



Study of the Current and Ongoing Effects of the Operation of the Seattle-Tacoma International Airport

May 29, 2020

prepared by:



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Washington State Department of Commerce
as authorized by ESSB 6032



Washington State
Department of
Commerce

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Executive summary

Background

The Washington State Legislature asked the Department of Commerce in March 2018 to implement the provisions of (Proviso) Section 127(63) of Engrossed Substitute Senate Bill (ESSB 6032) using the following language:

- “(63) (a) \$300,000 of the general fund—state appropriation for fiscal year 2019 and \$300,000 of the general fund—local appropriation are provided solely for the department to contract with a consultant to study the current and ongoing impacts of the Seattle-Tacoma international airport. The general fund—state funding provided in this subsection serves as a state match and may not be spent unless \$300,000 of local matching funds is transferred to the department.*
- (b) The final study scope shall be developed by the department, in consultation with organizations or entities including members of the legislature, the port of Seattle, and the cities listed in subsection (c)(i),*
- (c) The study scope must include, but not be limited to:*
- (i) The impacts that the current and ongoing airport operations have air traffic noise, public health, traffic, congestion, and parking in residential areas, effects on residential and nonresidential property values, and economic development opportunities, in the cities of SeaTac, Burien, Des Moines, Tukwila, Federal Way, Normandy Park;*
 - (ii) The benefits to the same cities referenced in (c)(i) derived due to proximity to the airport, including wages and taxes from airport-related operations, property tax derived from commercial development directly tied to airport-related operations, and improved access to transit resulting from proximity to the airport; and*
 - (iii) Options and recommendations for mitigating any negative impacts, or bolstering potential benefits identified through the analysis, including what role the state plays in addressing impacts and benefits.*
 - (iv) The department must collect data and relevant information from various sources including the port of Seattle, listed cities and communities, regional planning agencies, and other studies.*
 - (v) The study must be delivered to the legislature by December 1, 2019.”*

The legislature since revised the delivery date of the study from Dec. 1, 2019 to June 1, 2020 via Engrossed House Bill (ESHB) 119 Section 129.

This study (the “2020 Study”) acknowledges the importance of Seattle-Tacoma International Airport, not only to the Seattle region but to the state of Washington and should not be construed as “anti-airport” in any fashion.

The 2020 study was based on an objective and independent review and evaluation of existing data to assess the effects that airport operations have on the six cities referenced above – Burien, Des Moines, Federal Way, Normandy Park, the city of SeaTac, and Tukwila – an area that includes over 237,000 residents and covers over 61 square miles. The consultants gathered information from over 400 technical references and met with over 200 people while investigating eight general areas over a 22-year period (1997 through 2019), including:

- Air quality
- Noise
- Environmental effects
- Mobility
- Light
- Public safety
- Public health
- Socio-economics

For each city in the study area, the consultants researched over 65 data points between 1997 and 2019 – over 8,500 data points total (2009 served as a mid-point year). Anecdotal information from study area residents and business owners was also considered.

General findings

Seattle-Tacoma International Airport has grown faster than its surrounding area. Since the 2000 Census, the study area, King County, and the Seattle metropolitan area have grown between 22.8% and 29.4%, while the number of passengers at the airport grew by over 75%, and the number of air carrier operations grew by almost 81%.

The study area cities experience effects to varying degrees. The main negative effect was from **noise**, with additional concerns about **air quality**. There were also some positive effects – **economic benefits** from the airport, as well as its **convenience** and **accessibility**. There are some data gaps where information was not available or was inconsistent, including air quality, public health, and other socio-economic metrics.

The National Plan of Integrated Airport Systems (NPIAS – a report to Congress every two years that supports funding of the U.S. airport system) states on its first page eight guiding principles for airport development. The fifth guiding principle included in the NPIAS states:

“Airports should be compatible with surrounding communities, maintaining a balance between the needs of aviation, the environment, and the requirements of residents.”

General recommendations of the 2020 study include:

- #1. Establish a single source data clearinghouse for effect metrics and data.
- #2. Expand the study area to incorporate areas to the north so that the airport is located in the center of the study area.
- #3. Expand participation by the Port of Seattle in any follow-up studies.
- #4. Improve the airport/community relationship.
- #5. Develop a plan for airport-adjacent perimeter areas.
- #6. Follow NPIAS attribute #5 regarding surrounding communities.
- #7. Conduct an expanded Phase 2 study.

Effects from noise and vibration

Noise was the primary negative effect, especially in Burien, Des Moines, Normandy Park, Federal Way, and in parts of the city of SeaTac. This was due to the implementation of the NextGen procedures that concentrate flight tracks into a narrower area, as well as the airport’s rapid growth. Noise concerns include sleep disturbance, learning disruption, lower property values, and other concerns. Recommendations of the 2020 study include:

- #1. Develop a set of alternative noise metrics that do not rely on day-night average noise level (DNL) contours.
- #2. Increase the arrival glideslope to a minimum of 3 degrees.
- #3. Conduct an environmental review for flight track changes.
- #4. Institute noise abatement procedures for late-night operations
- #5. Expand noise monitor locations to include study area permanent and mobile monitors.
- #6. Address existing mitigation packages to fix faulty installations.
- #7. Revise the Port Commission makeup to include direct representation from the study area.
- #8. Conduct additional vibrational monitoring in the study area.
- #9. Determine the effects associated with sound exposure levels (SELs).
- #10. Determine the effectiveness of sound insulation practices, especially those used by the Port of Seattle in its mitigation packages.

Effects on air quality

Contributors to regional air quality include stationary sources (such as manufacturing), mobile sources (cars and trucks), as well as the airport. While the Seattle area is technically in compliance with EPA standards, that statement can be misleading because of the inadequate network of air quality monitors, most of which are not located close to the airport. There are other concerns that require additional research including ultra-fine particulates (UFPs), reports by study area residents of a black residue, and other concerns. There are also gaps in the air quality data, some of which may be outdated, that warrant additional study. Recommendations of the 2020 study include:

- #1. Improve the current monitoring network by increasing the number and location of monitors in and around the airport.
- #2. Establish monitoring guidelines for new locations that consider economics, security, logistics, and atmospheric and pollution considerations.
- #3. Deploy PurpleAir monitors to get a general sample of air quality trends.
- #4. Research the connection of ultrafine particles and health effects.
- #5. Conduct a study and improve the monitoring network to determine the extent of regional air pollution effects that are directly related to airport activity. (Seattle-King County Health District is studying regional impacts related to air quality. Their findings were not completed in time to inform this study.)

Regional impacts associated with the airport air pollution emissions are likely not fully reflected by the current air quality monitoring network because of geographic distribution of the monitors.

Effects on mobility

Mobility includes cars, buses, light rail, bicycles, and pedestrians (Seattle-Tacoma International Airport is one of the few U.S. airports to which people can walk). As with many urban areas, traffic has been an increasing problem in the Seattle region, partially because roadway network improvements have favored transit improvements over increasing roadway capacity. While congestion has increased at several intersections around the airport, weekday peak-period congestion is also a problem across the region. The airport is especially busy during holiday periods like Thanksgiving and Christmas. What is not clear is whether ridesharing services may be increasing pick-up/drop-off traffic.

Parking at the airport warrants additional study, since there were concerns of employees using park & ride lots and garages instead of the dedicated airport employee Lots. And while the main parking garage has increased its capacity, there was no data on where users are coming from. Recommendations of the 2020 study (many of which are for additional study) include:

- #1. Generate rental car forecasts for annual service demand.
- #2. Conduct an annual parking demand study for the main parking garage and employee parking lots.
- #3. Conduct an annual cell phone lot demand study to determine if the cell phone lot reduces congestion at the arrivals and departures areas in front of the terminal.
- #4. Inventory private parking lot data to determine the effect on the main parking garage.
- #5. Conduct an airport mobility modes survey to assess how passengers and employees travel to and from the airport.
- #6. Conduct a drop-off/pick-up zone study to assess congestion and vehicle and pedestrian flow in and around the airport property.
- #7. Forecast employee/vendor/tenant demand to ensure there are parking and mobility options to accommodate changing employment.
- #8. Develop an airport parking master plan in collaboration with airport vendors and employees, surrounding cities, King County Metro, and Sound Transit.
- #9. Develop a transportation improvement program database of all historical and current capital improvements in the Seattle-Tacoma International Airport area to demonstrate network changes over time.

- #10. Conduct a rental car origin-destination study to understand vehicle patterns and movements along the transportation network around the facility as well as understand where vehicles are traveling from to reach the facility.
- #11. Develop a targeted annual traffic monitoring system to create a consistent and reliable database that monitors congestion over time.
- #12. Conduct an annual transit demand analysis to document transit demand in the study area and ways to improve transit ridership to the airport.
- #13. Improve use of transit by airport passengers and employees.
- #14. Analyze park & ride use to determine how many individuals use the facilities to access the airport.
- #15. Conduct a park & ride license plate analysis to determine where vehicles originate and to better understand park & ride demand patterns.
- #16. Conduct an off-street parking license plate analysis to understand where vehicles originate from in the study area and the use of certain on-and off-street facilities.
- #17. Conduct a transit origin/destination Study to analyze travel patterns and average daily traffic in the study area.
- #18. Conduct an annual pedestrian count to determine the number of individuals that use the sidewalk along the front of the terminal and the Link Light Rail Airport/SeaTac station pedestrian bridge to access the airport.
- #19. Identify and eliminate pedestrian mobility barriers.
- #20. Conduct an ongoing on-street parking study in Burien, Tukwila, and SeaTac to monitor supply, use, duration, and areas with excessively high use from non-residents.
- #21. Establish an existing/baseline conditions for specific off-and on-street parking facilities in Burien, SeaTac, and Tukwila.
- #22. Establish and maintain a parking supply database to provide insight on parking demand in the area, and give local communities an inventory that can be expanded and monitored over time.
- #23. Adopt or expand parking permit programs in Burien and Tukwila to discourage long-term airport passenger and employee parking on residential streets.
- #24. Create an informational program to educate airport employees and passengers regarding local parking restrictions.
- #25. The Port of Seattle should adopt a formal policy that prohibits airport employees from using on-street off-airport parking during working hours.

Effects on surface water, groundwater and soil

The airport has taken positive steps to protect area streams, floodplains, and wetlands. More monitoring and testing are recommended to ensure the long-term protection of these sensitive environmental assets. There are some concerns regarding leakages from underground storage tanks – both off and on the airport. Study area residents reported a black residue on surfaces (ground, structures, etc.). Recommendations of the 2020 study include:

- #1. Correct potential errors and data gaps to create a more consistent data record.
- #2. Improve receiving stream data through more permanent monitoring stations downstream and a suite of water quality parameters that are collected at outfalls regularly to make results more consistent and comparable.
- #3. Further study air pollution effects on surface water through independent analyses of citizen-reported pollution samples on surface water locations.
- #4. Conduct independent testing of “black soot” to determine its chemical composition and potential source(s).
- #5. Conduct ongoing monitoring and sampling of AOMA groundwater monitoring wells on a three-year cycle for key indicator parameters.

