HARVEY FIELD AIRPORT

SNOHOMISH, WA

Foundation for the Future

2018 Airport Master Plan

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1.0 INTRODUCTION

The goal of this Airport Master Plan (AMP) is to prepare guidance that allows Harvey Field (S43 or Airport) to continue to operate in a safe and effective manner as demand and technologies change and evolve. The Master Plan and associated Airport Layout Plan (ALP) will determine the extent, type, and schedule of development needed to not only maintain current service levels but to grow the airport in a healthy and feasible way. The Master Plan was last officially updated in 2010. Due to a change in the Airport's critical aircraft[1] and Federal Aviation Administration (FAA) design standards, it is necessary to again review the needs of the Airport and community. This study will serve to update both the Master Plan and the ALP.

1.1 Study Goals

The overall goal is to develop a plan that meets FAA safety and design standards for the ARC B-II aircraft and guides S43 and the community into the future while meeting existing and future aviation needs. In order to accomplish this goal, the following main objectives have been defined:

- Determine the current condition of existing facilities and their efficiencies.
- Provide a planning document for the next 20 years that is technically accurate, realistically executable, and financially feasible.
- Prepare forecasts of aviation activity.
- Prepare a financial plan that is realistically achievable to attain. One that considers the operating budget, revenue, expenses, and potential FAA grant funding.
- Incorporate public involvement throughout the process to ensure that the future of the Airport aligns with the values and vision of the community.

1.2 Essential Public Facility Designation

Harvey Field has been designated as an Essential Public Facility (EPF) in accordance with the provisions of the Washington State Growth Management Act - RCW 36.70A (GMA) and the Planning Enabling Act - RCW 36.70 (PEA). This designation was granted to protect public use general aviation airports that are essential to the state's aviation system from encroachment by incompatible land uses. The EPF requires that cities and counties planning under the GMA through their local comprehensive plans and growth regulations:

- protect EPFs by discouraging adjacent siting of incompatible land uses
- ensure that land use actions allow for the siting of EPFs
- promote orderly expansion and development of existing EPFs

[1] Critical aircraft is the most demanding aircraft or family of aircraft that account for at least 500 annual operations. An airfield is designed for its critical aircraft.

1.3 Regional Airport System Plan

The Puget Sound Regional Council (PSRC) completed a Regional Airport System Plan (RASP) in 2001. Of the 24 public use airports in the Puget Sound Region, Harvey Field ranked fifth in total annual operations (140,700) and fourth in based aircraft (360) for calendar year 1998. The Airport noted that overall general aviation activity has declined since the 2001 RASP was completed; however, activity at Harvey Field has not dropped as much as indicated by the air traffic control records at towered airports such as Paine Field and others in the state. Harvey Field has experienced an increase in fuel sales, skydiving operations, flight instruction and based aircraft in 2015, as of March 1st, when compared to the same period in 2014.

Destination 2030, an update to the Metropolitan Transportation Plan, and a component of the RASP 2001, identifies Harvey Field as an airport of regional significance. This designation is intended to "protect the public investment in these facilities so they can fulfill their role."

1.4 Washington Aviation Systems Plan

In 2017 the Washington Aviation Systems Plan (WASP) was updated to look at how the entire aviation system performs and how individual airports interact to contribute to the system as a whole.

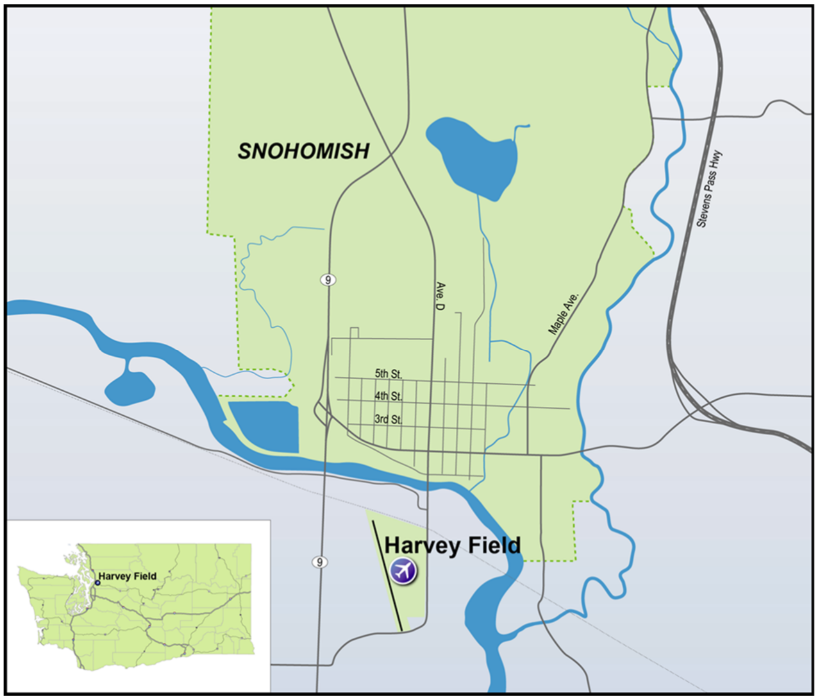
Within the WASP, Harvey Field is designated as a general aviation reliever airport. Reliever airports are defined as those designated by FAA as a having the function of relieving congestion at a commercial service airport and providing more general aviation access to the overall community.[2]

1.5 Airport Location

Harvey Field is located approximately one mile south of the City of Snohomish central business district (CBD) and is part of the Urban Growth Area (UGA). The City of Snohomish is located in Snohomish County, which is nestled in the Snohomish River Valley of the Puget Sound Region of Washington. Access to the Airport is provided via Airport Way (Avenue D north of Snohomish River) from U.S. Highway 2 from the north and State Route 9 from the north and south. **Figure 1-1** depicts the Airport's geographic location.

[2] Washington Aviation Systems Plan, http://www.wsdot.wa.gov/aviation/Planning/wasp.htm, July 2017

FIGURE 1-1 – LOCATION AND VICINITY MAP



Source: Jviation
Note: Not to scale

1.6 Airport Management and Ownership Structure

Harvey Field is privately owned and operated by Kandace Harvey as a public use general aviation reliever facility. Kandace Harvey is responsible for airport administration, including management of the airfield, lease negotiations, airport agreements, community involvement, and public relations. An airport manager oversees the daily operation of the Airport.

1.7 Airport History and Activity

The Harvey family emigrated from England in the mid-1800's and homesteaded near the Snohomish River on a 160-acre parcel of land, part of which is known today as Harvey Field. The Harveys constructed an east-west runway, a few hangars, fueling area, and a 10-unit motel which became the Snohomish Airfield, Inc. in 1945. The administration building, maintenance shop, and restaurant were added in 1947.

Harvey Field continues to remain an important aviation component in the Puget Sound Regional Airport System and to the City of Snohomish and Snohomish County, as well as providing relief to general aviation for the congested Seattle-Tacoma aviation community. Although privately owned, S43 is open for public use without restriction and is listed in the National Plan of Integrated Airport Systems (NPIAS) and designated by FAA as a general aviation reliever airport.[3]

[3] Federal Aviation Administration Report to Congress National Plan of Integrated Airport Systems (NPIAS) 2015-2019.

Harvey Field is a destination for many aircraft in the northwest United States and beyond. The destinations for instrument flight rules (IFR)[4] and other flight plans filed from Harvey Field over the course of one year are depicted in **Figure 1-2** (each route shown represents a destination, not the number of flight plans filed). This broad reach is a significant asset for the viability and economic health of Snohomish city and county as well as neighboring communities in the region.

FIGURE 1-2 – FLIGHT PLANS (OCTOBER 2013 – OCTOBER 2014)

Sources: Jviation, Airport IQ Data Center, and Airport Records
Notes: Not to scale
Airport IQ Data Center: instrument flight plans (IFR) filed with the FAA over the course of a one-year period.
Airport Records: from Harvey Field Transient Pilot Registry for a one-year period.

[4] During certain meteorological conditions, the FAA requires pilots to file a flight plan and follow instrument flight rules (IFR), which require pilots to comply with more restrictive weather requirements and certain air traffic control procedures. IFR flight plans are required for air carrier operations and typically filed by the business segment of GA that uses turboprop and business jet aircraft (rather than pleasure fliers).

2.0 INVENTORY

This chapter documents the type and general condition of the existing facilities at Harvey Field (S43 or the Airport). The inventory is a complete compilation of all facilities and systems of the Airport including airfield, terminal area, navigational aids, ground access, parking, pavement conditions, utilities, and other characteristics. **Chapter 5, Environmental Inventory** describes the baseline conditions at S43 in 2014.

Table 2-1 and **Table 2-2** summarize the major landside and airside components of S43. These key items will be discussed in greater detail throughout this chapter.

TABLE 2-1 – AIRFIELD PAVEMENT INVENTORY

Item	Description
Runway 15L/33R	– 2,671 feet by 36 feet – Consists of non-standard paved asphalt - good condition – Published Strength: 10,000 pounds Single Wheel Gear (SWG) – Basic markings (numbers only) – good condition; centerline stripe; displaced thresholds
Taxiways	– Partial parallel – good condition – Non-standard with two end connectors and two midfield connectors – good condition
Runway 15R/33L	– 2,430 feet by 100 feet – Turf runway

Source: Jviation

TABLE 2-2 – AIRPORT FACILITIES INVENTORY

Item	Description
Navigational Aids	– Area Navigation (RNAV/Global Positioning System (GPS))
Visual Aids	– Low Intensity Runway Lights (LIRL) – non-standard – Green runway threshold lights (360 degrees) – Runway & Taxiway Guidance Signs – Taxiway pavement reflectors (blue) – fair condition – Wind Cone/Wind Tee
Fixed Base Operator (FBO)	– Hangars (1) – 5,000 square feet – Apron – 56,577 square feet – Terminal – office in portion of terminal (1,800 square feet)
Parking	– Employee, Tenant, and Visitor – approximately 106 paved and 125 unpaved spaces

Source: Jviation

2.1 FAA Advisory Circular 150/5300-13A, *Airport Design*

On September 28, 2012, the FAA released the first comprehensive update since 1989 of Advisory Circular (AC) 150/5300-13A, *Airport Design*, which replaced the previous AC in its entirety. FAA issued amendments on February 26, 2014. The new airport design guidance was used when assessing the facilities at S43 in **Chapter 4, Facility Requirements**.

The most significant changes from the previous *Airport Design* AC include the new standards and technical requirements of the Runway Design Code (RDC) and Taxiway Design Group (TDG).

The AC still uses a design aircraft; however, in most cases the design aircraft is a composite aircraft representing a collection of aircraft classified by three parameters: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and TDG. The FAA requires that critical design aircraft generate a minimum of 500 operations (takeoffs and landings) per year in order to be classified as the critical aircraft.

The AAC and ADG are combined to form the RDC. The TDG relates to the undercarriage dimension of the aircraft. Taxiway width and fillet standards, and in some instances runway to taxiway and taxiway/taxilane separation standards, are still determined by the ADG. AC 150/5300-13A requires selection of the RDC(s), the most demanding meteorological conditions for desired/planned levels of service for each runway, and then to apply the airport design criteria associated with the RDC and designated or planned approach visibility minimums. The associated taxiways are then designed accordingly to the designated TDG.

2.1.1 Runway Design Code

The FAA classifies airport runway facilities with a coding system known as the RDC. This classification helps apply design criteria appropriate to operational and physical characteristics of various aircraft types operating at an airport. As mentioned previously, the RDC of a runway is made up of three separate components: the AAC, the ADG, and approach visibility minimums.

The AAC is an *alphabetical* classification of an aircraft based upon 1.3 times the stall speed in a landing configuration at its maximum certified landing weight. The approach category for an airport is determined by the approach speed of the fastest aircraft that generates at least 500 operations annually, with Category A being the slowest approach speed and Category E the fastest. The categories are:

- **Category A**: Speed up to 90 knots
- **Category B**: Speed 91 knots to 120 knots
- **Category C**: Speed 121 knots to 140 knots
- **Category D**: Speed 141 knots to 165 knots
- **Category E**: Speed 166 knots or more

The ADG is a *numerical* classification of aircraft based on wingspan or tail height. If an airplane's wingspan and tail height are in two categories, the most demanding category is used. Similar to the approach category, the ADG for an airport is determined by the largest aircraft operating at least 500 times per year at the facility. Also, for airports with multiple runways, the published RDC is based on the most demanding aircraft for each runway specifically. ADG details are identified in **Table 2-3.** Examples of RDC aircraft types are shown in **Figure 2-1**.

TABLE 2-3 – AIRPLANE DESIGN GROUP

Group	Tail Height (feet)	Wingspan (feet)
I	<20	<49

Group	Tail Height (feet)	Wingspan (feet)
II	20 ≤ 30	49 ≤ 79
III	30 ≤ 45	79 ≤ 118
IV	45 ≤ 60	118 ≤ 171
V	60 ≤ 66	171 ≤ 214
VI	66 ≤ 80	214 ≤ 262

Source: FAA AC 150/5300-13A

FIGURE 2-1 – RDC AIRCRAFT TYPES

Source: Jviation

The RDC of a runway determines the runway width, shoulder width, runway separation distances from other runways and taxiways, runway safety area (RSA) dimensions, object-free area (OFA), obstacle-free zone (OFZ), and the widths and length of the runway protection zone (RPZ).

2.1.2 Taxiway Design Group

Previously, taxiway design was determined solely on the ADG of a runway complex. An ADG was based exclusively on the wingspan and tail height of the design aircraft, not the dimension of the aircraft undercarriage. With the release of AC 150/5300-13A, taxiway design standards are now based on the TDG and the ADG of a taxiway complex. The TDG of a taxiway complex is determined by the undercarriage dimensions, overall Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) distance, of the most demanding aircraft. Taxiway/taxilane width, shoulder width, and fillet standards, *and in some instances*, runway to taxiway and taxiway/taxilane separation requirements, are governed by the TDG. TDG improves the design of taxiways fillets and radii, enabling safe and efficient taxiing by airplanes while minimizing excess pavement. Harvey Field is a TDG-1A based upon the Cessna Grand Caravan 208B’s dimensions.

The ADG of a taxiway complex determines the taxiway separations from other taxiways/taxilanes, the taxiway safety area, the taxiway/taxilane object free area, and wingtip clearances.

2.2 Airfield Design Standards

The primary consideration for runway and taxiway design is the standards established by the FAA, which are based upon the critical aircraft. Runway dimensional design standards define the widths and clearances required to optimize safe operations in the landing and takeoff area. These dimensional standards vary depending upon the RDC for the runway and the type of approach that is provided. The most demanding, or critical aircraft currently using S43 are B-II. The current runway conditions for 15L/33R as well as B-II design standards are shown in **Table 2-4**.

TABLE 2-4 – RDC B-II (RW 15L/33R) FAA RUNWAY DESIGN STANDARDS

Standard	Runway 15L Current Conditions	Runway 33R Current Conditions	B-II Design Standards
Runway Width	36’	36’	75’
Runway Shoulder Width	NA	NA	10’
Runway Safety Area (RSA) Width	120’	120’	150’
RSA Beyond Runway Threshold	240’	240’	300’
Runway Object Free Area (ROFA) Width	250’	250’	500’
ROFA Beyond Runway End	240’	240’	300’
Runway Centerline to Parallel Taxiway Centerline[a]	85’	91’	240’
Runway Centerline to Aircraft Parking[b]	247’[b] 589’[c]	247’[b] 589[c]	250’
Runway Holding Position Markings[d]	<125’	<125’	200’

Sources: Airport Management and FAA AC 150/5300-13A
Notes: [a] Harvey Field has a partial parallel and separation distances vary
[b] Grass tie-downs in mid-field
[c] Main apron
[d] Vary but all less than standard for B-II of 200 feet.

2.3 Modification of Design Standards

Harvey Field currently has two FAA-approved modifications of design standards. These modifications were approved for the conditions at the time of approval, April 27, 1988. The modifications are as follows.

Displaced Thresholds

Runway 15/33[1] has displaced thresholds to accommodate existing obstructions to the approach ends of each runway. Runway 15 has a displaced threshold to clear railroad tracks (23 feet) on the north end of the airfield. This displacement is approximately 452 feet to the south of the runway pavement end. Runway 33 has a threshold displacement approximately 241 feet to the north of the existing pavement end to clear Airport Way (17 feet). This modification of standards is approved indefinitely, provided the use of Runway 15-33 does not change.

Building Restriction Line

The standard taxiway centerline to object free area (OFA) separation is 44.5 feet. Two buildings, a storage building and a residence, extend 24 feet within the OFA on the east side of Runway 15/33[2] at the south end. Approximately 210 feet of the south end of the existing runway will be abandoned, so the buildings will not be adjacent to any runway or taxiway. The runway safety area is not affected.

An acceptable level of safety is provided by abandoning the south 210 feet of Runway 15/33. This modification of standards is approved indefinitely, provided the use of Runway 15/33 does not change.

These modifications of standards will be reviewed in **Chapter 4, Facility Requirements**.

2.4 Airfield/Airspace

2.4.1 Runways

S43 airfield configuration consists of one paved active runway, Runway 15L/33R (2,671' x 36'), constructed to support a weight-bearing capacity of no greater than 10,000 pounds for single wheel gear (SWG) and a second unmarked parallel turf strip, Runway 15R/33L (2,430' x 100'). Runway 15L has a marked threshold displacement of 452 feet and Runway 33R has a marked threshold displacement of 241 feet for obstruction clearance. Runway 15R has a threshold displacement of 446 feet and Runway 33L has a threshold displacement of 245 feet for obstruction clearances.

Per the FAA Airport Master Record (FAA Form 5010-1), the current Airport Reference Point (ARP) is located at Latitude 47°54'29.35"N and Longitude 122°06'19.466"W. The ARP is the latitude and longitude of the approximate center of the runway(s) at an airport. The established airport

[1] Referencing existing Runway 15L/33R
[2] Ibid.

elevation, which is defined as the highest point along an airport's runway(s) is 22.35 feet above mean sea level (MSL).

Runway headings are designated using a two-digit number between 01 and 36. The number represents the direction the runway faces relative to magnetic north. The two-digit runway headings are rounded to the nearest 10 degrees (and the last 0 is typically left off). A runway numbered 22, for example, will be pointing towards southwest at 220° magnetic. Because runway numbers are rounded up or down to the nearest 10 degrees, actual runway headings vary within +/- 5 degrees either side of the painted runway number. For example, a runway aligned to 224° magnetic will be designated as Runway 22, and a runway pointing 216° will also be designated as Runway 22. On the opposite end of the runway designated 22 will be 04, or magnetic heading of 040°.

Runways are aligned in relation to true north. True north is a fixed geographical position based on the latitude and longitude intersection. Since true north is fixed, the true bearing of each runway end is also fixed (i.e. does not change over time). However, the location of true north and magnetic north are different; magnetic north is not fixed, but instead moves constantly. As a result, there is always a difference between the true bearing and the magnetic heading of each runway end, and the difference is constantly changing. When the difference exceeds the +/- 50 range, then the runway magnetic heading is changed.

The National Oceanic and Atmospheric Administration (NOAA) determines the difference between true north and magnetic north for every point in the U.S., as well as the magnetic declination for every latitude/longitude coordinate in the U.S. The lines of equal magnetic declination are referred to as isogonic lines. At S43, the magnetic declination is 160°11' E. NOAA also measures the annual rate of change of magnetic north, which indicates that the rate of change of magnetic north at S43 is 0°9' W per year.

Subtracting the magnetic declination (160°11' E) from the true bearing of the runway (165.040) results in a magnetic heading of 149^{0}, rounded up to 150^{0}. Given the relatively small rate of change anticipated in magnetic north, the runway's current magnetic heading (15/33) will remain valid through the end of the planning period. However, it is recommended that an airfield survey be conducted during the next major runway project at the end of the planning period to verify the true bearing and coordinates of each runway end at that time. The needle on a compass orients according to the earth's magnetic field, and compasses are used in aircraft as a way to provide directional guidance. Runway designations are determined by magnetic north and adjusted orientation. The earth's magnetic shifting is measured, recorded, and applied to an airport's runway numerals. Subsequently, different numbers are periodically painted on the runway to accurately represent the magnetic heading of the runway. The magnetic heading for the runway should be re-evaluated periodically.

Runway pavement condition and strength are discussed in **Section 2.4.4**.

2.4.2 Taxiways

The taxiway system at S43 consists of a curving 16-foot-wide, nonstandard, partial parallel taxiway that connects the runway ends to the terminal area and aircraft parking apron. **Table 2-5** and **Figure 2-2** provide an overview of the existing taxiway system's information and layout.

Taxiway pavement condition and strength are discussed in **Section 2.4.4**.

TABLE 2-5 – TAXIWAY SYSTEM

Taxiway	Description	Width (feet)
Partial Parallel	Partial parallel taxiway that connects the runway ends to the terminal area and aircraft parking apron	16
Runway 15L connector	Taxiway connector just south of Runway 15L threshold; connects to partial parallel leading to aircraft parking apron and terminal	16
Mid-field	Taxiway connector approximately 700' north of Runway 33R threshold; connects to partial parallel leading to aircraft parking apron and terminal	16

Source: Jviation

FIGURE 2-2 – AIRFIELD LAYOUT

Source: Jviation

2.4.3 Apron

S43 has a main aircraft parking apron that serves the Snohomish Flying Fleet, transient aircraft tie-downs, fueling operations, and access to and from hangar areas, as depicted in **Figure 2-2**. The apron is located west of the Runway 15L threshold. The total apron area is approximately 56,577 square feet. The apron pavement is asphalt and is in good condition.

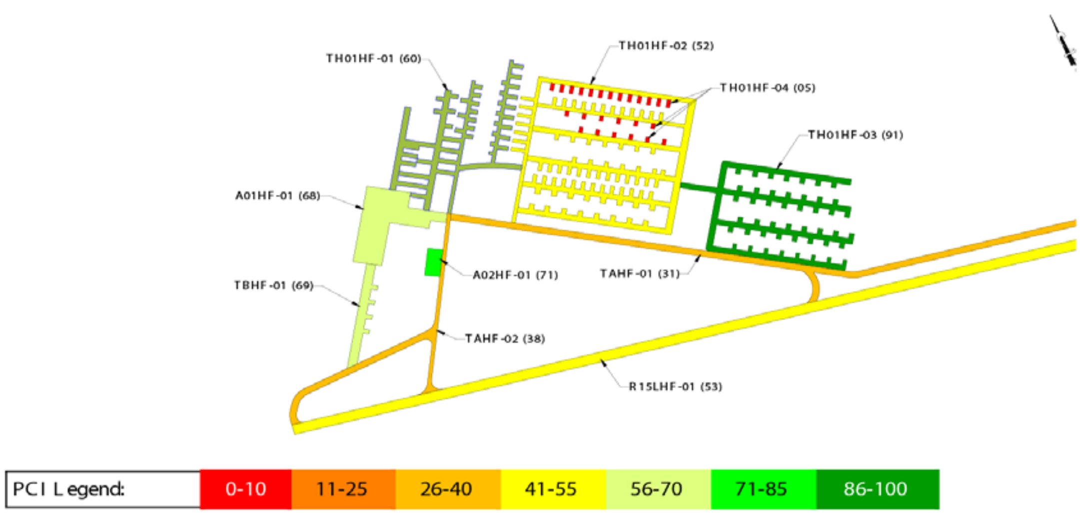
Apron pavement condition and strength are discussed in **Section 2.4.4**.

2.4.4 Pavement Condition and Strength

The FAA recommends in AC 150/5380-6b, *Guidelines and Procedures for Maintenance of Airport Pavements*, that a detailed pavement inspection be conducted that follows the American Society for Testing and Materials (ASTM) D 5340, Standard Test Method for Airport Pavement Condition Index Surveys. This method employs a visual rating system for pavement distress and is known as the Pavement Condition Index (PCI). The PCI scale ranges from a value of zero (representing a pavement in a failed condition) to a value of 100 (representing a pavement in excellent condition). Overall, the surfaces at S43 range from a PCI of 5 to 91, as shown on **Figure 2-3**, with an overall rating of 56.[3] The apron, southern taxilanes, and northern taxilanes are all in good condition. The midfield taxilanes are in fair condition while some of the pads are failing. The partial parallel, connectors, and runway, while noted to be in fair condition, were rehabilitated following the state report and are currently in good condition.

Runway 15L/33R is constructed to support a weight-bearing capacity of no greater than 10,000 pounds for a single wheel gear (SWG) as shown in **Figure 2-4**. The taxiway and apron weight-bearing capacities are not published.

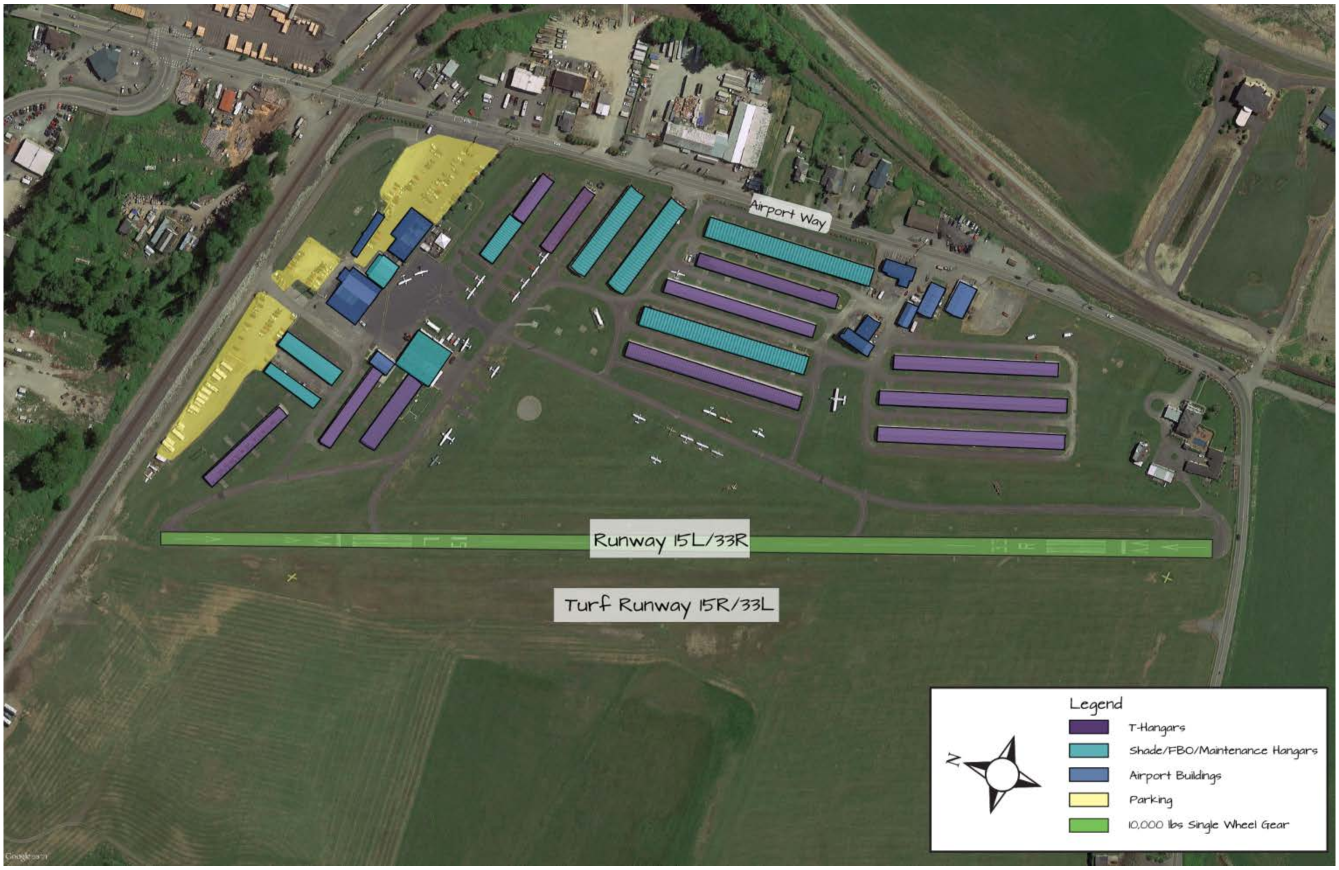
FIGURE 2-3 – S43 PAVEMENT CONDITION INDEX



Source: 2013 Washington State Pavement Management Report
Note: Runway 15L/33R and main taxiway were rehabilitated following this report and are currently in good condition.

[3] Washington Statewide Airport Pavement Management Report, June 2013

FIGURE 2-4 - EXISTING PAVEMENT STRENGTH



Source: Jviation

2.4.5 Lighting, Markings, and Signage of Runways and Taxi

Runway 15L/33R has low-intensity runway lighting (LIRL) that are positioned in a non-standard manner from the pavement edge. The lights were installed in 1975, upgraded in 1995, and are in fair condition. The runway also has green threshold lights (360 degrees) that are in fair condition. The turf runway, 15R/33L is not lighted.

The partial parallel taxiway and two connectors are not equipped with a lighting system. All taxiway pavement edges are marked with blue reflectors that are in fair condition.

Airfield signage gives pilots visual guidance information for all phases of movement on the airfield. S43 is not currently equipped with FAA required signage.

2.4.6 Visual and Navigational Airport Aids

The Airport's visual and navigational aids (NAVAIDs) are summarized in **Table 2-6**.

TABLE 2-6 – S43 VISUAL AND NAVAIDS SUMMARY TABLE

General	Runway 15L/33R
Wind Cone and Tee	LIRL[/a/]
UNICOM	RNAV (GPS)[/b/]

Source: Jviation
/a/ Low Intensity Runway Lighting
/b/ Area Navigation

Harvey Field has a weather observation system on site in partnership with a local college. However, this is not an approved weather observation system. Pilots are able to obtain weather information from either the Arlington Municipal Airport's (16 nautical miles north; 135.625 MHz or 360-435-6192), or Paine Field/ Snohomish County Airport's (7 nautical miles west; 425-355-6192) Automated Weather Observation System (AWOS). An AWOS is an automated sensor suite which is voice synthesized to provide a weather report that can be transmitted via VHF radio, non-directional beacon (NDB), or VHF omni-directional radio range (VOR), ensuring that pilots on approach have up-to-date airport weather for safe and efficient aviation operations. Most AWOS observe and record temperature and dew point in degrees Celsius; wind speed and direction in knots; visibility, cloud coverage, and ceiling up to 12,000 feet; freezing rain; thunderstorm (lightning); and altimeter setting.

S43 has a wind cone and wind tee located at the mid-point of Runway 15L/33R which are in good condition.

2.4.7 Air Traffic Service Areas and Aviation Communications

FAA air traffic controllers, stationed in control towers and Air Route Traffic Control Center (ARTCC), provide air traffic control within defined geographic jurisdictions. There are 22 ARTCC geographic jurisdictions established within the continental United States. S43 is within the Seattle ARTCC geographic jurisdiction which includes the airspace in Washington, most of Oregon, and parts of Idaho, Montana, Nevada, and California, as well as the neighboring area into the Pacific Ocean. The Seattle ARTCC can be reached at frequency 128.5 MHz.

2.4.8 Instrument Approach Procedures

An instrument approach procedure is a sequence of maneuvers to guide aircraft operating under FAA's Instrument Flight Rules (IFR) from the beginning of the initial approach to a runway to landing. Currently, the FAA recognizes three instrument approach types: precision, approach with vertical guidance (APV), and non-precision. The FAA definitions of these approach types are as follows.

- **Precision Approach**: An instrument approach procedure providing course and vertical path guidance conforming to FAA Order 8260.3B, U.S. Standard for Terminal Instrument

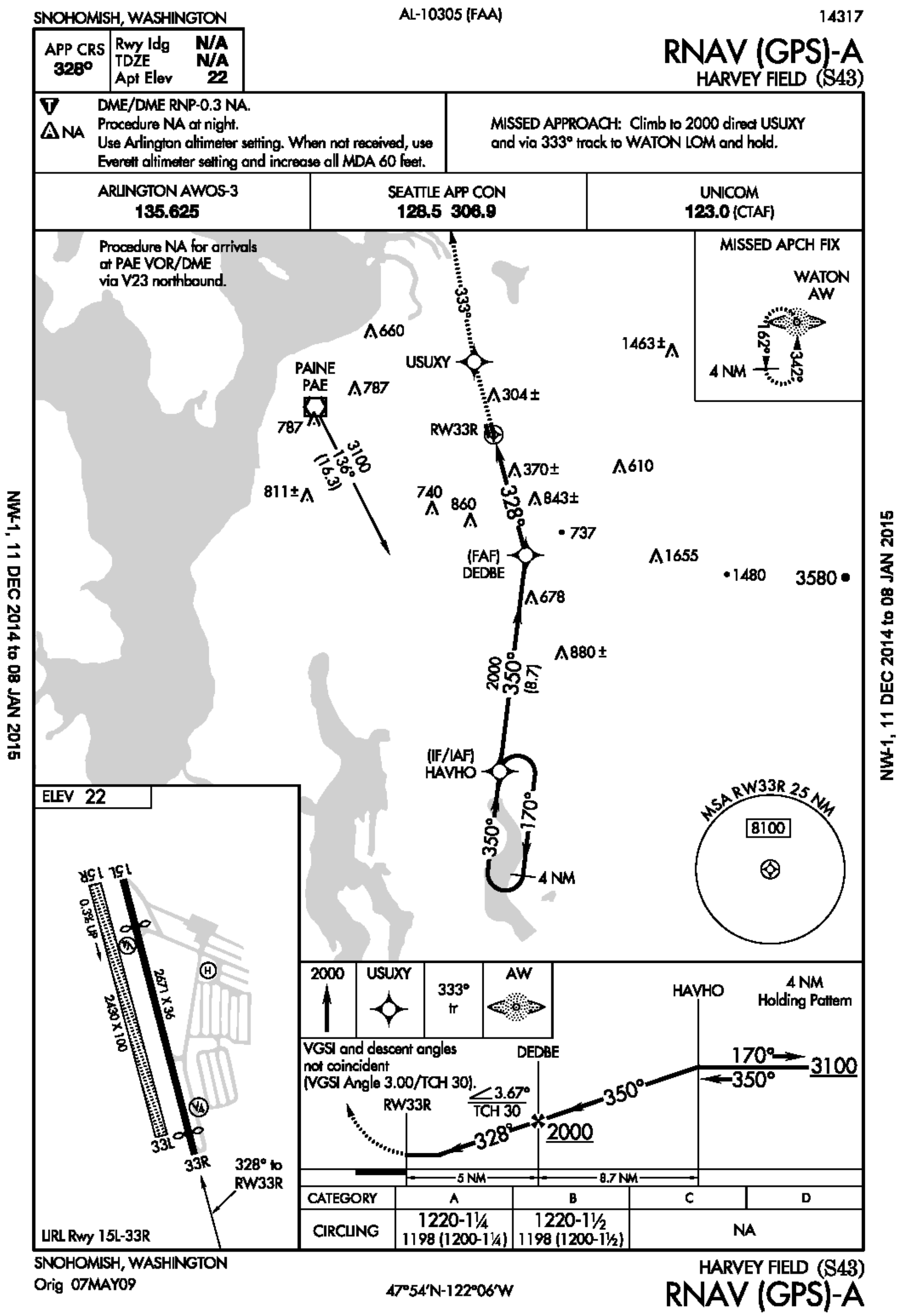
Procedures (TERPS), requirements. Instrument Landing System (ILS), Precision Approach Radar, and Microwave Landing System (MLS) are examples of precision approaches and are commonly referred to in the context of conventional approach technologies via the use of ground-based navigational aids. Harvey Field does not have a precision approach.

