircraft operations by DNL time periods and by aircraft type. Daytime is defined as 7:00 a.m. to 9:59 p.m. and nighttime is defined as 10:00 p.m. to 6:59 a.m. Departures and arrivals were the two types of flight operations modeled for the EA.
- Aircraft noise and performance characteristics. The AEDT database contains noise and performance data for more than 300 different aircraft types. AEDT accesses the noise and performance data for takeoff, landing, and pattern operations by those aircraft. The database provides single-event noise levels for slant distances from 200 feet to 25,000 feet for several thrust or power settings for each aircraft type. Performance data includes thrust, speed, and altitude profiles for takeoffs and landings.
- Stage length, which is a surrogate for an aircraft's weight that varies according to its fuel load. Stage length is assigned according to each departure's trip distance to its destination, using city-pair information provided in the operations forecast. The assigned stage length then determines the appropriate flight performance profile from the AEDT database.
- Flight profiles, which are based on standard flight procedures for each aircraft type contained in the AEDT database. Information in the flight profiles describe the sequence of altitudes, thrust/power settings, and airspeeds for departure and arrival operations.
- Runway use, which is the allocation of flight operations to each runway, on an AAD basis, by DNL time periods, operation type, and aircraft type.
- Flight tracks and their usage. A flight track is the two-dimensional projection of the aircraft's three-dimensional flight path onto the ground. A modeled flight track represents one or more actual flight tracks. Modeled flight tracks for a given flight corridor typically consist of a backbone track and sub-tracks which represent the average location and dispersion of the actual flights in the corridor. Each backbone flight track typically represents a general heading for departures or originating point for arrivals. As each runway usually has multiple headings and originating points, the distribution of operations, or track use, on an AAD basis, must be specified. Operations are further spread on backbone tracks and sub-tracks via distribution percentages on an AAD basis.

3.2 Noise Exposure Contours

Noise contours (i.e., lines of equal noise exposure, usually expressed in terms of DNL) are typically used to illustrate average daily noise exposure around an airport. Noise contours are conceptually similar to topographic contour maps. A set of concentric contours, representing successively lower DNL, usually extends away from the airport's runways. DNL contours are typically presented in 5 dB increments on a base map, with each successive contour representing a 5 dB decrease in noise exposure on an AAD basis. Contours developed for the EA represent 65 DNL, 70 DNL, and 75 DNL. 60 DNL is also shown for informational purposes only.

For purposes of the EA, the noise contours show areas exposed to each DNL level. It is important to recognize that a line drawn on a map does not imply that a particular noise condition exists on one side of the line and not the other.

3.3 Grid Point Noise Calculations

Besides noise contours, the AEDT provides another way to show noise levels in the airport environs. DNL (or other metrics supported by the AEDT) can be calculated for specific locations, defined as grid points, and can be presented in a number of formats. Grid point analyses can show the change in noise levels over specific locations and are helpful in determining where significant or reportable noise changes may occur.

For the EA, noise levels are developed for one area-wide grid set. The NSA grid points are defined to cover the complete NSA area. The NSA grid consists of a rectangle with points spaced 0.02 NMI (122 feet) apart, extending approximately 5 NMI to the east and west and 5 NMI to the north and south from the Airport Reference Point (which is near the geographic center of HOU's runways).

4. Future Alternatives

The following sections discuss the development of the future 2027 aircraft operational forecast, runway use, flight tracks, and flight track usage for the future 2027 No Action and Proposed Action Alternative. **Section 4.8** discusses the comparison between the two alternatives.

4.1 Forecast

The forecast developed for the Domestic Redevelopment Program (DRP) was used as the basis for this EA. The EA forecast was compared to the FAA Terminal Area Forecast (TAF) released in January of 2024 and while higher than the 2023 TAF the forecast was within five percent of the total forecast operations and within 10 percent for commercial operations which is within FAA guidelines. Therefore, the interpolated DRP EA forecast was used for the future 2027 operational levels in this EA, which are shown in **Table 4**.

Table 4. 2027 Forecast Operations Compared to the FAA TAF

Source: HMMH, 2024; FAA 2023 TAF, HOU DRP EA Forecast

2027 Forecast	Air Carrier	Air Taxi	General Aviation	Military	Total
Interpolated DRP EA Forecast	153,162	29,960	54,967	670	238,759
FAA TAF	142,598	29,418	54,716	596	227,328
Difference	10,564	542	251	74	11,431
Percent Difference	7%	2%	0%	12%	5%

The interpolated DRP EA forecast for 2027 is used for the 2027 No Action and Proposed Action modeling for this EA.

Table 5. 2027 Forecast Annual and Average Annual Day Operations

Source: HMMH, 2024; HOU DRP EA Forecast

2027 Forecast	Air Carrier	Air Taxi	General Aviation	Military	Total
Annual Operations	153,162	29,960	54,967	670	238,759
Average Annual Day (AAD) Operations	419.6	82.1	150.6	1.8	654.1

Table 6. 2027 Forecast AAD Operations

Source: HMMH, 2024; HOU DRP EA Forecast

Category	Engine Type	AEDT Type	Arrivals		Departures		Total
			Day	Night	Day	Night	
Air Carrier	Jet	717200	2.9	0.4	2.8	0.5	6.6
		737700	104.2	11.2	101.2	14.2	230.8
		737800	46.6	9.6	44.6	11.6	112.4
		7378MAX	13.2	3.5	12.6	4.1	33.5
		A320-211	4.5	1.1	3.9	1.7	11.3
		A320-271N	1.8	0.3	1.8	0.3	4.1
		CRJ9-ER	9.4	1.1	8.8	1.7	21.0
		Subtotal	182.6	27.2	175.8	34.0	419.6
Air Taxi	Jet	BD-700-1A10	0.3	<0.1	0.3	<0.1	0.6
		BD-700-1A11	0.2	<0.1	0.2	<0.1	0.3
		CL600	3.3	<0.1	3.3	0.1	6.9
		CNA510	0.6	<0.1	0.6	0.1	1.4
		CNA55B	6.1	0.6	6.0	0.7	13.4
		CNA560XL	3.4	0.3	3.3	0.3	7.2
		CNA680	7.2	0.6	7.3	0.5	15.6
		CNA750	2.0	<0.1	2.0	<0.1	4.1
		EMB145	0.5	<0.1	0.5	0.0	0.9
		EMB14L	3.5	<0.1	3.5	<0.1	7.1
		FAL900EX	0.9	<0.1	0.9	<0.1	1.9
		GV	0.7	<0.1	0.7	<0.1	1.5
		LEAR35	5.2	0.9	4.9	1.2	12.2
		MU3001	0.9	<0.1	0.9	<0.1	1.9
	Turboprop	CNA208	<0.1	1.1	<0.1	1.0	2.1
		DHC6	2.3	0.2	2.3	0.2	5.0
		Subtotal	37.1	3.9	36.6	4.5	82.1
General Aviation	Jet	BD-700-1A10	0.3	<0.1	0.3	<0.1	0.7
		BD-700-1A11	0.4	<0.1	0.4	<0.1	0.9
		CIT3	2.3	0.1	2.2	0.3	4.9