- #6. Coordinate with study area comprehensive plans to ensure the ongoing health and preservation of groundwater and soil areas throughout the study area.

Effects from light

Light intrusion was not found to be a concern in the study area. The airport is upgrading metal halide lighting with energy efficient LED fixtures, which also addresses glare. Recommendations of the 2020 study include:

- #1. Update airport high mast lighting and replace with LED sources.
- #2. Adopt study area lighting Standards that would establish guidelines for future developments and renovations of existing facilities.

Effects on public safety

Public safety varies by city in the study area, and there are no known links to the airport. Crime has stabilized and, in some cases, decreased in the study area, including motor vehicle thefts, violent crimes, and property crimes. Normandy Park has the lowest incidence of most crimes, but Tukwila reported the highest rate of most reported crimes, which may be due to the concentration of retail destinations (such as Southcenter Mall). However, it could not be determined if these negative effects were attributable to proximity to Seattle-Tacoma International Airport.

Human trafficking and illegal drug trafficking are global problems, the former often associated with large metropolitan areas with international airports. It was not possible to track any effects in the study area due to the absence of data at the municipal level. Hotel rooms in the study area are concentrated in the cities of SeaTac and Tukwila, but that does not prove a direct link to human trafficking or illegal drug trafficking. The legalization of recreational and medical marijuana use has also altered drug enforcement in many communities, not only locally but nationwide. Recommendations of the 2020 study include:

- #1. Modify the second level study to include areas to the north of Seattle-Tacoma International Airport.
- #2. Consider an airport overlay district to address crime on a multi-city level.
- #3. Pursue multiple approaches to assist victims of sex trafficking.
- #4. Consider Crime Prevention Through Environmental Design (CPTED) principles in portions of the study area.

Effects on public health

Public health metrics vary within the study area and there was no data that indicated a link to the airport. Multiple factors contribute to public health including income level, poor health habits, genetic predispositions, and other diverse sources. Further research and analysis are recommended.

Public health outcomes noted include decreases in the accident rate and some declines in the rates of cancer and heart disease in the study area cities and King County between 2012 and 2016. Life expectancy in the study area cities is almost equal to the average for the state of Washington and the U.S. and is only slightly below the King County average. However, it could not be determined if these were due to national trends, attributable to proximity to Seattle-Tacoma International Airport or other contributing factors.

The method that public health statistics were available prevented a local-level analysis for four of the six study area cities (Des Moines/Normandy Park and SeaTac/Tukwila), making local level comparisons impossible. Additional studies with a finer grain of analysis are recommended to address these data gaps. Recommendations of the 2020 study (some which are now underway) include:

- #1. Establish an independent noise monitoring authority to determine if thresholds for noise established by the Federal Aviation Authority are adequate given local circumstances, as well as appropriate strategies for mitigating effects.
- #2. Expand the study area to include other neighborhoods that may be affected by Seattle-Tacoma International Airport, including West Seattle, Beacon Hill, and Renton.
- #3. Develop more detailed public health statistics at the census tract or enumeration district level to afford a more detailed comparison of health effects and airport-related data (noise contours, flight tracks, etc.).

- #4. Approve/reauthorize bills to address mitigation packages that have failed or are inadequate.
- #5. Audit local building and zoning standards to identify any inconsistencies between local regulations and federal rules.
- #6. Identify new construction potentially affected by airport use.
- #7. Establish a health effect assessment process to determine potential health effects of new developments.
- #8. Require alternative fuel use for airport users.
- #9. Expand the late night noise limitation program to reduce effects on neighborhoods.
- #10. Replant trees throughout the study area to help absorb noise and air toxins.
- #11. Expand Port efforts to promote public health.

Effects on socio-economics

Socio-economic effects vary by city. Benefits include airport employment, hotel tax revenues, relatively higher multi-family and industrial rents, and proximity to air service as a locational advantage for corporate development.

Demographically, the study area trends older (with the exception of the cities of SeaTac and Tukwila). Except for Normandy Park, the study area has a higher percentage of minority population with a lower income and without a college degree than King County. Study area students come from a higher percentage of minority homes, tended to test lower in arts and math scores, and had higher incidents of obesity. The study area has slower rates of growth and slower increases in home values, with commercial vacancy rates below equilibrium (consistent with many cities since the Great Recession), median household incomes below the average for King County, and more owner-occupied households that spend 30% or more of their income for housing. However, it could not be determined if these are due to airport proximity or other factors. Recommendations of the 2020 study include:

- #1. All parties should commit to a shared objective.
- #2. Consider a “study area-wide” overlay district.
- #3. Conduct additional analyses.

Summary of study area effects

The following presents a general assessment of the all of the effects in the study area attributable to aviation activity, categorized into four effect types. There are numerous data gaps that have been identified in the 2020 study that are recommended for additional study and analysis.

Summary of Study Area Effects Attributable to Aviation Activity – 1997 to 2019

- Positive effect attributable to aviation activity
- Negative effect attributable to aviation activity
- Neutral/no effect attributable to aviation activity
- Inconclusive data/needs additional study

METRIC	STUDY AREA CITY																	
	Burien			Des Moines			Federal Way			Normandy Park			SeaTac			Tukwila		
	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019
EFFECTS FROM NOISE & VIBRATION																		
Noise	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	○	○	○
Vibration	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
EFFECTS ON AIR QUALITY																		
CO	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
HC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
NO _x	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
SO ₂	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
VOC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PM ₁₀	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PM _{2.5}	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
UFP's	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Summary of Study Area Effects Attributable to Aviation Activity – 1997 to 2019

- Positive effect attributable to aviation activity
- Negative effect attributable to aviation activity
- Neutral/no effect attributable to aviation activity
- Inconclusive data/needs additional study

METRIC	STUDY AREA CITY																	
	Burien			Des Moines			Federal Way			Normandy Park			SeaTac			Tukwila		
	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019
EFFECTS ON MOBILITY																		
Traffic	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Transit/Rail	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Transit/Bus	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Parking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	■	■	■
Bicycle	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Pedestrian	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
EFFECTS ON SURFACE WATER																		
Stormwater Runoff	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Floodplains	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Wetlands	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
EFFECTS ON GROUNDWATER & SOIL																		
Groundwater	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Soil	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

EFFECTS FROM LIGHT																	
Light	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
EFFECTS ON PUBLIC HEALTH																	
Cancer	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Heart Disease	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Alzheimer's Disease	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Chronic Lower Respiratory Disease	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Stroke	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Accidents and External Causes	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Suicide	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Life Expectancy	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Maternal and Child Health	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Access to Care	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
EFFECTS ON PUBLIC SAFETY																	
Violent Crime	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Property Crime	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Motor Vehicle Theft	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Human Trafficking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Drug Trafficking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Summary of Study Area Effects Attributable to Aviation Activity – 1997 to 2019 (continued)

- Positive effect attributable to aviation activity
- Negative effect attributable to aviation activity
- Neutral/no effect attributable to aviation activity
- Inconclusive data/needs additional study

METRIC	STUDY AREA CITY																	
	Burien			Des Moines			Federal Way			Normandy Park			SeaTac			Tukwila		
	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019
EFFECTS ON SOCIO-ECONOMICS																		
Housing	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	■	■	■
Employment	■	■	■	■	■	■	■	■	■	○	○	○	■	■	■	■	■	■
Retail Market	○	○	○	○	○	○	○	○	○	○	○	○	■	■	■	■	■	■
Office Market	○	○	○	■	■	■	○	○	○	■	■	■	■	■	■	○	○	○
Industrial Market	■	■	■	■	■	■	○	○	○	■	■	■	○	○	○	○	○	○
Hotel Revenue	■	■	■	■	■	■	○	○	○	○	○	○	■	■	■	■	■	■
Tax Revenues	○	○	○	○	○	○	○	○	○	○	○	○	■	■	■	○	○	○

*** END ***

Study of the Current and Ongoing Effects of the Operation of the Seattle-Tacoma International Airport

A. BASIS FOR THE STUDY

The Washington State Legislature asked the Department of Commerce in March 2018 to implement the provisions of (Proviso) Section 127(63) of Engrossed Substitute Senate Bill (ESSB 6032) using the following language:

- “(63) (a) \$300,000 of the general fund—state appropriation for fiscal year 2019 and \$300,000 of the general fund—local appropriation are provided solely for the department to contract with a consultant to study the current and ongoing impacts of the Seattle-Tacoma international airport. The general fund—state funding provided in this subsection serves as a state match and may not be spent unless \$300,000 of local matching funds is transferred to the department.*
- (b) The final study scope shall be developed by the department, in consultation with organizations or entities including members of the legislature, the port of Seattle, and the cities listed in subsection (c)(i),*
- (c) The study scope must include, but not be limited to:*
- (i) The impacts that the current and ongoing airport operations have air traffic noise, public health, traffic, congestion, and parking in residential areas, effects on residential and nonresidential property values, and economic development opportunities, in the cities of SeaTac, Burien, Des Moines, Tukwila, Federal Way, Normandy Park;*
 - (ii) The benefits to the same cities referenced in (c)(i) derived due to proximity to the airport, including wages and taxes from airport-related operations, property tax derived from commercial development directly tied to airport-related operations, and improved access to transit resulting from proximity to the airport; and*
 - (iii) Options and recommendations for mitigating any negative impacts, or bolstering potential benefits identified through the analysis, including what role the state plays in addressing impacts and benefits.*
 - (iv) The department must collect data and relevant information from various sources including the port of Seattle, listed cities and communities, regional planning agencies, and other studies.*
 - (v) The study must be delivered to the legislature by December 1, 2019.”*

The legislature since revised the delivery date of the study from Dec. 1, 2019 to June 1, 2020 via Engrossed House Bill (ESHB) 119 Section 129.

This study (the “2020 study”) acknowledges the importance of Seattle-Tacoma International Airport, not only to the Seattle region but to the state of Washington and should **not** be construed as “anti-airport” in any fashion.

The 2020 study was based on an objective and independent review and evaluation of existing data to assess the effects that airport operations might have on the six cities referenced above – Burien, Des Moines, Federal Way, Normandy Park, the city of SeaTac, and Tukwila – an area that includes over 237,000 residents and covers over 61 square miles. The consultants gathered information from over 400 technical references and met with over 200 people while investigating eight general areas over a 22-year period (1997 through 2019), including:

- Air quality
- Noise
- Environmental effects
- Mobility
- Light
- Public safety
- Public health
- Socio-economics

For each study area city, the consultants researched over 65 data points between 1997 and 2019 – over 8,500 data points total. Anecdotal information from study area residents and business owners was also considered.

It is important to note that this study (hereafter referred to as the 2020 study) is not to oppose or impede the operations, growth, or success of Seattle-Tacoma International Airport. While there is some similarity to a 1997 study regarding the third runway, it is not an extension or continuation of that 1997 study.