- **Approach Procedure with Vertical Guidance (APV)**: An instrument approach based on a navigation system that is not required to meet the precision approach standards of TERPS but provides course and glidepath deviation information. Localizer type directional aid (LDA) with glidepath, lateral navigation (LNAV)/vertical navigation (VNAV), and localizer performance with vertical guidance (LPV) are examples of APV approaches. Guidance provided for APV approaches via GPS do not require the use of ground-based navigational aids. There is no LPV or APV approach to Harvey Field.
- **Non-precision Approach**: An instrument approach based on a navigation system which provides course deviation (horizontal) information, but no glidepath deviation (vertical) information. VOR, non-directional beacon (NDB), LNAV, and circling minima are examples of non-precision approaches. Guidance provided for non-precision approaches via GPS do not require the use of ground-based navigational aids.

GPS satellite-based instrument approaches follow the same basic guidelines as ground-based systems, with the lowest possible minimums for approaches with horizontal only guidance being 300 feet above threshold and at least one mile of visibility (300-1). With the addition of vertical guidance through Wide Area Augmentation System (WAAS) or Ground Based Augmentation System (GBAS), the lowest minimums are generally 200-½ when an approach lighting system is installed.

As discussed previously, S43 has one published non-precision approach procedure, an RNAV/GPS-A (see **Figure 2-5**). The approach provides a circle-to-land procedure to either 15L or 33R at the pilot's discretion. This type of a procedure does not allow a straight-in approach to either runway, and as a result, the approach is visual instead of non-precision. The lowest minimums are 1,220 feet (MSL) and 1,198 feet (MSL) for military aircraft. Approach Category A aircraft (including military) have a 1¼ mile visibility while Category B aircraft have a 1½ mile visibility. Minimum descent altitude is associated with non-precision approaches and is the lowest altitude an aircraft can fly until the pilot sees the airport environment. If the pilot has not seen the airport environment by the designated Missed Approach Point (MAP), a missed approach is initiated.

FIGURE 2-5 – HARVEY FIELD RNAV/GPS-A APPROACH



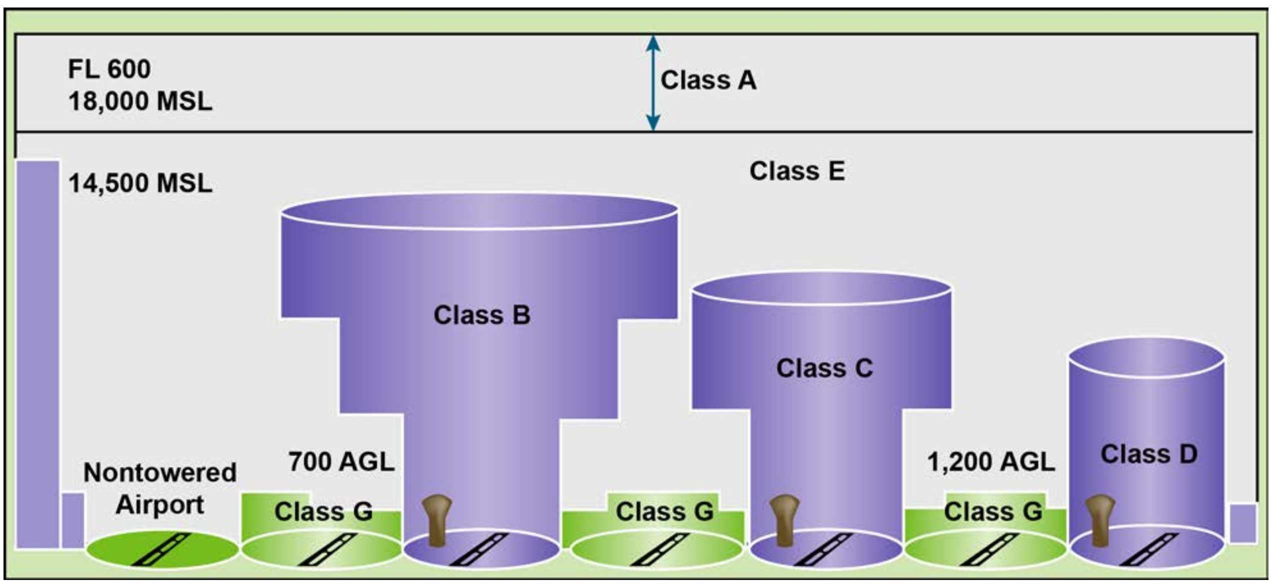
Source: SkyVector, https://skyvector.com/files/tpp/1413/pdf/10305RA.PDF, Accessed December 2014

2.4.9 Airport Airspace and Usage

FAA designates the airspace surrounding airports using a letter classification ranging from A to E, as depicted in **Figure 2-6**. The most restrictive of these airspaces is Class A airspace. It exists between 18,000 and 60,000 feet above mean sea level (MSL). Class A is controlled airspace applicable during the enroute portion of flight. Classifications are based on the level and type of aircraft operations for a specific airport. Airspace surrounding the nation's busiest airports, like Seattle-Tacoma International Airport, is designated as Class B, and is strictly controlled by air traffic control. Other towered airports are surrounded by Class C and D airspace. For airports such as S43 that have no tower, the surrounding airspace is designated as Class E. Airspace classified as Class E is subject to less restrictive air traffic control than that of Classes A through D. The primary restriction to this airspace is maintaining separation from other aircraft and minimum weather requirements of three statute mile visibilities and remaining clear of clouds by 1,000 feet above, 500 feet below, and 2,000 feet horizontally.

Airspace that has not been designated as Class A, B, C, D, or E airspace is classified as Class G (uncontrolled) airspace. This airspace extends from the surface to 1,200 above ground level (AGL), as described in FAA Order JO 7400.2K, Procedures for Handling Airspace Matters.

FIGURE 2-6 – AIRSPACE CLASSIFICATIONS

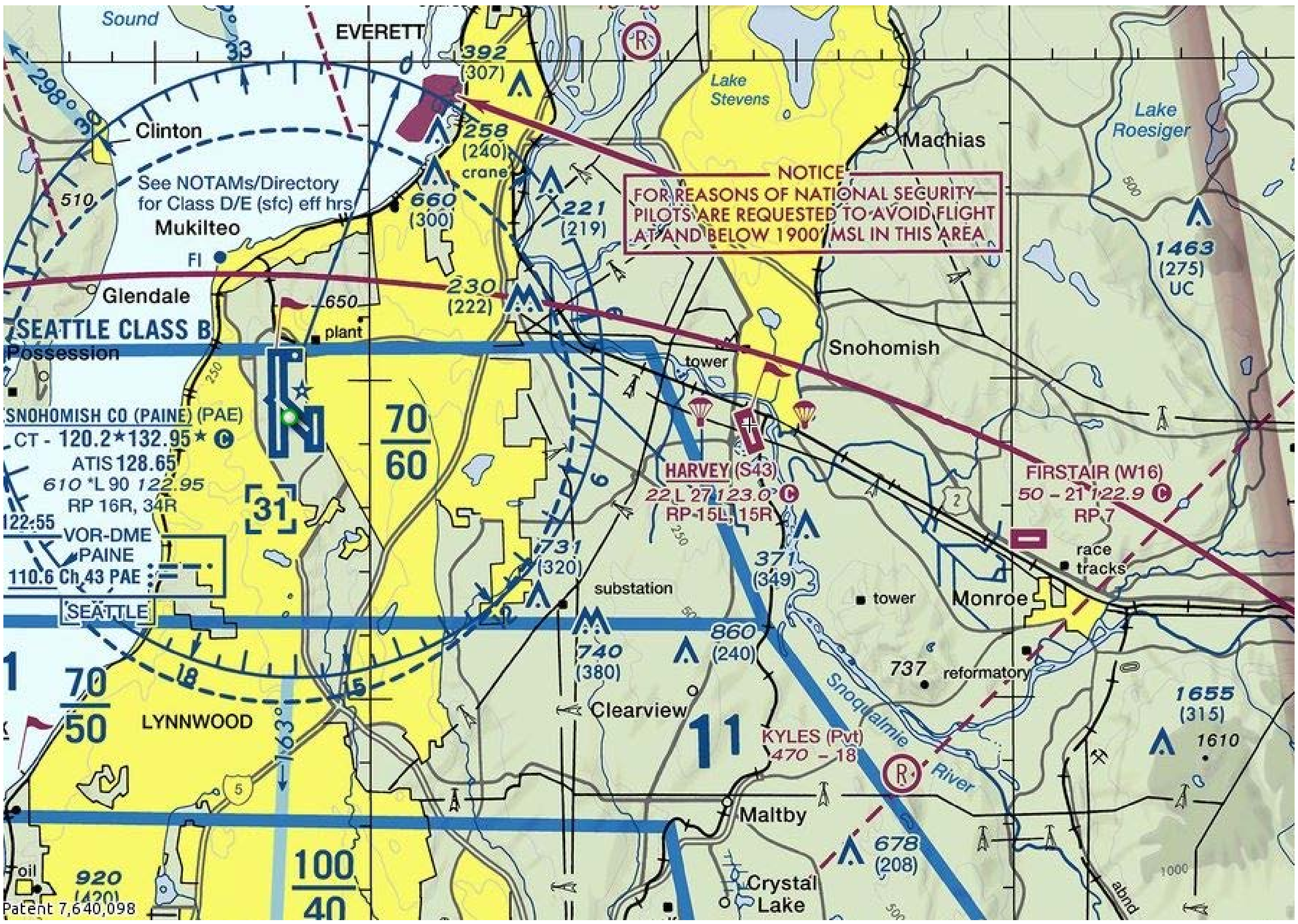


Source: Federal Aviation Administration

Figure 2-7 and **Figure 2-8** depict the airspace surrounding S43. As shown, Harvey Field is adjacent to Seattle's Class B airspace and just to the east of Paine Field's Class C airspace. The floor of Seattle's Class B airspace near Harvey Field is 6,000 feet, which allows aircraft to arrive at S43 and depart from S43 to the east, north, and south without flying into the Class B airspace. However, pilots must obtain air traffic control permission to operate inside Seattle's Class B airspace and Paine Field's Class C airspace.

Harvey Field is also inside the 30-mile Mode C veil[4] which requires all aircraft to have operable transponders[5] unless otherwise authorized by air traffic control. However, an aircraft that was not originally certificated with an engine-driven electrical system or which has not subsequently been certified with a system installed may conduct operations within a Mode C veil provided the aircraft remains outside Class A, B, or C airspace; and below the altitude of the ceiling of a Class B or Class C airspace area designated for an airport or 10,000 feet MSL, whichever is lower.[6]

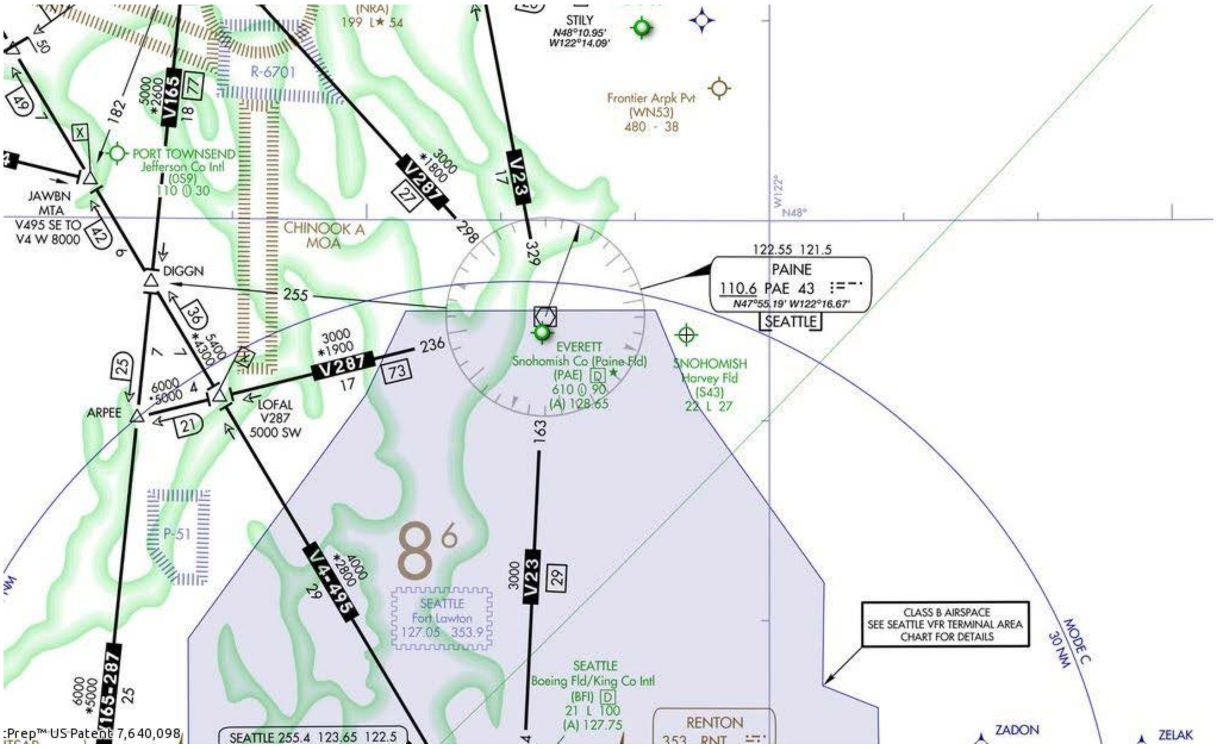
FIGURE 2-7 – VISUAL FLIGHT RULES AERONAUTICAL CHART



Source: Seattle Aeronautical Chart, 88th edition, December 11, 2014
Note: Not to scale

[4] Airspace within 30 nautical miles of an airport listed in Appendix D, Section 1 of 14 CFR Part 91 (generally primary airports within Class B airspace areas), from the surface upward to 10,000 feet mean sea level.
[5] Aircraft must be equipped with automatic pressure altitude reporting equipment having Mode C capability.
[6] Federal Aviation Administration Aeronautical Information Manual (AIM): Official Guide to Basic Flight Information and ATC Procedures

FIGURE 2-8 – INSTRUMENT FLIGHT RULES AERONAUTICAL CHART



Note: Not to scale

Source: United States Government Flight Information Publication, IFR Enroute Low Altitude –U.S., November 13, 2014

2.4.10 Obstructions to Air Navigation

Obstructions are defined as any object of natural growth, terrain, permanent or temporary construction equipment, or permanent or temporary manmade structures that penetrate a 14 Code of Federal Regulations (CFR) Part 77 imaginary surface.

Obstructions exist on the approaches to each runway end; consequently Runway 15L/33R has displaced thresholds. Runway 15L's threshold is displaced by 452 feet to the south in order to clear railroad tracks on the north end of the airfield while Runway 33R's threshold is displaced 241 feet to the north to clear Airport Way (displacement due to runway safety area and vehicle height). Trees are also obstructions off the Runway 15L end and power lines are off the departure end of Runway 33R, see **Table 2-7**.

TABLE 2-7 – S43 EXISTING OBSTRUCTIONS

Obstruction	14 CFR Part 77 Surface	Distance from Departure End	
		Runway 15L	Runway 33R
Trees	Approach	81' – 685'	-
Airport Way	Approach	44'	-
Fence	Approach	37'	-
Power line	Approach	-	32'

Obstruction	14 CFR Part 77 Surface	Distance from Departure End	
		Runway 15L	Runway 33R
Power Line	Approach	-	131’
Tower	Approach	-	5,708
Railroad tracks	Approach		-
Tower	Approach	-	6,076’

Source: Takeoff Minimums, (Obstacle) Departure Procedures and Diverse Vector Area (Radar Vectors), http://155.178.201.160/d-tpp/1413/NW1TO.PDF, accessed December 2014

2.4.11 Airport Noise Abatement Procedures[7]

The management of Harvey Field is committed to aircraft operating procedures which minimize noise impact on airport neighbors. Voluntary noise abatement procedures have been established for use and pilots are asked to cooperate to the extent possible. It is understood that air traffic control instructions and safety considerations may at times require deviation from the suggested procedures. While following the noise abatement procedure for Runways 33L/R over-flight of the city and residential area on Avenues I and J should be avoided when safe operation permits. Pilots, when departing Runways 33L/R, should climb straight ahead, tracking the extended runway centerline, and turn to a heading of 290 degrees “after” crossing the railroad tracks and “before” the river as safe operation permits. When departing the airport traffic area on the left “45” off runway 33L/R, pilots are to remain north of the river/railroad. Arrival traffic inbound on the “45” for runway 33L/R should remain south of the railroad tracks to avoid departing traffic. Northerly turns are not recommended until west of the power lines and above 1,000 feet. While departing to the south, pilots are expected to climb along the runway centerline to the traffic pattern altitude (1,000 feet above airfield elevation) before turning to a course heading when departing the pattern.

2.5 General Aviation Facilities

General Aviation (GA) facilities provide services to GA operators at an airport. GA facilities include the Fixed Base Operator (FBO), hangars, and apron/tie-down space.

2.5.1 Fixed Base Operator (FBO)

An FBO is an aviation-related business that provides services for general aviation pilots, aircraft, and passengers. However, some FBOs fuel air carrier aircraft, and provide deicing and light maintenance. FBO services range from GA aircraft fueling, ground servicing, aircraft maintenance and repair, in-flight catering, flight training, and aircraft rental. FBOs may also serve as a terminal for passengers boarding GA aircraft and may include a lobby, restrooms, vending, and rental car services. Pilot lounges, flight planning rooms, weather computers, and pilot shops are also typical in FBOs.

[7] Noise Abatement Procedure, www.harveyfield.com/Noise.aspx, accessed November 2014.

Currently, S43 is served by one FBO, Snohomish Flying Service, see **Figure 2-9**. The FBO is located on the GA apron at the northeast side of Runway 15L. The FBO is open from 7:30am-9pm in the summer and 8am-6pm in the winter and provides the following services:

- FAA-approved flight training (airplane and helicopter)
- FAR Part 133 Rotorcraft Long Line Training
- Fuel/Line service (AvGas and Jet A fuel) – self-serve and full service
- Aircraft Ferry and Aircraft Maintenance services (Major and Minor)
- Pilot supplies
- U.S. and Canadian charters
- Flight planning room, conference room, showers and dorms
- Courtesy vehicles

FIGURE 2-9 – SNOHOMISH FLYING SERVICE

Sources: Jviation and Harvey Field

2.5.2 Airport Hangars

Hangars are enclosed structures for the parking, servicing, and maintenance of aircraft, and are designed to protect aircraft from environmental elements such as wind, snow, hail, ice, and rain. The majority of hangar structures are either box-style or T-style designs. Box-style hangars, also known as conventional hangars, have a box-shaped or rectangular footprint and range in size to hold one or two single-engine aircraft up to accommodating several corporate jet aircraft. T-style hangars are known as T-hangars which are a series interconnected aircraft hangars with footprints in the shape of a "T." T-hangars generally store one single- or multi-engine aircraft each, while box-style hangars can range in size from those that accommodate one small plane to those that accommodate many aircraft of various sizes. A third type of hangar is an open or shade hangar which provides a roof but is not enclosed.

S43 has box/conventional hangars, T-hangars, and shade hangars for aircraft storage (**Figure 2-10**, **Figure 2-11**, and **Figure 2-12**).

Figure 2-13 depicts the hangar and structure locations. **Table 2-8** details hangar size, number of units, condition, and utilities for each as well as other airport structures.

FIGURE 2-10 – S43 BOX/CONVENTIONAL HANGARS

Sources: Jviation and Harvey Field

FIGURE 2-11 – S43 T-HANGARS

Sources: Jviation and Harvey Field

FIGURE 2-12 – S43 SHADE HANGARS

Sources: Jviation and Harvey Field

FIGURE 2-13 – AIRPORT BUILDINGS AND HANGARS

Sources: Airport Administration and Jviation
Note: Not to scale

TABLE 2-8 – EXISTING HANGARS & AIRPORT BUILDINGS

Legend #	Description	Units	Area (sf)	Condition
1A	Airport Restaurant	-	4,356	Fair
1B	Airport Administrative Office	-	1,800	Good
1C	Snohomish Flying Service	-	1,800	Good
2, STE A	Harvey Development, LLC/ LHT&E	-	700	Good
2, STE B	Student Dorms	-	800	Good

Legend #	Description	Units	Area (sf)	Condition
2, STE C	Community Conventional Hangar – Dream Barns Inc.	6	5,000	Good
2, STE D	Parachute Rigging Center	-	500	Good
2, STE E	Ground Maintenance	-	690	Good
3	Skydive Snohomish	-	2,355	Good
4	T-Hangar	14	12,480	Good
5	T-Hangar	4	3,720	Good
6	T-Hangar	6	5,430	Good
7	T-Hangar	9	7,920	Fair
8	RV Storage	-	4,650	Fair
9	Shade Hangar	12	7,480	Fair
10	T-Hangar	12	11,040	Fair
11	Shade Hangar	13	8,820	Good
12	T-Hangar	7	6,900	Fair
13	Superior Machine Manufacturing / SNS Industries / Badgett Aircraft Restoration	-	3,200	Fair
14	Airport Welding Helicarc Welding	-	4,032	Good
15	Community Event/Rental Facility	-	3,000	Good
16	Shade Hangar	15	11,264	Good
17	Shade Hangar	15	12,374	Good
18	RV Storage	-	19,872	Good
19	Shade Hangar	6	5,070	Good
20	Maintenance Shop (Snohomish Flying Service)	4/a/	5,000	Good
21	Common Hangar	5	5,000	Good
22	Shade Hangar	25	18,000	Excellent
23	TechMob & DGI Investments & Residential Rental Unit	-	2,545	Good
24	Airport Equipment Barn	-	1,920	Poor
25	Airport Equipment Barn Annex	-	1,800	Poor
26	Student Apartment/Dorms	-	1,938	Good
27	Airport Grounds Maintenance Shop	-	1,680	Fair
28	T-Hangar	16	14,240	Excellent
29	T-Hangar	14	13,056	Excellent
30	T-Hangar	16	14,816	Excellent
31	T-Hangar	16	14,816	Excellent

Source: Airport Administration, 2015
Note: /a/Units are not included in total storage as aircraft are only temporarily stored for maintenance

2.5.3 Based Aircraft

The Airport had a total of 249 based aircraft in 2014; 211 are stored in hangars and 38 on tie-downs. **Table 2-9** lists a breakdown of based aircraft by type.

TABLE 2-9 – 2014 BASED AIRCRAFT

Aircraft Type	Amount
Single Engine	231
Multi Engine	6
Turbine	3
Glider	1
Helicopters	6
Ultralight	2
TOTAL	249

Source: FAA, Airport Master Record, 2014

2.5.4 Based & Transient Aircraft Parking Aprons & Tie-downs

Aircraft parking aprons, also known as ramps, are paved surfaces designed for parking and servicing aircraft. Aprons provide access to terminals, hangars, and FBO facilities, locations to transfer cargo from aircraft, and areas for aircraft fueling and maintenance. An apron's size and pavement strength varies greatly at different airports and even on the same airport. Factors contributing to size and strength include: aircraft type, available space, special aircraft needs, and the configuration of terminals, hangars, and FBOs. In addition, whether aircraft power-in/power-out to parking positions, or if tugs are used to pull-in and/or push-out the aircraft, can greatly impact an apron's parking capacity.

Harvey Field's aircraft parking apron is used for the tie-down, fueling, maneuvering of vehicles and aircraft, and consists of the following areas (see **Figure 2-2**):

Main Aircraft Parking Apron/Tie-Down: The main airport apron is paved and used for the Snohomish Flying Fleet, transient aircraft tie-down, fueling operations, and access to and from the hangar areas.

Paved Tie-Down Area: There is a paved tie-down area located south and east of the main aircraft apron, south side of the east-west taxiway, and south side of Building 20/21.

These paved tie-down areas accommodate 21 based aircraft. Seven of the tie-downs accommodate larger aircraft.

Grass Tie-Down Area: Harvey Field has several grass tie-down areas. One is located in the center of the airfield terminal area; a second is on the west side of the center north-south taxiway; and a third is east of the restaurant outdoor dining area. The grass tie-downs can accommodate 24 aircraft with expansion availability. Nine of the 24 are reserved for transient aircraft and the remaining 15 are used for based aircraft.

Paved Helipad Parking: There is a designated helipad parking area located north of the Jet A fueling operation. The helipads accommodate based and transient helicopters; two pads are designated for based helicopters and two for transient to accommodate a total of four helicopters.

Pavement type and condition is discussed in Section 2.4.4.

2.6 Airport Equipment

The Airport owns and operates several pieces of large equipment to perform maintenance and snow removal. Snow Removal Equipment (SRE) is eligible for FAA funding.

2.6.1 Snow Removal Equipment (SRE)

Snow removal equipment (SRE) is used to clear the runway, taxiways, and apron at the Airport. Two Kubota Tractors, a Ford 5000 tractor, loader, D-4 Cat and sweeper are owned by the Airport and are in good condition.

2.6.2 Other Equipment

The Airport has other equipment that is used for mowing, aircraft fueling, courtesy cars, and airport maintenance. **Table 2-10** includes a list of this equipment as well as its current condition.

TABLE 2-10 – AIRPORT EQUIPMENT

Make/Model	Use	Condition
Ford	Fuel truck (100 LL)	Good
GMC	Fuel truck (Jet A)	Good
Ford	Passenger bus	Good
Ford	Passenger bus	Good
Ford/F150	Flatbed utility truck	Good
Chevrolet/C2500	Utility dump truck	Good
Ford/F150	Utility with dump bed	Good
Ford/F150	Service pick-up (red)	Good
Ford/F150	Service pick-up (white)	Excellent
Ford/F150	Service pick-up (burgundy)	Excellent
Ford/Expedition	Courtesy SUV (black)	Excellent
Ford/Fusion	Courtesy car (burgundy)	Excellent
EZ-Go	Golf cart w/cover	Good
Ford	Ladder truck	Poor
Tank	Trailer w/spray tank (500 gallons)	Good
Hyster	Fork lift	Good
Lektro	Aircraft tug	Good
Lektro	Aircraft tug	Good
FOD Boss	Runway/Taxiway sweeper	Excellent
John Deere/JD1435	Riding mower	Excellent
John Deere/JD1435	Riding mower	Excellent
Caterpillar/D4C	Dozer/Crawler	Good

Make/Model	Use	Condition
Kubota	Backhoe	Good
Kubota	Front loader	Good
Kubota	Sweeper	Good
Kubota	Post hole digger	Good
Kubota	Auger	Good
Kubota	Tractor – open cab	Excellent
Kubota	Tractor – closed cab	Excellent
Land Pride	3-deck mower	Good
Land Pride	3-deck mower	Good
Landa	Commercial pressure washer	Good

Source: Airport Administration Records, 2015

2.7 Support Facilities

2.7.1 Snow Removal Equipment (SRE) Storage Buildings and Maintenance

The Airport has three equipment maintenance and storage facilities, Buildings 25, 27, and 2D. Building 27 is primarily used for equipment maintenance, and Buildings 25 and 2D are utilized primarily for storage.

2.7.2 Aircraft Fuel Storage and Use

Aircraft typically use two fuel types: AvGas and Jet A. AvGas, or Aviation Gasoline, is used by aircraft with reciprocating piston engines. The most common grade of AvGas is 100 low lead (LL). Jet A is a kerosene type fuel, which contains no lead, and is used for powering jet and turbo-prop engine aircraft. Aviation fuel is currently stored in separate areas at Harvey Field. The AvGas tank is adjacent to the Snohomish Flying Service FBO/maintenance hangar and the Jet A tank is located in the helicopter parking area, east of shade hangars #16 and #17. Each tank is a double–walled, 12,000-gallon above-ground storage tank (AST) with fuel containment. The tanks are owned by Harvey Field and are in excellent condition. **Figure 2-14** and **Figure 2-15** depict the fuel truck delivery system and fuel tanks.

FIGURE 2-14 – S43 FUEL TRUCK DELIVERY SYSTEM

Sources: Jviation and Harvey Field

FIGURE 2-15 – S43 AVGAS (LEFT) AND JET A (RIGHT) SELF-SERVE 24-HOUR CARD LOCK

Sources: Jviation and Harvey Field

Table 2-11 details the fuel pumped by type from 2000 through 2014. The majority of Jet A fuel is used locally by the skydiving operator for their Cessna 208 Caravans; transient turbine aircraft operations at Harvey Field are minimal.

TABLE 2-11 – FUEL FLOWAGE

Year	100 LL (gallons)	Jet A (gallons)
2000	109,494	20,918
2001	97,674	9,768
2002	105,726	18,695
2003	101,441	13,294
2004	76,885	10,917
2005	92,480	11,137
2006	95,846	19,925
2007	83,531	22,140
2008	83,544	18,646
2009	78,178	31,204

Year	100 LL (gallons)	Jet A (gallons)
2010	69,052	32,264
2011	72,423	28,699
2012	58,961	36,110
2013	62,864	28,305
2014	63,071	29,111

Source: Airport Administration Records, 2000 to 2014

2.7.3 Airport Equipment Maintenance Shop and Storage

There are three buildings (2D, 25, and 27) dedicated to equipment maintenance and storage at Harvey Field. Buildings 25 and 27 are located between the two groups of T-hangars, east of the runway mid-point and Building 2D on the north ramp west of Hangar 15 on the main ramp. The maintenance and storage buildings are in fair condition and are currently used to store snow removal equipment and grounds maintenance/mowing equipment.

2.8 Access, Circulation, and Parking

Adequate vehicular access to the Airport, as well as parking facilities, are necessary for effective operation. The following summarizes existing road and parking conditions at the Airport.

2.8.1 Airport Access Road & Circulation Network

The main access road to Harvey Field is Airport Way, a two-lane rural major collector in Snohomish County. Airport Way bounds Harvey Field to the east and the south and provides access to the Airport from State Route 9 (SR9), Lowell Snohomish River Road, and Springhetti Road. The 2008 Snohomish County Transportation Element analyzed the level of service (LOS) for Airport Way and noted it was in arrears.[8] The LOS for Airport Way, which is located inside the urban growth area, is LOS E (unstable traffic flow with significant delays). Delay occurs at the SR9 signal and is compounded by southbound traffic at the stop-controlled intersection of Springhetti Road and Airport Way. A traffic study of Airport Way was completed in 2007 as part of the prior Master Plan. This study and further analysis will be discussed in Chapter 4, Facility Requirements and Chapter 5, Alternatives Analysis.

2.8.2 Auto Parking

Paved parking at S43 is available at the Airport entrance and can accommodate 105 vehicles. An unpaved area is available along the north access road and can accommodate 95 vehicles. Gravel parking is available at the gate entry to Hangar 10/18 for six vehicles, and employee parking is behind Building 2 and accommodates 30 vehicles. Paved and gravel parking lots that can accommodate 100 vehicles are located off Airport Way in the southeast corner of the Airport around

[8] Defined as "any arterial units operating, or forecast to operate within six years, below the adopted level-of-service standard contained in SCC 30.66B.100, unless a financial commitment is in place to complete improvements or implement strategies that are forecast to remedy the deficiency within six years."

Buildings 13, 14, 23, and 24. The parking lots are free of charge for airport users, employees, and tenants.

2.9 Utilities

Harvey Field has a variety of public utilities. Public utilities include electrical, garbage, propane, city water, various septic systems, Nibbler onsite sewage treatment facility for the restaurant, and fiber optics and communications. Waste water is treated on-site.

2.9.1 Electricity

Electricity is provided by Snohomish County Public Utility District.

2.9.2 Water Supply

Potable water is provided through the City of Snohomish water system. The current line and pressure is adequate to serve existing service to the south Snohomish UGA.

2.9.3 Waste Water

Waste water for Harvey Field is handled by an on-field, septic Nibbler Treatment System[9] and is adequate for the existing development.

2.9.4 Fiber Optics and Communications

Direct TV, Dish, Comcast, and Frontier Communications provide phone, TV, and internet service to Harvey Field.

2.9.5 Waste Management & Recycling

Waste is collected by Waste Management at Harvey Field. Currently cardboard is the only collected recycled waste at the Airport; it is collected by Rubatino.

2.9.6 Propane Gas

Propane gas is supplied to Harvey Field by Northern Energy.

2.10 Meteorological Data

Environmental elements play a significant role in an airport's layout and design. Temperatures impact runway length, and prevailing winds are one of the most important environmental elements as it dictates runway orientation.

[9] The Nibbler Treatment System is a system of pods inserted into a septic tank. The pods push air into the wastewater, creating a turbulent aerobic environment that digests organic material naturally.

2.10.1 Wind Coverage

Wind conditions are particularly important for runway use at an airport. Each aircraft has an acceptable crosswind component for landing and takeoff. The crosswind component is a calculation of the speed of wind at a right angle to the runway centerline. When the acceptable crosswind component of an aircraft is exceeded the aircraft must divert to another runway or a completely different airport.