Category	Engine Type	AEDT Type	Arrivals		Departures		Total
			Day	Night	Day	Night	
		CL600	3.4	0.2	3.4	0.2	7.2
		CL601	3.6	0.2	3.4	0.4	7.6
		CNA510	0.7	<0.1	0.7	<0.1	1.4
		CNA525C	6.0	0.3	5.7	0.6	12.4
		CNA55B	3.1	0.2	3.1	0.2	6.7
		CNA560U	2.8	0.2	2.9	0.1	6.1
		CNA560XL	3.5	0.2	3.5	0.2	7.4
		CNA680	3.1	0.2	3.1	0.2	6.4
		CNA750	3.4	0.2	3.4	0.2	7.1
		EMB145	0.2	<0.1	0.2	<0.1	0.5
		FAL900EX	2.7	<0.1	2.6	0.2	5.5
		G650ER	0.6	<0.1	0.6	<0.1	1.3
		GIV	3.8	0.3	3.7	0.4	8.3
		GV	1.4	0.1	1.4	0.1	3.0
		IA1125	0.8	<0.1	0.8	0.1	1.8
		LEAR35	9.9	1.0	9.7	1.2	21.8
		MU3001	1.9	0.1	1.9	0.1	4.1
	Turboprop	CNA208	2.1	0.1	2.1	0.2	4.5
		DHC6	8.5	0.7	8.4	0.8	18.4
	Piston	COMSEP	4.3	0.2	4.3	0.3	9.1
	Helicopter	B206L	1.0	<0.1	0.7	0.4	2.3
		EC130	0.3	0.2	0.3	0.2	1.1
		Subtotal	70.2	5.1	68.6	6.7	150.6
Military	**Jet**	GV	0.8	0.1	0.8	0.1	1.8
		Subtotal	0.8	0.1	0.8	0.1	1.8
Total			290.7	36.3	281.8	45.3	654.1
Note: Totals may not match exactly due to rounding.							

4.2 Physical Description of the Airfield Layout

The airport physical parameters of most importance are the locations of the aircraft noise sources, such as the start-of-takeoff roll (SOTR) for departing aircraft and the landing threshold for arriving aircraft. Information regarding the airfield layout at HOU was obtained from the FAA 5010 data[18], as shown in **Figure 14**. There are three operational runways; Runway 13R-31L is 7,602 feet long and 150 feet wide, Runway 13L-31R is 5,148 feet long and 100 feet wide, and Runway 4-22 is 7,602 feet long and 150 feet wide. Because helicopters do not use the runways like fixed-wing aircraft, helicopter activity is modeled

[18] https://adip.faa.gov/agis/public/#/simpleAirportMap/HOU

departing from and arriving to one of the “helipad” spots desginated on the airfields for modeling purposes. Those spots are indicated on **Figure 14**.

Table 7 provides the modeled physical parameters for the Forecast Conditions.

Table 7. HOU Airfield Layout Details

Source: FAA 5010 data, accessed September 26, 2024.

Runway	Latitude (degrees)	Longitude (degrees)	Elevation (feet, MSL)	Length (feet)	Displaced Landing Threshold (ft)	Glide Slope (degrees)	Threshold Crossing Height (ft)
13L	29.652607	-95.283871	44.9	5,148	-	3	60
31R	29.642782	-95.272203	39.6	5,148	-	-	-
13R	29.650935	-95.285511	44.6	7,602	1,034	3	52
31L	29.636424	-95.268285	41.5	7,602	-	3	76
4	29.63911	-95.285322	42.0	7,602	-	3	58
22	29.654158	-95.268712	38.9	7,602	-	3	49
FBO	29.639601	-95.275138	46.0	-	-	-	-
POLICE	29.649141	-95.268712	46.0	-	-	-	-

4.3 Runway Utilization

Aircraft arriving to a given runway end have a different noise signature than departing aircraft. For this reason, and because it indicates how often aircraft fly in any given direction, runway utilization is a key factor in determining the noise exposure around the airport. **Table 8** and **Table 9** summarize runway utilization rates modeled for each aircraft category in 2027 No Action scenario, developed from the 12-month Passur radar data. The rates are presented for all categories for each runway end. Runway choice is often dictated by wind conditions, but other factors such as the time of day, specific aircraft runway length requirements, and the relative location on the airfield influence the choice as well.

Table 8. Modeled 2027 No Action Jet Runway Use Percentages

Source: Passur Radar data

Runway	Air Carrier Jets				Air Taxi Jets				Geneal Aviation Jets				Military Jets			
	Arrivals		Departures		Arrivals		Departures		Arrivals		Departures		Arrivals		Departures	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
4	40%	37%	8%	8%	40%	36%	22%	34%	39%	37%	20%	23%	21%	16%	7%	37%
13L	--	--	--	--	<1%	--	<1%	<1%	<1%	<1%	<1%	<1%	14%	1%	3%	5%
13R	47%	52%	36%	39%	46%	49%	41%	40%	46%	52%	23%	23%	51%	24%	20%	48%
22	7%	6%	45%	44%	7%	9%	30%	20%	7%	6%	44%	44%	5%	48%	56%	6%
31L	7%	5%	12%	8%	7%	7%	7%	5%	7%	5%	12%	9%	8%	7%	6%	4%
31R	--	--	--	<1%	<1%	--	<1%	<1%	<1%	--	<1%	<1%	2%	5%	7%	<1%

Note: Column sums may not appear to be exactly 100% due to rounding.