Difference between the 1997 study and the 2020 study

The 1997 study – the “Sea-Tac International Airport Mitigation Study” (February 1997) – was authorized by a 1995 grant by then-State Sen. Mike Heavy and was administered by the Department of Commerce’s predecessor (the Department of Community, Trade, and Economic Development, known as CTED). It was in response to concerns regarding the potential for increased aviation-related effects upon neighboring communities as a result of Seattle-Tacoma International Airport’s then-proposed third runway. The 1997 study was tasked with assessing the third runway’s projected construction and operational effects of the then-proposed third runway, and developing mitigation strategies for the cities of Burien, Des Moines, Federal Way, Normandy Park, and Tukwila, the Highline School District, and the Highline Community Hospital. That study was completed in February 1997.

The 1997 study reviewed the draft environmental impact statement (EIS) and considered how an expanded Seattle-Tacoma International Airport with the third runway would affect its surrounding communities.

The 2020 study looks at historical data between 1997 and roughly 2019 and seeks to establish a baseline of ongoing airport operations using a variety of metrics. The 2020 study does not include new modelling or sampling, nor should it be considered in any way to be an EIS or an environmental assessment (EA).

The two studies are not the same, have slightly different study areas, and are not to be considered as directly related. Where the 1997 study projected future potential conditions based on an EIS, the 2020 study evaluates historical data for the last 23 years. It is not an extension of the 1997 study.

B. THE CONSULTANT TEAM

In response to ESSB 6032, the Department of Commerce solicited proposals in early 2019, advertised both locally (metropolitan Seattle area) and nationally. A shortlist was selected for interviews in April 2019 and upon conclusion, a consultant team lead by Stantec was selected to conduct this study.

Stantec is a multi-disciplinary engineering-planning-architecture firm with offices worldwide. The Stantec team includes staff from the Seattle metropolitan region as well as other offices. (The Stantec project director leading this effort also led the 1997 study while with a previous firm.)

As part of the Stantec team, Denver-based Ricker Cunningham is providing real estate economics, community strategies and addressing quality of life indicators for the study area. Ricker Cunningham and the leadership of the Stantec team have more than 20 years of experience working together on similar projects.

C. THE STUDY AREA

The 1997 and 2020 studies do have some degree of similarity in that the cities of Burien, Des Moines, Federal Way, Normandy Park, and Tukwila were included in both studies (the city of SeaTac was not officially a part of the 1997 Study). While the 2020 study does not include the Highline School District and the Highline Community Hospital, the expansion of the city of Burien’s corporate limits now includes many of these same areas. Figure 1 shows a map of the study area, and Figure 2 details the six study area cities.

The study area covers 61.36 square miles (approximately 2.65% of the total area of King County), but its population of represents 10.7% of King County’s population (237,498 people).

The study area’s density is roughly 3.3 times greater than the county average – 3,396.3 persons per square mile in the study area versus 1,034 in King County. This indicated that the study area is more densely populated and more urbanized than the average in King County. This concentration of population close to Seattle-Tacoma International Airport has contributed to concerns regarding the compatibility of airport operations, going back many decades.

Figure 1
Study area

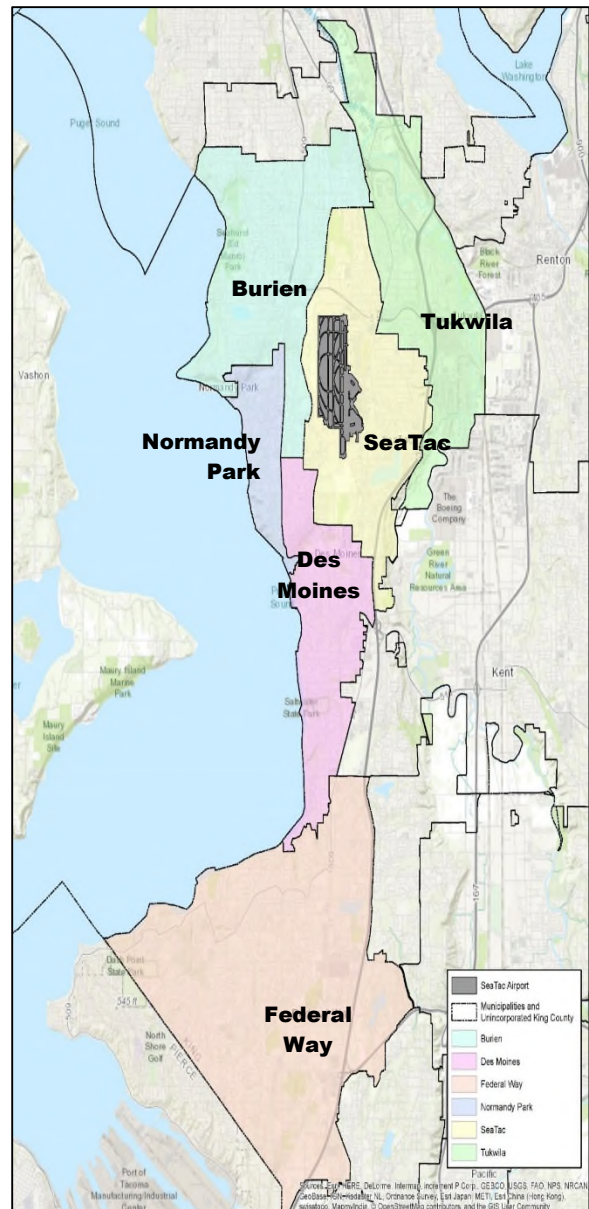


Figure 2
Study area cities

City	Incorporated	Total Area (in square miles)	2018 Population	Average Density (people per square mile)
City of Burien	1993	10.11	51,908	5,134.3/sq. mi.
City of Des Moines	1959	6.41	32,364	5,049.0/sq. mi.
City of Federal Way	1990	22.49	97,044	4,330.4/sq. mi.
City of Normandy Park	1953	2.51	6,649	2,649.0/sq. mi.
City of SeaTac	1990	* 10.24	29,239	* 2,855.4/sq. mi.
City of Tukwila	1908	9.60	20,294	2,113.9/sq. mi.
TOTALS		61.36	237,498	3,870.6/sq. mi.

Source: Cities of Burien, Des Moines, Federal Way, Normandy Park, SeaTac and Tukwila; and US Census

- * According to officials from the city of SeaTac, approximately 40% of the city's 10.24 square mile area is composed of Seattle-Tacoma International Airport land, making the non-airport portion of the city approximately 6.15 square miles. Using this adjusted area, the average density increases to 4,754.3 persons per square mile (up from 2,855.4 as shown in Figure 2), making it the third most densely-populated study area city behind Burien and Des Moines.

D. STUDY APPROACH

The purpose of the 2020 study is to **objectively** and **independently** evaluate and assess a variety of effects (positive, negative and neutral) associated with the operation of Seattle-Tacoma International Airport and to establish a baseline that may be used to evaluate current and future operations:

- Positive effects include such factors as higher-paying jobs, increased tax revenue, etc.
- Negative effects include such factors as concerns about noise, air quality, public health, etc.
- Neutral effects are those with little to no measurable positive or negative effect.

This evaluation and assessment were limited to existing data covering the period from 1997 through 2019. No additional sampling, modelling, or new data collection was included in the scope of the study.

As part of the 2020 study, the consultant teams presented regular updates to an advisory committee and held two public workshops for public input. The consultant team also met with city staff, elected officials, staff from the Port of Seattle, and representatives from various public agencies city to gather data.

While the 2020 study acknowledges the importance of Seattle-Tacoma International Airport as a significant regional and statewide asset, the 2020 study remains independent and takes no sides. The 2020 study does not argue for or against Seattle-Tacoma International Airport, nor does it advocate for any city, neighborhood, organization, or resident. The 2020 study attempts to address the following basic questions:

- Do the study area cities enjoy any benefits by being close to Seattle-Tacoma International Airport?
- Are the study area cities shouldering a regionally disproportionate burden because of their location?

These questions are not easily answered. In the years between the 1997 and 2020 studies, the region (as well as the study area cities) have experienced multiple changes, and there has been ongoing regional growth that has roughly doubled the population of the Seattle metropolitan area. The 2020 study is tasked with determining:

- What effects are directly related to Seattle-Tacoma International Airport operations (direct effects)?
- What effects are the result of natural organic regional growth (induced effects)?

The approach to this study makes the following assumptions:

- **Available data**

The 2020 study is based on the analysis and evaluation of available existing data from 1997 through 2019 to assess any effects associated with Seattle-Tacoma International Airport. Information to be reviewed comes from diverse sources, including the Port of Seattle, the study area cities, King County, the city of Seattle, the Puget Sound Regional Council (PSRC), various state and federal agencies, etc.

- **No new modelling, sampling or data collection**

The 2020 study is based on existing data and does not generate new information through modelling, sampling, or other data collection. (The project scope, budget and schedule did not allow for new modelling and data collection tasks).

- **Public input**
The 2020 study considers and evaluates information provided by individual citizens from the study area cities, provided that the information can be independently verified or validated. Information that could not be verified or validated is considered part of the anecdotal public input component to help identify additional concerns with airport operations.
- **Milestone dates**
The 2020 study uses the following milestone years to evaluate potential effects experienced in the study area cities that may be attributable to aviation-related activity:
 - **1997** – The base year using information available from the 1997 study.
 - **2009** – The first full year of operations of the third runway.
 - **2019** – The most current year of available data (depending on how the data is collected, the “present” year sometimes varies between 2018 and 2019).
- **Evaluation standards**
The 2020 study evaluates and assesses various metrics experienced by the study area cities based on appropriate existing state and federal legislation, policies, and regulations. The existence of proposed metrics, ongoing research and international studies, while of interest, are not currently enforceable but may be relevant in the future.

E. THE TECHNICAL ADVISORY COMMITTEE

A technical advisory committee (TAC) was established to provide guidance and input to the consultant team, as well as to present a variety of draft information for review and discussion. The TAC was composed of staff and citizen representatives from each study area city, as well as two members of the Washington State Legislature. Several members of the Department of Commerce staff also attended TAC meetings. Many of the TAC members are also members of local airport committees in their respective study area cities.

Figure 3
Technical Advisory Committee

Organization	Name	Role
City of Burien	Rose Clark	Citizen representative
	Brian Wilson	City Manager
City of Des Moines	Steve Edmiston	Citizen representative
	Michael Matthias	City Manager
City of Federal Way	David Berger	Citizen representative
	Bill Vadino	Policy Advisor to the Mayor
City of Normandy Park	Mark Hoppen	City Manager
	Kathleen Waters	Citizen representative
City of SeaTac	Steve Pilcher,	Director of Community & Economic Development
	Roger Kadeg	Citizen representative
City of Tukwila	Brandon Miles	Economic Development Liaison, Mayor’s Office
	Jim Haggerton	Citizen representative
Washington State Legislature	Rep. Tina Orwall	33rd Legislative District
	Rep. Mike Pellicciotti	30th Legislative District
Washington Department of Commerce	Gary Idleburg	Project manager
	Dave Anderson	Managing director
	Mark Barkley	Assistant director, Local Government Division
	Matthew Ojennus	Senior planner
	<i>Mark McCaskill</i>	<i>Director, Growth Management Services Unit (former)</i>
	<i>Ike Nwankwo</i>	<i>Western Washington manager (retired)</i>

(Note: Names in *italics* are Department of Commerce staff who left the agency prior to the completion of the project.)