Per FAA AC 150/5300-13A, Airport Design, when the current runway(s) provides less than 95 percent wind coverage for any aircraft that use the airport on a regular basis, a crosswind(s) runway should be considered. The crosswind components of 10.5, 13, 16, and 20 knots were used for this analysis to look at the allowable crosswind component of different sizes of aircraft. A 10.5-knot crosswind component is used for small aircraft weighing 12,500 pounds or less, and a 20-knot crosswind component is used for an aircraft the size of a Boeing 767.

The weather observations were obtained from the National Climatic Data Center (NCDC) for Snohomish County Airport (Paine Field), and were taken from 2000 to 2009. According to the FAA, the desirable wind coverage for an airport is 95 percent during all weather conditions, which means that runways should be oriented so that the maximum crosswind component does not exceed more than five percent of the time.

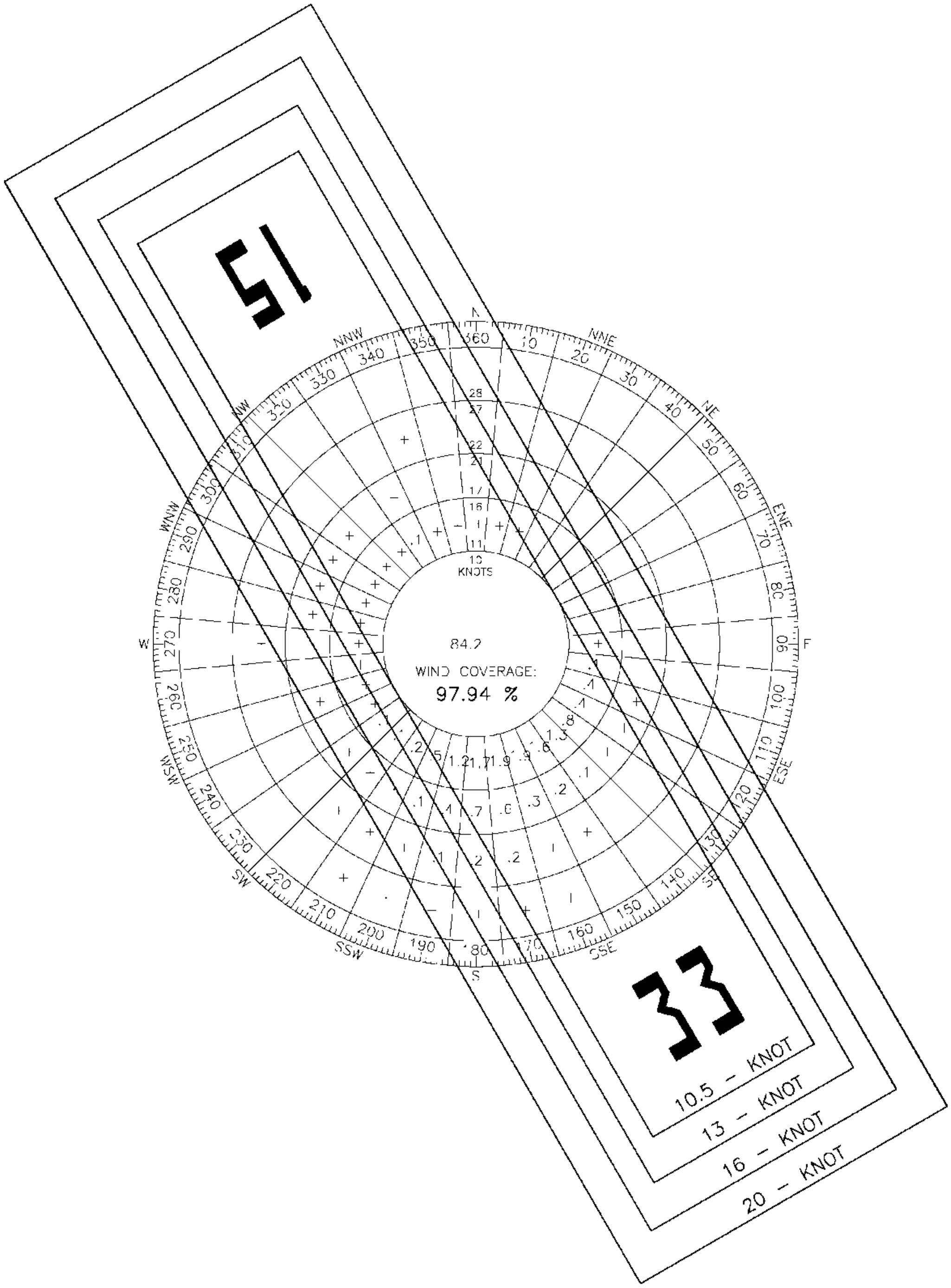
As shown in **Table 2-12**, the runway orientation of Runway 15L/33R provides 97.94 percent coverage for a 10.5-knot crosswind, which is over the FAA crosswind component requirement of 95 percent. "All Weather" includes data on the winds observed for all types of weather conditions during the observation period. The data collected indicates that during IFR conditions, the existing combined runway orientations provide 97.84 percent coverage for a 10.5-knot crosswind, which exceeds the FAA recommendation. The FAA All Weather and IFR weather wind roses are depicted in **Figure 2-16** and **Figure 2-17**.

TABLE 2-12 – S43 WIND COVERAGE

All Weather	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 15L	86.09%	87.33%	87.92%	88.09%
Runway 33R	63.88%	63.99%	64.10%	64.11%
Runway 15L/33R	97.94%	99.20%	99.80%	99.97%
IFR	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 15L	89.37%	90.72%	91.29%	91.49%
Runway 33R	53.12%	53.19%	53.24%	53.25%
Runway 15L/33R	97.84%	99.20%	99.77%	99.98%

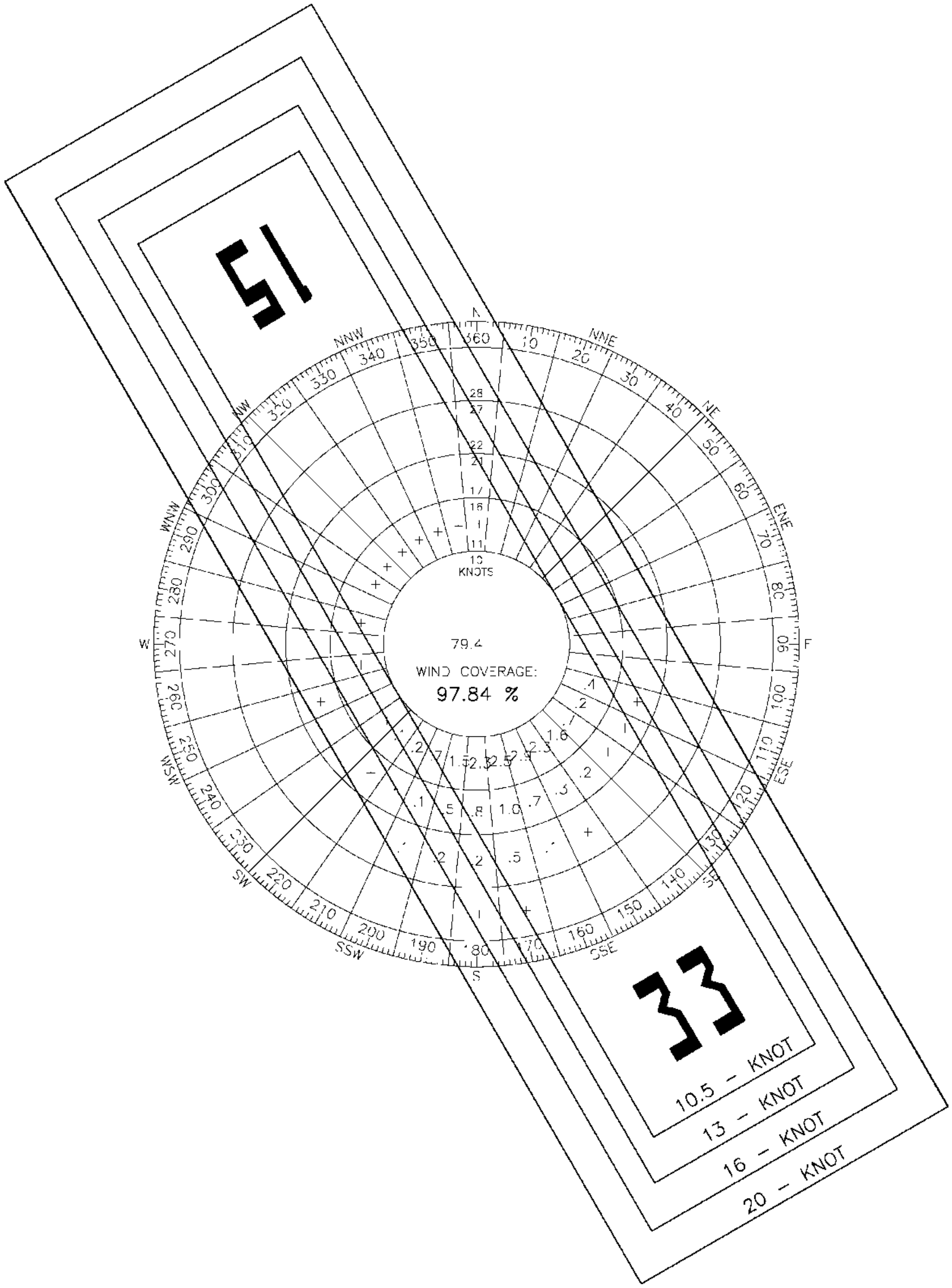
Source: NCDC, Station 72793 Snohomish County Airport (Paine Field), WA Annual Period of Record: 2000-2009

FIGURE 2-16 – ALL-WEATHER WIND ROSE



Source: NCDC, Station 72793 Snohomish County Airport (Paine Field), WA Annual Period of Record: 2000-2009

FIGURE 2-17 – IFR WIND ROSE



Source: NCDC, Station 72793 Snohomish County Airport (Paine Field), WA Annual Period of Record: 2000-2009

2.10.2 Temperature

The mean maximum temperature of the hottest month, also known as the airport reference temperature, occurs in August with a temperature of 73.9°F.

2.10.3 Precipitation

November and December are typically the rainiest months in Snohomish, with total precipitation averaging 47.8 inches per year. The average snowfall averages 8.4 inches per year, with most of the snow fall occurring December through February.[10]

2.11 Regional Setting and Land Use

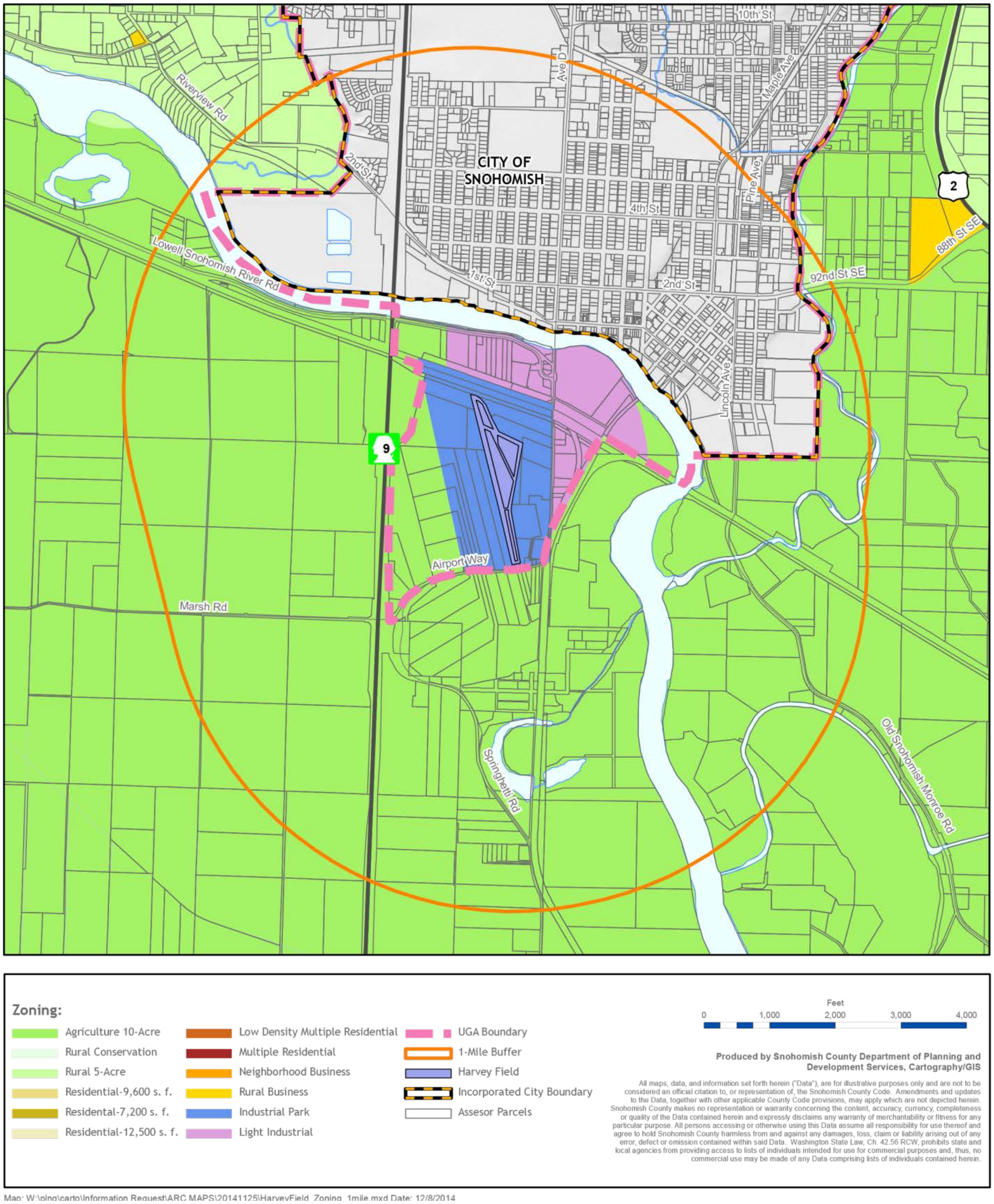
Harvey Field is located in the Snohomish County urban growth area (UGA). The primary goal of land use planning in and around Harvey Field is to provide safe airport operations and to promote compatible land uses and implement land use actions that allow for the orderly expansion and development of the Airport as an essential public facility (EPF).

The airfield is zoned industrial park according to Snohomish County zoning. Existing zoned land uses adjacent to Harvey Field and the Industrial Park consist of light industrial to the north and east, agriculture to the south and west as well as State Route 9 to the west, see **Figure 2-18**.

An Airport and Land Use Compatibility Project is currently underway by Snohomish County Planning and Development Services. The project is a state-mandated project to discourage incompatible land uses around the county's general aviation airports. The County issued a preliminary draft on their recommendations and the County Commissioners were briefed in early 2015. The County Planning Commission voted to approve the code changes at a public hearing on February 24, 2015 with a recommendation that the council/planning department consider permitting projects currently underway, but may not yet be permitted when code revisions are expected to be implemented in June 2015. To date, Harvey Field has been a stakeholder in the County's process and will continue to review any proposals and comment.

[10] Western Region Climate Center, Monroe, Washington station. http://www.wrcc.dri.edu/summary/Climsmwa.html, accessed December 2014

FIGURE 2-18 – SNOHOMISH COUNTY ZONING: ONE-MILE RADIUS AROUND HARVEY FIELD



Source: Snohomish County Planning and Development Services, December 2014
Note: Not to Scale

2.12 Airport User Surveys

To assess the adequacy of the airport facility and desired improvements, surveys were distributed to tenants and owners/operators of aircraft at Harvey Field.

Examples of the surveys are located in **Appendix B, User Surveys**.

3.0 AVIATION ACTIVITY FORECASTS

3.1 Introduction

Aviation activity forecasts are essential for airport master plans because they serve as the basis for a number of important recommendations and decisions. Aviation activity forecasts are used to determine:

- Appropriate design aircraft and FAA airport design criteria.
- Facility requirements to accommodate existing and projected demand, primarily through the demand-capacity analysis.
- Capital investments, project priorities, cost estimates, and timing.
- Future aeronautical revenue potential.
- Environmental coordination, review, and studies that may be required prior to project implementation.

As stated in FAA's Advisory Circular (AC) 150/5070-6B: *Airport Master Plans*, aviation forecasts should be "realistic, based upon the latest available data, reflect current airport conditions, and provide adequate justification for airport planning and development."

Aviation forecasts typically encompass three planning periods: the short-term (0-5 years), intermediate period (6-10 years), and long-range outlook (10-20 years). In addition to various measures of aviation activity, forecasts also identify the future critical design aircraft. The forecast periods for the Harvey Field Master Plan are:

- Base Year: 2014
- Short-Term: 2015-2019
- Intermediate Period: 2020-2024
- Long-Term Outlook: 2025-2034

3.2 Background

Harvey Field accommodates a wide variety of general aviation users (illustrated in **Figure 3-1**, **Figure 3-2**, **Figure 3-3**, **Figure 3-4**, and **Figure 3-5**), ranging from private/recreational flying to flight training (fixed wing and rotorcraft), scenic flights and air tours, government agency/public services, hot air ballooning, as well as an active parachute drop operation. Cessna Caravans (CE-208B single-engine turboprop) are used for the parachute operations. Flight training and parachute activity are generated by aircraft owned by the airport owner/operator, and they generate a large volume of takeoffs and landings at Harvey Field, particularly when there are visual weather conditions (Visual Flight Rules ((VFR)). The average number of daily aircraft operations is significantly lower during periods of poor (i.e. Instrument Flight Rules (IFR)) weather conditions, compared to good weather at Harvey Field.

FIGURE 3-1 – CESSNA 208B GRAND CARAVAN – SKYDIVING OPERATIONS

Source: Harvey Field

FIGURE 3-2 – HELICOPTERS (FLIGHT TRAINING) & HOT AIR BALLOONS

Source: Harvey Field

FIGURE 3-3 – BELL 205 – SNOHOMISH COUNTY EMERGENCY RESPONSE

Source: Harvey Field

FIGURE 3-4 – CESSNA 152 – FLIGHT TRAINING

Source: Harvey Field

FIGURE 3-5 – CESSNA 172 – FLIGHT TRAINING

Source: Harvey Field

3.3 Aviation Activity and Forecast Data Available for Harvey Field

While forecasting is essential for a successful master plan, there are a number of inherent limitations that affect projections of future activity. Forecasts are developed based on historical data and trends, present conditions, and future outlooks accounting for a number of external variables, such as demographic trends.

The type and quality of data available concerning aviation activity on a local level has a direct bearing on the reliability (statistical level of confidence) in the forecasts. Harvey Field is similar to the large majority of airports in the U.S., which also do not have an air traffic control tower (ATCT). As a result there are no air traffic controllers compiling aviation activity counts – i.e. aircraft takeoffs and landings. Aviation activity levels at Harvey Field were estimated by the airport administration, Washington State Department of Transportation (WSDOT), and the FAA. Because the owner/operator of Harvey Field also owns and operates the flight training and parachute aircraft, the airport's estimate of recent trends and current activity levels at Harvey Field is considered to be the most accurate.

One consequence of different sources of estimated activity levels is that they frequently do not coincide with each other. Given the fact that they are estimates, it is often difficult to reconcile the differences.

Some agencies have used various electronic counters to take sample measurements of aviation activity at non-towered airports in an effort to validate activity estimates. While electronic counters are useful, they also require a substantial investment of cost and labor, and counters are not eligible for FAA grants. Electronic counters have not been used at Harvey Field, so there has been no validation of the aviation activity estimates. Aviation counters were utilized by Washington DOT during the first Master Planning effort that was conducted in the early 1980's, but traffic counters have not been used since then.

3.4 Forecast Techniques

There a number of forecast techniques recommended by the FAA[1] depending on the level of activity and complexity at each airport. The forecast techniques include: regression analysis, trend analysis, and extrapolation, market share (ratio) analysis, and smoothing, as well as applied growth rates and judgmental projections, among others. The FAA recommends that the forecast techniques used be appropriate to each airport and situation. As stated in the FAA AC *Airport Master Plans*: "An existing forecast, on the other hand, may be all that is required for simpler projects. Planners should determine the appropriate level of forecasting effort in the course of pre-planning and scoping the study." For Harvey Field, it was determined that application of the FAA's Terminal Area Forecast (TAF) growth rate through 2034 was appropriate, for the following reasons:

- FAA's TAF reflects a top-down outlook based on industry trends that are consistent with activity levels at Harvey Field.
- The growth rate in FAA's TAF is consistent with the airport administration's estimate of future activity.
- Use of forecast techniques such as regression and least-squares analysis are not appropriate for Harvey Field because of the following reasons:
    - Aviation activity data at S43 is estimated, not counted.
    - The total level of aviation activity at S43 is relatively small compared to the larger socio-economic conditions in Snohomish County.
    - The statistical correlation between aviation activity at S43 and socio-economic conditions in the County are not strong enough to use regression analysis.

3.5 Historic and Current Aviation Activity Trends

There are four sources of historic and current aviation activity data for Harvey Field:

- Airport Management Records for 2014 and 2015.
- FAA Airport Master Record Form 5010 – current activity estimates:
- FAA Terminal Area Forecast (TAF) – historic and future aviation activity
- Washington State Department of Transportation (WSDOT) Aviation System Plan – historic and future aviation activity

[1] Sources: FAA AC 1505070-6B, *Airport Master Plans*; FAA & GRA, Inc. *Forecasting Aviation Activity by Airport*, 2001

3.5.1 S43 Airport Management Activity Records

The owner/manager (Airport) of Harvey Field reviewed the FAA Airport Master Record, Form 5010, as well as the FAA's latest Terminal Area Forecast (TAF) and noted that actual based aircraft and operations are lower than FAA estimates. The Airport examined historic fuel sales records, the number of based aircraft, hours flown by flight training aircraft, and current parachute activity, and determined that estimated annual aircraft operations in calendar year 2014 equaled 100,220. That represents an average of 274 takeoffs and landings every day of the calendar year. A formal request to amend FAA's Form 5010 and the TAF was submitted to and accepted by FAA, based on airport management records (letter attached in **Appendix C, Terminal Area Forecast**). **Table 3-1** and **Table 3-2** depict the based aircraft numbers and operations.

The number of based aircraft counted by the Airport (249) is relatively close to the estimate in FAA's Form 5010 (258). The number of based aircraft fluctuate at any given airport within a given time period due a variety of factors.

TABLE 3-1 – BASED AIRCRAFT (2014)

Aircraft Type	Amount
Single Engine	231
Multi Engine	6
Turbine	3
Glider	1
Helicopters	6
Ultralight	2
Total Based Aircraft	249

Source: Harvey Field Records, 2015

TABLE 3-2 – AIRCRAFT OPERATIONS

Aircraft Type	Operations
Air Carrier	0
Air Taxi	1,500
General Aviation Local	51,920
General Aviation Itinerant	46,600
Military	200
Total Operations	100,220
– Average Operations Per Day	274
– Average Operations Per Based Aircraft (OPBA)	402

Source: Harvey Field Records, 2015

3.5.2 FAA Airport Master Record Form 5010

The FAA Airport Master Record Form 5010 provides historical based aircraft and operational data as filed with/by the FAA. Form 5010 is part of FAA's Airport Master Record, and the forms are normally compiled by State DOT airport inspectors. Inspectors typically visit each airport and interview the airport manager and tenants to compile activity estimates. The last 5010 inspection date listed is August 19, 2014. The Form 5010 is used to primarily cross-reference other data sources. **Table 3-3** depicts the based aircraft and **Table 3-4** the aircraft operations as detailed on the 5010. The 139,195 aircraft operations estimated for year ending July 31, 2014 represent an average of 381 aircraft takeoffs and landings each day of the year. The Form 5010 estimates of annual operations at Harvey Field are 39 percent higher than the Airport's records indicate. Given that a large percentage of aircraft operations at Harvey Field are conducted by aircraft owned and operated by the airport management, the airport's records of activity are considered to be more accurate in terms of existing activity levels.

TABLE 3-3 – BASED AIRCRAFT - FAA FORM 5010

Aircraft Type	Number
Single Engine (SE)	233
Multi Engine (ME)	8
Jet (J)	1
Total Fixed Wing: (SE + ME + J)	242
Helicopters	8
Gliders	2
Military	0
Ultra-Light	6
Total Based Aircraft	258

Source: FAA Airport Master Record Form 5010, year ending July 31, 2014

TABLE 3-4 – AIRCRAFT OPERATIONS - FAA FORM 5010

Aircraft Type	Operations
Air Carrier	0
Air Taxi	8,445
General Aviation Local	44,540
General Aviation Itinerant	86,135
Military	75
Total Operations	139,195
– Average Operations Per Day	381
– Average Operations Per Based Aircraft (OPBA)	539

Note: Operations for 12 months ending: July 31, 2014
Source: FAA Airport Master Record Form 5010

3.5.3 FAA Terminal Area Forecast: Historic and Future Aviation Activity at Harvey Field

The FAA Terminal Area Forecast (TAF) provides both historic and projected aviation activity for specific airports included in FAA's National Plan of Integrated Airport Systems (NPIAS). The FAA's TAF is updated annually and is used by the FAA to determine budget and staffing needs of the FAA, as well as being a resource for airport operators, the general public, and other interested parties. The TAF provides a guideline for developing forecasts, and is used for comparison of scenario-driven forecasts with FAA developed forecasts.

An acceptable forecast analysis that is consistent with the FAA TAF is generally the requirement for FAA's approval of an airport master plan forecast.[2] **Table 3-5** details percent change in aircraft operations at Harvey Field from 1990 through 2040. **Figure 3-6** details the historic operations from the TAF, while **Figure 3-7** details historic based aircraft. **Figure 3-8** and **Figure 3-9** detail the forecasted operations and based aircraft, respectively and **Table 3-6** details the compound annual growth rate for operations.

TABLE 3-5 –AIRCRAFT OPERATIONS AT HARVEY FIELD - PERCENT CHANGE

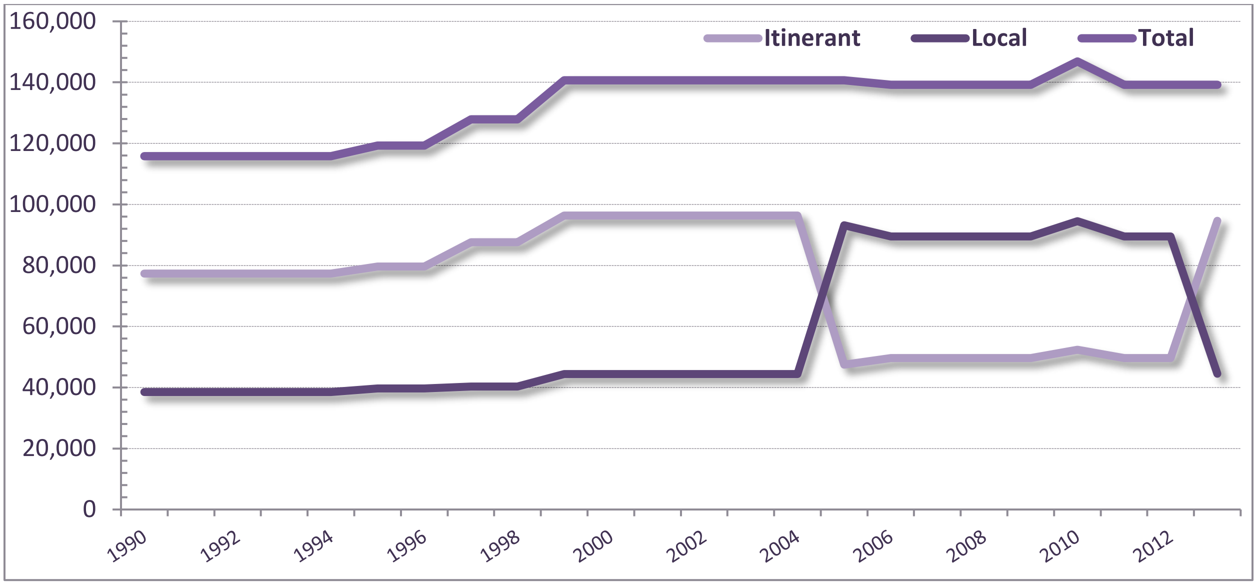
Period	Itinerant	Local	Total	Based AC
1990-2012	-35.8%	132.5%	20.2%	-30.1%
2013-2040	16.0%	16.2%	16.1%	25.5%

Source: FAA Terminal Area Forecast, issued January 2015

General aviation activity records maintained by air traffic controllers at specific airports show that aircraft operations at any given airport typically fluctuate over given time periods. The fluctuations estimated by the FAA at Harvey Field are therefore consistent with broader activity trends. However, FAA did not indicate why activity levels fluctuated at Harvey Field as shown in **Figure 3-6**, particularly in the 2005 time frame when there was a large change in local and itinerant operations or the drop in based aircraft shown in **Figure 3-7**. See **Appendix C, Terminal Area Forecast** for the FAA TAF table.

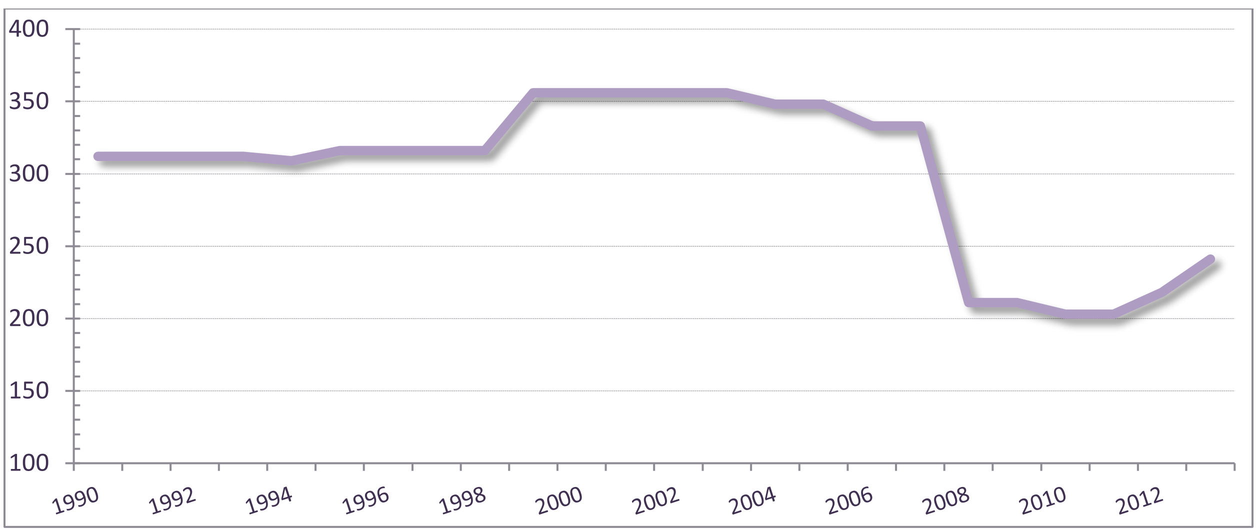
[2] FAA AC 150/5070-6B, *Airport Master Plans*

FIGURE 3-6 – TAF HISTORIC OPERATIONS AT HARVEY FIELD (FY 1990-2013)



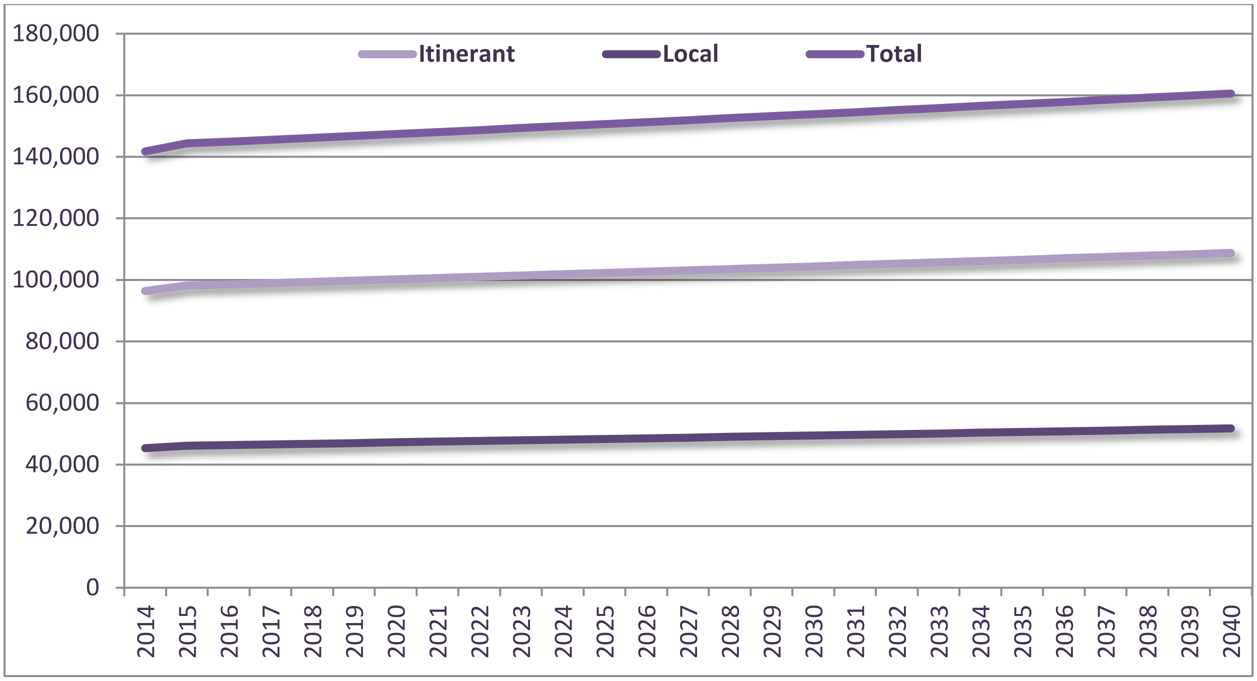
Source: FAA Terminal Area Forecast, issued January 2015

FIGURE 3-7 – HARVEY FIELD HISTORIC BASED AIRCRAFT (FAA TAF)