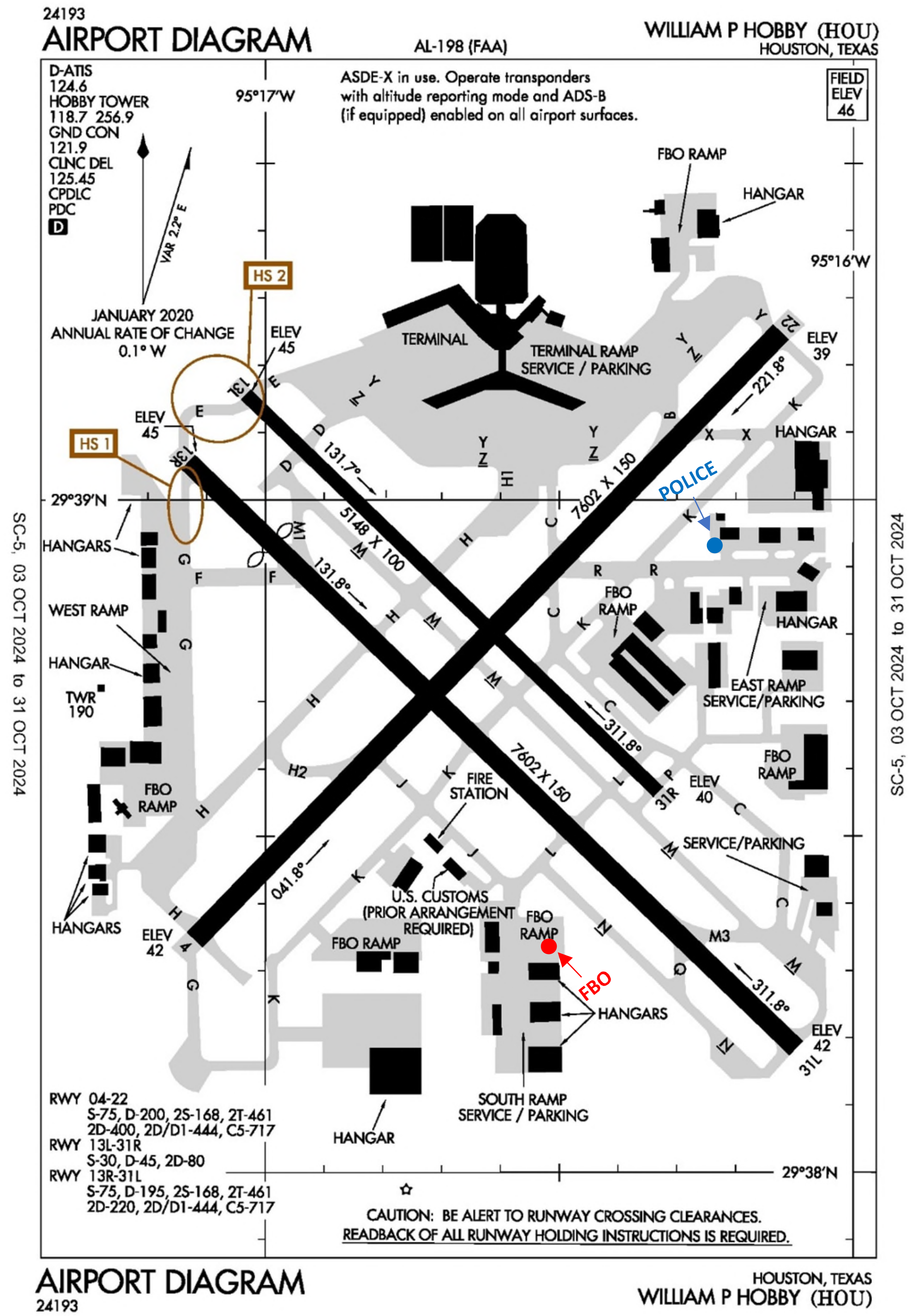

Figure 14. Existing Airport Layout: HOU Airport Diagram

Source: https://www.faa.gov/airports/runway_safety/diagrams, accessed October 4, 2024
Note: "Helipad" locations for noise modeling purposes are depicted with red and blue dots.

Table 9. Modeled 2027 No Action Non-Jet Runway Use Percentages

Source: Passur Radar data

Runway	Air Taxi Non-Jets				General Aviation Non-Jets			
	Arrivals		Departures		Arrivals		Departures	
	Day	Night	Day	Night	Day	Night	Day	Night
4	40%	44%	22%	36%	40%	39%	21%	28%
13L	6%	2%	2%	<1%	6%	3%	2%	3%
13R	40%	43%	34%	18%	40%	48%	24%	27%
22	6%	5%	31%	29%	7%	6%	39%	32%
31L	8%	6%	10%	16%	6%	4%	12%	6%
31R	<1%	--	2%	1%	<1%	--	2%	4%
Note: Column sums may not appear to be exactly 100% due to rounding.								

The proposed project will include full depth concrete pavement rehabilitation, replacement of the asphalt runway shoulder pavements, replacement of airfield signage, electrical lighting upgrades using LED technology, and runway painting and markings. Runway 13R-31L is expected to be fully closed during construction. The closure is expected to last at least 12 months; therefore, the Proposed Action reflects no operations on Runway 13R-31L for the 12-month period. The proposed project would cause temporary changes in runway use during construction and would potentially result in temporary changes in aircraft noise for some communities near the airport.

The No Action runway use was adjusted for the Proposed Action. In No Action scenario, Runways 4 and 13R are the most used arrival runways. Runways 13R and 22 are the most used departure runways. In the Proposed Action scenario, any aircraft that would normally depart from or land at Runway 13R would use Runway 4 instead. Any aircraft that would normally depart from or land at Runway 31L would use Runway 22 instead. Operations that use Runway 13L-31R would remain the same in the Proposed Action scenario. **Table 10** and **Table 11** provide the runway utilization rates modeled for each aircraft category in the 2027 Proposed Action scenario.

Table 10. Modeled 2027 Proposed Action Jet Runway Use Percentages

Source: Passur Radar data, HMMH 2024

Runway	Air Carrier Jets				Air Taxi Jets				Geneal Aviation Jets				Military Jets			
	Arrivals		Departures		Arrivals		Departures		Arrivals		Departures		Arrivals		Departures	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
4	87%	89%	43%	47%	86%	85%	62%	75%	85%	89%	43%	46%	72%	39%	28%	85%
13L	--	--	--	--	<1%	--	<1%	<1%	<1%	<1%	<1%	<1%	14%	1%	3%	5%
13R	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
22	13%	11%	57%	53%	14%	15%	37%	25%	15%	11%	56%	53%	13%	55%	62%	10%
31L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
31R	--	--	--	<1%	<1%	--	<1%	<1%	<1%	--	<1%	<1%	2%	5%	7%	<1%
Note: Column sums may not appear to be exactly 100% due to rounding.																

Table 11. Modeled 2027 Proposed Action Non-Jet Runway Use Percentages

Source: Passur Radar data, HMMH 2024

Runway	Air Taxi Non-Jets				General Aviation Non-Jets			
	Arrivals		Departures		Arrivals		Departures	
	Day	Night	Day	Night	Day	Night	Day	Night
4	80%	87%	56%	54%	80%	87%	45%	55%
13L	6%	2%	2%	<1%	6%	3%	2%	3%
13R	--	--	--	--	--	--	--	--
22	14%	11%	40%	44%	13%	10%	51%	38%
31L	--	--	--	--	--	--	--	--
31R	<1%	--	2%	1%	<1%	--	2%	4%
Note: Column sums may not appear to be exactly 100% due to rounding.								