TAC meetings were conducted monthly at the city of SeaTac City Council Chambers (with the exception of the Oct. 28, 2019 TAC meeting held at North Highline Fire Station #18 while the SeaTac City Council Chamber was being renovated).

TAC meetings were not intended to be public meetings and did not include opportunities for public comment or discussion. Other opportunities for public input were provided during the 2020 study (described in the following section).

F. PUBLIC INPUT OPPORTUNITIES

As noted, the purpose of the 2020 study was to conduct an independent and objective evaluation of Seattle-Tacoma International Airport operations – both positive and negative – and not to advocate on behalf of any single individual or community. The 2020 study was not intended to serve as a public forum for commentary on various aspects of Seattle-Tacoma International Airport.

During the course of the 2020 study, additional data was offered to the consultant team from study area citizens. The consultant team used data that could be independently verified and validated. Information that could not be verified/validated was considered as anecdotal input, which also helped the consultant team identify issues important to the public.

Information and insight from the public were provided during the 2020 study, and several opportunities were provided for public input:

- **June and July 2019 – Stakeholder interviews**
A series of interviews was conducted with nearly 50 stakeholders representing the study area cities (stakeholders were named by each individual city).
- **July 24, 2019 – Public workshop #1**
The first workshop was held at Tye High School (city of SeaTac) to present the study’s approach, scope, and schedule. Public comments were taken via in-person 1-to-1 meetings and through a comment board.
- **Nov. 6, 2019 – Public workshop #2**
The second workshop was held at the Burien City Hall/Library to present draft research observations. Public comments were taken via Q&A session and through written comment cards.
- **Sept 16, 2019 and Nov. 20, 2019 – Mitigation package meetings**
Meetings conducted by State Rep. Tina Orwall regarding citizen concerns with the mitigation packages offered by the Port of Seattle.
- **Nov. 12, 2019 – Mitigation and UFP meeting**
A meeting was conducted by State Rep. Tina Orwall and State Sen. Karen Kaiser regarding citizen mitigation issues and an update of the ultra-fine particulate study from the University of Washington researchers.
- **Jan. 6, 2020 – Special TAC meeting**
A special TAC meeting was conducted at the city of SeaTac City Council Chambers with selected citizen representatives invited held to solicit additional detailed input on the study’s approach and findings.
- **April 1, 2020 – Online summary**
An online video summary of the 2020 study was made available for download by anyone from the Department of Commerce’s website, accompanied by an abstract of the draft report’s executive summary.

Some citizens stated that the 2020 study did not go far enough in advocating for their interests or did not extend geographically to neighborhoods that were not part of the ESSB 6032 study grant area. The study area cities were defined by ESSB 6032 and the project's scope, schedule and budget defined what the consultant team could focus on during the project schedule. Further evaluation and analysis outside these parameters could be accommodated as part of a follow-up study.

Many residents voiced long-standing concerns about how operations at Seattle-Tacoma International Airport have affected their communities, and in some cases their individual homes. Some of these concerns date back to 1970 and the opening of the second runway. Concerns range from the quality of noise mitigation packages to nighttime passenger and cargo flights to issues regarding property values and effects on public health.

While the consultant team acknowledges the importance of these issues, the 2020 study was not designed to be a forum for additional concerns regarding Seattle-Tacoma International Airport. As mentioned, public input did help determine the magnitude of some concerns, especially where data was unavailable, inconsistent, or incomplete. Those disparities are noted as part of this study.

An unexpected problem

Beginning in early 2020, an unanticipated problem derailed the remainder of public meetings and presentations. The Seattle region experienced one of the early U.S. outbreaks of the COVID-19 coronavirus – a global pandemic that resulted in nationwide and international travel restrictions and regionwide shelter-in-place orders. From March through June 2020, this order prevented the consultant team from presenting the 2020 study's findings, including in-person presentations to the TAC, to each study area city council, to the Department of Commerce leadership, and to state legislators and other interested parties.

Alternatively, an online TAC meeting was conducted in mid-March 2020, and a narrated video summary of the report was posted online in April 2020 for public review. The draft report was also posted on the Department of Commerce website for review and comment during this same period. Ongoing health concerns prevented final in-person presentations in May 2020.

G. THE SHARED HISTORY OF THE STUDY AREA

The study area has been inhabited by for hundreds (perhaps thousands) of years prior to the development of Seattle-Tacoma International Airport. It was initially the home to the Lushootseed-speaking tribes of the Muckleshoot, Puyallup, Duwamish, and Suquamish peoples who established encampments for fishing, clamming, hunting and agriculture. By the mid-1800s, settlers and homesteaders began establishing small communities throughout the area.

As is common with metropolitan areas, the six study area cities grew at different paces. Tukwila was the first to incorporate as a city (1908), with Normandy Park and Federal Way becoming cities in the 1950s (1953 and 1959, respectively). Federal Way and SeaTac both incorporated on the same day in 1990, with Burien officially becoming a city in 1993. And while they all incorporated at different times, they all were growing as early "suburbs" to the larger city of Seattle.

Burien, Normandy Park and Federal Way were developing neighborhoods and communities that had a combination of Puget Sound views, dramatic topography, and dense tree cover. Some referred to Normandy Park as "Boeing-ville" because of the number of Boeing executives who resided in the community.

All study area cities leveraged some mode of transportation – highway, railroad, or boat – as a means to grow. Tukwila’s strategic location along Interstate 5 and railroad freight lines helped it become a leader in retail and warehouse/distribution development.

An industry closely tied to Seattle and King County is aviation, and aircraft manufacturer Boeing has been an important part of the region for over 100 years. Interest in aviation accelerated after World War I, initially for mail and cargo delivery, then for commercial routes in the 1920s. Boeing Field (King County International Airport) began offering passenger service in 1928 and was eventually replaced by Seattle-Tacoma International Airport as the region’s main passenger airport in 1947. (The U.S. military had taken control of Boeing Field in the 1940s as a response to the 1941 attack on Pearl Harbor, Hawaii.)

Despite “growing up together”, many of the study area cities have had previous concerns with operations at Seattle-Tacoma International Airport, including the development of the second runway in 1970 (Runway 16C/34C) and its associated noise and air quality. Those concerns were echoed 27 years later with the 1997 proposal of a third runway (Runway 16R/34L). Both runways were constructed despite local objections.

Study area growth

From 2000 to 2018, the entire study area, as well as the City of Seattle, King County, and the Seattle metropolitan statistical area (MSA) experienced growth, but at varying rates – from 22.8% for the study area to 32.2% for the city of Seattle. (The city of Burien’s growth rate was also partially the result of a significant annexation in 2010 that added 1,600 acres and 14,292 residents to the city at once. Without the 2010 annexation, Burien’s growth rate would have been closer to 20%.)

Figure 4
Area Growth: 2000-2018

Area	2000 Population	2018 Population	Growth: 2000-2018
City of Burien	31,881	51,908	62.8%
City of Des Moines	29,267	32,364	10.6%
City of Federal Way	83,259	97,044	16.6%
City of Normandy Park	6,392	6,660	4.0%
City of SeaTac	25,496	29,239	14.7%
City of Tukwila	17,181	20,294	18.1%
Total: Study area cities	193,476	237,449	22.8%
City of Seattle	563,374	744,955	32.2%
King County	1,737,034	2,233,163	28.6%
Seattle MSA	3,043,878	3,939,363	29.4%
Seattle-Tacoma International Airport	2000 Passengers	2018 Passengers	Growth: 2000-2018
Total Annual Passengers	28,408,553	49,849,520	75.5%
Seattle-Tacoma International Airport	2000 Operations	2018 Operations	Growth: 2000-2018
Air Carrier	236,355	427,170	80.7%
Air Taxi	203,723	8,509	(-95.8%)
General Aviation	5,448	2,625	(-51.8%)
Military	95	87	(-8.4%)
Civil	56	0	(-100.0%)
Total Annual Operations	445,677	438,391	(-1.6%)

Source: Cities of Burien, Des Moines, Federal Way, Normandy Park, SeaTac and Tukwila; and US Census

Although the study area is growing, it is not growing as fast as other parts of the area (refer to Figure 3). However, the largest growth rate in the study area (2000 to 2018) is associated with both the number of passengers at Seattle-Tacoma International Airport (75.5%) and air carrier operations (80.7%). Non-air carrier operations (including air taxi, general aviation, military and civil operations) all decreased during the same period, indicating a rise in the prominence of commercial activity (passenger and cargo) at Seattle-Tacoma International Airport.

Based solely on the above data, no direct correlation can be made between dramatic growth at the Seattle-Tacoma International Airport and the slower growth rates in the study area cities.

Since the above data was initially collected, the Port of Seattle published the 2019 annual passenger and operation counts. The 2019 annual passenger count increased 6.2% over 2018 (to 51,829,239 passengers), while operations fell 5.8% from the previous year (down to 412,916). This disparity may be related to increasing seat count in aircraft and/or the use of larger aircraft on select routes.

H. AIRPORT CASE STUDIES

The 2020 study examined three other airports that shared similar characteristics with Seattle-Tacoma International Airport – U.S. airports with international service with similar land area that are surrounded by other development or by water. The three case study airports were:

- Boston Logan International Airport (Boston, Massachusetts).
- Miami International Airport (Miami, Florida).
- Phoenix Sky Harbor International Airport (Phoenix, Arizona).

Figure 5
Airport Comparisons

Attribute	Seattle-Tacoma	Boston Logan	Miami	Phoenix Sky Harbor
Year opened	1944	1923	1928	1928
Size (acres)	2,500 acres	2,384 acres	3,230 acres	3,400 acres
# of runways	3 runways	6 runways	4 runways	3 runways
# of terminals	3 terminals	4 terminals	4 terminals	3 terminals
# of gates	80 gates	103 gates	131 gates	116 gates
Passengers (2018)	49,849,520	40,941,925	45,044,312	44,943,686
Operations (2018)	438,391	424,024	416,032	434,252
Efficiency ratios (2018):				
▪ Annual passengers per operation	113.7	96.6	108.3	103.5
▪ Annual passengers per gate	623,119.0	397,494.4	343,849.7	387,445.6
▪ Daily passengers per gate	1,707.2	1,089.0	942.0	1,061.5

Figure 5 shows the comparison of the above airports with Seattle-Tacoma International Airport. All three airports had concerns with noise affecting surrounding residential areas and addressed them in different ways. Other comparisons include:

- Seattle-Tacoma International Airport is a very efficient facility. It has the highest ratio of passengers per operation and handles over 1,700 passengers per gate per day every day (2018 annual average).
- The experience of Phoenix Sky Harbor with the NextGen procedures is similar to that experienced in the study area cities.
- The land use redevelopment strategy at Phoenix Sky Harbor went beyond standard mitigation practices. Phoenix is working with the community to return acquired parcels to active development, adding jobs and revenue back into the region.