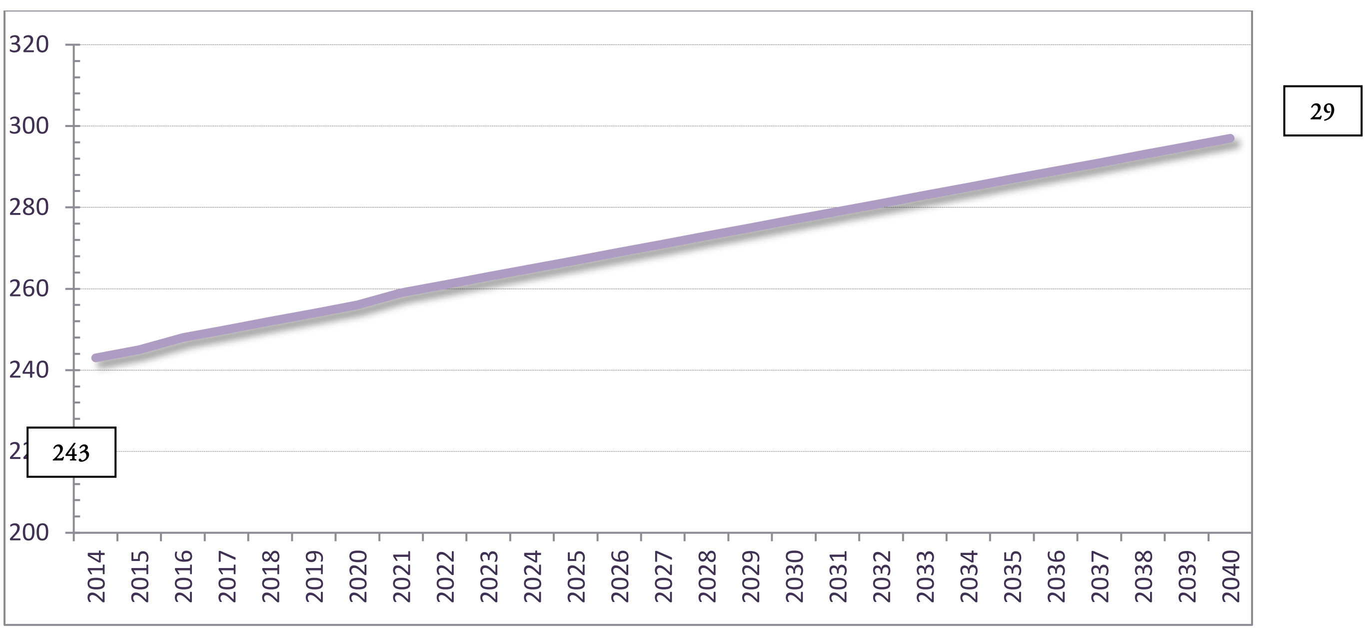
Source: FAA Terminal Area Forecast, issued January 2015

FIGURE 3-8 – TAF FORECASTED OPERATIONS AT HARVEY FIELD (FY 2014-2040)



Source: FAA Terminal Area Forecast, issued January 2015

FIGURE 3-9 – HARVEY FIELD FORECAST OF BASED AIRCRAFT (FAA TAF)



Source: FAA Terminal Area Forecast, issued January 2015

TABLE 3-6 – COMPOUND ANNUAL GROWTH RATE (CAGR) FOR HARVEY FIELD (FAA TAF)

Period	Itinerant			Local			Total Ops	Based Aircraft
	GA	Military	Total	Civil	Military	Total		
1990-2000	2.0%	2.0%	2.0%	1.3%	0.0%	1.3%	1.8%	1.2%
2000-2013	-0.6%	-18.2%	-0.1%	0.0%	0.0%	0.0%	-0.1%	-2.7%
2014-2019	0.6%	0.0%	0.6%	0.6%	0.0%	0.6%	0.6%	0.7%
2020-2030	0.4%	0.0%	0.4%	0.4%	0.0%	0.4%	0.4%	0.7%
2031-2040	0.4%	0.0%	0.4%	0.4%	0.0%	0.4%	0.4%	0.6%

Source: FAA Terminal Area Forecast, issued January 2015

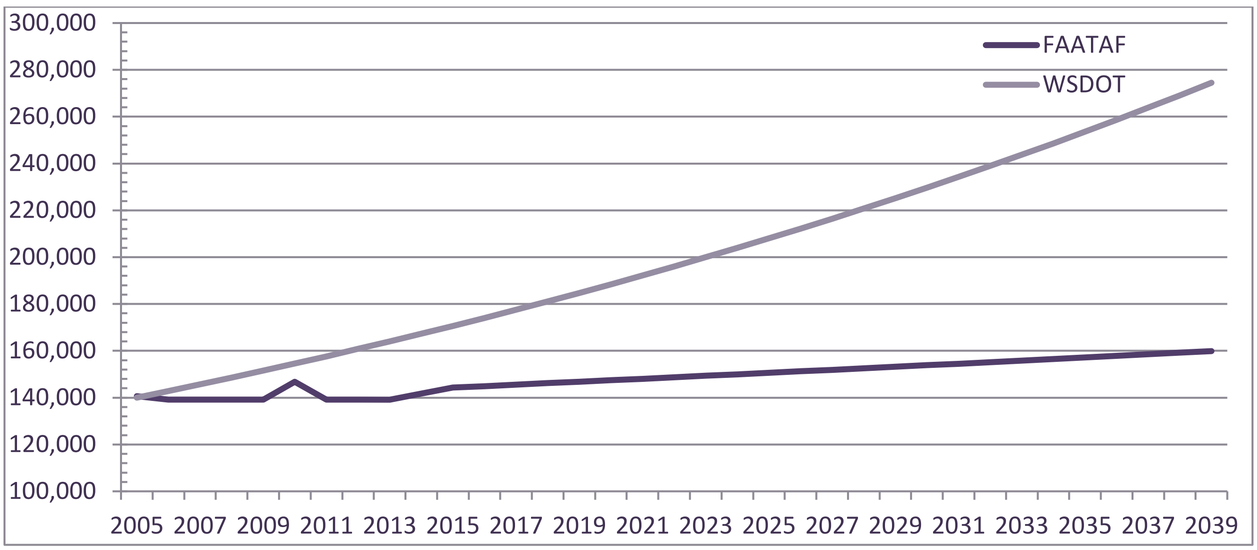
Summary of Key Points:

- Because there is no control tower at Harvey Field, activity levels are estimated. In addition, activity levels at almost every airport fluctuate over time, in response to both short- and long-term opportunities as well as pressures.
- The wide variety of aviation activity at Harvey Field means that as one segment of the market (such as private/pleasure flying) declines over a short period, another segment of activity, such as flight training and/or parachuting, often increase in response to different market forces.
- The Airport estimates that annual operations at Harvey Field were approximately 39,000 less than estimated by the FAA in 2014. Given that the airport management owns and operates the aircraft that generate a large share of activity, the airport's activity records are considered to be more accurate than the FAA's Form 5010 or TAF.
- FAA TAF activity data is estimated, and there is no background information that explains the large fluctuation in operations in the 2004-2005 time period.
- Although the FAA estimated that aviation activity was relatively flat between 1990 and 2012, they predict that aircraft operations at Harvey Field will increase between 2013 and 2040.
- The socio-economic and demographic characteristics of the Puget Sound Region (discussed in following text) are projected to increase through 2040, similar to the FAA's TAF forecast rate of growth for Harvey Field. As noted below, the statistical correlation between regional socio-economic trends and aviation activity at Harvey Field are not strong enough to prepare regression analysis projections, but future growth trends are similar.
- The FAA's forecast of based aircraft through 2040 appears reasonable in relation to the strong socio-economic growth projected for the Puget Sound Region. Harvey Field is attractive to airplane owners and pilots who prefer not to operate at towered airports, such as Paine Field.

3.5.4 Washington DOT (WSDOT) Aviation System Plan: Historic and Future Aviation Activity at Harvey Field

WSDOT Aviation System Plan (ASP) forecasts were prepared in 2005, and projected a higher growth rate than FAA's TAF, as shown on **Figure 3-10** and **Table 3-7**. The WSDOT forecast reflects the higher growth rates of general aviation (GA) activity experienced in the late 1990s and early 2000s compared to later in the decade, and the state's higher rate of growth reflects that trend. As noted below, data from towered airports throughout Washington show a steady decline in GA operations, and FAA's lower growth rate in their TAF is more consistent with that trend. It is recognized that Harvey Field accommodates different types of GA activities compared to most of the towered airports in the state, but the overall downward trend in towered GA operations reflects the broader pressures on the GA industry including higher fuel prices, the higher cost of new aircraft, maintenance, etc. In a number of respects, Harvey Field serves as a unique facility compared to many other airports in Washington, and as result has experienced different trends than seen elsewhere.

FIGURE 3-10 – HARVEY FIELD – FORECAST OF AIRCRAFT OPERATIONS



Sources: WSDOT Aviation System Plan and FAA Terminal Area Forecast

TABLE 3-7 – COMPOUND ANNUAL GROWTH RATE (CAGR) FOR HARVEY FIELD

Period	WSDOT	FAA TAF
2005-2040	2.0%[a]	0.4%

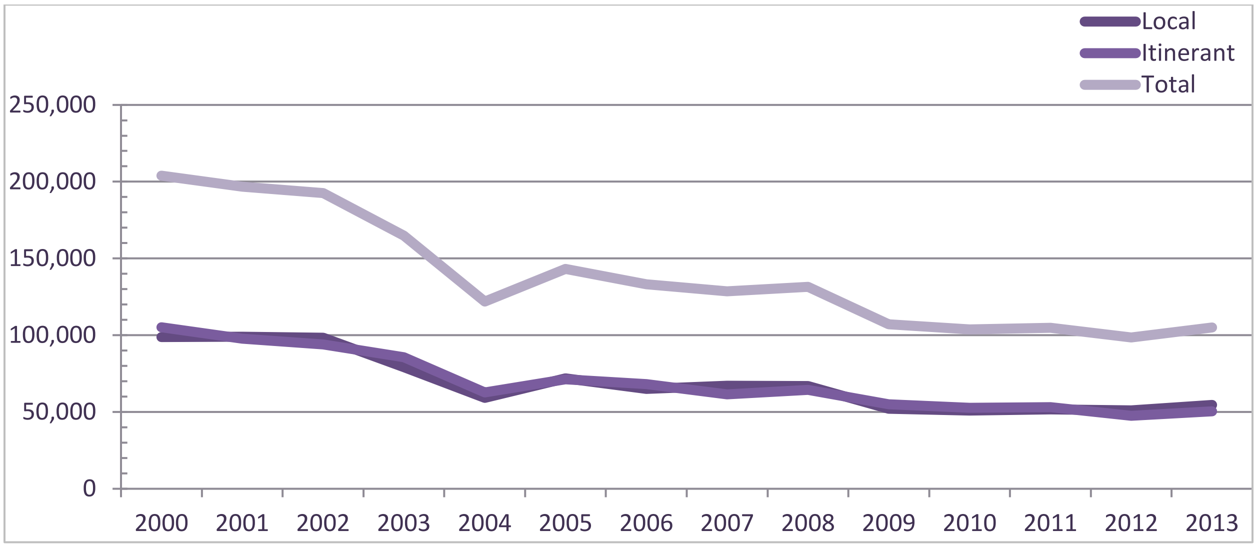
Note: [a]WSDOT period is only through 2039
Sources: WSDOT Aviation System Plan and FAA Terminal Area Forecast, issued January 2015

3.6 Regional and Statewide GA Aviation Activity

A number of airports within the Puget Sound Region have air traffic control towers, and therefore count aircraft operations. Paine Field (PAE) is a towered airport located less than 20 miles west of Harvey Field. As counted by the FAA air traffic controllers, total GA activity at PAE decreased by 48.5 percent between 2000 and 2013 (CAGR -5.4 percent); see **Figure 3-11**.

It is important to note that the type and nature of GA missions and aircraft that operate at PAE are different than those at Harvey Field. Therefore, the decline in traffic at PAE is not necessarily reflective of activity at Harvey Field. For example, PAE accommodates a high volume of corporate and air taxi activity, while Harvey Field accommodates high volumes of training and parachute operations. However, the decline in GA activity recorded at PAE is consistent with GA activity trends recorded by air traffic controllers throughout Washington and the FAA's Northwest Mountain Region, and is indicative of downward pressures on the GA industry, some of which are discussed in Section **3.9**. Harvey Field estimated that aircraft operations have declined by approximately 20 percent over the last 10 years.

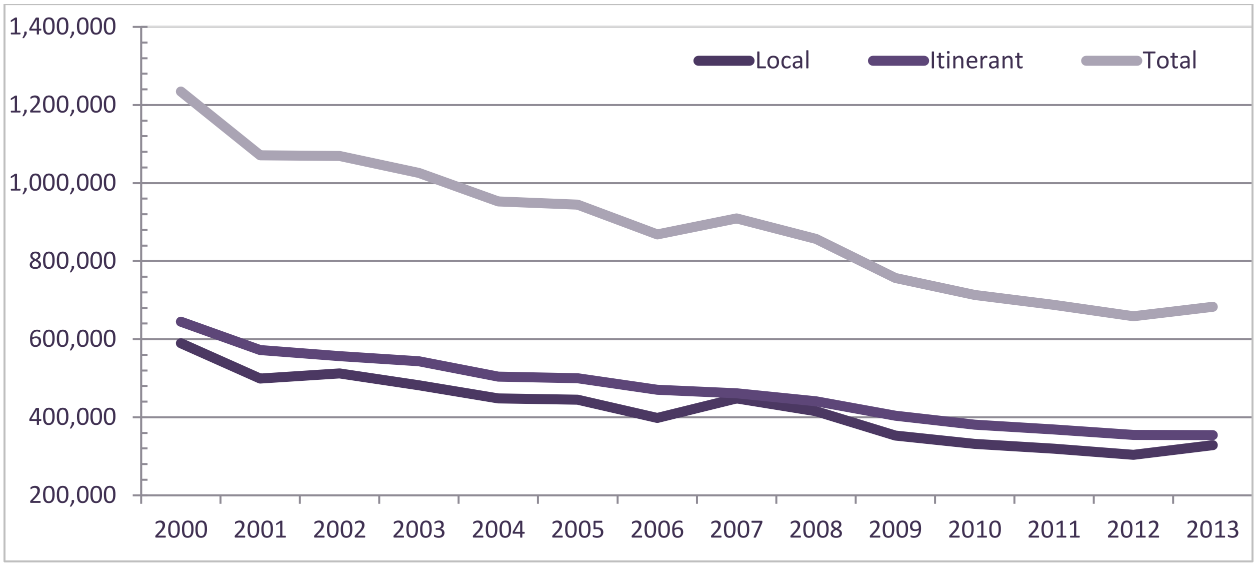
FIGURE 3-11– GENERAL AVIATION AIRCRAFT OPERATIONS – PAINE FIELD (PAE)



Source: FAA ATADS

Similar downward trends in overall GA activity were recorded at towered airports throughout Washington between 2000 and 2013; total GA operations at all towered airports in the state declined by 44.7 percent (CAGR -4.8 percent, see **Figure 3-12**) At many towered airports in Washington, such as Paine Field, corporate and air taxi activity represent a higher percent of GA traffic than at Harvey Field, which accounts for some of the different trends in activity between 2000 – 2013.

FIGURE 3-12 – GENERAL AVIATION AIRCRAFT OPERATIONS – CIVILIAN TOWERED AIRPORTS IN WASHINGTON

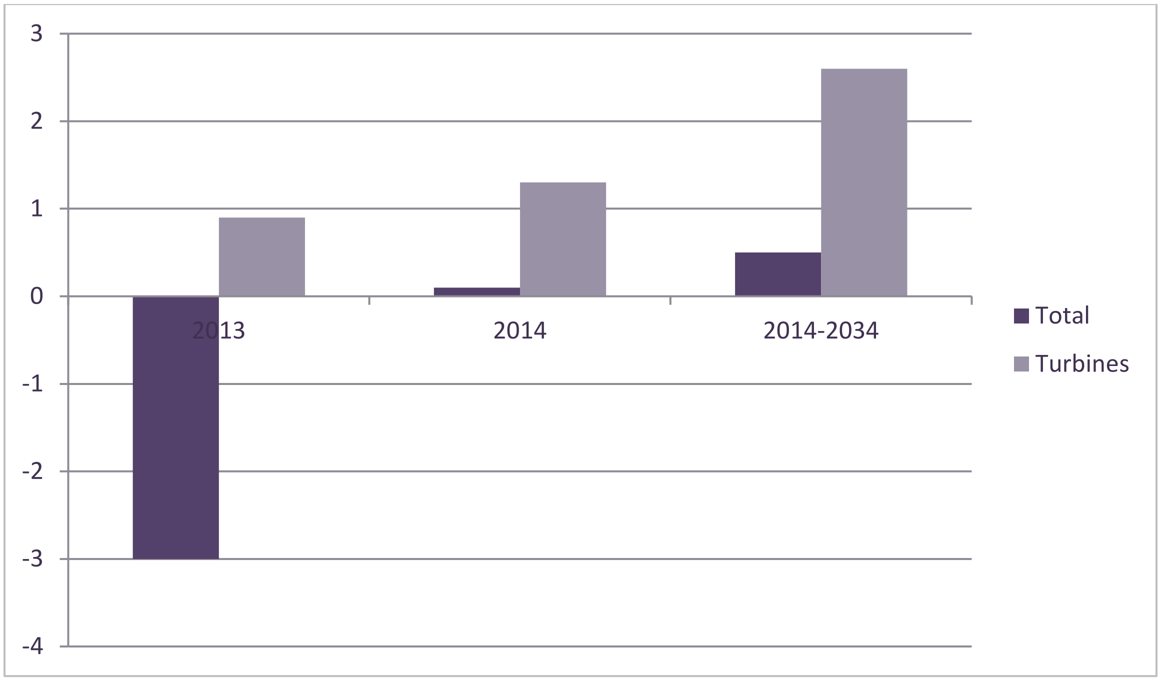


Source: FAA ATADS

3.7 National General Aviation Activity - FAA Aerospace Forecasts, FY 2014-2034

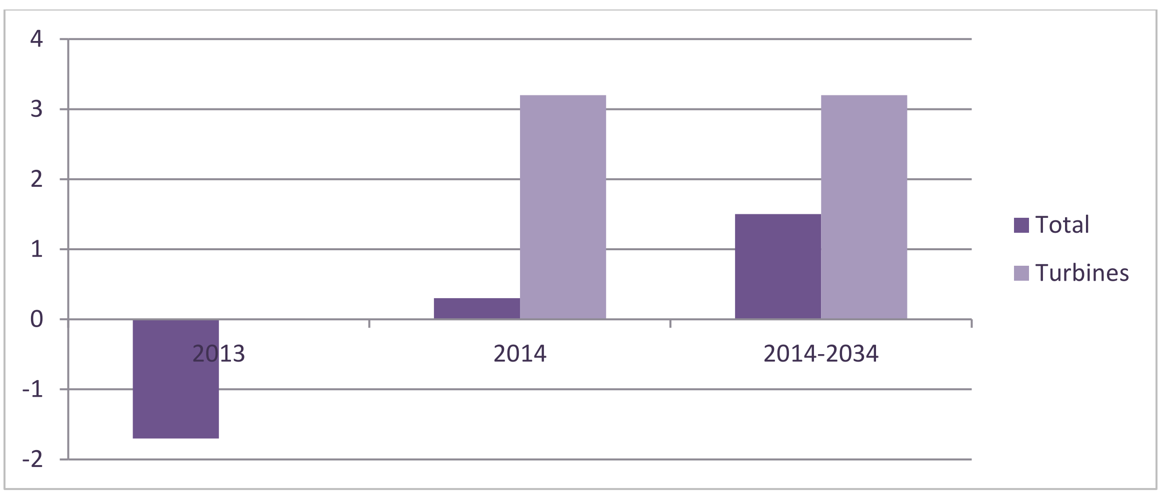
The FAA issues their national aerospace forecasts annually, which cover a 20-year period. The most recent aerospace forecast predicts that GA activity will vary significantly between piston-engine and turbine-engine aircraft. Piston-engine aircraft will experience relatively little growth through 2034, while turbine-powered aircraft will experience a more robust growth rate, see **Figure 3-13** and **Figure 3-14**.

FIGURE 3-13 – ACTIVE GENERAL AVIATION AIRCRAFT AND HOURS FLOWN



Source: FAA Aerospace Forecasts, FY 2014-2034

FIGURE 3-14 – GENERAL AVIATION HOURS FLOWN



Source: FAA Aerospace Forecasts, FY 2014-2034

3.8 Local and Regional Demographic Trends

As noted previously, there are several reasons why the use of regression and least-squares analysis and forecast techniques are not relevant for projecting activity at Harvey Field, including the fact that there is not a strong statistical correlation between socio-economic trends in Snohomish County and aviation activity at Harvey Field. But overall socio-economic and demographic trends, as shown below, are projected to continue growing in the region through 2040, which at the very least means that aviation activity at Harvey Field will not be constrained by factors such as growing unemployment, decreasing population, or declining per capita income. In other words, the positive socio-economic outlook for the Puget Sound Region through 2040 should support growing activity at Harvey Field with all other factors (such as aviation fuel prices, etc.) remaining steady.

According to the Puget Sound Regional Council's 2012 Regional Macroeconomic Forecast (**Table 3-8**) the overall population, employment, and per capita income are projected to increase steadily through 2040 in the Puget Sound Region.

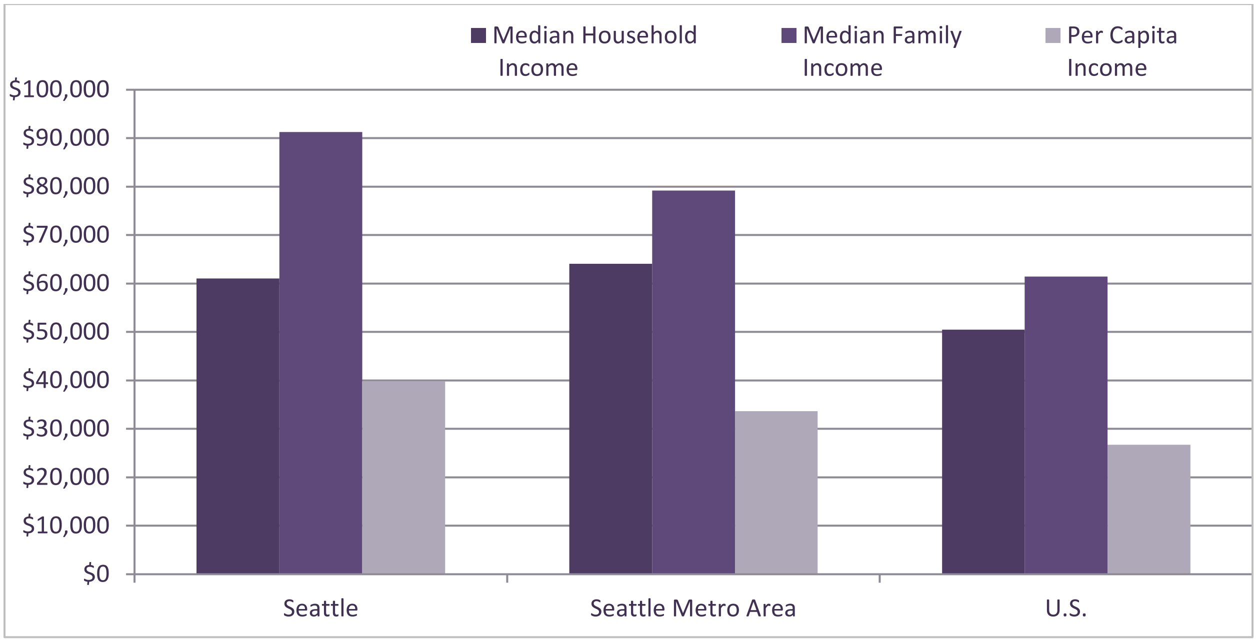
- The average per capita income in the greater Seattle Metro Region is among the highest in the U.S. **(Figure 3-15**).
- The overall strong growth in demographic trends support growing GA activity at Harvey Field, particularly in terms of personal/discretionary flying, flight training, parachuting, and business-related aviation.
- Public service and construction-related aviation activity are driven more by public agency and specific industry demands than the regional economy.

TABLE 3-8 - PUGET SOUND ECONOMIC FORECASTS: 2000-2040

Puget Sound Forecast 2012	2000	2010	2020	2030	2040	Percent Change 2000-2040
Employment (thousands)	1,721.9	1,726.6	2,091.2	2,317.6	2,711.4	57.4%
Personal Income (millions $00)	122,204	151,101	226,205	326,645	452,491	270.3%
Consumer Price Index (1982-84 =1.00)	1.79	2.24	3.49	4.30	5.18	189.4%
Population, (thousands)	3,271.1	3,680.5	4,127.7	4,531.5	4,974.8	52.1%
Households (thousands)	1,280.7	1,460.0	1,662.5	1,819.3	2,067.8	61.4%

Source: Puget Sound Regional Council, 2012 Regional Macroeconomic Forecast

FIGURE 3-15 - 2011 INCOME ESTIMATES (SEATTLE, SEATTLE METRO AREA, AND U.S.)



Source: 2011 American Community Survey estimates, U.S. Census Bureau, and City of Seattle Department of Planning & Development
Notes: 2011 latest year income data was available on City website. In the ACS, people are asked about income during the previous 12 months. Because the ACS is conducted throughout the year, the 2011 ACS includes incomes for the 12-month periods as early as January through December of 2010 and as late as December of 2010 through November of 2011. ACS estimates have high margins of error.

3.9 Factors that May Impact Future GA Activity

Although Harvey Field is situated in the Puget Sound Region of Washington, GA activity at Harvey Field is also affected by broad national trends. Those trends are directly impacting GA activity at many airports across the U.S. and Washington, a number of which are discussed below. Each one represents potential risks to the forecast of activity at Harvey Field, and it is difficult to predict how and when each factor will evolve over time:

- Rising price of 100LL AvGas, and potential limited availability or disappearance of low-leaded AvGas before 2020. Since mid-2014 aviation fuel prices have declined slightly due to falling oil and gas prices globally, but aviation fuel prices have also been very volatile for more than a decade. At the current time there is no ready replacement for 100LL, although FAA and several private companies are working to find a viable replacement.
- Aging and declining GA pilot population has been a long-term trend.
- Rising cost of new GA aircraft and parts has outpaced the overall rate of inflation for many years.
- The average age of piston-engine GA aircraft is more than 45 years old. As a result, maintenance costs are rising steadily, and many airplane parts are becoming scarce, and more difficult and expensive to find.

- Recent changes in minimum experience levels for new airline pilot hires (minimum 1,500 hours flight time) significantly increased training costs and the time to obtain ATP license. That has impacted the number of students starting flight training due to the increased cost of obtaining sufficient licenses and experience needed to qualify to fly for the airlines.

3.10 Methodology and Conclusions

Although GA activity at Harvey Field encompasses a wide variety of missions, a large share of aviation activity is generated by flight training and parachute operations, which are owned and operated by the airport. Airport management has indicated that particular activity will continue to grow throughout the future, as well as private/pleasure flying, some air taxi operations, and public service missions. The application of FAA's TAF growth rate is appropriate for Harvey Field, starting with the airport's current estimates of activity, because FAA's growth rate reflects continued positive trends reflected in stable aviation fuel prices, continued demand for flight training and sport parachuting, continued private/pleasure flying, and continued use of Harvey Field by public service agencies. As noted previously, use of forecast techniques such as regression and least-squares analysis, etc., are not appropriate for Harvey Field for a variety of reasons, including insufficient statistical confidence levels.

3.11 Recommended Forecast of Aviation Activity at Harvey Field

The recommended forecast for Harvey Field (**Table 3-9** and **Table 3-10**) matches the FAA TAF for the following reasons:

- The Puget Sound Region's demographic indicators are projected to continue growing at a strong pace through 2040, which should stimulate demand for GA activity at Harvey Field.
- Washington DOT's Aviation System Plan projected growth rate at Harvey Field is assumed to be too optimistic based on national trends in GA activity.
- There are potential risks to the forecasted growth in activity at S43 as listed is **Section 3.9**. Actual activity trends should be monitored on a regular basis to ensure they are tracking with the forecasts.

Appendix B of the FAA document "Forecasting Aviation Activity by Airport" recommends formatting the preferred forecast data into a particular tabular format for ease of readability. This format is shown in **Table 3-11**.

TABLE 3-9 – HARVEY FIELD RECOMMENDED FORECAST

Base Year	GA Itinerant Operations	GA Local Operations	Air Taxi	Military	Total Operations	Based Aircraft
2014	46,600	51,920	1,500	200	100,220	249
2019	48,500	52,432	1,517	200	102,649	261
2024	49,500	53,468	1,551	200	104,719	272
2034	51,500	55,249	1,601	200	108,550	292

Source: Jviation

TABLE 3-10 – HARVEY FIELD RECOMMENDED FORECAST: COMPOUND ANNUAL GROWTH RATE (CAGR)

Period	Itinerant Operations	Local Operations	Total Operations	Based AC
2015-2019	0.83%	0.20%	0.22%	0.00%
2020-2024	0.41%	0.39%	0.44%	0.00%
2025-2034	0.40%	0.32%	0.31%	0.00%

Source: Jviation

TABLE 3-11 – HARVEY FIELD RECOMMENDED FORECAST

Template for Comparing Airport Planning and TAF Forecasts AIRPORT NAME: Harvey Field Airport				
	Year	AMP Forecast	FAA TAF	AMP/TAF (% Difference)
Passenger Enplanements				
– Base yr.	2014	-	-	0.0%
– Base yr. + 5yrs.	2019	-	-	0.0%
– Base yr. + 10yrs.	2024	-	-	0.0%
– Base yr. + 15yrs.	2029	-	-	0.0%
– Base yr. + 20yrs.	2034	-	-	0.0%
Commercial Operations				
– Base yr.	2014	-	-	0.0%
– Base yr. + 5yrs.	2019	-	-	0.0%
– Base yr. + 10yrs.	2024	-	-	0.0%
– Base yr. + 15yrs.	2029	-	-	0.0%
– Base yr. + 20yrs.	2034	-	-	0.0%
Total Operations				
– Base yr.	2014	100,220	141,739	-29.3%
– Base yr. + 5yrs.	2019	102,649	146,803	-30.2%
– Base yr. + 10yrs.	2024	104,719	149,959	-30.4%
– Base yr. + 15yrs.	2029	106,832	153,190	-30.5%
– Base yr. + 20yrs.	2034	108,550	156,496	-30.6%
Based Aircraft				
– Base yr.	2014	249	243	2.5%
– Base yr. + 5yrs.	2019	260	254	2.4%
– Base yr. + 10yrs.	2024	270	265	1.9%
– Base yr. + 15yrs.	2029	281	275	2.2%
– Base yr. + 20yrs.	2034	292	285	2.5%

Sources: Federal Aviation Administration and Jviation
Notes: FAA TAF data uses U.S. Government fiscal year - October through September. Airport master plan uses calendar year.
AF/TAF (% Difference) column has embedded formulas.

3.12 Critical Design Aircraft

The FAA's airport design criteria are based on accommodating the largest aircraft that meet the substantial use threshold. The FAA defines "substantial use" as a minimum of 500 itinerant operations (takeoffs and landings) per year, which is an average of 1.4 operations per day. The Airport has several aircraft that fall within Airport Reference Code (ARC) B-II (small) and generate activity levels that well exceed the FAA's threshold. These aircraft are best represented by the Cessna 208B Caravan, King Air 200, Quest Kodiak, DeHavilland Twin Otter, DeHavilland DHC-2 Beaver, and TBM 700. This mix of aircraft represents the existing and future critical design aircraft for Harvey Field. **Table 3-11** and **Table 3-12** detail operations by aircraft type over the forecast period.

TABLE 3-12 - HARVEY FIELD RECOMMENDED OPERATIONS FORECAST BY TYPE OF AIRCRAFT

Base Year	Total Operations	ARC A-I, A-II, B-I	ARC B-II
2014	100,220	96,813	3,407
2019	102,649	99,159	3,490
2024	104,719	101,159	3,560
2034	108,550	104,859	3,691

Source: Jviation

TABLE 3-13 - HARVEY FIELD RECOMMENDED BASED AIRCRAFT FORECAST BY TYPE OF AIRCRAFT

Base Year	Based Aircraft	ARC A-I, A-II, B-I	ARC B-II
2014	249	246	3
2019	261	257	4
2024	272	267	5
2034	292	285	7

Source: Jviation

4.0 FACILITY REQUIREMENTS

This chapter documents the facilities needed to meet the demand requirements for Harvey Field (S43 or Airport) as described in **Chapter 3, Aviation Activity Forecasts**. Current facilities were examined to determine if they meet existing demands of the Airport as well as future needs. The extent of improvements required to meet the demand, to replace items that will exceed their useful life during the planning period, or are needed to support the long-term viability of the Airport were determined and documented with appropriate calculations in this chapter. Certain items identified in this chapter may have multiple alternatives which were examined to determine the preferred alternatives. These items are explored in **Chapter 6, Alternatives Analysis**.

4.1 FAA Design Standards

As described in **Chapter 2**, the Runway Design Code (RDC) is a classification given to aircraft based on the maximum approach speed and wingspan of the aircraft, and the lowest approach visibility minimums. This classification is then used to identify FAA airport standards appropriate to the design and construction of airport operational facilities. The RDC for Runway 15L-33R is B-II. The RDC for Runway 15R-33L is A/B-I Small-Visual. A purpose of this Master Plan is to analyze existing facilities with respect to their compliance with FAA design standards and to propose feasible improvements that correct any standards deficiencies.

The most demanding aircraft currently and forecast to operate at S43 include:

- Beechcraft King Air 250
- DeHavilland DHC-2 Beaver
- DeHavilland DHC-6 Twin Otter
- Socata TBM-700
- Quest Kodiak
- Cessna Grand Caravan Blackhawk

As discussed in **Section 3.12**, based on the mix of aircraft currently using, and forecast to continue to use Harvey Field, B-II design standards[1] are the appropriate standard for S43. **Table 4-1** compares FAA design standards with the current conditions on existing Runway 15L/33R. As described in **Section 2.2** and **Table 4-1**, S43 does not meet B-II design standards.