4.4 Aircraft Stage Length and Operational Profiles

Within the AEDT database, aircraft departure profiles are defined by a range of trip distances identified as “stage lengths.” Higher stage lengths (longer trip distances) are associated with heavier aircraft due to the increase in fuel requirements for the flight. For example, a departure aircraft with a trip distance less than 500 NMI would be assigned a stage length value of one, where a departure aircraft with a trip distance of 3,000 NMI would be assigned a stage length value of five. Error! Reference source not found. provides the stage length classifications by their associated trip distances.

Table 12. AEDT Stage Length Categories

Source: AEDT 3f User Guide, December 2023

Category	Stage Length (NMI)
1	0-500
2	500-1,000
3	1,000-1,500
4	1,500-2,500
5	2,500-3,500
6	3,500-4,500
7	4,500-5,500
8	5,500-6,500
9	6,500-11,000
M	Maximum range at maximum takeoff weight
Note: Stage Length is defined as the distance an aircraft travels from takeoff to landing	

The stage lengths flown from HOU are based on the city pair information provided by the radar data operations. Typically, widebody aircraft which operate on long haul routes have higher stage lengths.

AEDT includes standard flight procedure data for each aircraft that represents each phase of flight to or from the airport. Information related to aircraft speed, altitude, thrust settings, flap settings, and distance are available and used by AEDT to calculate noise levels on the ground. Standard aircraft departure profiles are supplied from the runway (field elevation) up to 10,000 feet above ground level

(AGL). Aircraft arrival profiles are supplied from 6,000 feet AGL down to the runway including the application of reverse thrust and rollout. The FAA requires that these standard arrival and departure profiles be used unless there is evidence that they are not applicable. The noise calculations presented in this document used the standard AEDT departure profiles.

Table 13. Modeled Departure Stage Length Usage by Aircraft Type

Source: Passur Radar data, HMMH 2024

AEDT ANP Type	Stage Length (%)										Total
	1	2	3	4	5	6	7	8	9	M	
717200	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
737700	44%	42%	13%	1%	0%	0%	0%	0%	0%	0%	100%
737800	28%	53%	19%	<1%	0%	0%	0%	0%	0%	0%	100%
7378MAX	24%	52%	24%	0%	0%	0%	0%	0%	0%	0%	100%
A320-211	3%	97%	0%	0%	0%	0%	0%	0%	0%	0%	100%
A320-271N	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
BD-700-1A10	33%	31%	36%	0%	0%	0%	0%	0%	0%	0%	100%
BD-700-1A11	28%	31%	40%	0%	0%	1%	0%	0%	0%	0%	100%
CIT3	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CL600	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CL601	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CNA208	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CNA510	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CNA525C	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CNA55B	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CNA560U	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CNA560XL	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CNA680	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CNA750	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
COMSEP	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
CRJ9-ER	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
DHC6	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
EMB145	87%	10%	3%	0%	0%	0%	0%	0%	0%	0%	100%
EMB14L	96%	4%	0%	0%	0%	0%	0%	0%	0%	0%	100%
FAL900EX	45%	40%	13%	1%	0%	0%	0%	0%	0%	0%	100%
G650ER	26%	31%	43%	0%	0%	0%	0%	0%	0%	0%	100%
GIV	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
GV	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
IA1125	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
LEAR35	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
MU3001	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%

4.5 Flight Track Geometry and Utilization Rates

For the noise analysis, model flight tracks were developed representing the path along the ground over which aircraft generally fly. Departure corridors are defined by a series of individual flight tracks located across the width of the corridor. Generally, aircraft on approach to a runway end are located within a smaller corridor due to the use of navigational instruments. To model the flight corridors in AEDT, consolidated flight tracks were developed from the radar data and given a track ID. Flight tracks modeled for the existing conditions and forecast scenarios are shown in **Figure 15** (Arrival Tracks) and **Figure 16** (Departure Tracks). The modeled flight track percentages are shown in **Table 14.**

Table 14. Model Flight Track Utilization

Source: HOU DRP EA

Operation Type	Runway	Track Group	Air Carrier	Air Taxi		General Aviation		Military
			Jet	Jet	Non-Jet	Jet	Non-Jet	Jet
Arrivals	**4**	RW4	100%	100%	100%	100%	100%	100%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	13L	RW13L	100%	100%	100%	100%	100%	100%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	13R	RW13R	100%	100%	100%	100%	100%	100%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	22	RW22	100%	100%	100%	100%	100%	100%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	31L	RW31L	100%	100%	100%	100%	100%	100%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	31R	RW31R	100%	100%	100%	100%	100%	100%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Departures	**4**	RW04E	33%	33%	33%	33%	33%	33%
		RW04N	33%	33%	33%	33%	33%	33%
		RW04NE	33%	33%	33%	33%	33%	33%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	13L	RW13LE	33%	33%	33%	33%	33%	33%
		RW13LN	33%	33%	33%	33%	33%	33%
		RW13LNE	33%	33%	33%	33%	33%	33%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	13R	RW13RE	33%	33%	33%	33%	33%	33%
		RW13RN	33%	33%	33%	33%	33%	33%
		RW13RNE	33%	33%	33%	33%	33%	33%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	22	RW22SE	50%	50%	50%	50%	50%	50%
		RW22W	50%	50%	50%	50%	50%	50%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	31L	RW31LNW	50%	50%	50%	50%	50%	50%
		RW31LW	50%	50%	50%	50%	50%	50%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	31R	RW31RNW	50%	50%	50%	50%	50%	50%
		RW31RW	50%	50%	50%	50%	50%	50%
		Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