- Miami’s community outreach programs, including a van equipped with mobile noise monitors, was the most far-reaching effort of the airports studied. The designed “art noise” wall, while not a perfect solution, was an indicator of Massport’s interest in providing some measure of abatement approaches that are sensitive to its surroundings. Boston also had a more extensive community outreach effort. Both Miami and Boston implemented policies and procedures designed to protect the environment, from ISO certification to LEED building practices to how aircraft are powered and cooled while parked at the gate.

While the above case studies do not cover every comparable U.S. airport to Seattle-Tacoma International Airport, they indicate what comparable airports are doing to address community concerns.

This should **not** be interpreted in any way as a critique or condemnation of the efforts to date by the Port of Seattle. It does indicate what the case study airports with similar annual passenger and operation performance have done to address community concerns regarding their facilities. A more extensive survey is recommended to get a more complete picture of how U.S. airports comparable to Seattle-Tacoma International Airport address their community compatibility issues.

I. THE NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS

Every two years, the U.S. Secretary of Transportation is required to submit to Congress the National Plan of Integrated Airport Systems (NPIAS) that “estimates the costs associated with establishing a system of airports that adequately meets the needs of civil aviation and supports the U.S. Department of Defense and the U.S. Postal Service.”

This is the mechanism for developing public-use airports in the U.S. and supports the U.S. Department of Transportation’s (DOT) and the Federal Aviation Administration’s goals of safety, infrastructure, innovation, and accountability as mandated by Title 49 USC, Section 47103.

On page 1 of the most recent Report to Congress (26 September 2018), the NPIAS defines a list of eight attributes to be followed. These principles were articulated more than 25 years ago and were reaffirmed by both the Federal Aviation Administration and the aviation industry in 2011. Of the eight attributes, Principle #5 is appropriate with regards to how airport-area communities are addressed:

“Airports should be compatible with surrounding communities, maintaining a balance between the needs of aviation, the environment, and the requirements of residents.”

Additionally, Executive Order 12893 (31 January 1994) requires that “federal investments should be cost beneficial”. This executive order included other key principles that the Federal Aviation Administration supports through its administration of the NPIAS, including:

- Support of state and local planning and information management systems.
- Support for private sector participation.
- Support for effective administration of grant programs like airport improvement program (AIP).

Given that every U.S. airport is required to abide by the attributes and guiding principles established in the NPIAS, this study recommends that the Port of Seattle and Seattle-Tacoma International Airport take these principles into account, especially Principle #5 regarding compatibility with surrounding communities.

J. WHAT WE HEARD FROM THE PUBLIC

In addition to research data over a 22-year period, the consultant team received input from the public to help establish the concerns and priorities that were concerns of the residents of the study area. Public input was gathered in a variety of ways, including:

- A series of 1-to-1 and small group stakeholder interviews composed of citizens, homeowners, business owners, and other interests in the study area cities.
- Two public workshops (July 2019 and November 2019) to gather public comment regarding the 2020 study and draft preliminary findings.

During this process, almost 200 people were involved, including both long-time and new residents. The top concerns voiced were regarding noise and air quality:

▪ **Noise**

Noise was the primary concern among the residents who commented during the 2020 study. Noise complaints date back to the development of the third runway more than 20 years ago (and some go as far back as the second runway in 1970). Noise-related complaints were relatively constant from 1997 until 2017 with a few thousand each year. Complaints spiked dramatically in 2018 (over 170,000 complaints) and 2019 (over 400,000 complaints). This spike in 2018 and 2019 is consistent with the increase in annual operations and annual passengers at Seattle-Tacoma International Airport.

The Port of Seattle also indicated that the dramatic increase in noise complaints after 2017 was due in part to the development of an app that allowed for noise complaints to be submitted automatically to the airport with the push of a button. The Port of Seattle also reports that this app is used for airports nationwide, not just Seattle-Tacoma International Airport.

▪ **Air Quality**

Air quality concerns were a close second concerns, especially how air quality can affect health, the environment, property values, and quality of life. A new category of air pollutant – ultrafine particulates (UFPs) – was also a concern of the public. (A concurrent study on UFPs was being conducted by the University of Washington, which did not detail effects on human health.)

Other concerns raised by the public during the 2020 study included (not in order of importance or priority):

- Failure of mitigation packages as part of the third runway mitigation process.
- Traffic congestion, specifically on Airport Expressway, along International Boulevard/US Highway 99 at Arrivals Drive/South 182nd Street, on State Route 518 westbound (west of the I-5/I-405 interchange), and State Route 518 eastbound (west of the Des Moines Memorial Drive interchange).
- Concerns that South King County is a “dumping ground” for undesirable land uses. Examples given included the Federal Detention Center (2425 S. 200th St.) and the Federal Aviation Administration Flight Standards District Office (2200 S. 216th St.) – neither of which contributes property tax revenues to the local communities.
- A general mistrust by members of the public of the Federal Aviation Administration, the Port of Seattle, and Seattle-Tacoma International Airport. This level of skepticism appears to most acute in Burien, Des Moines, Federal Way, and Normandy Park. However, it is important to note that this is not uniform across the study area. For instance, the city of SeaTac has reported that its working relationship with the Port of Seattle is quite good, as evidenced by an interlocal agreement between the two entities.
- Violent crime, property crime, and motor vehicle theft in the study area cities is disproportionate.
- Property crime activity in the study area cities is disproportionate.
- Motor vehicle theft and related activity in the study area cities is disproportionate.

- Homelessness is a regional problem and is pervasive near the airport.
- Airport proximity influences health statistics.
- Airport proximity exceeds appropriate health standards.
- There are noise-induced health concerns.
- Port of Seattle programs and other efforts (sustainability and fly quiet) have been ineffective.
- Previous noise mitigation packages are ineffective.
- The relationship with the Port is generally poor, but also varies by community.
- Airport revenues are not shared with South King County communities.
- The most vulnerable groups are being the most adversely affected.
- Positive and negative effects vary among the study area cities.
- Housing that is most adversely affected is near the airport.
- School performance has suffered due to airport effects.
- The Port of Seattle is not responsive to the cities in the study area.
- NextGen procedures have enhanced adverse effects.
- Airport employment levels for area residents are not what they used to be.

Some citizens provided data and studies regarding noise and air quality to the consultant team. This information was reviewed and included in the 2020 study only when it could be independently verified and validated. When that was not possible, the information was taken as an anecdotal indicator of public concern regarding specific aspects of the airport and its operation.

It is important to note that the public did not speak with a “unified monolithic voice.” Concerns varied from city to city within the study area:

- Input from those west and south of the airport tended to prioritize noise and air quality as primary concerns (predominantly Burien, Des Moines, Normandy Park and Federal Way, with some areas in the city of SeaTac immediately north of the airport).
- Those living northeast and east of the airport tended to also have issues with noise from Boeing Field/King County International, noted more concerns with traffic, and were interested in ways to increase and improve economic development.

Public anecdotal information is important in that it may augment gaps in objective data. These comments tend to point to areas of concern that should be addressed on a local or a community-wide level. It also helped inform the consultant team regarding the recommendations included in this document.

K. EFFECTS FROM NOISE AND VIBRATION

The consultant team was tasked with evaluating a variety of effects to determine a baseline of what effect Seattle-Tacoma International Airport has on the study area cities. Effects were studied as far back as 1997 and up to the most currently available data – usually 2018 or 2019. As noted, input was also considered through stakeholder interviews, public workshops, and monthly meetings with the TAC.

The following were the effects from noise and vibration in the study area.

- **Positive effects of noise and vibration**
There are no known positive results of receiving noise or vibration.
- **Neutral effects of noise and vibration**
There are no known neutral results of receiving noise or vibration.

▪ **Negative effects of noise and vibration**

As stated above, noise was the top concern voiced by residents of the study area. This was not entirely unexpected, as similar complaints were raised in the 1997 study, and noise is often a common critique of airports by their surrounding communities. While an average residential structure can provide some measure of sound attenuation, there is no known technology that mitigates noise effects in outdoor areas (yards, parks, etc.). Increases in air carrier operations at Seattle-Tacoma International Airport from 1997 to 2019 have also seen an increase in the number of complaints, as well as concerns of adverse associated effects of noise exposure, including:

- Annoyance
- Sleep disturbance
- Cardiovascular effects
- Children’s learning and cognitive impairment
- Speech interference
- Depressed property values
- Effects on wildlife and domestic pets.

The incidence of noise related complaints generally aligns with flight tracks, late-night operations, and occasional on-airfield maintenance run-ups and reverse thrusting. Despite being in what federal standards consider to be “acceptable,” many of these complaints are located within the 65 day-night average noise level (DNL) contour. The DNL method of averaging noise over a 24-hour period is not an accurate representation of how area residents, workers, and visitors experience noise, which is as an individual single event.

▪ **Noise and vibration data gaps**

Insufficient data was found to make a determination regarding how vibration affects the study area. Additional study, monitoring and data collection would be necessary to make any determinations regarding vibration.

L. EFFECTS ON AIR QUALITY

The data regarding air quality does not tell the whole story regarding study area effects. While the data indicates that King County is in attainment with federal standards, the lack of working air quality monitors in the study area does not accurately depict the study area’s air quality.

▪ **Positive effects on air quality**

Toxic emissions are showing a downward trend, and the airport has taken initiatives to reduce emissions, with a plan to fuel all flights at the airport with sustainable aviation fuels by 2028. But without an adequate and operational air quality monitor network, the effect of these improvements upon the study area cannot be adequately measured.

▪ **Neutral effects on air quality**

There are no known neutral effects on air quality in the study area.

▪ **Negative effects on air quality**

Despite some positive signs, negative effects on air quality continue:

- Increased aircraft operations negatively affect local and regional air quality.
- Reports of “black soot” on study area properties, which requires additional independent testing to determine its chemical composition and source.
- Black carbon emissions from aircraft also contribute to atmospheric warming.
- Concerns about UFP pollution (which requires further study).

▪ **Air quality data gaps**

Numerous data gaps affected the 2020 study's ability to specifically list air quality effects, including:

- The inability to compare data from EDMA to AEDT models.
- Differences between 2016 and 2017 emissions data.
- Dated EIS data relating to air quality and emissions.
- Toxic concentration information that is not based on data from monitoring stations close to the airport.
- Additional study on UFPs is needed to determine the extent of potential health effects.

M. EFFECTS ON MOBILITY

Since 1997, the study area, King County, city of Seattle, and the Seattle MSA have all grown. The challenge of the 2020 study was separating regional traffic growth versus traffic growth associated with airport operations.