TABLE 4-1 – FAA B-II DESIGN STANDARDS VS S43

Standard	B-II Design Standards[a]	Runway 15L/33R Current Conditions[a]
Runway Width	75	36
Runway Shoulder Width	10	n/a
Runway Safety Area (RSA) Width	150	120
RSA Beyond Runway Threshold	300	240

[1] Federal Aviation Administration Advisory Circular (AC) 150/5300-13A, *Airport Design*

Standard	B-II Design Standards/a/	Runway 15L/33R Current Conditions/a/
Runway Protection Zone	250 x 1000 x 450	50 – 138/b/
Runway Object Free Area (ROFA) Width	500 (250 to Rwy C/L)	135
ROFA Beyond Runway End	300	240
Obstacle Free Zone (OFZ) Width	250 (125 to Rwy C/L)	85 (Twy to Rwy C/L)
OFZ Beyond Runway End	200	200
Runway Centerline to Parallel Taxiway Centerline	240	85 – 91/c/
Runway Centerline to Aircraft Parking	240	247/d/ 589/e/
Taxiway Centerline to Fixed or Moveable Object	44.5	
Runway Holding Position Markings	125	<125/f/

Notes: /a/Dimensions are in feet
/b/ 33R: road and fence; 15L: powerline and railroad tracks
/c/Harvey Field has a partial parallel and separation distances vary
/d/Grass tie-downs in mid-field
/e/Main apron
/f/Vary but all less than standard for B-II of 200 feet
Sources: Airport Management and FAA AC 150/5300-13A, *Airport Design*

4.1.1 Runway Safety Area

The runway safety area (RSA) is a defined area surrounding the runway provided to reduce the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the paved surface. The standard RSA for a B-II airport is 150 feet wide and extends 300 feet beyond the end of the runway. The Runway's existing RSA is 120 feet wide and extends 240 feet beyond each end of the runway's displaced thresholds.

It is recommended that the RSA be designed and constructed to meet standards. Chapter 6, Alternative Analysis reviews standard RSA options.

4.1.2 Runway Protection Zone

The runway protection zone (RPZ) is an area at ground level prior to the threshold or beyond the runway end which is kept clear of objects, to enhance the safety and protection of people and property on the ground. The standard RPZ for a B-II airport is a trapezoid 250 feet wide 1,000 feet long, flaring to a 450-foot width. The RPZ is centered on the runway centerline and begins 200 feet from the runway end.

Among the land uses and structures FAA seeks to eliminate from RPZs are:

- Buildings and structures (Examples include, but are not limited to: residences, schools, churches, hospitals or other medical care facilities, commercial/industrial buildings, etc.)
- Recreational land use (Examples include, but are not limited to: golf courses, sports fields, amusement parks, other places of public assembly, etc.)
- Transportation facilities. Examples include, but are not limited to:

  - Rail facilities – light or heavy, passenger or freight
  - Public roads/highways
  - Vehicular parking facilities
- Fuel storage facilities (above and below ground)
- Hazardous material storage (above and below ground)
- Wastewater treatment facilities
- Above-ground utility infrastructure (i.e. electrical substations), including any type of solar panel installations.

When considering airfield projects such as a new runway configuration, FAA requires the airport owner identify and document the full range of alternatives that could:

1. Avoid introducing the land use issue within the RPZ
2. Minimize the impact of the land use in the RPZ (such as routing a new roadway out of the RPZ's central core area (called "controlled activity area) and/or farther away from the runway end, etc.
3. Mitigate risk to people and property on the ground, such as tunneling, depressing and/or protecting a roadway through the RPZ, or implementing operational measures to mitigate any risks.

As noted in **Table 4-1**, Airport Way and the airport fence are 10 feet from the paved end of runway 33R, creating both obstructions and incompatible uses. In addition, Burlington Northern Santa Fe railroad tracks and Puget Sound Energy powerlines create both obstructions and incompatible uses in the approach to Runway 15L.

It is recommended that the RPZ be owned by the airport and kept clear of the types of structures, objects and land uses that are described above. Chapter 6, Alternative Analysis, reviews options for achieving recommended RPZ.

4.1.3 Runway Object Free Area

A runway object free area (ROFA) enhances the safety of aircraft operations by providing an area centered on a runway, taxiway, or taxilane centerline that is cleared of above-ground objects. Only objects that are less than three inches tall or that are needed for aircraft operations, such as pavement edge lights, are allowed within the ROFA. S43 does not meet ROFA requirements.

It is recommended that the ROFA be designed and implemented to meet standards. Chapter 6, Alternative Analysis reviews options to provide a standard ROFA.

4.1.4 Obstacle Free Zone

The obstacle free zone (OFZ) is a volume of airspace intended to protect aircraft in the landing and departure stages of flight. It must remain clear of object penetrations, including aircraft but excepting frangible navigational aids (NAVAIDs). The OFZ is 250 feet wide and extends 200 feet beyond the end of the runway.

S43 does not meet OFZ requirements for RDC B-II. Further addressed in next paragraph, with Runway Hold Position Markings.

4.1.5 Runway Hold Position Markings

Hold lines at airports without control towers, such as S43, identify the location where a pilot should ensure there is adequate separation from other aircraft before proceeding onto the runway. These locations are chosen to ensure that aircraft are clear of the RSA and OFZ during operations. S43's holding position should be 125 feet from runway centerline.

S43 does not meet these requirements. It is recommended that the hold position lines be corrected to meet RDC B-II standards. Chapter 6, Alternative Analysis reviews the correction options.

4.1.6 Building Restriction Lines

Building restriction lines (BRLs) run parallel to the runway and are offset at a distance that ensures that construction remains outside of terminal instrument procedures (TERPS) surfaces and other protected surfaces as required by 14 CFR Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*. The BRLs at S43 are calculated based on a structure height 26 feet above the elevation of the runway. S43 was issued a Modification of Design Standards (MOS) for the BRL in 1988. The MOS is approved indefinitely, provided the use of Runway 15L/33R does not change. Because Harvey Field's RDC changed to B-II since the MOS was issued, the modification needs to be re-evaluated.

Options for meeting all standards, including BRL, at S43 are examined in tandem with runway and taxiway alternatives in Chapter 6, Alternatives Analysis.

4.2 Airside Requirements

The airside components evaluated include the runway, taxiways, FAA safety standards, navigational and landing aids, airspace requirements, and obstructions.

FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, "Table 3-4, Standards for Instrument Approach Procedures" recommends that runways with circling instrument approaches, such as Harvey Field, have:

- Full parallel taxiway
- Low or medium intensity runway lights
- Minimum runway length of 2,400 to 3,200 feet[2]

[2] Runways less than 3,200 feet are protected by 14 CFR Part 77 to a lesser extent. However, runways as short as 2,400 feet could support an instrument approach provided the lowest height above the airport is based on clearing any 200-foot obstacle within the final approach segment.

- Meet threshold siting surface criteria

The sections below discuss each of these criteria in relation to a single paved Runway 15L/33R. A single runway has an annual operational capacity well in excess of 200,000 operations per year (FAA AC 150/5060-5, *Airport Capacity and Delay)*. Although S43 currently has a second runway, Runway 15R/33L, there is no capacity requirement to retain two runways.

4.2.1 Runway

Runway Orientation

The ability of the runway to meet the requirements of airport users is one of the most critical components to the success of an airport. The runway must have the capacity, length, width, strength, and proper orientation to the wind to meet the demands of its users. This section examines several key factors used in the determination of the adequacy of the runway system.

Runway orientation is the alignment of the runway in relation to magnetic north, and is primarily influenced by wind direction. Runways are aligned so the prevailing wind creates the least amount of crosswind operations. Recognizing that there are variable weather conditions, aircraft are designed to land with an acceptable degree of crosswind, referred to as the crosswind component. When conditions are above the maximum allowable crosswind component for a particular type of aircraft, said aircraft must use another runway or divert to another airport. Since S43 has just one paved runway, the only option is to divert to another airport. To reduce the amount of diversions due to wind, the most ideal runway layout results in an allowable crosswind component for the design aircraft 95 percent of the time.

Harvey Field's wind coverage (discussed in **Section 2.10.1**) meets the 95 percent FAA recommended crosswind coverage for all weather conditions for 10.5 and 13 knots.

Runway Magnetic Bearing

Numbering for each runway end is evaluated against magnetic bearing every five years. The FAA reviews two end digits in a given year (such as 0-5, 1-6, and so on) for variation with magnetic bearing. Results from the evaluation distinguish which airports have runway bearings that require a re-designation. Written notice from the FAA Air Traffic Organization (ATO) will be issued to airports with runway designations that are due to be changed and typically an opportunity, such as a pavement maintenance project, is looked for to facilitate the change. Response to the FAA written notice initiates coordination with the Airspace Evaluation Program Specialist that will commence the 12-month period during which publication changes are planned. The planning includes scheduled changes to the Airport Facilities Directory (AFD), FAA 5010 Airport Master Record, and instrument approach procedures. During the transition between designations, local Notices to Airmen (NOTAM) are issued for visual approaches, whereas affected instrument approach procedures may be temporarily offline during the limited transitional period prior to publication. Physical pavement updates can commence after the 12-month planning period, but it can take longer if it's necessary to coordinate with other improvements.

Runway Length

Runway 15L-33R is paved, and is 2,761 feet long and 36 feet wide, with displaced thresholds of 452' and 242' respectively. Because Runway 15R-33L is turf and 2,430 feet long and is not needed for capacity purposes, this runway length analysis will focus on whether the length of Runway 15L-33R is adequate for the current and projected aircraft fleet operating at S43.

There are two methods to determine the runway length needed to accommodate the existing and projected fleet mix, namely,

1. Use FAA AC 150/5325-4, *Runway Length Requirements for Airport Design,* Chapter 2, Section 205, Figure 2-1, runway length curves to determine runway length needed to serve 100 percent of the small aircraft fleet with fewer than 10 passenger seats. Small aircraft are defined as those with maximum gross weight of less than 12,500 lbs. Alternatively,
2. Use FAA AC 150/5325-4, *Runway Length Requirements for Airport Design*, Chapter 4 - Determine the runway length requirements for specific critical aircraft using the individual Aircraft Flight manual (AFM) and/or Pilot Operating Handbook (POH).

Using the first method – FAA AC 150/5325-4 fleet curves - a 3,400 foot long runway would serve 100 percent of the small aircraft fleet with fewer than 10 passenger seats. 95% of the small airplane fleet would be accommodated on a 2,850 foot long runway.

For several reasons, the second method of analyzing runway length requirements for specific aircraft was taken. Those reasons are as follows:

- The runway curves contained in AC 150/5325-4B Figures 2-1 and 2-2 are solving for 95% of the national fleet and include aircraft that don't perform well (these tend to be older and poorly performing models). Therefore, the curves are conservative and tend to produce longer lengths. In the case of Harvey, it makes sense to using the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual to determine the recommended runway length of the specific fleet mix that is using and forecasted to use the airport.
- Harvey Field is a highly attractive airport for skydiving, hot air ballooning, and banner towing and is forecast to remain so in the future.
- Increased business traffic is not forecast at Harvey Field.
- Citizens interested in Harvey Field's future, while concerned about runway improvements that could attract larger aircraft, acknowledge the value of safety improvements that enhance the Airport's significant domestic and international fixed wing and rotorcraft helicopter flight training operations.

For all of these reasons, – some of which constrain runway length - the runway length analysis was conducted on the grouping of critical aircraft operating at Harvey Field. Based on the following analysis, a recommended runway length of 2,600' is yielded. **However, the Alternative Analysis Chapter will provide justification as to why 2400' was determined to be the minimum**

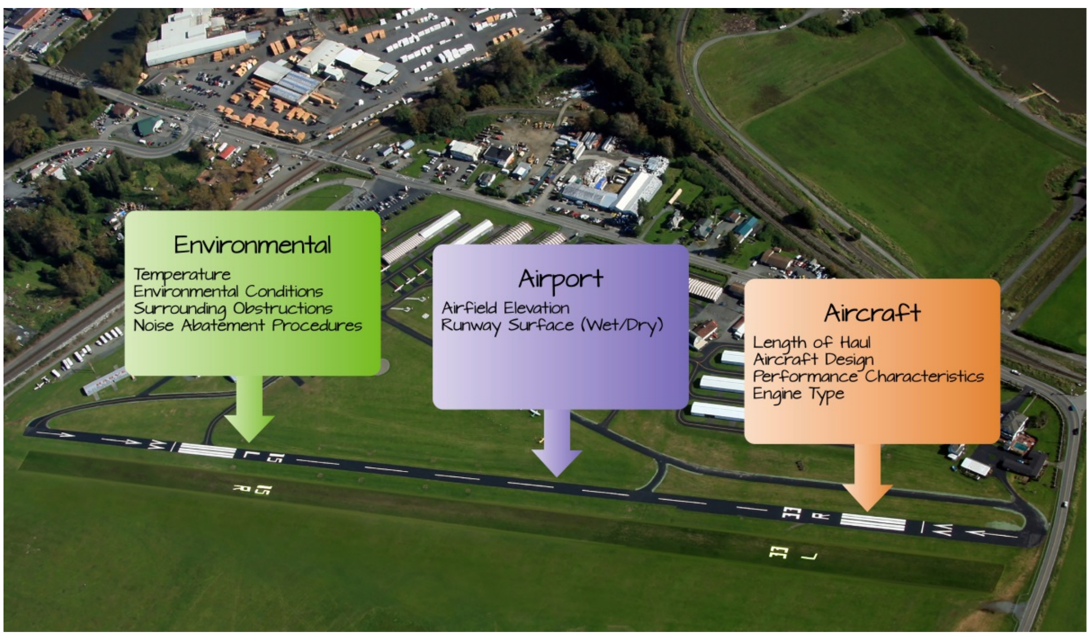
recommended runway length that is appropriate to serve the Airport's existing and future critical aircraft operations.

Required Runway Length for Critical Aircraft

Aircraft takeoff and landing runway length requirements are determined by numerous factors, including:

- aircraft performance characteristics at various weights
- density altitude (airport elevation + ambient temperature + atmospheric pressure + relative humidity)
- wind velocity and direction
- runway surface type (e.g. paved, turf, etc.) and slope
- runway surface condition (wet, dry, snow, slush, etc.)
- Approaches and Departures with no obstructions

FIGURE 4-1 – IMPACTS TO RUNWAY LENGTH



Source: Jviation

Using the methodology based on AFM or POH described in FAA AC 150/5325-4, the runway length requirements at S43 were determined by the Cessna Caravan Blackhawk. The Blackhawk meets the FAA's definition of critical aircraft: The most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is 500 annual operations, excluding touch-and-go operations.[3]

[3] Federal Aviation Administration Advisory Circular (AC) 150/5000-17, *Critical Aircraft and Regular Use Determination*

While no other aircraft within the B-II group met the critical aircraft definition of 500 operations or regular use of the airport, several aircraft types were identified below and AFM/POH materials were reviewed and both takeoff and landing distances for the given conditions at S43: 23' msl elevation, mean daily maximum temperature of the hottest month at 74° F/23° C, zero winds, no runway slope, and a paved runway.

- Cessna Caravan Blackhawk - CRITICAL AIRCRAFT
- Beechcraft King Air 250
- DeHavilland Beaver
- Dehavilland Twin Otter
- Socata TBM 700
- Quest Kodiak

The iterative planning process that ultimately identified the Airport's feasible and operationally viable development plan is described in **Chapter 6 Alternative Analysis.**

Critical Aircraft

The Cessna Caravan (with the Blackhawk engine conversion) is used for parachuting at S43. It does not have any passenger seats or soundproofing in the cabin, and typically takes off with less than full fuel. As a result, the aircraft operates at less than maximum gross weight, which improves the climb rate to drop altitudes, and also results in shorter runway length on takeoff and landing. However, to assure a most conservative analysis, the Blackhawk runway length requirements were prepared for maximum gross takeoff and landing weight, with cargo pod installed.

The non-critical aircraft listed in this chapter were identified in the operations logbook for S43. The AFM or POH was reviewed to determine the takeoff and landing distances at maximum gross weight at S43 (**Table 4-3**). The takeoff and landing performance tables and charts for each aircraft, are in **Appendix D, Aircraft Performance Charts**.

As noted in **Table 4-3**, 'Takeoff Distance" is the ground roll distance plus climb distance to clear a 50-foot obstacle. Similarly, "Landing Distance" is measured from the location of a 50-foot obstacle to completion of ground roll. AC 150/5325-4B, para 201 states that runway length curves are based on FAR Part 23 defined runway takeoff and landing requirements. FAR Part 23 in turn defines the both the takeoff and landing distances relative to clearance over 50' obstacle, for the subject category of aircraft.

TABLE 4-2 – TAKEOFF AND LANDING PERFORMANCE[1]

Aircraft	Takeoff Distance	Landing Distance
Beech King Air 250[2]	2,400'/2,600'	2,100'
D-H Beaver	1,310'	1,300'
D-H Twin Otter	1,500'	1,975'
Socata TBM 700	2,238'	2,187'
Quest Kodiak	1,264'	1,693'

Aircraft	Takeoff Distance	Landing Distance
Cessna Caravan Blackhawk w/ Cargo Pod	2,111’	1,625’

Note 1: Except as noted, distances are based on max. takeoff or landing weight, 74° F/23° C, sea level, calm winds, no runway slope, paved runway, distance to clear 50’ obstacle. See Attachment K for each aircraft’s performance tables and charts.
Note 2: 2,400 runway @ 11.8K. 2600’ runway @ 12.5K’ Max Gross Take Off Wt.

Runway Width

Harvey Field’s RDC of B-II requires a minimum runway width of 75 feet. Additionally, 10-foot-wide runway shoulders and 95-foot-wide by 150-foot-long runway blast pads are standard design. S43’s existing runway width is 36 feet, with approach visibility minimums of greater than or equal to one mile. **Table 4-4** compares the RDC design standards with the existing Runway 15L/33R.

TABLE 4-3 – RUNWAY DESIGN STANDARDS

Standard	ARC B-II (small) ≥ 1-Mile Visibility Minimums[a]	Existing Runway 15/33 Conditions[a]
Runway Width	75	36
Runway Shoulder Width	10	None
Blast Pad Width	95	None
Blast Pad Length	150	None
Runway CL to Parallel TW CL	240	85-91
Taxiway Centerline to Fixed or Moveable Object	44.5	
Runway Hold Line	125	<125

Notes: [a] Dimensions are in feet
Source: FAA AC 150/53-00-13A, *Airport Design*

It is recommended that the Runway be widened to meet current RDC B-II (small) standards. The need for runway blast pads and shoulders are also part of the RDC B-II design standards. Options to meet standards are reviewed in Chapter 6, Alternative Analysis.

Runway Line of Sight

The runway line of sight standard requires that two points five feet above the runway centerline be mutually visible for the entire length of the runway. If there is a parallel taxiway, the two five-foot points must be visible for one-half of the runway length. S43’s existing partial parallel taxiway and taxiway grades allow for mutual visibility of two five-foot points for at least half of the runway length.

Runway 15L/33R meets the runway line of sight requirements.

Runway Strength

Airfields are constructed to provide adequate pavement strength for aircraft loads, as well as resisting the abrasive action of traffic and deterioration from adverse weather conditions and other influences.

Runway 15L/33R has a weight-bearing capacity designed to accommodate 10,000 pounds for single-wheel gear (SWG) equipped aircraft.

It is recommended that the pavement strength be increased to accommodate 12,500 pounds SWG.

4.2.2 Taxiways and Taxilanes

Taxiways are designed to provide movement from one part of an airport to another. Ideally, the taxiway system should allow an aircraft to taxi to an associated runway in the most direct manner without having to change speed or cross active runways. Taxilanes are designed for lower speed movement and provide access from taxiways to aircraft parking positions and other terminal areas.

The taxiway design standards for width and separation are dictated by Aircraft Design Group (ADG) and Taxiway Design Group (TDG) as described in FAA AC 150/5300-13A, *Airport Design*. The TDG is determined by the main gear width (MGW) and the cockpit to main gear (CMG) of the largest aircraft operating at an airport on a frequent basis (critical aircraft). Based upon the critical aircraft (Cessna Grand Caravan), S43's TDG is 1A. All taxiways require a designated width of a Taxiway Safety Area (TSA) and Taxiway Object Free Area (TOFA) centered on the taxiway centerline. These standards allow for the safe movement of aircraft without the threat of striking any objects or other aircraft. **Table 4-5** compares S43's existing taxiway conditions to design standards for ADGII/TDG 1A.

TABLE 4-4– TAXIWAY DESIGN STANDARDS VS S43 EXISTING CONDITIONS

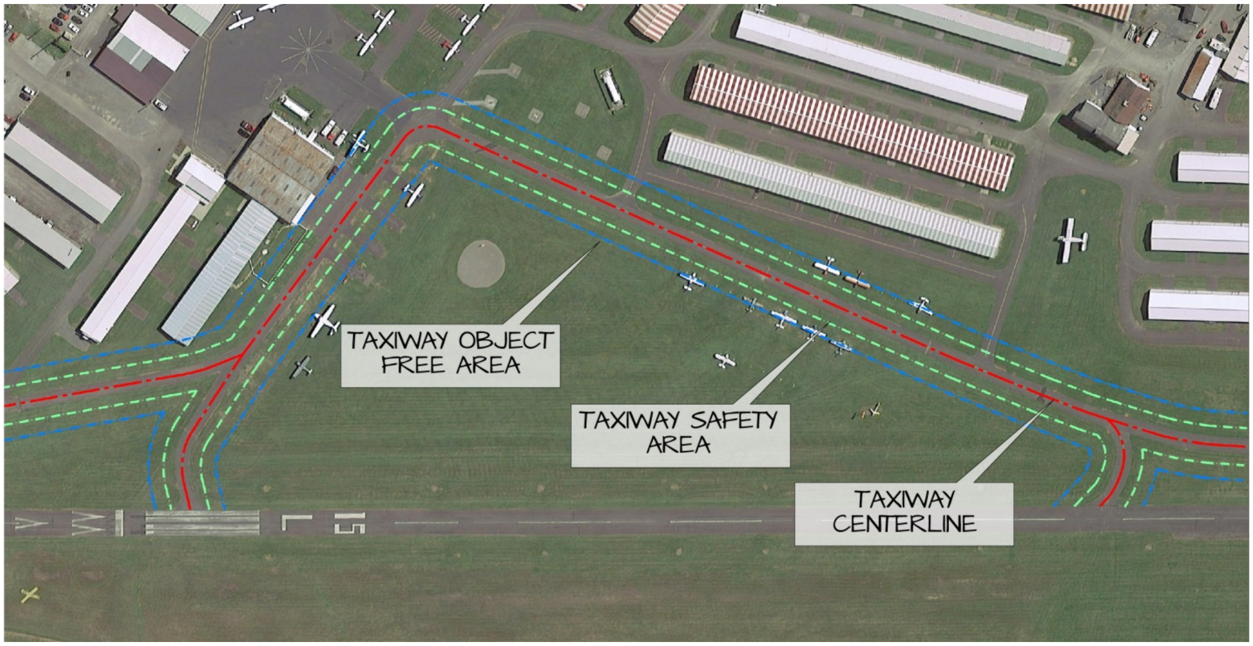
Criteria	ADG II TDG 1A Taxiway[a]	S43 Existing Taxiway & Connectors[a]
Width	25	16
Taxiway Safety Area Width	79	79
Taxiway Object Free Area Width	131	Non-standard[b]
Taxiway Centerline to – Runway Centerline – Fixed or Moveable Object	 240 65.5	 85-91 65.5
Taxiway Wing Tip Clearance	26	26
Taxiway Shoulder Width	10	None

Notes: [a]Dimensions are in feet
[b]Tie-downs are located within taxiway object free area as well as the corner of a hangar
Sources: FAA AC 150/5300-13A, *Airport Design* and Jviation

The FAA recommends a full parallel taxiway for airports with an RDC B-II (small), such as Harvey Field. The Airport has a partial parallel taxiway to Runway 15L/33R as well as several connector taxiways. The taxiways are not equipped with a lighting system but do have blue reflectors to mark pavement edges. Lighting recommendations are discussed in **Section 4.2.3**.

S43's taxiways are 16 feet wide which does not meet the TDG 1A standard of 25 feet. Also, as illustrated in **Figure 4-3**, tie-downs and a portion of a hangar are within the taxiway object free area.

FIGURE 4-2 – TAXIWAY STANDARDS



Note: Not to scale
Source: Jviation

Taxiway and taxilane pavements are in good condition with exception of the midfield taxilanes that are in fair condition with several pads failing (see **Figure 2-3, S43 Pavement Conditions Index** for details).

A full parallel taxiway with connectors meeting FAA design criteria for RDG II/TDG 1A is recommended. It is also recommended that grass tie-downs be reconfigured to accommodate FAA standard taxiway object free areas. Options for each of these recommendations are explored in Chapter 6, Alternatives Analysis. Routine maintenance, such as crack and joint sealing, should be performed on a scheduled basis to extend the life of the pavements.

4.2.3 Airfield Lighting, Signage, and NAVAIDs

Harvey Field has limited and non-standard lighting and NAVAIDs. This section discusses the current condition as well as standard lighting, signage, and NAVAIDs recommendations.

Airfield signage (taxiway, runway, direction, etc.) is not currently installed at the Airport but is recommended to give pilots visual guidance information for movement on the airfield.

The Airport recently purchased, but has not yet installed, a rotating beacon which will aid identification of the airfield during nighttime and periods of low visibility. Locations for beacon placement are reviewed in the **Chapter 6**, **Alternatives Analysis**.

Runway 15L/33R currently has non-standard low intensity runway lighting (LIRL) and the taxiways are not currently equipped with a lighting system. Installation of medium intensity runway lighting (MIRL) and medium intensity taxiway lighting (MITL) or stake-mounted reflectors would enhance the visibility of the runway and taxiway environment for pilots at night and during periods of reduced visibility day and night.

The Airport currently has threshold lights with 360-degree green lenses. The FAA standard lighting color is red for the 180-degree portion of the lens facing the runway and green for the 180-degree portion of the lens facing the approach.

Harvey Field does not have visual guidance indicators for either runway end. The installation of precision approach path indicators (PAPI) would enhance approaches at night and during periods of poor visibility, particularly given the obstructions in the vicinity of the runway.

There is a Common Traffic Advisory Frequency (CTAF) on 123.0 MHz which is used to provide airport advisories, and for pilots to self-announce their position and intentions. The CTAF should be used to activate the runway and taxiway lighting systems.

There are no ground-based radio NAVAIDs at S43. The nearest VHF omni-directional range (VOR) transmitter is at Paine Field, located approximately seven nautical miles (nm) west, which adequately serves aircraft flying into and out of S43. The majority of aircraft use global positioning system (GPS) for navigation, including both panel-mounted and portable GPS receivers.

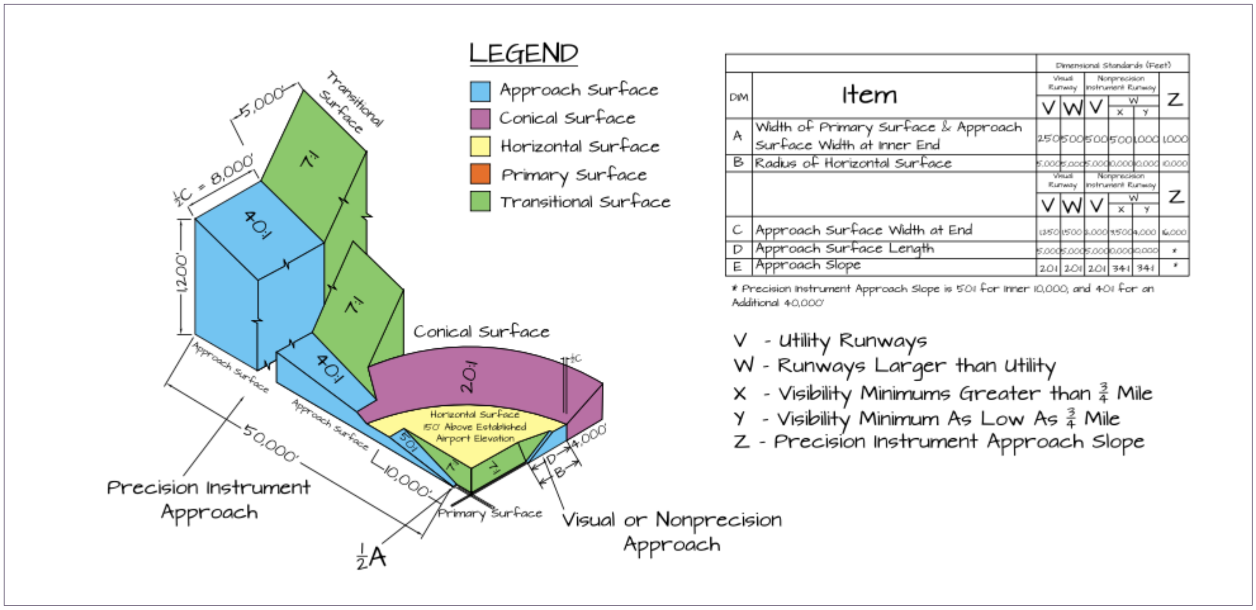
The following improvements are recommended:

- *Replace LIRLs with MIRLs (activated through CTAF)*
- *Install MITLS (activated through CTAF), or stake-mounted reflectors*
- *Replace portion of threshold lights with red lenses*
- *Install PAPIs on both runway ends*
- *Install airfield signage*

4.2.4 Airspace Requirements and Instrument Approach Review

14 CFR Part 77 defines and establishes the standards for determining obstructions that affect airspace in the vicinity of an airport. Prior to any airport development, a 14 CFR Part 77 evaluation must be conducted regardless of the project scale to verify that there will be no hazardous effects to air navigation due to construction. 14 CFR Part 77 defines an airport's imaginary surfaces, which are geometric shapes that are in relation to the airport and each runway. The size and dimensions of these imaginary surfaces are based on the category of each runway for current and future airport operations. The five imaginary surfaces are defined on the following page and depicted in **Figure 4-4**.

FIGURE 4-3 – PART 77 SURFACES



Source: FAA 14 CFR Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*

- **Primary Surface:** The primary surface is an imaginary obstruction-limiting surface that is specified as a rectangular surface longitudinally centered on a runway. The specific dimensions of this surface are functions of types of approaches, existing or planned, for the runway.
- **Approach Surface:** The approach surface is an imaginary obstruction-limiting surface that is longitudinally centered on an extended runway centerline. It extends outward and upward from the primary surface at each end of a runway, at a designated slope and distance, determined upon the type of available or planned approach by aircraft to a runway.
- **Horizontal Surface:** The horizontal surface is an imaginary obstruction-limiting surface that is specified as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specific horizontal dimension of this surface is a function of the types of approaches existing or planned for the runway.
- **Conical Surface:** The conical surface is an imaginary obstruction-limiting surface that extends from the edge of the horizontal surface outward and upward at a slope of 20:1(horizontal:vertical) for a horizontal distance of 4,000 feet.
- **Transitional Surface:** The transitional surface is an imaginary obstruction-limiting surface that extends outward and upward at right angles to the runway centerline and the runway centerline, extended at a slope of 7:1 (horizontal: vertical) from the sides of the primary surface.

As discussed in **Chapter 2, Inventory**, S43 has one published non-precision GPS approach procedure. It is designated as a circle-to-land procedure, which means that approaching aircraft can land on any runway. Even though the final approach course is closely aligned to the centerline of Runway 33R, the FAA has established a minimum descent altitude (MDA) of 1,220 feet above the

Airport, and 1.5-mile visibility minimums, which exceed the maximum approach angle as a straight-in approach to Runway 33R. Additionally, the final approach fix (FAF) is located five miles from the Runway 33R end; both the relatively high MDA and the location of the FAF are greater than FAA Order 8260.3, *TERPS*[4] typically allows for a non-precision GPS straight-in approach procedures.

In addition, night approaches are not allowed, and only AAC A and B (<121 knots) are allowed to use the GPS procedure. AAC C and D aircraft are not allowed to use the published approach.

Although recent technological advancements have made the use of satellite-based navigation systems possible, these systems will not alleviate the need to clear the imaginary surfaces defined in FAA Order 8260.3, *TERPS*.

4.2.5 Known FAR Part 77 Airspace Penetrations

Existing obstructions are discussed in **Section 2.4.10**. Runway 15/33 has displaced thresholds to accommodate existing obstructions to the approach ends of each runway. Runway 15 has a displaced threshold to clear railroad tracks (23 feet) on the north end of the airfield. This displacement is approximately 452 feet to the south of the runway pavement end. Runway 33 has a threshold displacement approximately 241 feet to the north of the existing pavement end to clear Airport Way (17 feet).

Options to clear both runway approach surfaces are evaluated in Chapter 6, Alternative Analysis.

4.3 General Aviation

The number and types of GA operations and based aircraft can be converted into a generalized projection of GA facility needs. GA facilities include the FBO, hangars, apron, and tie-down space.

4.3.1 Aircraft Parking Aprons

Apron space, a major component of GA facilities, should be strategically utilized, taking into account the location of airport terminal buildings, fixed based operator (FBO) facilities, and other aviation-related access facilities. Aprons provide parking for based and transient aircraft, and access to the terminal facilities, fueling, and surface transportation. FAA AC 150/5300-13A, *Airport Design,* Appendix 5, provides guidelines in assisting with the determination of the layout and design of airplane parking apron(s) and tie-down area(s) for based and transient aircraft.

Figure 4-5 depicts S43's apron and tie-down areas. Paved and turf based aircraft tie-downs are on the east side of the Airport. Paved tie-downs are at capacity but grass/turf tie-downs are not. The main aircraft parking apron adjacent to the FBO on the northeast side of Harvey Field is approximately 260 feet by 130 feet (33,800 square feet), providing permanent tie down for the flight school fleet. No based or transient aircraft parking is provided in this area.

[4] 8260.3B – United States Standard for Terminal Instrument Procedures (TERPS)

The transient day time ramp parking is limited and is located on the northwest ramp adjacent to the skydiving center and the aircraft maintenance facility.

The apron is space constrained, requiring tugs to park aircraft. Transient aircraft prefer to power-in and power-out of their parking position. Typically, a 10-foot separation is provided between each parking position, and taxilanes are designed for the critical aircraft. S43's existing and future critical aircraft design group is II, which has a maximum wingspan of 79 feet. The Cessna 208B Caravan has a 52-foot wingspan, and the King Air 250, the Piper Malibu, and the Piper Matrix have a 43-foot wingspan. Economies of cost and space can also be achieved by designing parking for specific aircraft that use a particular portion of the airport.

Providing sufficient space for power-in/power-out parking on the main apron for approximately six aircraft requires an area at least twice the current size—approximately 70,000 square feet.