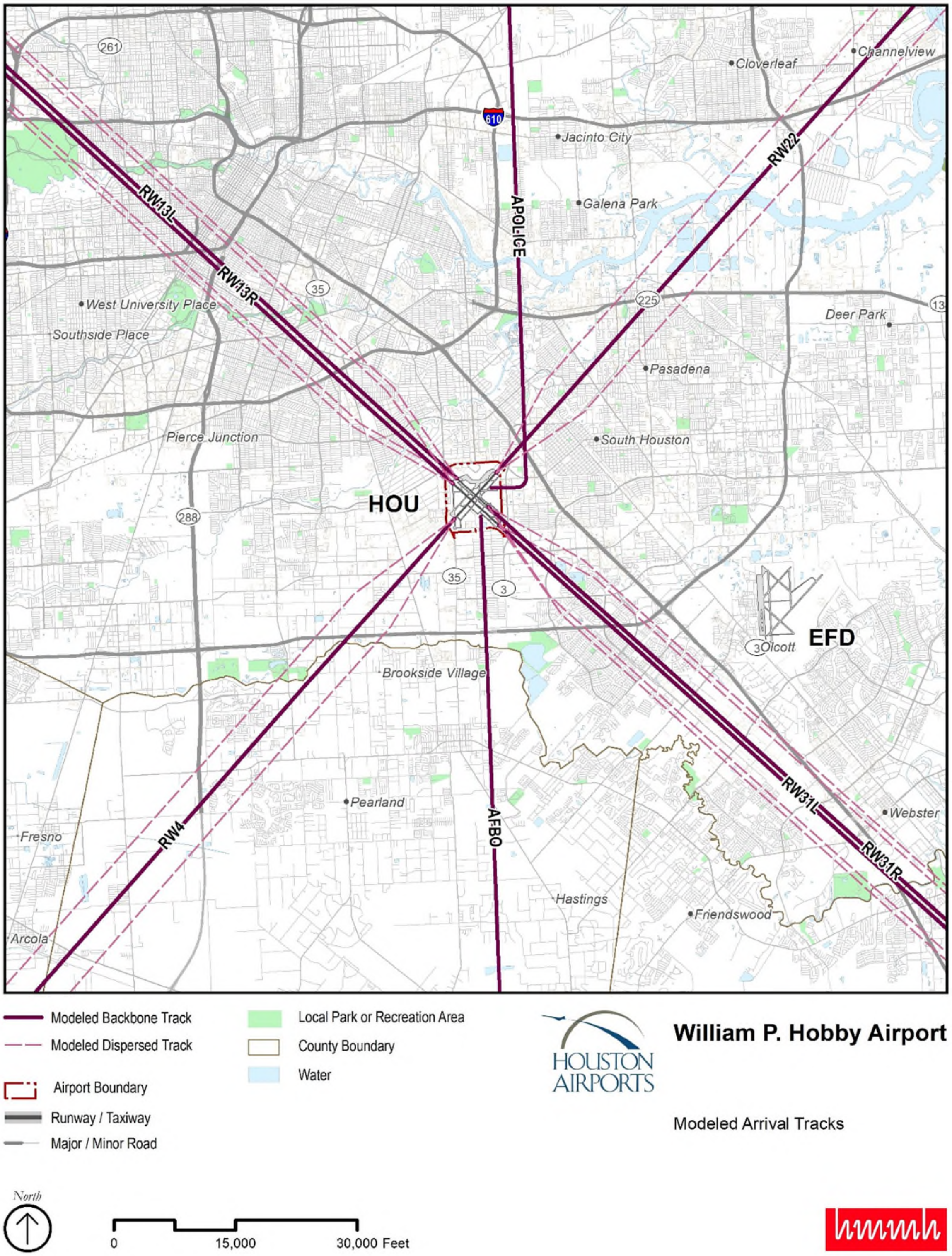

Figure 15. Modeled Arrival Tracks

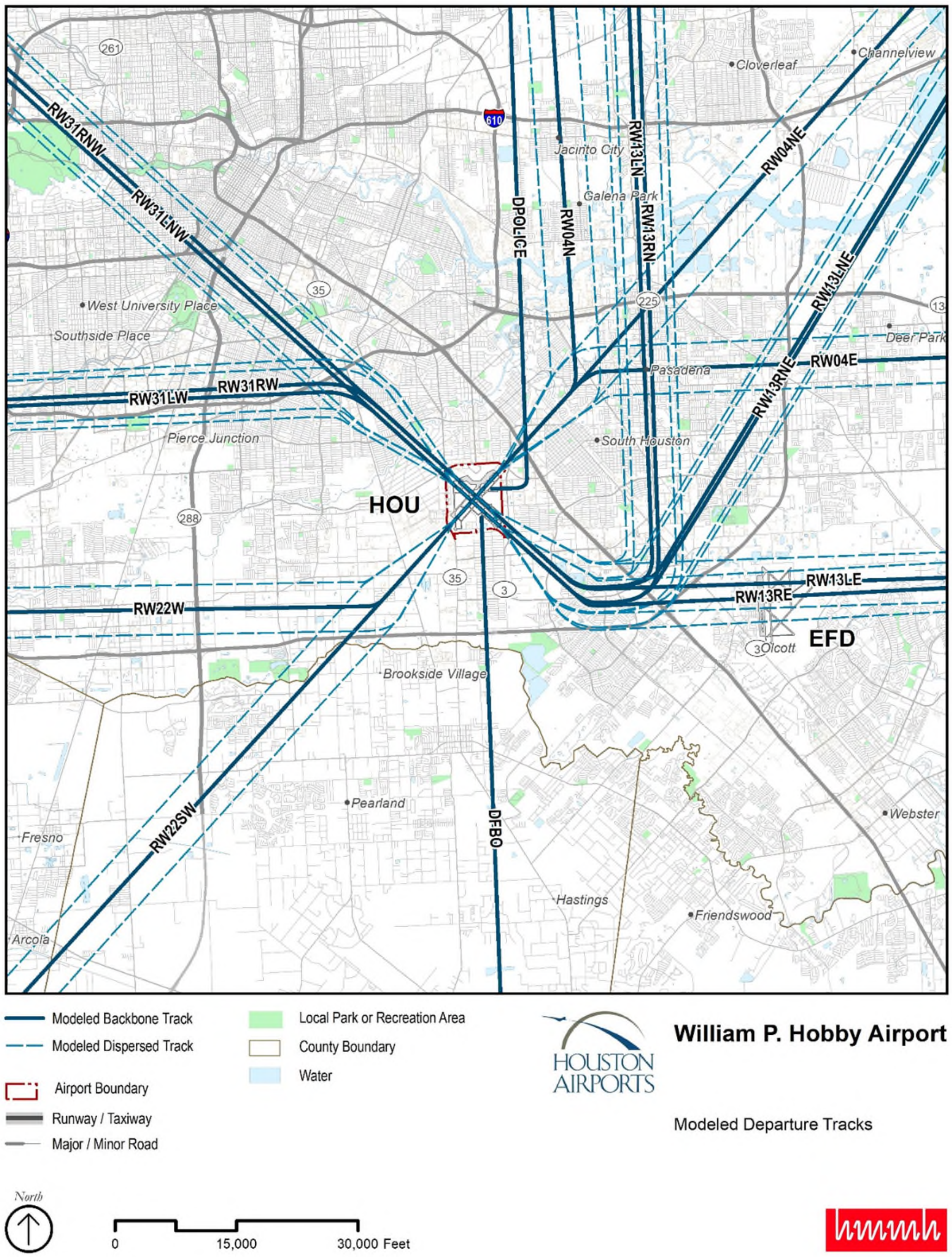

Figure 16. Modeled Departure Tracks

4.6 Future No Action Noise Exposure Contours

Figure 17 displays the 60 – 75 dB DNL noise contours for the 2027 No Action over a map of the existing land use in the study area. The FAA's guidelines for land use compatibility presented in Appendix A of 14 CFR Part 150 (**Table 3** above) state that all land uses are generally compatible with aircraft noise below DNL 65 dB. The DNL 65 dB noise contour for Runway 13R-31L extends into residential land use to the northwest and southeast of the airport. The DNL 65 dB noise contour for Runway 4-22 extends into residential land use to the southwest and northeast of the airport. The DNL 65 dB contour extends away from the airport in the following areas:

- The contour extends to the northwest of Runway 13R-31L along the extended runway centerline into residential land use to almost Sims Bayou.
- The contour extends to the southeast of the Runway 13R-31L along the extended runway centerline into residential land use to past Almeda Genoa Rd and Blackhawk Blvd.
- The contour extends to the southwest of Runway 4-22 along the extended runway centerline into residential land use to past Almeda Genoa Rd.
- The contour extends to the northeast of Runway 4-22 along the extended runway centerline into residential land use to just past Monroe Rd.