▪ **Positive effects on mobility**

Positive effects include:

- Airport Expressway – Construction of Airport Expressway provide a direct route to the airport that does not rely on local streets.
- Transit improvements – Transit use is promoted by Sound Transit's Link light rail line, Express bus, RapidRide service and Park & Ride lots.
- Cell phone lot – The cell phone lot provides a nearby waiting area for drivers meeting arriving passengers.
- Consolidated rental car facility – Development of the remote consolidated rental car facility has removed dozens of shuttle buses previously operated by the individual rental car companies.
- Local street improvements – Traffic flow improvements on local surface roads including center turn lanes and dedicated bus lanes. Also included are improvements to local sidewalks and bike lanes to encourage walking and bike access.
- Airport employee parking – The Port of Seattle has developed dedicated employee parking areas north and south of the airport.
- Local parking – Local parking requirements are generally higher than industry standards. Airport-area parking in adjacent neighborhoods is not the problem as was first thought.

▪ **Neutral effects on mobility**

There are no known neutral effects on mobility in the study area.

▪ **Negative effects on mobility**

Negative effects include:

- Highway capacity – Since 2000, the capacity of the regional highway network (Interstates 5 and 405, State Routes 509 and 518) has not kept pace with regional population growth. Improvements have favored transit and high-occupancy vehicle (HOV) access (such as HOV lanes and preferential ramp signals).
- Congestion – During certain peak travel periods (Thanksgiving, Christmas, etc.), there is visible traffic congestion on Airport Expressway, which can backup to connecting highways and local streets. Average Level of Service (LOS) ratings have worsened since 1997 on surrounding local streets.

- Airport employee parking in Park and Ride lots – Some citizens have noted that airport employees are using Park and Ride facilities, such as the Angle Lake Light Rail Station garage.
- **Mobility data gaps**
Numerous data gaps regarding mobility were noted in the 2020 study:
 - It is currently not known what effect on-demand car services (Uber and Lyft, which did not exist in 1997) have on local and regional traffic.
 - While there have been improvements to the transportation network, these have tended to favor transit, pedestrian, and bicycle access. The overall capacity of the area network has not substantially increased since 1997. And while the airport is thought to contribute to local and regional traffic, the data is insufficient to determine the extent of this contribution.

N. EFFECTS ON SURFACE WATER QUALITY

▪ **Positive effects on surface water quality**

The Port of Seattle has made several investments in the infrastructure to preserve and protect the quality of surface water, including:

- Construction of 112 acres of wetland near the airport.
- Enhanced about two miles of stream habitat, including the relocation of 1,000 feet of Miller Creek’s stream channel.
- Excavated 60-acre feet of floodplain storage capacity.
- Installed 200 pieces of large woody debris, removed two culverts that blocked fish passage, and focused on stabilizing four eroded portions of Miller Creek’s stream channel.
- Supplements streamflow to Miller and Des Moines creeks every summer to ensure adequate water levels for fish.
- Created and enhanced 65 acres of off-site wetland and wetland buffer adjacent to the Green River in Auburn to mitigate the loss of wetland habitat for waterfowl near the airport.
- Upgraded the industrial wastewater system (IWS) and stormwater management systems (SWS) to more efficiently capture and treat stormwater runoff from the airport.
- Kept stormwater discharges from the airport well below permit limits with low variability in comparison to other airports and industrial stormwater.

The near-constant monitoring of stormwater runoff water quality required by the National Pollution Discharge Elimination System (NPDES) permitting program and adjustments to stormwater management in response to water quality results leave little in the way of negative effects to surface water quality and habitat in the immediate area. However, Seattle-Tacoma International Airport occasionally exceeds those criteria, and even short-term violations can affect salmon habitats. With instances of pre-spawning mortality already recorded in Miller, Walker, and Des Moines Creeks, and throughout the Puget Sound region, it is important to understand the effects any pollution can have on salmon populations.

▪ **Neutral effects on surface water quality**

There are no known neutral effects on surface water quality in the study area.

▪ **Negative effects on air quality**

There are no known negative effects on surface water quality in the study area.

O. EFFECTS ON GROUNDWATER AND SOIL

- **Positive effects on groundwater and soil**

The Port of Seattle, the Department of Ecology, and other agencies have documented incidents of on-airport contaminated and NPDES exceedances. The Port of Seattle has taken steps to address areas of concern, but on-going work and monitoring is required.

- **Neutral effects on groundwater and soil**

There are no known neutral effects on groundwater and soil in the study area.

- **Negative effects on groundwater and soil**

Negative effects include:

- Known on-airport contaminated sites include Budget Auto Facility, Concourse B/Gate B, Continental Airlines Hydrant System, Delta Airlines Auto Gas Tank Cluster, Delta Airlines Fuel Farm, Northwest Airlines Hangar Tanks, Northwest Airlines Fuel Farm, Northwest Airlines Hydrant Systems, South Satellite Baggage Tunnel, Pan Am Airlines Avgas (Aviation Gas) Tanks, Pan Am Airlines Fuel Farm, Consolidated Rental Car Facility, and United Air Lines (UAL) Fuel Farm/Continental Airlines Fuel Farm.
- Surface water quality exceedances were detected in Miller and Des Moines.

Negative effects that are not attributable to Seattle-Tacoma International Airport include:

- According to the Department of Ecology’s database, several underground storage tanks not on airport property were noted to be leaking. Any underground storage tanks not on airport property are not problems attributable to aviation activity.
- There may be long-term effects that were also associated with the operation of the former Asarco Tacoma Smelter (opened in 1917, closed in 1985). Any effects associated with the closed smelter are not attributable to aviation activity.

Some citizens raised concerns regarding the effect on soils, gardens, and landscaping from “black soot” that they believe are the result of air pollution associated with aircraft. The composition of the reported “black soot” has not been confirmed by the 2020 study. It requires study and analysis by an independent testing laboratory before its source can be attributed.

P. EFFECTS FROM LIGHT

- **Positive effects from light**

Seattle-Tacoma International Airport is replacing the older-generation of lighting (metal halide) with energy-efficient LED fixtures that also create less glare. This helps to reduce increased skyglow that often is a problem with standard metal halide lighting.

The data indicates that light intrusion or pollution is being reduced at Seattle-Tacoma International Airport as a result of improving its light fixtures and high-mast lighting.

- **Neutral effects from light**

There are no known neutral effects from light in the study area.

- **Negative effects on air quality**

There are no known negative effects from light in the study area.

Q. EFFECTS ON PUBLIC SAFETY

- **Positive effects on public safety**

Crime has stabilized and, in some cases, decreased in the study area, including motor vehicle thefts, violent crimes, and property crimes. Normandy Park has the lowest incidence of most crimes. However, it could not be determined if these positive effects were attributable to aviation activity or proximity to Seattle-Tacoma International Airport or were due to other contributing factors.

- **Neutral effects on public safety**

There are no known neutral effects on public safety in the study area.

- **Negative effects on public safety**

Tukwila reported the highest rate of most reported crimes. It is suspected that this may be due to the location of major regional retail destinations in Tukwila (such as Southcenter Mall), and it may also be possible that more crimes are reported to police in Tukwila than in other study area cities. However, it could not be determined if these negative effects were attributable to aviation activity or proximity to Seattle-Tacoma International Airport or were due to other contributing factors.

- **Public safety data gaps**

Incidents of human trafficking and drug trafficking were not traceable in the study area due to insufficient readily available data.

R. EFFECTS ON PUBLIC HEALTH

- **Positive effects on public health**

There are some positive health outcomes in the study area, including decreases in the accident rate, and some declines in the rates of cancer and heart disease in the study area cities and King County between 2012 and 2016. Life expectancy in the study area cities is almost equal to the average for the state of Washington and the U.S. and is only slightly below the King County average. However, it could not be determined if these positive effects were attributable to aviation activity or proximity to Seattle-Tacoma International Airport or were due to national trends or other contributing factors.

- **Neutral effects on public safety**

There are no known neutral effects on public health in the study area.

- **Negative effects on public safety**

While negative concerns outweigh positive effects, there are multiple contributing factors that affect public health. These include poor health habits, genetic predisposition, income level, and other diverse sources. The manner that public health statistics were available prevented a local-level analysis for four of the six study area cities. Poor health can have a devastating effect on individuals and families, and there is no current data that indicates it is attributable to aviation activity at Seattle-Tacoma International Airport specifically in the study area. Further research and analysis is recommended.

- **Public health data gaps**

The way public health information was gathered combined data for several cities (Des Moines/Normandy Park and SeaTac/Tukwila), making local level comparisons impossible. Additional studies with a finer grain of analysis are recommended to address these data gaps.

S. EFFECTS ON SOCIO-ECONOMICS

- **Positive effects on socio-economics**

Positive effects include Seattle-Tacoma International Airport as a source of employment for the study area cities, revenue from hotel rooms and supporting businesses in the vicinity of the airport, and proximity to air service as a locational advantage for companies within a 30-minute drive of the airport.

- **Neutral effects on socio-economics**

Neutral effects include lower median home sale prices, areas located farthest from the airport considered more valuable, and commercial vacancy rates well below equilibrium, a consistent trend being experienced in many cities since the Great Recession.

- **Negative effects on socio-economics**

Negative effects include school districts with a “lower socio-economic profile” than that of King County, median household incomes below the average for King County, and owner-occupied households that spend 30% or more of their income for housing.

- **Socio-economic data gaps**

Given the existing data, it could not be determined if the study area cities experience slower rates of growth and increase in home values due to airport proximity or due to other factors. The study area cities experience some benefits from airport-related employment and relatively higher multi-family and industrial rents. However, it could not be determined if these were attributable to aviation activity or proximity to Seattle-Tacoma International Airport or were due to other contributing factors.

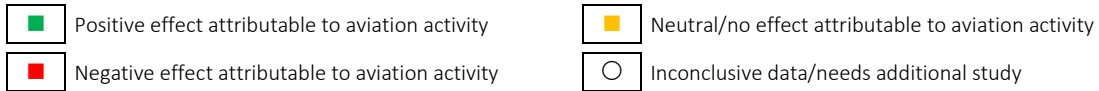
T. SUMMARY OF AVIATION-RELATED EFFECTS

Figure 6 presents a general assessment of the all of the effects in the study area attributable to aviation activity, categorized into four effect types:

- Positive effect attributable to aviation activity.
- Negative effect attributable to aviation activity.
- Neutral or no effect attributable to aviation activity.
- Inconclusive data/needs additional study.

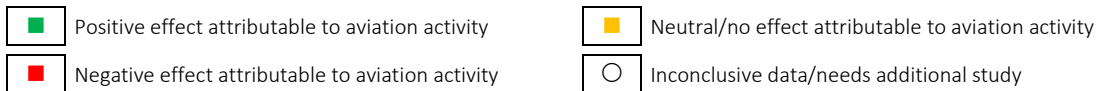
There are a variety of data gaps and limited information that inhibit the ability to determine the effect aviation activity has on the study area. There are numerous data gaps that have been identified in the 2020 study that are recommended for additional study and analysis.