It is recommended that additional apron space be provided for transient aircraft as well as paved tie-down space. Reconfiguring grass tie-downs to meet taxiway object free area criteria is also recommended. Chapter 6, Alternative Analysis evaluates feasible options to expand apron space.

Helicopter Parking

The FBO provides FAA-approved helicopter flight training. S43 has six based helicopters, two of which are used for flight training, scenic and photo flights, and rental. Other helicopter activity includes recreational, local news stations, law enforcement, search and rescue, private business use, and forestry/logging operations.

The helicopter parking area is south of the main apron, shown in **Figure 4-5**. The helicopter parking area is shared with the Jet A fuel tank, which occasionally causes congestion with fueling operations.

It is recommended that the helicopter parking area be relocated to a less congested area. Options are reviewed in Chapter 6, Alternative Analysis.

FIGURE 4-4 – AIRCRAFT PARKING APRON/TIE-DOWNS

Source: Jviation

4.3.2 Apron Pavement

The apron pavement is in good condition and should be maintained. See **Figure 2-3, S43 Pavement Condition Index** for more information.

It is recommended that preventative pavement maintenance be continued to ensure pavement life.

4.3.3 Aircraft Storage Requirements

The majority of based aircraft at S43 are single-engine pistons, and most airplanes are stored in hangars instead of on tie-downs. Hangars at S43 range from conventional (multi-plane) hangars, fully enclosed T-hangars, to shade hangars (i.e. with no doors). T-hangar and shade hangar units typically store a single airplane, but are nested in rows of hangars.

Hangars facing 99th Avenue SE/Airport Way are not accessible by aircraft due to insufficient clearance between the hangar structure and the Snohomish County right-of-way.

Of the usable hangars, S43 currently has:

- Ten rows of T-hangars with a total of 114 storage units (54%)
- Six rows of shade hangars with a total of 86 units (41%)
- Two conventional/common hangars with capacity for 11 airplanes (5%)
- **Total existing hangar storage capacity = 211 airplanes (100%)**

Hangars serve a variety of functions including aircraft storage, aircraft maintenance, manufacturing and restoration, equipment and vehicle storage, meeting/conference/training rooms, parachute rigging center, etc. FAA grant assurances specifically state that airplane owners are allowed to perform maintenance on their own aircraft in the facilities that they own or lease. However, if the airport is federally obligated, there may be some existing uses within hangars that wouldn't be considered aeronautical uses.

Approximately 211 of the 249 based aircraft are stored in hangars, with 15 to 20 on a waiting list for T-hangar or box[5] hangar spaces. There is no demand for shade hangars.

Table 4-6 depicts the forecasted demand for hangars at S43. As there is no demand for shade hangars, the percent of aircraft in T-hangars was increased to 57 percent over the planning period with the remainder allocated to conventional hangars.

TABLE 4-5 – FORECAST OF HANGAR DEMAND

Year	Based Aircraft	Based Aircraft in Hangars	T-Hangars	Shade Hangars	Conventional / Box Hangars
2016	249	211	114	86	11
2020	261	230	131	86	13
2025	272	239	136	86	17
2034	292	257	146	86	25

Note: Conventional hangar demand shown in terms of number of airplanes stored. The actual number of conventional hangars to be built will be determined by the specific type and size of aircraft to be stored, as well as the storage capacity of each hangar, and whether the hangars will be common use or privately leased.
Source: Jviation

It is recommended that, if feasible, additional hangars be constructed in the short-term to accommodate demand. Additional hangar construction should be built as needed and as space and airfield constraints allow. Chapter 6, Alternative Analysis evaluates options for hangar development.

4.3.4 Vehicle Parking

- Airport visitors – sightseers, flight students, aircraft renters, etc.
- Business customers (restaurant, FBO, parachute school, etc.)
- Airport staff & business employees
- Based airplane owners

[5] A box hangar is a standalone hangar that typically holds one aircraft as opposed to a conventional hangar which holds several.

- Courtesy vehicles
- Taxis, limos, shuttle vans, etc.
- Delivery & supply companies (post office, FedEx, UPS, Snap-on Tools, wholesale fuelers, etc.)

Based airplane owners, business customers, and delivery companies prefer to drive to and park at their destination with minimal walking. Airport visitors, employees, and taxis/limos, are more flexible in terms of where they park. As a result, vehicle parking is typically spread around an airport, e.g. adjacent to (or in) hangars, next to businesses, etc., versus in one central location.

The main vehicle parking lot at S43 is located adjacent to the terminal and restaurant and is paved with approximately 105 parking spaces. The airport manager reports that the lot is frequently full and additional capacity would be welcomed. An unpaved area adjacent to the main lot along the north access road can accommodate 95 vehicles (overflow lot); a portion of this area is used for trailer, RV, and glider parking. Employee parking is located behind Building 2 (30 gravel spaces), and at the gate entry to Hangar 10/18 (six gravel spaces). Additional gravel and paved parking is located in the southeast corner of the Airport off Airport Way (100 spaces). **Figure 4-6** illustrates the parking areas and approximate spaces.

FIGURE 4-5 – AUTO PARKING

Note: Not to scale
Source: Jviation

Aircraft operations are projected to increase by eight percent between 2015 and 2034. It is assumed that vehicle parking demand will increase by a similar amount over that period, which means there will also need to be a similar increase in parking capacity. As noted above, the main lot is often at capacity now, so the space should be increased at a greater rate than planned operational growth.

It is recommended that vehicle parking be increased by 15 to 25 percent over the planning period (additional 50 to 84 spaces). Additional parking locations are reviewed in Chapter 6, Alternatives Analysis.

4.4 Airport Support Facilities

4.4.1 Fuel Storage Requirements - 100LL, Jet A, and Self-Fueling

There are two above-ground fuel storage tanks at S43: a 12,000-gallon storage tank for Jet A and a 12,000-gallon storage tank for 100LL AvGas. The fuel tanks are in very good condition and meet current EPA and Washington state regulations. There are also mobile fuelers and self-serve fuel pumps for Jet A and 100LL AvGas.

The key considerations in terms of assessing the capacity of the fuel storage tanks are:

- The frequency of deliveries by wholesale fuel suppliers
- The length of time that fuel sits in the tank

In general, additional fuel storage capacity is needed if wholesale fuel deliveries are required more than once a week. Based on the volume of Jet A and 100 LL fuel sold at Harvey Field (see **Table 2-11**), wholesale fuel deliveries occur less frequently, fluctuating throughout the year depending on the amount of fuel sold. Wholesale fuel trucks are typically 10,000 gallons in size, and wholesale suppliers want to off-load all, or almost all, of the 10,000 gallons when they make deliveries.

In addition, fuel quality deteriorates over time as it sits in tanks, particularly Jet A fuel, which is more time-sensitive than 100LL. Excess storage capacity means that some fuel will sit in storage tanks for long periods, which requires special attention and maintenance to prevent deterioration and contamination.

Based on the frequency of fuel deliveries and the amount of time the fuel sits in the tank, the existing fuel storage capacity for both Jet A and 100LL AvGas is adequate for the current and anticipated demand.

As discussed here and at 4.3.1, options for de-conflicting helicopter and fueling operations, as well as fuel storage locations, are addressed in Chapter 6, Alternative Analysis.

4.4.2 Airport Administration

The existing 3,600-square-foot Airport administration building houses the Airport office/administration on the second floor and the flight school on the ground floor. The flight school is currently at capacity and needs additional space for classrooms, instructor stations as well as flight simulators. Additional space or a separate facility is needed to meet the current demand as well as demand throughout the planning period.

It is recommended that, if feasible, additional flight school facilities be constructed in the short-term to accommodate demand. Chapter 6, Alternative Analysis evaluates options for flight school expansion.

4.4.3 Airport Maintenance Facilities & Equipment

Airport maintenance and storage facilities are currently located within the FBO and at the southeast corner of the Airport. These facilities suffice for existing and future demand. The equipment identified in **Section 2.6** is mostly in good or excellent condition and will last throughout the planning period. An additional truck with a snow plow/blade has been requested by the Airport to aid in clearing the runway, taxiways, and apron during the winter months.

It is recommended that preventative maintenance be done on equipment throughout the planning period.

4.4.4 Aircraft Maintenance Facilities & Equipment

Aircraft maintenance and storage facilities are currently located within the Airport maintenance facility and the space is inadequate. A larger facility is needed to be able to maintain the turbine caravan (critical aircraft): the limited space requires the rudder to be removed, the plane placed on a dolly, turned sideways, and the nose elevated in order to drop the tail enough to make it through the existing maintenance door opening.

Based upon the need to have sufficient space to maintain the Caravan as well as other aircraft at the same time, a 10,000-square-foot maintenance shop and associated 3,500-square-foot office/parts room is anticipated.

4.5 Facility Requirements Summary

A summary of existing facility deficiencies – relative to identified requirements and applicable FAA standards – as detailed in this chapter, is provided in **Table 4-7**. Options for remedy and/or improvements are e examined further in **Chapter 6, Alternatives Analysis**.

TABLE 4-6 – FACILITY REQUIREMENTS SUMMARY

Existing Facility	Consideration Applicable to Alternatives Analysis
Runway Orientation	Existing orientation provides required wind coverage
Runway	Runway width does not meet FAA standards. Runway length does not meet FAA recommendation. Does not meet FAA standards relative to runway excursions. Does not meet FAA policy for RPZ.
Runway Strength	Pavement does not meet FAA recommended strength for 12,500 single wheel gear
Runway Blast Pads	Does not meet FAA design standards
Runway Shoulders	Does not meet FAA design standards for 10 foot wide shoulders on either side of runway

TABLE 4-6 – FACILITY REQUIREMENTS SUMMARY

Existing Facility	Consideration Applicable to Alternatives Analysis
Taxiway System	Does not meet FAA design standards for runway/taxiway separation, taxiway safety and object free areas
Airfield Lighting, Signage [/a/]	Does not meet FAA design standards for runway or taxiway lighting
General Aviation/Transient Apron	Does not meet current or forecast demand.
Helicopter Parking	Creates congestion with fueling operations
Aircraft Hangar Storage	Does not meet current or forecast demand..
Vehicle Parking & Airport Access	Does not meet current or forecast demand..
Fuel Storage Requirements	Site consistent with solution to de-conflict fueling and helicopter operations.
Snow Removal Equipment	Not available on site

Note: [/a/]LIRL – low intensity runway lighting; MIRL – medium intensity runway lighting; PAPI – precision approach path indicators;
Source: Jviation

5.0 ENVIRONMENTAL INVENTORY

FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, and Order 5050.4B*, National Environmental Policy Act: Implementation Instruction for Airport Actions*, addresses specific environmental categories that are to be evaluated in environmental documents in accordance with the National Environmental Policy Act (NEPA). This chapter serves as a baseline inventory for the environmental categories within these documents, which exist at Harvey Field (S43 or the Airport).

5.1 Air Quality

Air quality analysis for federally funded projects must be prepared in accordance with applicable air quality statutes and regulations that include the Clean Air Act of 1970[1], the 1977 Clean Air Act Amendments[2], the 1990 Clean Air Act Amendments[3], and the National Ambient Air Quality Standards[4] (NAAQS). In particular, the air pollutants of concern in the assessment of impacts from airport-related sources include six "criteria pollutants:" carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2).

The EPA sets NAAQS for the aforementioned criteria pollutants. States are required to meet the national standards but can also set more stringent ambient air quality standards within the state. The State of Washington has adopted the current federal NAAQS in state regulations. The federal Clean Air Act requires EPA to review the NAAQS every five years to ensure continued protection of human health and the environment. State regulations are updated when EPA revises or establishes a new standard. The EPA designates areas as "in attainment" or "non-attainment" based on whether the NAAQS are met.

The Airport is located in Snohomish County, which is designated by the EPA as being in attainment status for all parts of the county for all criteria.[5] However, Snohomish County was previously a non-attainment area for O_3 and CO but re-designated to attainment in 2005 and 1996, respectively. To ensure the air quality continues to meet the NAAQS, a Maintenance State Implementation Plan was required.[6]

5.2 Coastal Resources

The Coastal Zone Management Act of 1972 (CZMA) encourages states to preserve, protect, develop, and, where possible, restore or enhance valuable coastal resources (e.g., wetlands, floodplains, estuaries, and wildlife habitats) along the Atlantic and Pacific Oceans and the Gulf of Mexico. The CZMA is unique in that state participation is voluntary and encouraged through federal financial incentives given to coastal states that develop and implement a comprehensive

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[1] U.S. Code. The Clean Air Act of 1970. U.S. Congress, Public Law 91-604, 42 U.S.C. §7401
[2] U.S. Code. The 1977 Clean Air Act Amendments, U.S. Congress, Public Law 95-95, 42 U.S.C. §7401
[3] U.S. Code. The 1990 Clean Air Act Amendments, U.S. Congress, Public Law 101-549, 42 U.S.C. §7401
[4] 40 CFR Part 50, Section 121, National Ambient Air Quality Standard
[5] U.S. Environmental Protection Agency, Green Book – Current Nonattainment Counties for All Criteria Pollutants, www.epa.gov/airquality/greenbook/astate.html, accessed January 2015
[6] Department of Ecology, State of Washington, Air Quality, www.ecy.wa.gov, accessed February 2015.

Coastal Zone Management Program (CZMP). Washington was the first state to adopt the program, and its CZMP was approved by the federal government in 1976. Fifteen counties comprise Washington's coastal zone, including Snohomish County, as shown on **Figure 5-1**. The state's program document, *Managing Washington's Coast*[7], was updated in 2003.

Since Washington participates in the voluntary federal CZM Improvements Grants Program (Section 309 Program), it receives special funding to assist in making improvements to the program. The funds have been primarily used for updates and amendments to the Shoreline Master Program Guidelines under the state's Shoreline Management Act.[8]

Washington also participates in the Coastal and Estuarine Land Conservation Program (CELCP), which helps protect important coastal and estuarine areas that have significant conservation, recreation, ecological, historical, or aesthetic values and are threatened by conversion to another use. Congress has not yet authorized dedicated grant funds but a state plan has been drafted to assure the state's eligibility for future participation.[9]

FIGURE 5-1 – WASHINGTON'S COASTAL ZONE

Note: Not to scale
Source: Department of Ecology, State of Washington, Coastal Zone Management, www.ecy.wa.gov, accessed February 2015

The Shorelands and Environmental Assistance Program (SEA) administer Washington's CZM grant. SEA's Northwest Office covers Snohomish County who identified 10 Areas of Particular Concern (APC) within the state, based on criteria developed in 1976:

[7] Department of Ecology, State of Washington, Coastal Zone Management, www.ecy.wa.gov, accessed February 2015
[8] Ibid
[9] Ibid

- The area contains a resource feature of environmental value considered to be of greater than local significance or concern;
- The area is identified as an area of particular concern by state or federal legislation, administrative and regulatory programs, or land ownership; or
- The area has the potential for more than one major land or water use or has a resource sought by ostensibly incompatible users.[10]

One APC exists in Snohomish County, Snohomish River Estuary. The estuary benefits from the large amount of fresh water released by the Snohomish River into the Puget Sound from a single source (second largest in the state by volume). The estuary lies just north of Everett, the state's fifth largest city, approximately nine miles northwest of Snohomish.

Because Snohomish County lies within the coastal management area, any federal activities that affect land use, water use, or natural resources of the coastal zone must comply with the six laws identified in the CZMP: The Shoreline Management Act, State Environmental Policy Act (SEPA), Clean Water Act (CWA), Clean Air Act (CAA), Energy Facility Site Evaluation Council (EFSEC), and Ocean Resource Management Act (ORMA).

Federal consistency is the process that evaluates the proposed activity or development. Federal consistency provides an opportunity for the public, local governments, Tribes, and state agencies to review the federal action. Actions must fall into at least one of three categories to trigger the federal consistency process:

- activities undertaken by a federal agency
- activities requiring federal approval
- activities using federal funding

5.3 Compatible Land Use

Harvey Field is located in the City of Snohomish Urban Growth Area (UGA). The primary goal of land use planning in and around Harvey Field is to provide safe airport operations, promote compatible land uses, and implement land use actions that allow for the orderly expansion and development of the Airport as an Essential Public Facility (EPF).

Figure 5-2 illustrates the UGA boundary and the existing zoning surrounding and including the airfield. The county zoning designation for S43 is Industrial Park. Existing land uses and zoning adjacent to Harvey Field consist of light industrial to the north and east, agriculture to the south and west as well as State Route 9 to the west.

Figure 5-3 depicts the future land use surrounding the Airport. The area immediately adjacent to and north of S43 changed from light industrial to urban industrial[11] and expanded to include the land previously zoned as agriculture in the northwest corner. The area within the UGA boundary

[10] Managing Washington's Coast, Washington State's Coastal Zone Management Program, February 2001

[11] Urban Industrial (UI) identifies industrial and manufacturing areas in UGAs (Snohomish County General Policy Plan, Land Use – Adopted June 10, 2015; Effective Date: July 2, 2015).

west and south of the Airport changed from industrial park and agriculture to urban industrial, with the exception of a small area at the southwest portion of the UGA being designated urban horticulture.

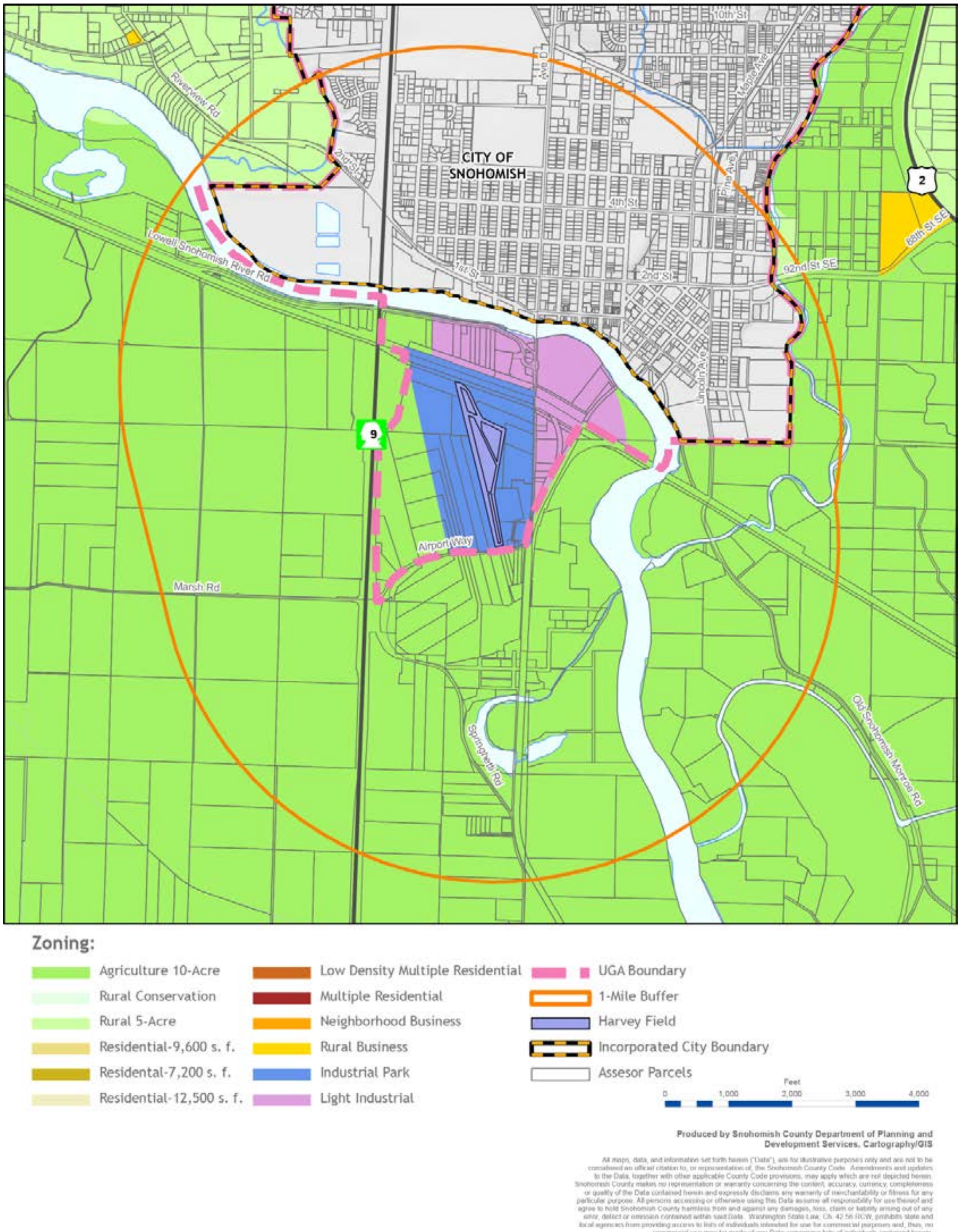
Snohomish County Planning and Development Services recently enacted an Airport and Land Use Compatibility ordinance. The ordinance is a state-mandated project to discourage incompatible land uses around the county's general aviation airports that operate for the benefit of the public.[12]

5.4 Construction Impacts

Construction impacts relate to a specific project's impacts during construction activities including construction noise, dust and noise from heavy equipment traffic, disposal of construction debris, and air and water pollution. As this chapter serves as a baseline and does not address specific project impacts, no further discussion is presented; please reference **Sections 5.1**, **5.12**, and **5.15** for baseline information on air quality, noise, and water quality, respectively.

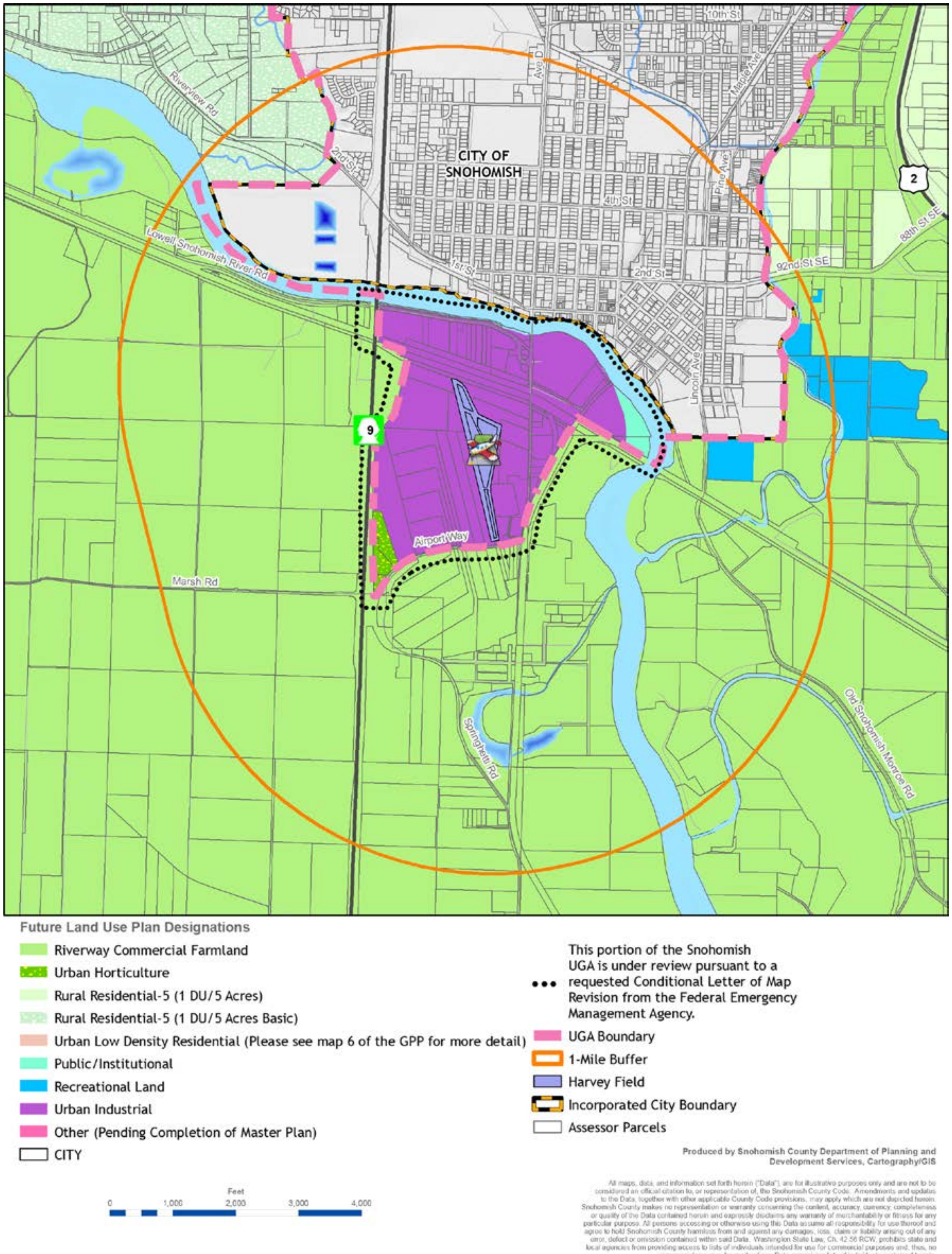
[12] Snohomish County Ordinance 15-025, Chapter 30.32E Airport Compatibility (effective May 24, 2015)

FIGURE 5-2 – SNOHOMISH COUNTY ZONING – ONE-MILE RADIUS



Note: Not to scale
Source: Snohomish County Department of Planning and Development Services, 2015

FIGURE 5-3 – SNOHOMISH COUNTY FUTURE LAND USE – ONE-MILE RADIUS



Note: Not to scale
Source: Snohomish County Department of Planning and Development Services, 2015

5.5 Department of Transportation Act 4(f)

The Department of Transportation (DOT) Act, Section 4(f)[13] provides that the "Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance or land from a historic site of national, state, or local significance unless there is no feasible or prudent alternative and the use of such land includes all possible planning to minimize harm resulting from the use."

The FAA has adopted the regulations the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) issued in March 2008 (23 CFR Part 774)[14] to address project-related effects on Section 4(f) resources.

For Section 4(f) purposes, a proposed action would eliminate a resource's use in one of two ways.

- *Physical use*. Here, the action physically occupies and directly uses the Section 4(f) resource. Here an action's occupancy or direct control (via purchase) causes a change in the use of the Section 4(f) resources. For example, building a runway safety area across a fairway of a publicly-owned golf course is a physical taking because the transportation facility physically used the course by eliminating the fairway.
- *Constructive use*. Here, the action indirectly uses a Section 4(f) resource by substantially impairing the resource's intended use, features, or attributes. For example, a constructive use of an overnight camping area would occur when project-related aircraft noise eliminates the camping area's solitude. Although not physically occupying the area, the project indirectly uses the area by substantially impairing the features and attributes (i.e., solitude) that are necessary for the area to be used as an overnight camping area.

The City of Snohomish has 18 park and recreation areas/facilities. None are located adjacent to the Airport; however, four (Snohomish County Visitor Center, Kla, Ha Ya Park, Riverfront Gazebo, and Cady Landing) are located between a quarter and half mile northeast of the Airport across the Snohomish River.

Two designated historic sites are located within approximately 1,000 feet of Harvey Field. The National Register of Historic Places (NRHP)-listed Snohomish Historic District is north across the Snohomish River from S43 and the Fred Behling Farm, which is listed on the Washington Heritage Barn Register, is south of S43. Six previously inventoried buildings are within the boundaries of S43 but only one has been evaluated for NRHP eligibility and was found not eligible - see **Section 5.10** for further detail.

5.6 Farmlands

The Farmland Protection Policy Act (FPPA) regulates federal actions that may affect or convert farmland to a non-agricultural use. FPPA defines farmland as "prime or unique land as determined

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[13] U.S. Department of Transportation Act, section 4(f), recodified and renumbered as § 303(c) of 49 U.S.C.

[14] Vol. 73 Federal Register, page 13395, Mar. 2008

by the participating state or unit of local government and considered to be of statewide or local importance."

The Natural Resources Conservation Service (NRCS) Web Soil Survey was used to review soils on and around S43. **Table 5-1** details the three soil types on Airport property; all of which are classified as prime farmland; **Figure 5-4** depicts the map unit symbol (soils). The FPPA excludes land that was dedicated to urban use, including aviation, prior to 1982. Map unit symbol 56 was dedicated prior to 1982 and is excluded. The areas that include map unit symbols 55 and 66 are partially used for aviation use and partially dedicated to agricultural use. As these two symbols represent prime farmland, consultation with the NRCS will be necessary prior to any development to conclude if there will be a conversion from prime farmland to classification.

TABLE 5-1 – ON-AIRPORT SOIL CLASSIFICATIONS

Map Unit Symbol	Map Unit Name	Farmland Classification
55	Puget silty clay loam	Prime (if drained and either protected from flooding or not frequently flooded during growing season)
56	Puyallup fine sandy loam	Prime
66	Sultan silt loam	Prime

Source: Natural Resource Conservation Service, Web Soil Survey, www.websoilsurvey.nrcs.usda.gov, accessed February 2015

FIGURE 5-4 – NRCS SOILS

Note: Not to scale

Source: Natural Resource Conservation Service, Web Soil Survey, www.websoilsurvey.nrcs.usda.gov, accessed February 2015

5.7 Fish, Wildlife, and Plants

Requirements have been set forth by the Endangered Species Act[15], Sikes Act[16], Fish and Wildlife Coordination Act[17], Fish and Wildlife Conservation Act[18], and the Migratory Bird Treaty Act[19], for the protection of fish, wildlife, and plants of local and national significance. The Watershed Company conducted a study to review Airport property (see **Appendix E, Biological Assessment** for the resulting technical memorandum). The study included both a desktop and field review.

Eighteen federally listed species occur in Snohomish County and the Airport area, as listed in **Table 5-2**. According to the Priority Habitat and Species Data available from the Washington Department of Fish and Wildlife, there are no listed terrestrial species near Harvey Field. However, multiple threatened or endangered fish species are documented in the Snohomish River and Batt Slough, including Chinook salmon, steelhead, and bull trout.

Additionally, numerous birds protected by the Migratory Bird Treaty Act are potentially present near Harvey Field as shown in **Table 5-3**. There is a known bald eagle nest southeast of the Airport along the Snohomish River.

TABLE 5-2 – ENDANGERED SPECIES ACT (ESA)-LISTED SPECIES PRESENT/HISTORICALLY PRESENT IN SNOHOMISH COUNTY

Species	Federal Status	Date listed	State Status	Habitat Description
Oregon Spotted Frog *Rana pretiosa*	Threatened	9/29/2014	Endangered	Large, emergent wetlands in forested landscapes near a perennial body of water.
Marbled murrelet *Brachyramphus marmoratus*	Threatened	10/1/1992	Threatened	Nearshore areas of Puget Sound for foraging and old-growth and mature coniferous forests for nesting.
Northern spotted owl *Strix occidentalis caurina*	Threatened	6/26/1990	Endangered	Old-growth and mature coniferous forests.
Streaked horned lark *Eremophila alpestris strigata*	Threatened	11/4/2013	Endangered	Native prairies, coastal dunes, and agricultural fields with substantial areas of bare ground. Only historical presence in Snohomish County.
Yellow-billed cuckoo *Coccyzus americanus*	Threatened	11/3/2014	Species of Concern	Large riparian corridors with dense canopy closures provided by cottonwood and willow communities.
Chinook salmon *Oncorhynchus tshwaytscha*	Threatened	6/28/2005	Species of Concern	Marine environment as adults, and estuarine environments for rearing. Mainstem of larger freshwater streams for spawning and seaward migration.
Steelhead *Oncorhynchus mykiss*	Threatened	5/11/2007	None	Variety of environments, including marine and freshwater. Preferred freshwater habitat is fast-moving, well-oxygenated streams with gravel substrate and deep pools.

15 Endangered Species Act of 1973, U.S. Congress, Public Law 93-205, 16 U.S.C §1531-1544
16 Sikes Act, Amendments of 1974, U.S. Congress, Public Law 93-452
17 Fish and Wildlife Coordination Act of 1958, U.S. Congress, Public Law 85-624, 16 U.S.C §661-666c
18 Fish and Wildlife Conservation Act of 1980, U.S. Congress, Public Law 96-366, 16 U.S.C §2901-2912
19 Migratory Bird Treaty Act of 1981, 16 U.S.C §703-712

Species	Federal Status	Date listed	State Status	Habitat Description
Bull trout *Salvelinus confluentus*	Threatened	6/10/1998	Species of Concern	Marine environment and cold, clean freshwater streams with stable stream conditions, substantial cover, and clean gravel substrate.
Bocaccio rockfish *Sebastes paucispinus*	Endangered	4/28/2010	Species of Concern	Marine environment. Rocky reefs, kelp canopies, and artificial structures as juveniles, transitioning to rocky bottoms and outcrops as adults. Typically found 50-250 meters deep.
Yellow rockfish *Sebastes ruberrimus*	Threatened	4/28/2010	Species of Concern	Rocky reefs, kelp canopies, and artificial structures as juveniles, transitioning to rocky bottoms and outcrops as adults. Typically found 91-180 meters deep.
Canary rockfish *Sebastes pinnigger*	Threatened	4/28/2010	Species of Concern	Marine environment. Rocky reefs, kelp canopies, and artificial structures as juveniles, transitioning to rocky bottoms and outcrops as adults. Typically found 50-250 meters deep.
Green sturgeon (Southern DPS) *Acipenser medirostris*	Threatened	4/7/2006	None	Spawn in mainstems of large, turbulent rivers with cobble substrate and clean cold water. Southern DPS does not spawn in Washington rivers. Adults inhabit oceans, bays, and estuaries. Rare in Puget Sound.
Eulachon *Thaleichthys pacificus*	Threatened	3/18/2010	Species of Concern	Inhabit ocean waters to 300 meters deep. Spawn in large, snowmelt-fed rivers less than 50^{o}F with sand or coarse gravel substrate. Not believed to spawn in Puget Sound tributaries.
Orca (killer whale) *Orcinus orcus*	Endangered	11/18/2005	Endangered	Marine environment, including Puget Sound residents.
Humpback whale *Megaptera novaeangliae*	Endangered	12/2/1970	Endangered	Marine environment from Central America and Mexico (winter) north to southern British Columbia (summer/fall). Rare in Puget Sound.
Canada lynx *Lynx canadensis*	Threatened	3/24/2000	Threatened	Moist coniferous forests with cold, snowy winters.
Grey wolf *Canis lupis*	Endangered	3/9/1978	Endangered	Anywhere large ungulates are available as prey base and human-caused mortality is not excessive. Only historically found in Snohomish County.
Grizzly bear *Ursus arctos horribilus*	Threatened	7/28/1975	Endangered	Areas with extensive forest cover interspersed with shrublands, grasslands and meadows. Home ranges must have complex habitat types. Only historically found in Snohomish County.