There are residential land uses south of Runway 31L end within the DNL 70 dB or higher contours.

Table 15 provides the population exposure, housing unit count, and contour areas for the 2027 Future No Action DNL noise contours. The DNL 65+ dB noise contour, which covers approximately 2,223 acres, contains 1,251 residents and 462 housing units. In addition, two noise-sensitive locations, Houston ISD Mykawa Farm and the New Vision Church, are within the 2027 Future No Action DNL 65+ dB noise contour.

Table 15. 2027 No Action Noise Contours Population, Housing, and Area

Source: HMMH, 2024; U.S. Census Bureau, 2020

DNL (dB) Noise Contour	Population Census	Housing Units	Area (acres)
65 - 70	1,228	456	1,427.88
70 - 75	23	6	445.06
> 75	0	0	350.06
Total	1,251	462	2,223.00

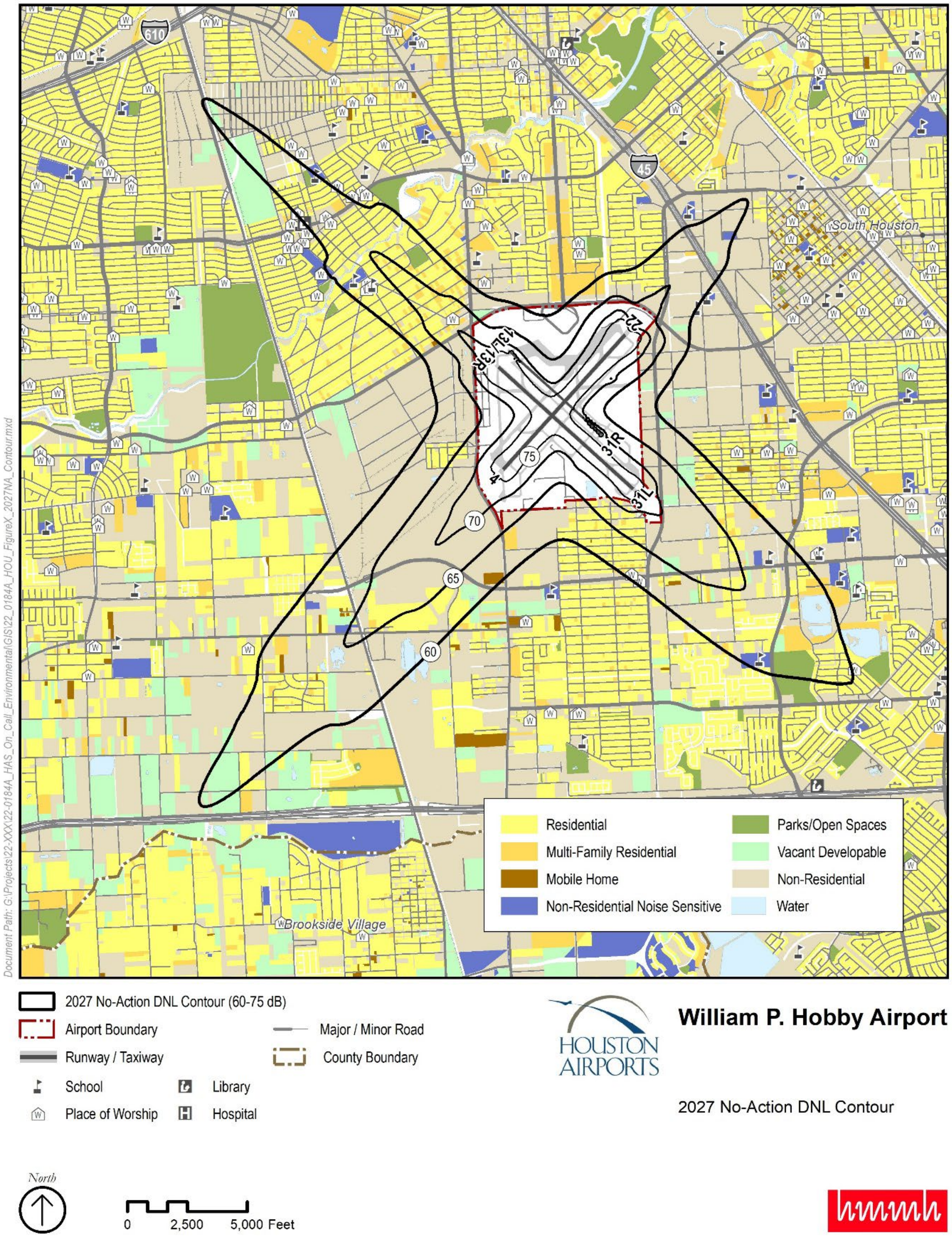

Figure 17. 2027 No Action Noise Exposure Contours with Land Use

4.7 Future Proposed Action Noise Exposure Contours

Figure 18 displays the 60 – 75 dB DNL noise contours for the 2027 Proposed Action over a map of the existing land use in the study area. The FAA's guidelines for land use compatibility presented in Appendix A of 14 CFR Part 150 (**Table 3** above) state that all land uses are generally compatible with aircraft noise below DNL 65 dB. The DNL 65 dB noise contour for Runway 4-22 extends into residential land use to the northeast and southwest of the airport. The DNL 65 dB contour extends away from the airport in the following areas:

- The contour extends to the southwest of the Runway 4-22 along the extended runway centerline into residential land use to past Fuqua St.
- The contour extends to the northeast of the Runway 4-22 along the extended runway centerline into residential land use to almost Winkler Dr.

There are residential land uses within the DNL 70 dB or higher contours northeast of the Runway 4-22 and west of Monroe Rd.

Table 16 provides the population exposure, housing unit count, and contour areas for the 2027 Future Proposed Action DNL noise contours. The DNL 65+ dB noise contour covers approximately **2,130.84** acres, contains **1,985** residents and **679** housing units. There are single-family and multi-family residential uses in Minnetex and Glenbrook Valley neighborhoods along the extended runway centerline of Runway 4-22. The DNL 65 dB noise contour for the 2027 Proposed Action expands further into these residential uses due to the increased operations on Runway 4-22. This causes an increase in population and housing units in the 2027 Future Proposed Action DNL noise contour as compared to the 2027 No Action DNL noise contour. In addition, KIPP Prime College Preparatory, Texans Can Academy, YES Prep Hobby Elementary, and Houston ISD Mykawa Farm are within the 2027 Future Proposed Action DNL 65+ dB noise contour.