Figure 6
Summary of Study area Effects Attributable to Aviation Activity – 1997 to 2019



METRIC	STUDY AREA CITY																	
	Burien			Des Moines			Federal Way			Normandy Park			SeaTac			Tukwila		
	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019
NOISE & VIBRATION																		
Noise	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	○	○	○
Vibration	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Vibration	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
AIR QUALITY																		
CO	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
HC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
NO _x	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
SO ₂	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
VOC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PM ₁₀	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PM _{2.5}	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
UFP's	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
MOBILITY																		
Traffic	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Transit/Rail	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Transit/Bus	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Parking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	■	■	■
Bicycle	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Pedestrian	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SURFACE WATER																		
Stormwater Runoff	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Floodplains	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Wetlands	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
GROUNDWATER & SOIL																		
Groundwater	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Soil	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LIGHT																		
Light	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PUBLIC HEALTH																		
Cancer	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Heart Disease	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Alzheimer's Disease	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Figure 6 (continued)
Summary of Study area Effects Attributable to Aviation Activity – 1997 to 2019



METRIC	STUDY AREA CITY																	
	Burien			Des Moines			Federal Way			Normandy Park			SeaTac			Tukwila		
	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019	1997	2009	2019
PUBLIC HEALTH (continued)																		
Chronic Lower Respiratory Disease	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Stroke	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Accidents & External Causes	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Suicide	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Life Expectancy	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Maternal & Child Health	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Access to Care	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PUBLIC SAFETY																		
Violent Crime	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Property Crime	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Motor Vehicle Theft	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Human Trafficking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Drug Trafficking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
SOCIO-ECONOMIC																		
Housing	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	■	■	■
Employment	■	■	■	■	■	■	■	■	■	○	○	○	■	■	■	■	■	■
Retail Market	○	○	○	○	○	○	○	○	○	○	○	○	■	■	■	■	■	■
Office Market	○	○	○	■	■	■	○	○	○	■	■	■	■	■	■	○	○	○
Industrial Market	■	■	■	■	■	■	○	○	○	■	■	■	○	○	○	○	○	○
Hotel Revenue	■	■	■	■	■	■	○	○	○	○	○	○	■	■	■	■	■	■
Tax Revenues	○	○	○	○	○	○	○	○	○	○	○	○	■	■	■	○	○	○

U. RECOMMENDATIONS

Figure 7 on the following pages lists 70 recommendations proposed by the consultant team to address effects and concerns in the study area.

The recommendations address the principal concerns of effects from noise and effects upon air quality. Many of the sources of these effects also cross recommendation categories. For example, aircraft overflights that generate complaints about noise also may be sources of air pollution that affect groundwater, soil, surface water, and various socio-economic metrics.

The challenge is that the data sources for all of the metrics researched and evaluated during the study period (1997 to 2018 or 2019) are not always consistent, do not present data in the same fashion from year to year, have changed modelling approaches, or are simply incomplete or non-existent. The 2020 study was limited to researching, evaluating and assessing data from existing and readily available sources. No new modelling, sampling, or data collection was included in the state grant's scope.

"Data gaps" affected the 2020 study's ability to comprehensively assess effects associated with Seattle-Tacoma International Airport given the limitations of schedule, scope and budget. Therefore, more study is necessary to create a longitudinal dataset that can be a more precise and complete picture of effects within the study area. Many of the following recommendations include the need for additional studies to supplement existing data (such as an origin-destination survey that can augment daily traffic counts).

One last area that impeded the consultant team was the project budget. The entire \$600,000 was not available to the consultant team, as \$100,000 was set aside by the state to cover internal costs. Only 83.3% of the total grant (\$500,000) was available for the actual consultant study. By comparison, the budget for the 1997 study administered by the precursor agency (the Department of Commerce, Trade and Economic Development) was \$775,000 for a similar study (assessing the effects of the then-proposed third runway). In current dollars, the 1997 study's budget would be over \$1.2 million. Therefore, a follow-up Phase 2 study is recommended to address the data gaps noted herein, with an appropriate budget to meet study scope and schedule requirements.

**Figure 7
Study Recommendations**

Recommendations: Noise and Vibration	
N.1	Develop a set of alternative noise metrics that do not rely on DNL contours.
N.2	Increase the arrival glideslope to a minimum of 3 degrees.
N.3	Conduct an environmental review for flight track changes.
N.4	Institute noise abatement procedures for late-night operations
N.5	Expand noise monitor locations to include study area permanent and mobile monitors.
N.6	Address existing mitigation packages to fix faulty installations.
N.7	Revise the Port Commission makeup to include direct representation from the study area.
N.8	Conduct additional vibrational monitoring in the study area.
N.9	Determine the effects associated with SELs.
N.10	Determine the effectiveness of sound insulation practices, especially those used by the Port of Seattle in its mitigation packages.
Recommendations: Air Quality	
AQ.1	Improve the current monitoring network by increasing the number and location of monitors in and around the airport.
AQ.2	Establish monitoring guidelines for new locations that consider economics, security, logistics, and atmospheric and pollution considerations.
AQ.3	Deploy Purple Air monitors to get a general sample of air quality trends.
AQ.4	Research the connection of ultrafine particles and health effects.
AQ.5	Conduct a study and improve the monitoring network to determine the extent of regional air pollution effects that are directly related to airport activity.
Recommendations: Mobility	
M.1	Generate rental car forecasts for annual service demand.
M.2	Conduct an annual parking demand study for the main parking garage and employee parking lots.
M.3	Conduct an annual cell phone lot demand study to determine if the cell phone lot reduces congestion at the arrivals and departures areas in front of the terminal.
M.4	Inventory private parking lot data to determine the effect on the main parking garage.
M.5	Conduct an airport mobility modes survey to assess how passengers and employees travel to and from the airport.
M.6	Conduct a drop-off/pick-up zone study to assess congestion and vehicle and pedestrian flow in and around the airport property.
M.7	Forecast employee/vendor/tenant demand to ensure there are parking and mobility options to accommodate changing employment.
M.8	Develop an airport parking master plan in collaboration with airport vendors and employees, surrounding cities, King County Metro, and Sound Transit.
M.9	Develop a transportation improvement program database of all historical and current capital improvements in the Seattle-Tacoma International Airport area to demonstrate network changes over time.
M.10	Conduct a rental car origin-destination study to understand vehicle patterns and movements along the transportation network around the facility, as well as understand where vehicles are traveling from to reach the facility.
M.11	Develop a targeted annual traffic monitoring system to create a consistent and reliable database that monitors congestion over time.
M.12	Conduct an annual transit demand analysis to document transit demand in the study area and ways to improve transit ridership to the airport
M.13	Improve use of airport passenger and employee transit.
M.14	Analyze park & ride use to determine how many people use the facilities to access the airport.
M.15	Conduct a park & ride license plate analysis to determine where vehicles originate and to better understand park & ride demand patterns.
M.16	Conduct an off-street parking license plate analysis to understand where vehicles originate from in the study area and the use of certain on-and off-street facilities.
M.17	Conduct a transit origin/destination study to analyze travel patterns and average daily traffic in the study area.
M.18	Conduct an annual pedestrian count to determine the number of people who use the sidewalk along the front of the terminal and the Link Light Rail Airport/SeaTac station pedestrian bridge to access the airport.
M.19	Identify and eliminate pedestrian mobility barriers.

Figure 7 (continued)	
Study Recommendations	
M.20	Conduct an on-going on-street parking study in Burien, Tukwila, and SeaTac to monitor supply, use, duration, and areas with excessively high use from non-residents.
M.21	Establish an existing/baseline conditions for specific off-and on-street parking facilities in Burien, SeaTac, and Tukwila.
M.22	Establish and maintain a parking supply database to provide insight on parking demand in the area and give local communities an inventory that can be expanded and monitored over time.
M.23	Adopt or expand parking permit programs in Burien and Tukwila to discourage long-term airport passenger and employee parking on residential streets.
M.24	Create an informational program to educate airport employees and passengers regarding local parking restrictions
M.25	The Port of Seattle should adopt a formal policy that prohibits Airport employees from using on-street off-airport parking during working hours.
Recommendations: Water Quality	
WQ.1	Correct potential errors and data gaps to create a more consistent data record.
WQ.2	Improve receiving stream data through more permanent monitoring stations downstream and a suite of water quality parameters that are collected at outfalls regularly to make results more consistent and comparable.
WQ.3	Further study air pollution effects on surface water through independent analyses of citizen-reported pollution samples on surface water locations.
Recommendations: Groundwater and Soil	
GW.1	Conduct independent testing of “black soot” to determine its chemical composition and potential source(s)
GW.2	Conduct ongoing monitoring and sampling of airport operations maintenance area (AOMA) groundwater monitoring wells on a three-year cycle for key indicator parameters.
GW.3	Coordinate with study area comprehensive plans to ensure the ongoing health and preservation of groundwater and soil areas throughout the study area.
Recommendations: Light	
L.1	Update airport high mast lighting and replace with LED sources.
L.2	Adopt study area lighting standards that would establish guidelines for future developments and renovations of existing facilities.
Recommendations: Public Safety	
PS.1	Modify the second level study to include areas to the north of Seattle-Tacoma International Airport.
PS.2	Consider an airport overlay district to address crime on a multi-city level.
PS.3	Pursue multiple approaches to assist victims of sex trafficking
PS.4	Consider CPTED principles in portions of the study area.
Recommendations: Public Health	
PH.1	Establish an independent noise monitoring authority to determine if thresholds for noise established by the Federal Aviation Authority are adequate given local circumstances, as well as appropriate strategies for mitigating effects.
PH.2	Expand the study area to include other neighborhoods that may be affected by Seattle-Tacoma International Airport, including West Seattle, Beacon Hill, and Renton.
PH.3	Develop more detailed public health statistics at the census tract or enumeration district level to afford a more detailed comparison of health effects and airport-related data (noise contours, flight tracks, etc.).
PH.4	Approve/reauthorize bills to address mitigation packages that have failed or are inadequate.
PH.5	Audit local building and zoning standards to identify any inconsistencies between local regulations and federal rules
PH.6	Identify new construction potentially affected by airport use.
PH.7	Establish a health effect assessment process to determine potential health effects of new developments.
PH.8	Require alternative fuel use for airport users.
PH.9	Expand the late night noise limitation program to reduce effect on neighborhoods.
PH.10	Replant trees throughout the study area to help absorb noise and air toxins.
PH.11	Expand Port efforts to promote public health.
Recommendations: Socio-Economics	
SE.1	All parties should commit to a shared objective.
SE.2	Consider a “study area-wide” overlay district.

SE.3	Conduct additional analyses.
Recommendations: General	
G.1	Establish a single source data clearinghouse for effect metrics and data.
G.2	Expand the study area to incorporate areas to the north so that the airport is located in the center of the study area.
G.3	Expand participation by the Port of Seattle in any follow-up studies.
G.4	Improve the airport/community relationship.
G.5	Develop a plan for airport-adjacent perimeter areas.
G.6	Follow NPIAS Attribute #5 regarding surrounding communities.
G.7	Conduct an expanded Phase 2 study.