Note: No ESA-listed threatened or endangered plan or insect species are documented to occur in Snohomish County
Source: The Watershed Company, Technical Memorandum, February 2015

TABLE 5-3 – MIGRATORY BIRDS OF CONCERN POTENTIALLY PRESENT WITHIN PROJECT AREA

Species	Seasonal Occurrence in Project Area	Habitat
Bald eagle *Haliaeetus leucocephalus*	Year-round	Coastal areas or near large inland lakes and rivers that have abundant fish and shores with large trees.
Black swift *Cypseloides niger*	Breeding	Forested areas near rivers (nesting) or mountainous areas and coastal cliffs (foraging)
Caspian tern *Hydroprogne caspia*	Breeding	Fresh- and saltwater wetlands, especially estuaries, coastal bays, and beaches.
Cassin's finch *Carpodacus cassinii*	Year-round	Dry, open, coniferous forests
Fox sparrow *Passerella liaca*	Year-round	Breed in high elevations, especially in wet meadows or in scattered conifers. Winter in recent clear-cuts and tangled brush, especially blackberry thickets.
Olive-sided flycatcher *Contopus coopen*	Breeding	Forest openings, preferring recently burned or cleared areas.
Peregrine falcon *Falco peregrinus*	Breeding	Hunt in open areas along coasts or large waterbodies. Nest on cliffs or cliff-like structures, including tall buildings in urban environments.
Purple finch *Carpodacus purpureus*	Year-round	Moist coniferous and mixed lowland forests.
Rufous hummingbird *Selasphorus rufus*	Breeding	Edges and open areas within coniferous forests.
Short-eared owl *Asio flammeus*	Year-round	Open terrain, including shrub-steppe, grasslands, agricultural areas, marshes, wet meadows, and shorelines.
Willow flycatcher *Empidonax traillii*	Breeding	Willow thickets and brushy areas near streams, marshes, or other wetlands, and in clear-cuts and other open areas with nearby trees or brush.

Source: The Watershed Company, Technical Memorandum, February 2015

5.8 Floodplains

Executive Order 11988, *Floodplain Management*[20] directs federal agencies to "avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative." The Federal Emergency Management Administration (FEMA) publishes floodplain maps to illustrate extent and type designations on Flood Insurance Rate Maps (FIRM).

Harvey Field falls on two FIRM panels, 53061C1061F and 53061C1065F, both with effective dates of September 16, 2005. Airport property is within a flood hazard area, Zone AE – density fringe area (base flood elevations determined), as shown on **Figure 5-5**.

Snohomish County Regulations specifically address the density fringe area as discussed in the following subsections:

> The density fringe designation, per Snohomish County Regulations Chapter 30.65.250, is defined as "The land area occupied by any use or development permitted by this chapter that will displace floodwaters shall not exceed two percent of the land area of that portion of the lot located in the density fringe area. The limitations of this section shall not apply to those uses listed in SCC 30.65.260." In this definition, "that will displace floodwaters" means any

[20] Executive Order 11988, Floodplain Management, 1977

> fill that would be placed at elevations below the base flood (100-year) water surface elevations. As the "storage area" considers only conservation of mass (water), there is no concept of flow conveyance obstruction other than water connectivity. This new designation essentially limits development to agricultural uses with associated farm buildings.[21]

The above-mentioned regulations in "layman's" terms:

- *"...land area occupied…that will displace floodwaters…"*
  - The fill limitations apply to sites located beneath the 100-yr flood elevation i.e. 23' (NGVD29) or 26.63' (NAVD88) at Harvey Field.
  - All of Harvey Field is lower than 26.63'; thus, SCC applies everywhere.
  - Cut cannot be used to "offset" fill impacts: 1 acre fill minus .25 acres cut ≠ 0.75 acres of fill.
  - Earthwork volume does not matter, only the footprint or 2D area.
- *"...shall not exceed two percent of the land area of that portion of the lot"*
  - Fill footprint divided by total airport land area equals two percent of total property area or less
  - Harvey Field is approximately 204.48 acres; thus, two percent of airport property equals 4.090 acres.
- *"The limitations of this section shall not apply to those uses listed in SCC 30.65.260."*
  - The two-percent limit does NOT apply to public uses, such as roads, specifically, Airport Way.

Snohomish County Regulations Chapter 30.65.255 defines the maximum allowable obstruction within a density fringe area. The regulation states "The maximum width (sum of widths) of all new construction, substantial improvements or other development shall not exceed 15 percent of the length of a line drawn perpendicular to the known floodwater flow direction at the point where the development(s) is located. The length of said line shall not extend beyond the property boundary or the edge of the density fringe area, whichever is less. The limitations of this section shall not apply to those uses listed in SCC 30.65.260."

In simple terms:

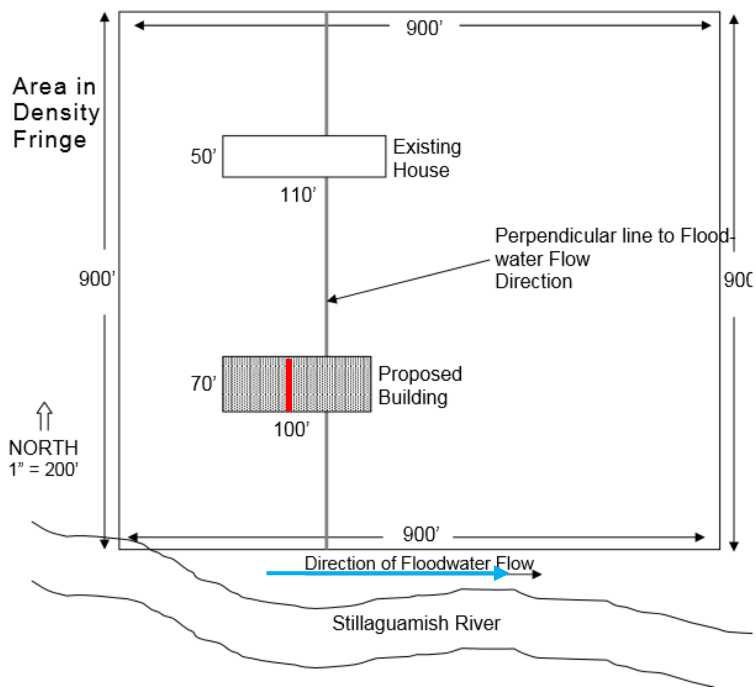
- *"a line drawn perpendicular to the known floodwater flow direction at the point where the development(s) is located. … length … shall not extend beyond the property boundary or the edge of the density fringe area, whichever is less."*

  The following example from the Snohomish County Flood Permit Application provides the best explanation of the regulation:

  - Determine the general floodplain flow direction.

[21] Biological Assessment for South Snohomish Urban Growth Area Letter of Map Revision Request, Curran Environmental Services, LLC, March 2010.

- Draw a line perpendicular to the flow direction.
- Draw the line where it intersects the largest width of new construction as a percentage of property width.
- Sum of fill widths/total property width must be less than 15 percent.



- 900' property width
- 70' new obstruction width
- 70'/900' = 7.8% < 15 %

- *"The maximum width (sum of widths) of all new construction, substantial improvements or other development…"*
  - New construction is fill minus anything that diverts or blocks flood flows.
- *"…shall not exceed 15 percent of the length …"*
  - Sum of fill widths divided by total property width equals 15 percent or less.

Lastly, Snohomish County Regulations Chapter 30.65.260 defines the exception to maximum allowable density and obstruction limitations: "The following uses shall be exempt from the maximum allowable density and obstruction limitations of SCC 30.65.250 and 30.65.255: (1) Water-dependent utilities; (2) Dikes; (3) Utility facilities; and (4) Public works (to include public roads, i.e. Airport Way), when the project proponent demonstrates that the floodwater displacement effects of the proposal when considered together with the maximum potential floodwater displacement allowed by SCC 30.65.250 and 30.65.255 shall not cause a cumulative increase in the base flood elevation of more than one foot. Floodwater displacement information shall be obtained and certified by a professional engineer."

In basic terminology:

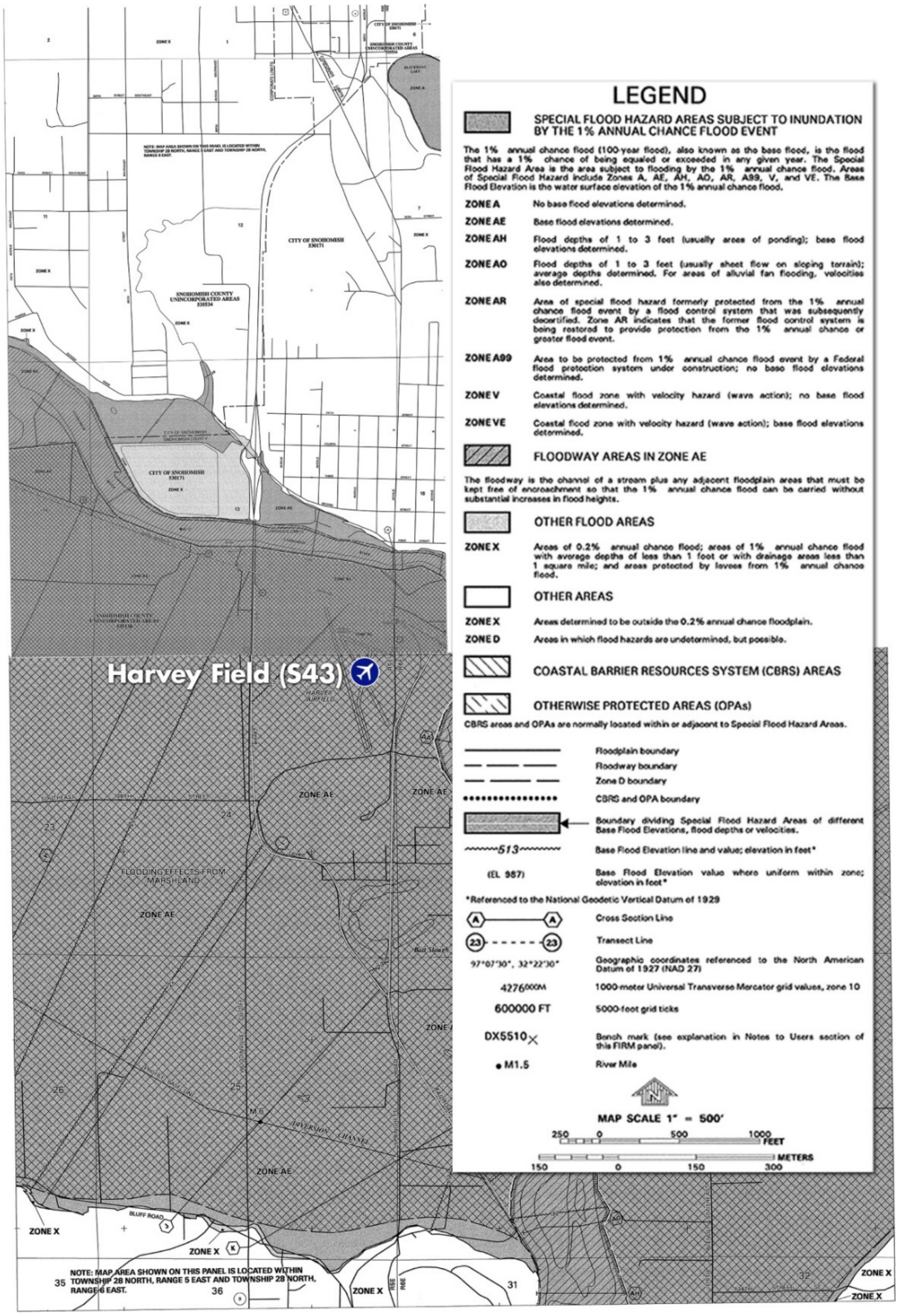
- *"…demonstrates that the floodwater displacement effects of the proposal when considered together with the maximum potential floodwater displacement allowed by SCC 30.65.250 and 30.65.255"*
    - Base Flood equals the 100-year flood elevation, as shown on the current FIRMs.
    - Floodwater displacement means that for every piece of material placed in construction of a road will take up some space that was previously available for water storage or conveyance during a flood.
    - Road relocation floodwater displacement calculation assumes that the maximum two percent area and 15 percent blockages will eventually occur on all properties located in the floodplain.
- *"Floodwater displacement information shall be obtained and certified by a professional engineer.*
    - Ray Walton of WEST Consultants created the original FEMA floodplain model in this area.
    - SCC only requires BFE modeling Public Works projects, i.e. Airport Way.

Prior to 2005, S43 was within an area designated as floodway fringe, which is a less restrictive area than density fringe. It is defined as the "portion of a floodplain which is inundated by floodwaters but is not within a defined floodway. Floodway fringes serve as temporary storage areas for floodwaters" (Snohomish County Code, 30.91F.440).

The re-designation, based on a study done in 2001 by WEST Consultants, Inc. (WEST), was conducted for the Seattle District, Corps of Engineers, with funding provided by FEMA Region 10. The study completed a detailed Flood Insurance Re-Study of the Snohomish River, which became effective on September 16, 2005. The hydraulic modeling for the study was based on the Corps' model, UNET, a one-dimensional, unsteady-flow model, which modeled the Snohomish River as a combination of "reaches" (the Snohomish River and distributaries, and Marshlands), and "storage areas". Harvey Field, Airport Way, and the area south of S43 lie entirely within storage area #9 (SA#9), as shown on **Figure 5-6**. Storage areas #2 and #3, which lie to the east and north, respectively, represent overflow pathways from the Snohomish River that directly influence water levels at Harvey Field.

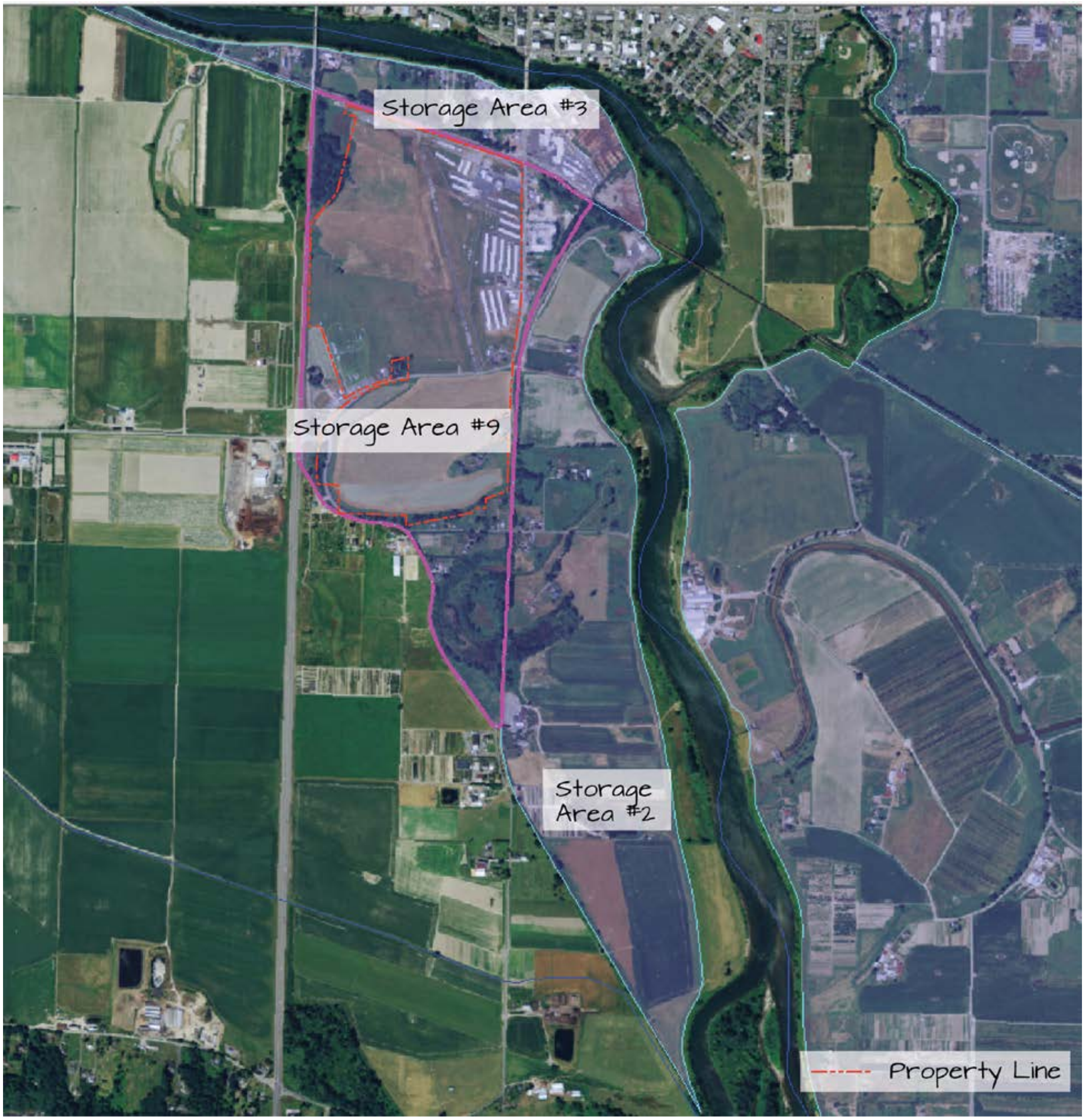
For purposes of this Master Plan, WEST modeled water surface elevations for flood events in storage areas #2, #3, and #9 for the 10, 50, 100, and 500-year events. The results showed that all three storage areas would be completely inundated with water during the 50, 100, and 500-year events; see **Appendix F, Water Surface Elevation Models** for additional detail and figures.

FIGURE 5-5 -– FLOODPLAINS



Note: Not to scale
Source: Federal Emergency Management Agency, FIRM, Panels 53061C1061F and 53061C1065F, Effective date September 16, 2005

FIGURE 5-6 – SNOHOMISH RIVER STORAGE AREAS NEAR HARVEY FIELD



Note: Not to scale
Source: West Consultants, Inc. 2015

5.9 Hazardous Material, Pollution Prevention, and Solid Waste

The Resource Conservation and Recovery Act (RCRA)[22], Comprehensive Environmental Response, Compensations, and Liability Act (CERCLA)[23], Superfund Amendments and Reauthorization Act

[22] U.S. Code, 1976, Resource Conservation and Recovery Act, 42 USC, §6901
[23] U.S. Code 1980, Comprehensive Environmental Response, Compensation and Liability Act, 42 USC, §9601-9628

(Superfund)[24], and the Community Environmental Response Facilitation Act (CERFA)[25] are the four predominant laws regulating actions related to the use, storage, transportation, or disposal of hazardous materials, chemicals, substances, and wastes. Federal actions that pertain to the funding or approval of airport projects require the analysis of the potential for environmental impacts per the regulating laws. Furthermore, property listed or considered for the National Priority List (NPL) should be evaluated in relation to Harvey Field's location. According to the NPL, no sites are located near Harvey Field.

Additionally, an **Airport Recycling, Reuse, and Waste Reduction Plan** can be found in **Appendix G**. The Plan provides a review of Harvey Field's recycling, reuse, and waste program and provides guidance on ways to reduce waste and improve recycling and reuse at the Airport.

5.10 Historical, Architectural, Archaeological, and Cultural Resources

The National Historic Preservation Act[26] and the Archaeological and Historical Preservation Act[27] regulate the preservation of historical, architectural, archaeological, and cultural resources. Federal actions and undertakings are required to evaluate the impact on these resources. The National Register of Historic Places (NRHP) and the Washington Heritage Barn Register were reviewed to identify properties close to S43. **Table 5-4** details the historic sites listed on the NRHP and/or the Washington Heritage Barn Register (WHR). **Figure 5-7** depicts their locations in relation to S43.

TABLE 5-4 – HISTORIC RESOURCES WITHIN 1,000 FEET OF HARVEY FIELD

Name	Location	Date Built	Historic Use	Status[/a/]
Snohomish Historic District	Roughly bounded by Avenue E, Fifth Street, Union Avenue, Northern Pacific Railroad, and Snohomish River	1859-1907	Commerce/Trade	Listed on WHR and NRHP
Fred Behling Farm	11018 Springhetti Road	Ca 1925	Agriculture/Subsistence - Farmstead	Listed on WHR and eligible for NRHP

Note: [/a/]WHR – Washington Heritage Barn Register; NRHP – National Register of Historic Places
Source: Cultural Resource Consultants, Inc., 2015

For purposes of this Master Plan, Cultural Resource Consultants, Inc. conducted a cultural resource assessment of Harvey Field which was considered to be the area of potential effect (APE). Assessment methods included a review of previous ethnographic, historical, and archaeological investigations in the local area; a records search at the Washington State Department of Archaeology and Historic Preservation (DAHP) for known sites; and a review of relevant background literature and maps. Fieldwork was not conducted as part of the assessment.

The research did not identify any archaeological sites at Harvey Field. However, the Snohomish River floodplain, where Harvey Field is situated, is considered to have a high potential for archaeological sites. An archaeological survey, including subsurface testing is recommended prior to

[24] U.S. Code 1986, Superfund Amendments and Reauthorization Act, 42 USC
[25] U.S. Code 1992, Community Environmental Response Facilitation Act, Public Law 102-426
[26] U.S. Code, 1966, National Historic Preservation Act of 1966, Public Law 89-665
[27] U.S. Code, 1974, Archaeological and Historical Preservation Act of 1974, 16 USC 469

any ground disturbance in the area. There were also numerous sites within a one-mile radius of Harvey Field as recorded at DAHP. Consultation with the tribes and DAHP will be required.

The assessment also discovered six previously inventoried buildings within the APE (**Table 5-5**). These buildings consist of three residences, a restaurant, and two airplane hangars. The building identified with reference number "6" caught fire in 2000 and was heavily damaged - the home was reconstructed following the fire. Buildings over 50 years old should be evaluated for NRHP eligibility and consultation with tribal parties and the Department of Archaeology and Historic Preservation (DAHP) should be completed prior to moving forward with any proposed development.

TABLE 5-5 – HISTORIC BUILDINGS WITHIN AREA OF POTENTIAL EFFECT

Reference No.	Built Date	Historic Use	WHR/NRHP Status
1	1959	Transportation – Air-Related	Unevaluated
2	1966	Transportation – Air-Related	Unevaluated
3	1885	Domestic – Single Family House	Unevaluated
4	1931	Domestic – Single Family House	Determined not eligible
5	1945	Commerce/Trade - Restaurant	Unevaluated
6[/a/]	1958	Domestic – Single Family House	Unevaluated

Note: [/a/]House heavily damaged by fire in 2000 and has since been rebuilt.
Source: Cultural Resource Consultants, Inc., 2015

FIGURE 5-7 – HISTORIC RESOURCES WITHIN 1,000 FEET OF HARVEY FIELD

Note: Not to scale
Source: Cultural Resource Consultants, Inc., 2015

5.11 Light Emissions and Visual Impacts

Federal regulations do not specifically regulate airport light emissions; however, the FAA does consider airport light emissions on communities and properties near an airport. Significant portions of light emissions at airports are a result of safety and security equipment and facilities. Harvey Field has three primary sources of light:

- **Runway Lighting**: lights outlining the runway, classified by the intensity or brightness the lights are capable of producing
- **VASIs**: system of lights on the side of an airport runway threshold that provides visual descent guidance information during approach
- **Apron/Parking Lights**: pole lighting on aprons and parking areas

All sources of light contribute to the safety of operations at the airport and produce an insignificant amount of light on the surrounding area.

5.12 Noise

Aircraft noise and noise surrounding airports are two of the most notorious issues related to the environment at airports. The FAA examines actions and development that may change runway configurations, airport/aircraft operation and/or movements, aircraft types, and flight patterns, all of which could ultimately alter the noise impacts on communities near an airport.

The extent of noise resulting from aircraft operations at S43 was determined using the FAA-approved computer simulation model *Integrated Noise Model (INM-Version 7.0d)*. The INM produces Day-Night Average Sound Level (DNL) contours (i.e., lines of equal noise exposure). The complete noise analysis is in **Appendix H, Noise Analysis**. **Table 5-6** presents S43's 2014 aircraft operational by category while **Table 5-7** provides the 2014 local aircraft and aircraft fleet of itinerant operations by time of day.

TABLE 5-6 – 2014 ANNUAL AIRCRAFT OPERATIONS BY CATEGORY

Aircraft Category	Operations
Air Taxi	1,500
General Aviation Local	51,920
General Aviation Itinerant	46,600
Military	200
Total	100,220

Source: Harvey Field Records, 2015

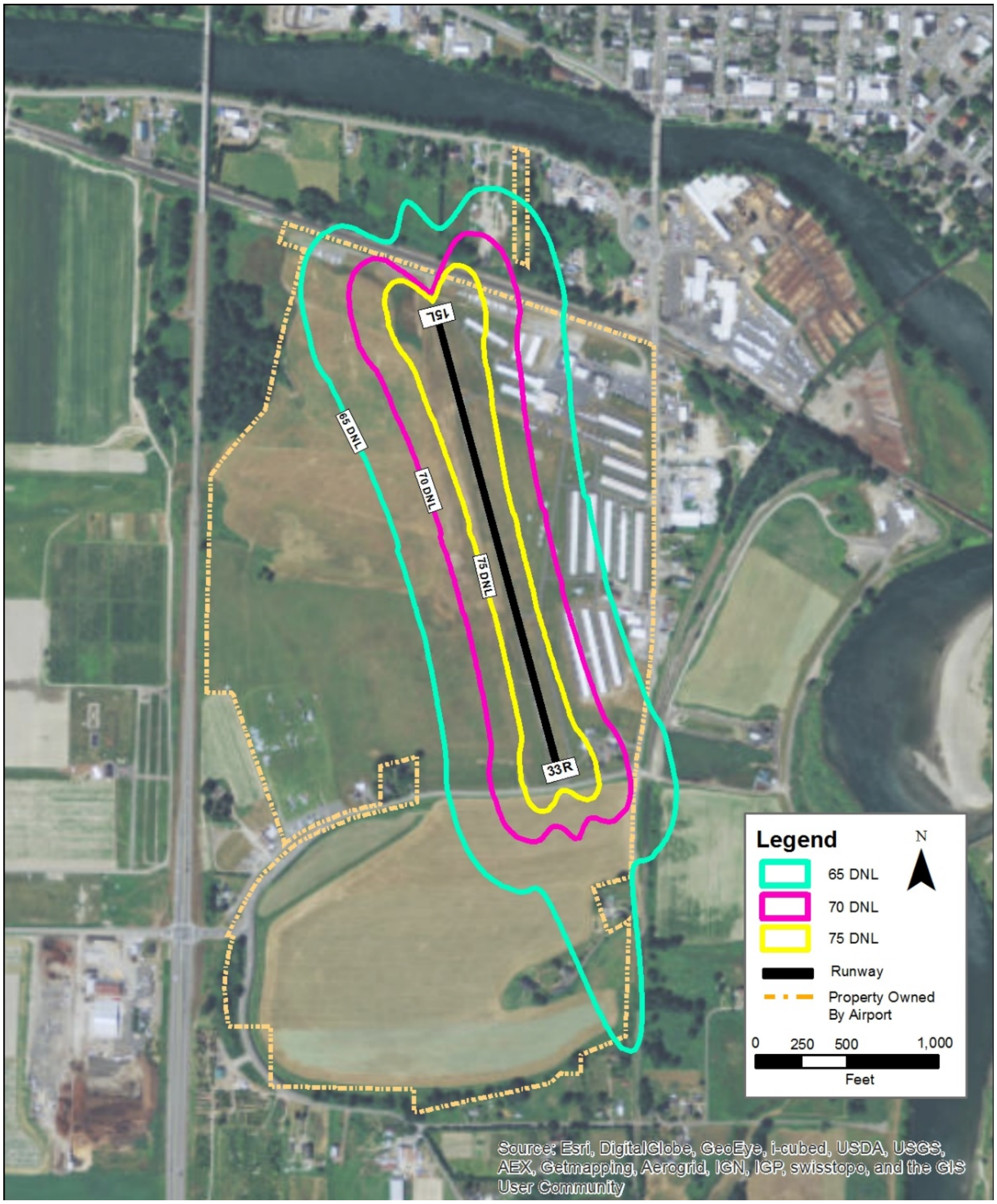
TABLE 5-7 – 2014 AVERAGE ANNUAL OPERATIONS AND INM FLEET MIX

Aircraft Category	Aircraft Types	INM Aircraft	Daytime Operations	Nighttime Operations	Total Operations
Operation Type: General Aviation Itinerant					
Single-Engine Piston	Cessna 150/ 152/ 172/ 177	CNA172	22,636	1,193	23,829
	Beech 33, Mooney M-20J/ K/ L, Piper Dakota/Arrow	GASEPV	5,746	302	6,048
	Cessna 182	CNA182	4,796	252	5,048
	Cessna 180/185/206/210	CNA206	4,645	244	4,889
Multi-Engine Piston	Beech 18/55/ 58, Aero Commander 500, Cessna 303/310/ 320/ 337, Diamond Twin Star	BEC58P	2,317	122	2,439
Turboprop	Cessna 208B, TBM-700	CNA208	1,619	85	1,704
	Cessna 441, Super King Air 200/ 300B, King Air 90/100, Mitsubishi MU-2	CNA441	1,618	85	1,703
Rotorcraft	Schweizer 300C	S300C	1,738	92	1,830
	R-22	R22	580	30	610
	Itinerant Total		45,695	2,405	48,100
Operation Type: General Aviation Local					
Single-Engine Piston	Cessna 150/ 152/ 172/ 177	CNA172	38,647	2,034	40,681
Multi-Engine Piston	Piper PA-23 Apache	BEC58P	3,956	208	4,164
Turboprop	Cessna 208B	CNA208	2,764	145	2,909
Rotorcraft	Schweizer 300C	S300C	3,957	209	4,166
	Local Total		49,324	2,596	51,920
Operation Type: Military					
Rotocraft	UH-60	S70	200		200
	Grand Total		95,219	5,001	100,220

Sources: FAA's Traffic Flow Management System Counts (TFMSC) and KB Environmental Sciences, Inc.

The 2014 65 DNL contour remains primarily within the S43 boundary as shown in **Figure 5-8**. The portions that extend above the north boundaries do not include any residents and are currently zoned as "light industrial" and "agricultural 10-acre" which are compatible with the 65 DNL contour. Three residences, with 13 people total, are within the 65 DNL contour on the southeast. The two within S43 boundaries are owned by the Harvey family and the off-airport property is a private owner.

FIGURE 5-8 – 2014 NOISE CONTOURS



Note: Not to scale
Source: KB Environmental Sciences, 2015

5.13 Secondary (Induced) Impacts

Per Order 1050.1E, secondary impacts result from shifts in population movement or growth; public service demands; and changes in business and economic activity to the extend influenced by airport development. As this chapter serves as a baseline for environmental conditions existing at S43, no further discussion is presented.

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

Socioeconomic effects could involve relocating people from their homes, moving businesses, or causing substantial changes in local traffic patterns. They also involve dividing or disrupting established communities or planned development, and creating notable changes in employment.

Executive Order 12898 requires Federal agencies to analyze project effects relative to low-income and minority populations. Environmental justice analysis considers the potential of a proposed action's alternatives to cause disproportionate and adverse effects on low-income or minority populations. The analysis of environmental justice impacts and associated mitigation ensures that no low-income or minority population bears a disproportionately high and adverse effects resulting from the implementation of the proposed action.

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* requires Federal agencies to make child protection a high priority because children may be more susceptible to environmental effects than adults.

No impacted populations as described above are within the boundaries of the study area – S43.

5.15 Water Quality

The Clean Water Act[28] provides the federal government the "authority to establish water quality standards, control discharges, develop waste treatment management plans and practices, prevent or minimize the loss of wetlands, location with regard to an aquifer or sensitive ecological area such as a wetland area, and regulate other issues concerning water quality."

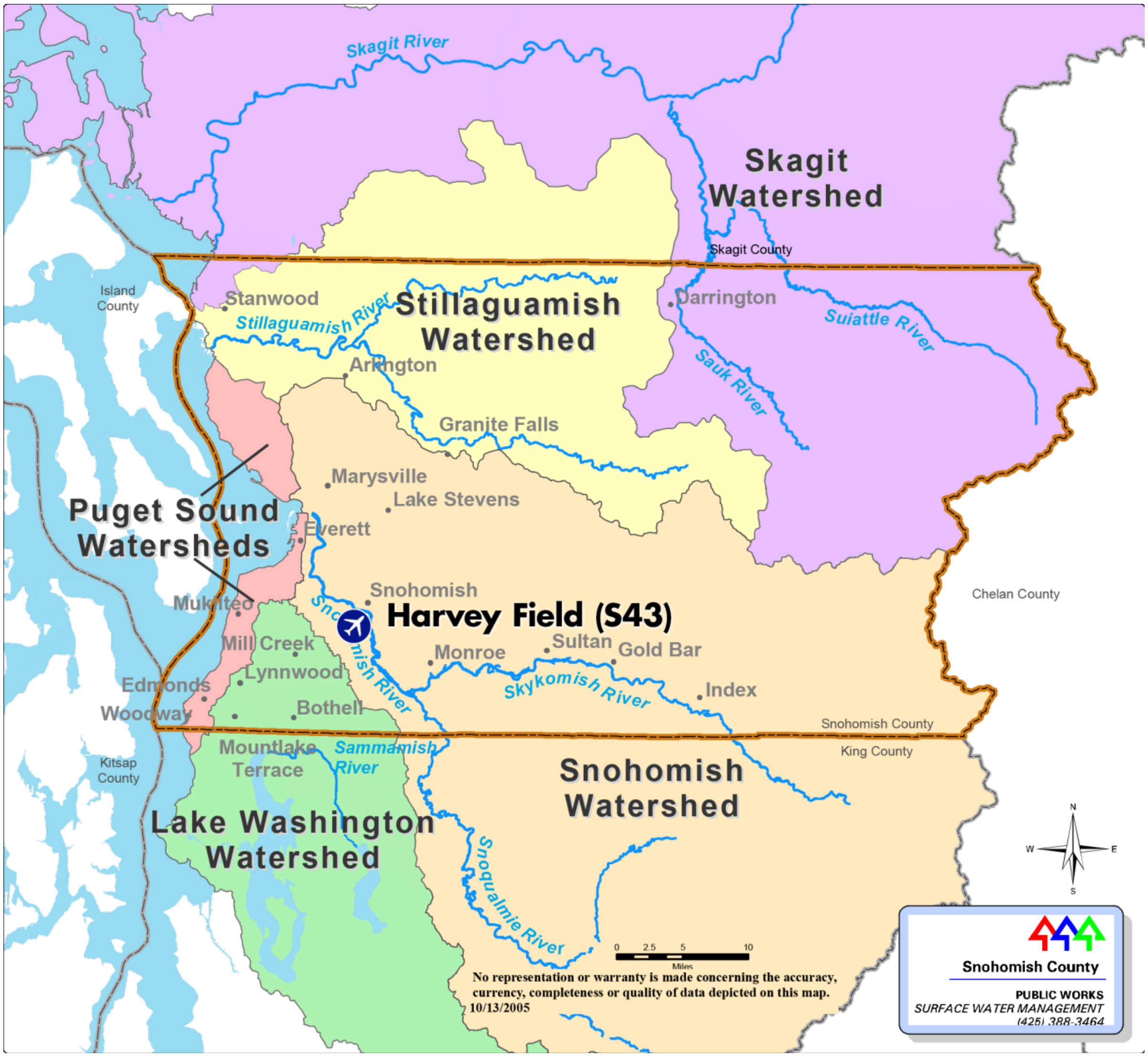
Snohomish County has five watersheds, depicted in **Figure 5-9**. Harvey Field is in the Snohomish Watershed. The City of Snohomish provides the Airport's water supply from the City's water system.