Table 16. 2027 Proposed Action Noise Contours Population, Housing, and Area

Source: HMMH, 2024; U.S. Census Bureau, 2020

DNL (dB) Noise Contour	Population Census	Housing Units	Area (acres)
65 - 70	1,970	674	1,409.23
70 - 75	15	5	439.46
> 75	0	0	282.15
Total	1,985	679	2,130.84

Figure 18. 2027 Proposed Action Noise Exposure Contours with Land Use

4.8 No Action and Proposed Action Comparison

The 2027 Proposed Action DNL 65 dB contour is larger than the No Action DNL 65 dB contour primarily along the extended runway 4-22 centerline northeast and southwest of the airport. The 2027 Proposed Action DNL 65 dB contour is smaller than the No Action DNL 65 dB contour primarily along the extended runway 13R-31L centerline northwest and southeast of the airport. This results in an increase in population and housing unit counts and a decrease in acreage. As shown in **Table 17**, the number of people exposed to a DNL 65 dB or greater noise level increases by 734 people with an increase of 217 housing units and a decrease in area of 92 acres. **Figure 19** provides a comparison of the DNL 65 dB contours for each of the 2027 alternatives.

Table 17. Comparison of Future 2027 Noise Contours Population, Housing, and Area

Source: HMMH, 2024; U.S. Census Bureau, 2020

Alternative	DNL (dB) Noise Contour	Population Census	Housing Units	Area (acres)
No Action	DNL 65-70 dB	1,228	456	1,427.88
	DNL 70-75 dB	23	6	445.06
	DNL 75+ dB	0	0	350.06
	Total	1,251	462	2,223.00
Proposed Action	DNL 65-70 dB	1,970	674	1,409.23
	DNL 70-75 dB	15	5	439.46
	DNL 75+ dB	0	0	282.15
	Total	1,985	679	2,130.84
Difference (Proposed Action – NAA)	DNL 65-70 dB	742	218	-18.65
	DNL 70-75 dB	-8	-1	-5.60
	DNL 75+ dB	0	0	-67.91
	Total	734	217	-92.16

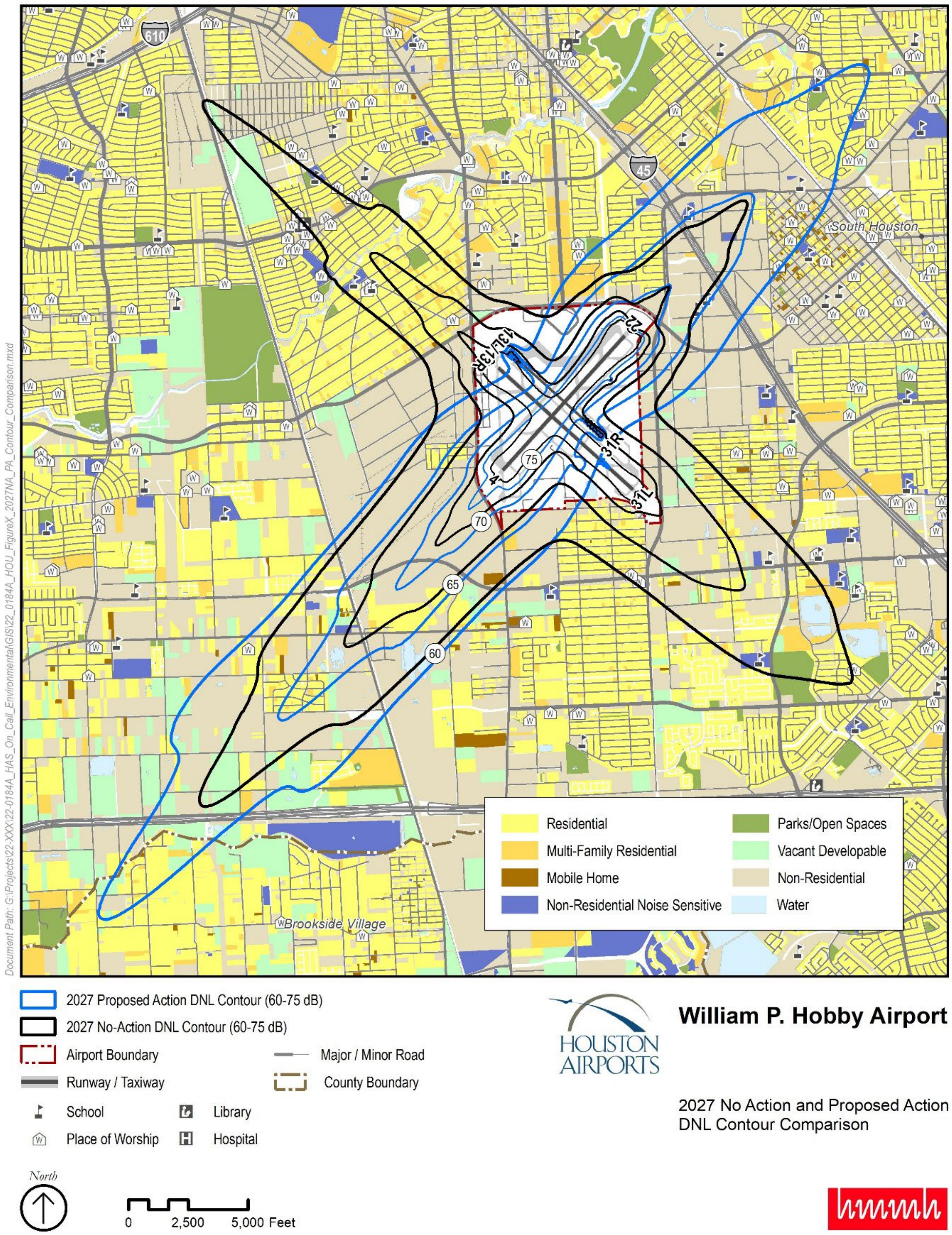

Figure 19. 2027 No Action and Proposed Action Noise Exposure Contours with Land Use

4.9 Future Proposed Action Grid Point Evaluation

HMMH evaluated the change in noise using the modeling grid. The grid was used to determine any significant changes within the 65 DNL contour. FAA considers a 1.5 dB change in noise within the Proposed Action 65 DNL over noise sensitive land use as a significant change in noise.[19] **Figure 20** displays the changes in noise levels between the No Action scenario and Proposed Action scenario in the study area. The red grid points along Runway 4-22 represent areas of 1.5 dB increase in the Proposed Action scenario. The green grid points along Runway 13R-31L represent areas of 1.5 dB decrease in the Proposed Action scenario.