V. CLIMATE CHANGE

While the issue of climate change was not part of the project scope, the issue arose as a question from several community members during this project. The consultant team was asked “what are you doing to address climate change,” and some community members expressed frustration that this was not part of the project.

The consultant team was not asked to investigate any effects that Seattle-Tacoma International Airport might have on climate change. The project resources (time and budget) were also insufficient to address such a broad and complex issue.

The 2020 study agrees with the bulk of climate research – that the climate has been increasingly affected by human activity. This is supported by research by scientists and academicians across the world. In 2016, 196 countries signed the Paris Accords to address climate change and its underlying causes (the U.S. withdrew from the agreement in June 2017).

The 2020 study did not research the issue of aviation-induced climate change, but it was addressed at the 2019 Paris Air Show. An article in Fortune magazine (June 2019) contained the following quote:

“Aviation currently accounts for around 2.5% of global carbon emissions, and the industry has pledged to halve its 2005-level footprint by 2050 through an offsetting program. Therefore, engineering firms were keen to showcase a range of eco-friendly inventions such as hybrid engines, urban mobility vehicles, and autonomous flight systems at the annual event, the largest for the aerospace industry. . . .It’s not just environmental considerations driving the research: UBS estimates sales of hybrid engines will be worth \$178 billion by 2040, while the electric vertical take-off and landing (eVTOL) market will be a \$285 billion business by 2030.”

The above quote did not specify which components of “aviation” account for 2.5% of global carbon emissions nor the source of this figure. It could be limited to aircraft emissions while operational, or it could involve the entire product life-cycle – from manufacture to decommissioning. The 2.5% figure likely does not address other airport-related activities, including ground transportation by travelers and employees.

The above quote makes a case for changes in aircraft technology (likely as a cost-savings for airlines), which will have a secondary benefit of addressing environmental concerns. These remain speculative projections at this point, but advances in hybrid and electromotive propulsion hold the promise to reduce noise and air pollution.

Beyond aircraft technology, there are promising trends in market acceptance of automobiles and light trucks with hybrid and fully-electric engines. This helps reduce tailpipe emissions but also shifts some energy-generation burdens to the power grid (for electric vehicle recharging). Simpler and more cost-effective measures are those that promote developments that encourage walkability, biking, and transit use – something that is happening across the region and the U.S. The Port of Seattle is taking steps to address environmental concerns – replacing old high-mast lighting with high-efficiency LEDs, use of more hybrid and electric vehicles,

and development of the Sustainable Airport Master Plan. But the 2020 study will not address – and was not asked to address – any potential climate change effects associated with operations at Seattle-Tacoma International Airport. This is an issue that is worthy of a separate investigation and study.

W. THE FUTURE

The 2020 study has noted future potentials that may affect the study area, King County, and the region. But these future potentials are speculative at best. Not only is there no guarantee that any of these future potentials will be viable, there are likely many more unknown innovations that could affect the study area.

For example, during the 1997 study there was no realistic prediction of innovations like smartphones, on-demand car services (other than conventional taxis), social media, etc. Even light rail access to Seattle-Tacoma International Airport was just a proposal. By 2020, all these unknown “futures” had become part of daily routine and have changed the way we live, work and play.

There are some technological innovations on the horizon, but no one in 2020 can accurately predict how, when or even if they will become a reality. These include such concepts as:

- Autonomous vehicles and connected cars (currently being tested worldwide in numerous cities)
- Flying cars and taxis (to be tested in several cities worldwide by 2023)
- Advanced aircraft engines that rely on alternative energy sources or hybrid engines
- Short Take-Off and Landing (STOL) and Vertical Take-Off and Landing (VTOL) aircraft for large-scale passenger and cargo service
- Hyperloop and below-grade high-speed tunnel systems (proof-of-concept currently being tested).

Advances in telecommunication technology – specifically 5G cellular service – promise to deliver fiber optic cable speeds wirelessly. In 2020, the nationwide 5G network is being constructed by various service providers, soon to be followed by a variety of 5G-capable devices. Proponents of 5G tout its ability to allow people to office anywhere, which could have some effect on commuting and air travel patterns, but there are no examples to-date of widespread applications that are changing our daily lives in such a fashion.

The new 5G service will also introduce a new generation of connected devices that create IoT – the “Internet of Things”. Projections vary on how many connected devices are in service in 2020 (smartphones, computers, tablets, smart televisions, digital assistants, etc.), but the numbers exceed the global population. By 2030, these devices are expected to increase exponentially to perhaps 30 billion or more worldwide. The deployment of billions of new connected devices and vehicles may have some influence on travel and commuting, but their effects remain hypothetical at present. The 2020 study recommends policy decisions and capital expenditures remain flexible enough to accommodate these as-yet unknown changes to the future.

The COVID-19 coronavirus pandemic during the last few months of the 2020 study impacted every aspect of daily life and economy globally. It forced the immediate pivot of retail, work and school to online platforms and working from home. Evidence of these changes was visible in dramatic reductions in travel patterns – from nearly empty highways to far fewer air passengers. Time will tell how these changes are manifest over time, but there is the potential that COVID-19 may have inexorably changed the nature of some travel habits.

New airport

The Seattle metropolitan area is currently served by three airports – Seattle-Tacoma International Airport, Paine Field, and Boeing Field (the latter provides commercial charter service). Discussion of a potential fourth airport has been ongoing for 26 years:

- In 1994, the Puget Sound Regional Council studied the potential for a new airport at several locations, all of which received significant opposition. The 1994 study ended with no further action.
- In 2005, Alaska Airlines and Southwest Airlines proposed using nearby Boeing Field, which was rejected by King County. (In addition to Seattle-Tacoma International Airport, Alaska Airlines now provides passenger service from Paine Field in Everett.)
- In 2019, Gov. Jay Inslee signed a bill sponsored by State Sen. Karen Keiser (Des Moines) to create a commission tasked with locating a new airport. The commission will identify six candidate locations by January 2021, with a preferred site being located by January 2022.

Developing a brand-new ground-up airport is a lengthy and complex process – the most recent completely new U.S. airport was Denver International Airport (DIA) which opened in February 1995 after 15 years of study, design, review and construction. Should the state of Washington identify a preferred location for a new airport by 2022, that airport might not be operational until at least 2037.

The Port of Seattle is also expanding airport facilities by an additional 19 gates to address increasing passenger demand. But in November 2019, Alaska Airlines – one of the primary carriers at Seattle-Tacoma International Airport – voiced its opposition to this expansion effort, citing issues with security clearance, passenger convenience, and increased congestion. Alaska Airlines contended that Seattle-Tacoma International Airport “is not on land big enough to sustain the expansion for a major airport” and cited Dallas/Fort Worth International Airport and Denver International Airport as examples. Seattle-Tacoma International Airport’s expansion appears to be moving forward in spite of this opposition.

The 2020 study does not discourage the investigation of a potential new airport, nor does it discourage facility improvements at the existing Seattle-Tacoma International Airport. A new airport is an attractive future potential, but it does not address immediate concerns and effects in the study area. The 2020 study promotes the new airport study while concurrently addressing the needs and concerns of the study area communities.

X. IN CLOSING

Seattle-Tacoma International Airport is one of the busiest airports in the U.S., and it is important to the economic health of the Seattle region and the state of Washington. The airport and the surrounding study area have grown up together in South King County for more than 75 years – their past, present, and futures are inextricably linked.

Change has been the one constant in South King County and the region. Portions of the study area cities are much more urbanized in 2020 than they were years earlier. When the 1997 study was prepared, it could not predict the rise of innovations like smartphones, social media, or app-driven car services. Twenty-three years later, much has changed that is now part of everyday life. Even something as basic as light rail was only a proposal in 1997 – but in 2020, it is an important link in accessing Seattle-Tacoma International Airport. And while the airport has continued to grow, the pace of that growth has accelerated since 2000, eclipsing the pace of growth locally and regionally.

The 2020 study was to assess effects related to aviation activity in the study area as a means to help address future effects as Seattle-Tacoma International Airport grew. However, there is no single metric – no “experience index” – to accurately incorporate all concerns into a single metric.

The 2020 study has determined that **noise** has been the primary issue during the study period (1997 to the present). **Air quality** and its associated possible effects on **public health** were also a concern, especially from some residents of the study area. Both noise and air quality concerns are not uncommon issues for areas close to airports in other cities. They can also affect aspects of the study area, including effects on the environment, human health, student learning, and the economy. The further definition of airborne particulate matter – specifically UFPs – merits further study to determine any epidemiological effects. The 2020 study does not have the data or local sampling evidence to reach a conclusion regarding UFP effects in the study area.

If the changes from 1997 to 2020 were unanticipated, the next 23 years – by 2043 – could bring new innovations that are beyond our present imagination, including new modes of travel, new means of aircraft propulsion, and new technologies that change how we live, work, play and travel.

As enticing as the future is, there are concerns that face the study area cities in 2020. As an important component in the region’s economy, Seattle-Tacoma International Airport should also strive to minimize effects from its operation so that the residents of Burien, Des Moines, Federal Way, Normandy Park, SeaTac, and Tukwila do not bear an undue burden, whether from noise, air quality, traffic congestions, or other effects.

A well-known aphorism often attributed to President John F. Kennedy states that “a rising tide lifts all boats.” It is recommended that this be a guiding principle in the further development and operation of Seattle-Tacoma International Airport as it continues to grow. What benefits the airport should have an associated benefit to the surrounding study area cities. And by extension, operations at the airport should not negatively affect its neighbors.

Y. APPENDICES

This report is supplemented by the following six appendices (separate document):

<https://deptofcommerce.box.com/s/vlw1drlw7cp6upgxsh3koe1diwh1dfo7>

- **Appendix A – Detailed Study Report**

- [Section 1 – Introduction.](#)

- [Section 2 – Historical background of the study area.](#)

- [Section 3 – Case studies of three comparable airports.](#)

- [Section 4 – Summary of public and community input.](#)

- [Section 5 – Summary of noise and vibration evaluation and analysis.](#)

- [Section 6 – Summary of air quality evaluation and analysis.](#)

- [Section 7 – Summary of mobility evaluation and analysis.](#)

- [Section 8 – Summary of surface water quality evaluation and analysis.](#)

- [Section 9 – Summary of groundwater and soil quality evaluation and analysis.](#)

- [Section 10 – Summary of light evaluation and analysis.](#)

- [Section 11 – Summary of public safety evaluation and analysis.](#)

- [Section 12– Summary of public health evaluation and analysis.](#)

- [Section 13 – Summary of socio-economic evaluation and analysis.](#)

- [Section 14 – Summary of study findings.](#)

- **Appendix B – References**

- A listing of technical references used in the 2020 study.

- **Appendix C – Stakeholder Interviews**

- A summary of all stakeholder interviews.

- **Appendix D – Project Contacts**

- A listing of people involved in the 2020 study, including attendees at the public workshops.

- **Appendix E – Glossary**

- A listing of technical terms used in the 2020 study.

- **Appendix F – Other Reports**

- Additional information provided.

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