The evaluation shows that multiple noise sensitive land uses northeast and southwest of airport, would experience a temporary significant increase in noise of DNL 1.5 dB or more, at or above 65 DNL noise exposure in the 2027 Proposed Action scenario when compared to the 2027 No Action scenario.

The change in noise and areas of significant impacts would be temporary as the proposed project will not alter runway thresholds or future use of Runway 13R-31L, and runway use is expected to return to No Action conditions once Runway 13R-31L reopens.

HMMH also evaluated the modeling grid covering the noise study area to evaluate any reportable change (+/-3 dB) between the 60 DNL and 65 DNL. **Figure 20** shows that the orange grid points northeast of Runway 4-22 along the extended centerline of Runway 4-22 would experience a 3dB or greater increase between the 60 DNL and 65 DNL. The blue grid points northwest and southeast of Runway 13R-31L along the extended centerline of Runway 13R-31L identify where there would be 3 dB or greater decrease between the 60 DNL and 65 DNL in the 2027 Proposed Action as compared to the 2027 No Action.

[19] FAA 2023 Desk Reference and FAA 1050.1F

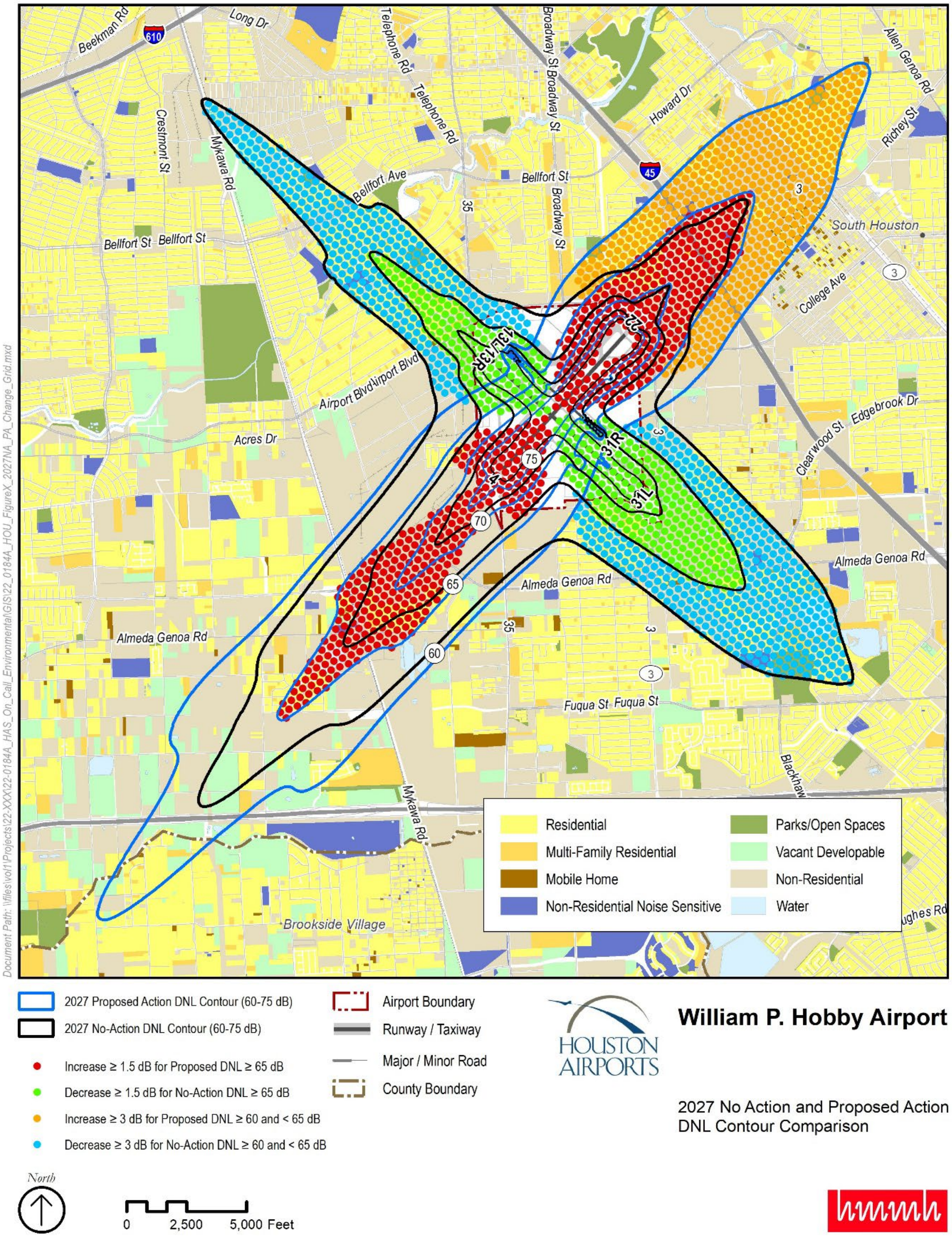

Figure 20. 2027 No Action and Proposed Action DNL Change Grid with Land Use

5. Mitigation

The Proposed Action Alternative results in two areas of temporary noise increase greater than 1.5 dB or more. This is considered an elevated noise impact by FAA since the Proposed Action Alternative results in noise-sensitive areas experiencing an increase of 1.5 dB at or above the day-night average sound level of 65 dB noise exposure when compared to the no action alternative for the same timeframe.

The first area where there is a temporary noise increase is located northeast of Runway 4-22 and extends over single-family and multi-family residential land uses. The second area where there is a temporary noise increase is located southwest of Runway 4-22 and extends over single-family, multi-family, and mobile home residential land use. The Proposed Action Alternative would cause short-term, temporary elevated noise levels during the construction period of approximately 26 months. After construction is over, the noise levels and associated contours would return to the existing condition which is equivalent to the No Action Alternative.

Because the Proposed Action Alternative is short-term in nature, no long-term mitigation is required. HAS plans to communicate the temporary noise increases through meeting with community leaders, city council members, and city managers, and by conducting community outreach specific to the affected residents. Notification of impacted communities will be done at least three to six months in advance of the Proposed Action's construction start date. HAS plans to provide an information leaflet of notification to residents prior to the start of the Proposed Action Alternative. The leaflets would describe the Proposed Action Preferred Alternative, the potential timeframe, and the temporary noise impacts due to the full closure of Runway 13R-31L. Along with the project information and its temporary effects, the affected residents will be informed of the significant benefits this runway reconstruction project will yield to the community.

HAS will inform community members of the temporary noise impacts in advance of any project work or changes caused by the runway closure. HAS will respond in a timely manner to request for information related to the proposed runway closure. The implementation of standard applicable engineering controls and best management practices will also reduce any construction noise increases.