The EPA and Snohomish County's Public Works Surface Water Management Division coordinate and issue water quality permits. S43 does not have any stormwater permits at this time.

Guidance on the measures necessary to control the quantity and quality of stormwater produced by new development and redevelopment to comply with water quality standards and contribute to the protection of receiving waters is provided by Washington's Department of Ecology's 2012 Stormwater Management Manual for Western Washington, as Amended in December 2014.

[28] U.S. Code, 1977 The Clean Water Act, 33 U.S.C. §1251-1387

FIGURE 5-9 – SNOHOMISH COUNTY WATERSHEDS



Note: Not to scale
Source: Snohomish County, Washington, snohomishcountywa.gov, accessed March 2015

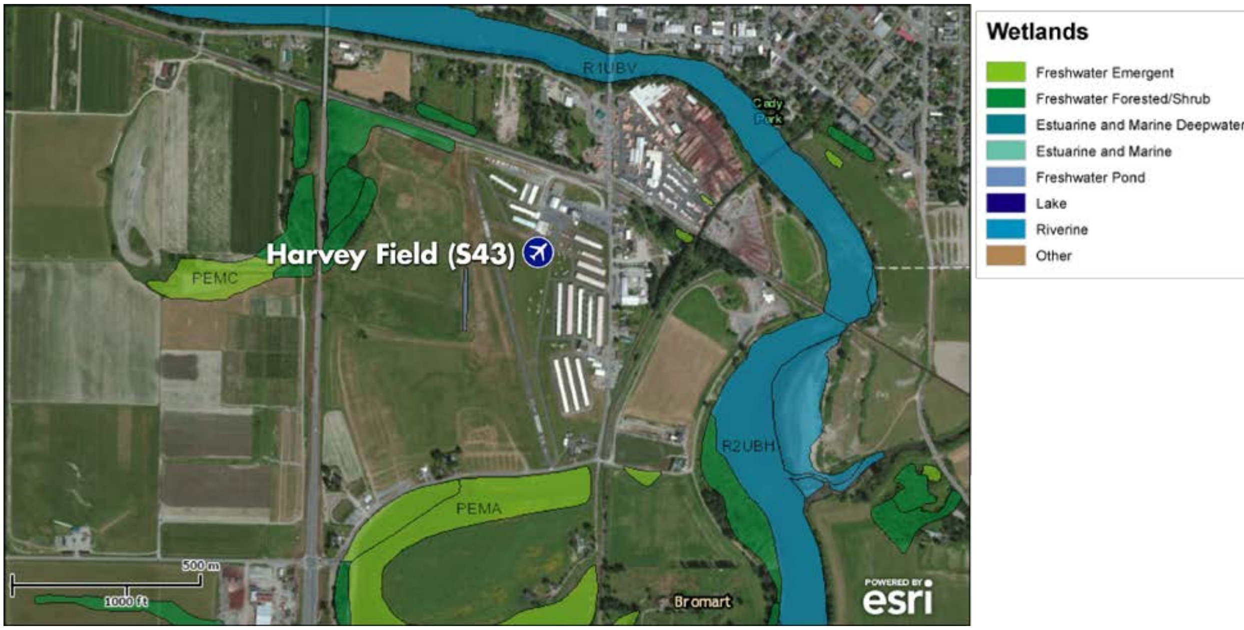
5.16 Wetlands

Wetlands are regulated under Secitons 401 and 404 of the Clean Water Act. The Washington Depatment of Ecology is responsible for compliance with Seciton 401 and the Army Corps of Engineers (Corps) is responsible for administering compliance with Section 404. Thereby, both are required to minimize the destruction, loss, or degradation of wetlands.

Executive Order 11990, *Protection of Wetlands*, defines wetlands as “those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.”

According to the National Wetlands Inventory (NWI), wetlands exist both around and on Airport property. **Figure 5-10** illustrates wetlands as identified in the NWI.

FIGURE 5-10 – NATIONAL WETLANDS INVENTORY MAP



Note: Not to scale
Source: U.S. Fish and Wildlife Service, National Wetlands Inventory, Wetlands Mapper, www.fws.gov/wetlands/Data/Mapper.html

The Watershed Company conducted a wetland delineation within the boundaries of S43; **Figure 5-11** depicts the study area. The complete Wetland Delineation Study is located in **Appendix I, Wetland Delineation**.

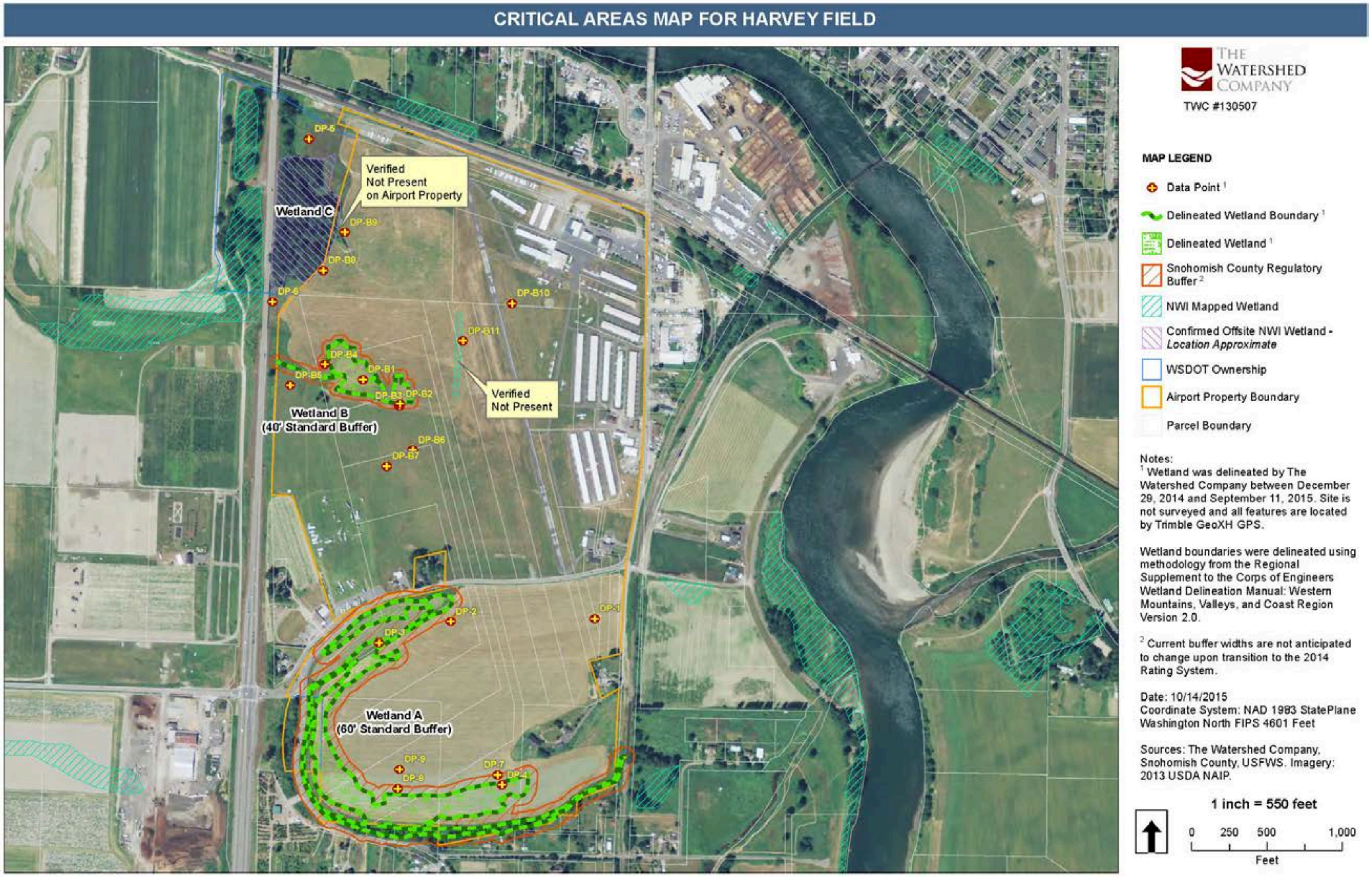
The study confirmed two wetlands within S43 boundaries - Wetlands A and B, as shown on **Figure 5-12** – and one located off-site near the northwest corner of the S43 boundary – Wetland C.

The extent of Wetland A, a large depressional wetland, at approximately 12 acres, is smaller than indicated on the NWI map (**Figure 5-10**). Wetland B is approximately 2.2 acres and is a depressional wetland located west of Runway 15L/33R. Wetland C, a depressional wetland, was also located but not field delineated and determined to be of smaller scale than shown on the NWI map.

FIGURE 5-11 – WETLAND DELINEATION STUDY AREA

Note: Not to scale
Source: The Watershed Company, September 2015

FIGURE 5-12 – WETLAND AREAS ON HARVEY FIELD



Note: Not to scale
Source: The Watershed Company, September 2015

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Wetlands in Snohomish County are regulated under Snohomish County Code (SCC) 30.62A, *Wetlands and Fish and Wildlife Habitat Conservation Areas*. Under SCC 30.62A, wetlands are classified as one of four categories based on the rating system. The County currently uses the 2004 rating system but it plans to adopt the 2014 rating system in 2015. Consequently, the 2014 rating system was used to classify wetlands on S43. Wetland A was determined to be a Category III; Wetland B, a Category IV; and Wetland C, a Category III. These categories are used in combination with the intensity of adjacent land use to determine the buffer area.

Table 5-8 depicts the 2014 rating system's draft buffer widths.

TABLE 5-8 – DRAFT WETLAND BUFFER WIDTHS

Wetland	Category	Standard Buffer Width[a]
A	III	60 feet
B	IV	40 feet
C	III	60 feet

Note: [a]Per Snohomish County 2014 Rating System
Source: The Watershed Company, September 2015

Impacts to wetlands require coordination with Snohomish County. The County does permit certain structures or facilities within wetlands and buffers, including utilities and transportation structures providing there are no feasible alternatives or the alternative would result in unreasonable or disproportionate costs. Stormwater detention/retention facilities, access and pedestrian walkways, vegetation trimming, and reconstruction or replacement of existing buildings are also allowed.

Direct impacts to wetlands require compensatory mitigation through wetland creation and/or wetland enhancement. There are several mitigation bank opportunities with service areas encompassing Harvey Field Airport. Snohomish River Basin and Skykomish Habitat Bank are mitigation banks approved for credit release in the Snohomish River basin. Both banks currently have credits available for release and are approved for use by the Corps, Ecology and Snohomish County. A third mitigation bank, Blue Heron Slough, is close to gaining approval from agencies. While this project may not need credits for many months, it is unlikely all credits would be sold within the timeframe of this project.

Prior to development, a Jurisdictional Determination will be required from the Corps and a permit application submitted to approve wetland impacts and mitigation. Purchasing credits at a wetland bank is typically the Corps preferred mitigation.

5.17 Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968, as amended[29], describes those river segments designated as, or eligible to be included in, the Wild and Scenic Rivers System. Impacts to designated rivers should be avoided or minimized to the extent possible. In addition, the President's 1979 *Environmental Message Directive* on Wild and Scenic Rivers[30] directs federal agencies to avoid or mitigate adverse

[29] U.S. Code, The Wild and Scenic Rivers Act of 1968, 16 USC 1271-1287, 1977
[30] Office of Environmental Policy, 1979, Policy Guidelines for Wild and Scenic Rivers, 1980

effects on rivers identified in the Nationwide Rivers Inventory as having potential for designation under the Wild and Scenic Rivers Act.

The act classifies rivers as wild, scenic, or recreational. **Table 5-9** describes each classification. However, regardless of classification, each river in the National System is administered with the goal of protecting and enhancing the values that caused it to be designated. A designated river is neither prohibited from development nor does it give the federal government control over private property. Voluntary stewardship by landowners and river users provides protection of the designated river as well as regulation and programs of federal, state, local, or tribal governments. In most cases not all land within boundaries is, or will be, publicly owned, and the act limits how much land the federal government is allowed to acquire from willing sellers.[31]

As of July 2011, the National System protects 12,598 miles of 203 rivers in 38 states and the Commonwealth of Puerto Rico; this is less than one-quarter of one percent of the nation's rivers.[32] Washington has approximately 70,439 miles of river, of which 197 miles are designated as wild and scenic.

TABLE 5-9 – WILD AND SCENIC RIVER CLASSIFICATIONS

Classification	Description
Wild	Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
Scenic	Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
Recreational	Those rivers or sections of rivers readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Source: National Wild and Scenic Rivers System, www.rivers.gov, accessed December 2014

Table 5-10 lists the wild and scenic rivers in Washington; **Figure 5-13** depicts the designated rivers in relation to S43.

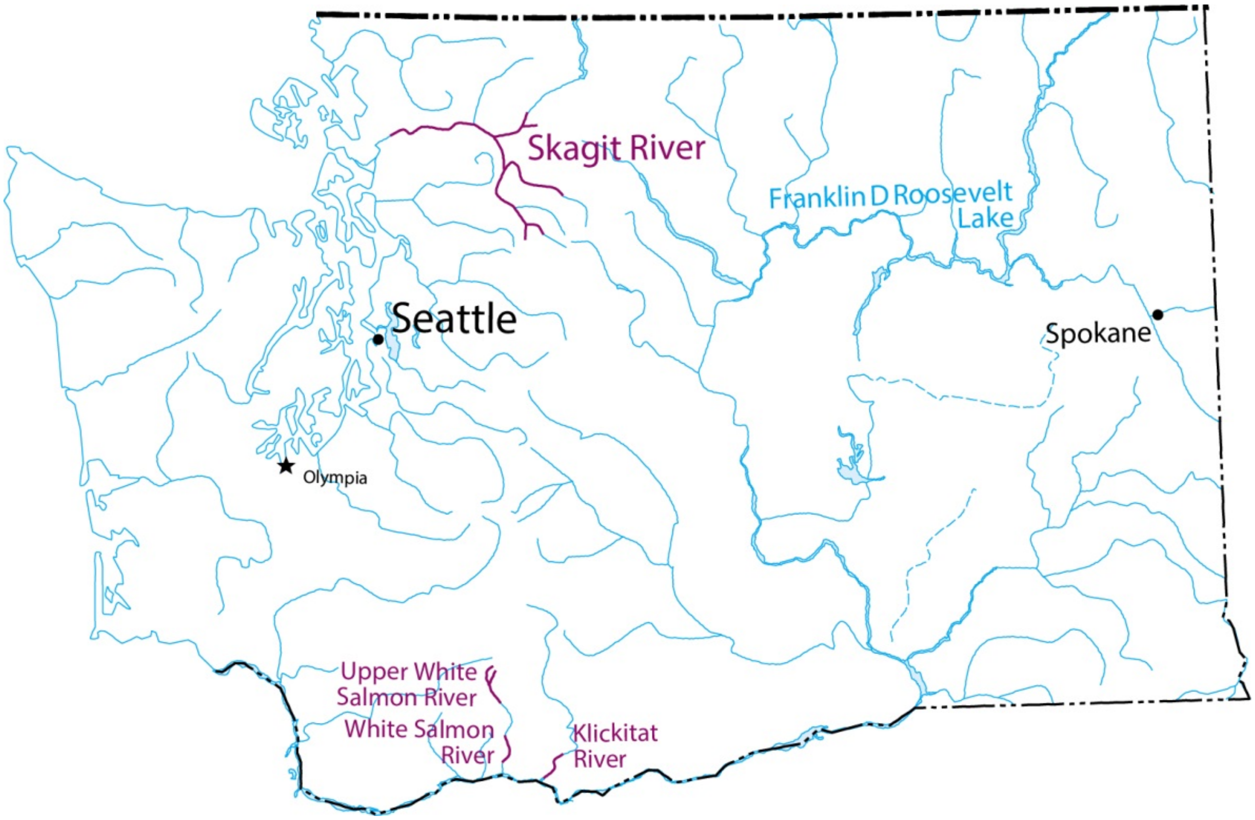
TABLE 5-10 – WILD AND SCENIC RIVERS IN WASHINGTON

River	Classification	Miles Designated
Klickitat River	Recreational	10.8
Skagit River	Scenic Recreational	100.0 58.5
White Salmon River	Wild Scenic	6.7 21.0

Source: National Wild and Scenic Rivers System, www.rivers.gov, accessed December 2014

[31] National Wild and Scenic Rivers System, www.rivers.gov, accessed July 2014
[32] Ibid

FIGURE 5-13 – WASHINGTON WILD AND SCENIC RIVER SEGMENTS



Note: Not to scale
Source: National Wild and Scenic Rivers System, www.rivers.gov, accessed December 2014

6.0 DEVELOPMENT ALTERNATIVES & RECOMMENDED PLAN

The purpose of this chapter is to identify and evaluate various development alternatives for Harvey Field (S43 or the Airport) that meet projected levels of aviation demand and their associated operational requirements, as well as fully reflect the constraints in the area, including sensitive environmental resources.

The result of this evaluation is a preferred development plan for the Airport that will support its evolution and growth in a manner that enables it to meet its future aviation needs in a way that is safe, efficient, and sustainable over the 20-year planning period. The preferred development plan is the culmination of the planning process detailed in this chapter and the previous five chapters and serves as the basis of the remaining two chapters of the Airport Master Plan (AMP) - the financial plan and the Airport Layout Plan (ALP).

As noted by the Federal Aviation Administration (FAA) in their advisory circular (AC) 150/5070-6B, *Airport Master Plans*:

> "Airports have a wide variety of development options, so an organized approach to identifying and evaluating alternative development options is essential for effective planning. The key elements of this process are:
>
> 1. Identification of alternative ways to address previously identified facility requirements.
> 2. Evaluation of the alternatives, individually and collectively, so that planners gain a thorough understanding of the strengths, weaknesses, and other implications of each.
> 3. Selection of the recommended alternative."

To develop alternatives that met airport operational needs and yet were consistent with site constraints, input was solicited from:

- Airport owner, manager, and tenants
- Planning Advisory Committee (PAC)
- Technical Advisory Committees (TAC)
- Snohomish County
- City of Snohomish
- Marshland Flood Control District
- Washington State Department of Transportation – Aviation
- FAA
- Airport neighbors
- interested citizens
- pilot groups

6.1 Development Goals

To assist in conducting the alternatives analysis, several development goals have been established for purposes of directing the planning effort and establishing continuity in the future development of the Airport. These goals take into account several considerations relating to the short- and long-term needs of the Airport, including safety, noise, capital improvements, land use compatibility, financial and economic conditions, public interest and investment, and community recognition and awareness.

While all are project-oriented, some goals represent more tangible activities than others; however, all are deemed important and appropriate to the future of the Airport. (These goals are designed to augment the AMP study objectives defined in **Chapter 1, Study Introduction and Goals**.) These development goals include the following:

- Safely and efficiently accommodate S43's forecasted aviation demand by providing necessary airport facilities and services.
- Provide effective guidance for the future development of S43 through the preparation of a logical development program that presents a realistic vision to meet future aviation-related demand.
- Prepare a plan that enables the Airport to fulfill the mission of facilitating and enhancing local, regional, and national general aviation services by "right-sizing" facilities.
- Conduct an analysis that identifies financially feasible projects that maximize use of available Airport areas while meeting needs of the community.
- Develop future development alternatives based upon the most efficient and cost-effective methods.
- Continue to develop and operate the Airport in a manner that is consistent with local ordinances and codes, federal and state statutes, federal grant assurances, federal agency regulations, and FAA design standards for Airport Reference Code (ARC) B-II airports.
- Ensure that development remains compatible with the surrounding community and the environment on and near airport property.
- Preserve the development potential beyond the forecasted aviation demand to account for possible future aviation services and facility demand increases resulting from unforeseen economic development initiatives and associated aviation uses.
- Encourage and protect public and private investment in land and facility development near the Airport.
- Provide a future non-precision instrument approach to both runway ends to improve service reliability.

6.2 Airside Alternatives Analysis

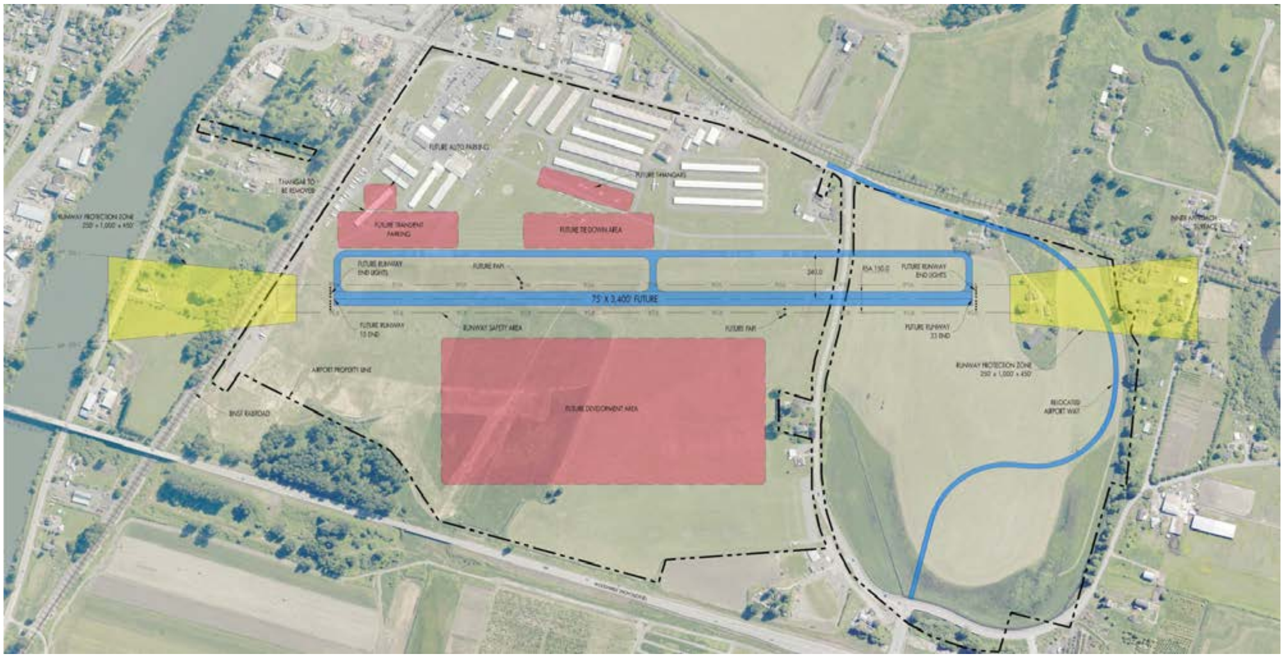
The facility requirements analysis presented in **Chapter 4** reflected what airport facilities would be needed to serve the fleet of small propeller driven aircraft with a maximum certificated takeoff weight of 12,500 pounds or less. The aircraft operating and forecast to operate at S43 over the 20-

year planning period fall into this category. The planning resulted in an alternatives analysis that took into account the airport's development needs in order to improve the airport as a system as well as the development goals outlined in **Section 6.1**. Further, the analysis remained responsive to environmental, fiscal, and constructability. In looking at a full range of alternatives, the analysis began with determining what runway length could be accommodated. As noted in AC 150/5000-17, **Section 3.2.2**, there are no FAA-established runway length standards for a specific RDC. The runway length requirement at an airport is driven by the needs of the critical aircraft, but the actual length constructed can be adjusted due to physical or environmental constraints. However, this sometimes results in operational penalties. **Chapter 4** demonstrated two acceptable methods of calculating the recommended runway length at the airport (yielding 3400' and 2600' runway lengths). **Chapter 6** outlines the alternatives analysis process which studied alternatives based on both runway length calculation methods.

Figure 6-1 illustrates the more conservative approach by demonstrating a 3,400-foot runway (using traditional runway-length curves outlined in AC 150/5325-4B), parallel taxiway, and future apron and hangar development that would meet the facilities requirements for the 20-year planning period. However, several factors work against building this unconstrained development option. The determinative criteria for all of the S43 airport development alternatives are identified and addressed in the following analysis. All of the alternatives were evaluated based on meeting the requirements set forth in **Chapter 4, Facility Requirements** as the predominant factor. Secondly, the alternatives were evaluated using the development goals as well as environmental screening criteria to avoid and minimize impacts, preliminary engineering to establish limits of disturbance and constructability, and financial feasibility to determine project viability.

The unconstrained results were alternatives that were driven by the determined facility requirements, as illustrated in **Figure 6-1**.

FIGURE 6-1 – UNCONSTRAINED FACILITIES REQUIREMENTS



Source: Jviation

6.3 Critical Design Requirements and Constraints

The minimum acceptable design goal for S43 included the following critical design requirements:

- Meet each FAA design standard as defined in the Facility Requirements without operational limitations, but specifically meet runway/taxiway design standards, with particular focus on a full runway safety area (RSA) and clear 20:1 approach surfaces (without resort to displaced thresholds) at each runway end.
- To clear incompatible land uses in the runway protection zone (RPZ) at each runway end to the best extent practicable, including the preclusion of residences.
- Meet Snohomish County Code (SCC) Chapter 30 requirements limiting construction, including fill, within the Density Fringe in order to make the Preferred Alternative feasible. For example, the fill footprint could not exceed 2% of the total property.
- Meet SCC road design standards and elevation requirements.

Identifying possible alternatives that meet the design goals above included accounting for **critical constraints** – i.e. unmodifiable elements that constrain the options. For example, the Burlington Northern Santa Fe (BNSF) railroad tracks are a critical constraint. The tracks are not moveable and therefore must be accommodated “as-is” in any design alternative. By way of contrast, Airport Way is a major thoroughfare for the community, but is not, on its face, immovable. The critical constraints at S43 are listed below, along with a brief explanation of their “criticality:”

- BNSF railroad tracks: The tracks are immovable because Harvey Field does not own sufficient property to move the tracks north, away from the runway.

- S43 property ownership: Public agencies with right of eminent domain may acquire property required for public purposes. Although Harvey Field is an Essential Public Facility (as defined in Washington's Growth Management Act and adopted in Snohomish County's strategic plan), as a privately-owned facility the Airport may acquire land only when offered by a willing seller. For this reason, Harvey Field has purchased properties surrounding the Airport over the past 30 years, both to protect critical airspace and accommodate airport improvements to meet FAA airport safety standards.

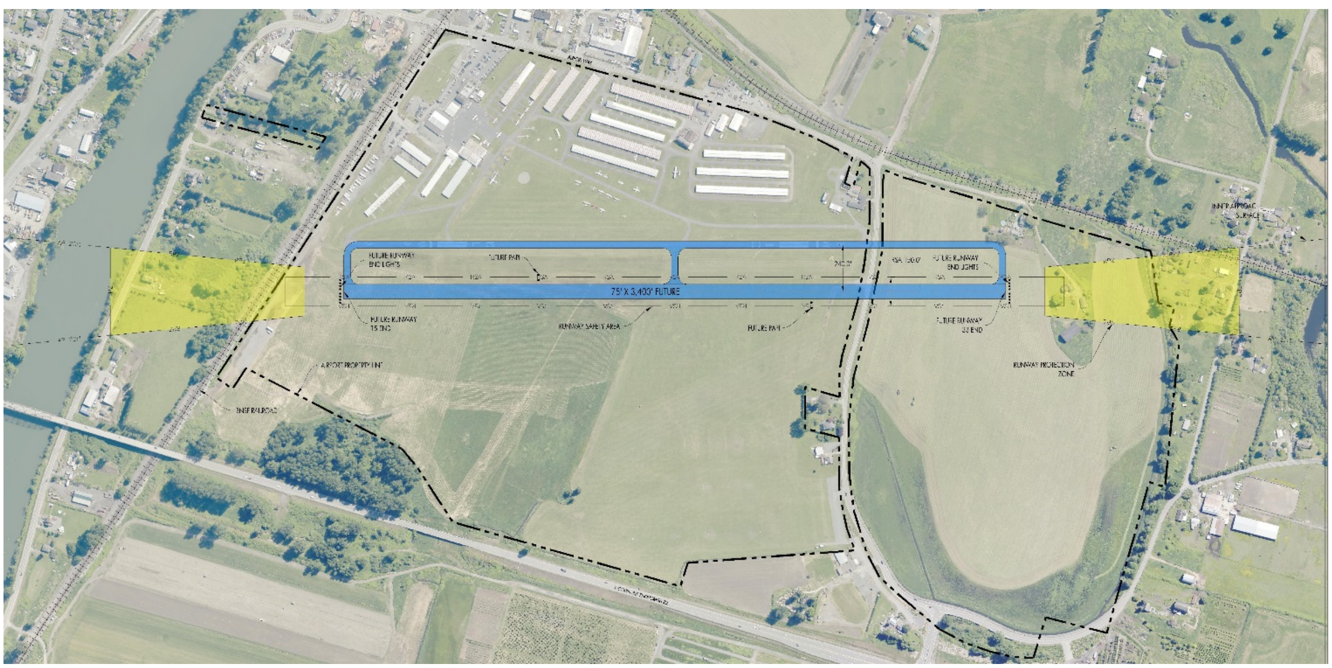
6.4 Design Process – Airside Alternatives Identification & Analysis

Any design process with competing design constraints is an iterative process, prescribed by first selecting a "starting point" design solution, then repeatedly analyzing and refining the solution until all critical design criteria are met. What follows is a general description of how the design process unfolded at S43. The design process began with the first priority: meeting FAA runway and taxiway safety and design standards. Alternatives that were evaluated and eliminated because they did not meet these standards are included in **Appendix J, PAC Master Plan Update Presentation**.

6.4.1 Alternative 1: Starting Point

The starting point solution for a new runway/taxiway system is shown in **Figure 6-2**.

FIGURE 6-2 – ALTERNATIVE 1: STARTING POINT



Source: Jviation

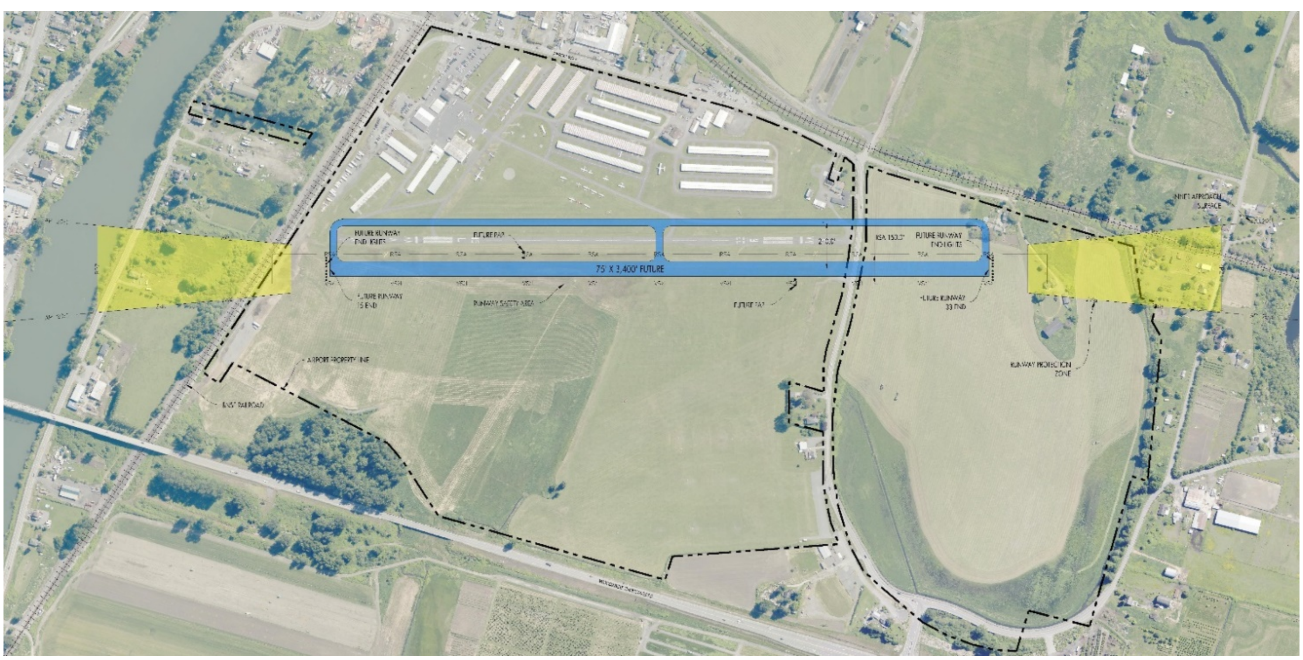
Alternative 1 uses the recommended a runway length of 3,400 feet for total operational needs. The Starting Point shown in **Figure 6-2** efficiently preserves existing Runway 15L/33R (plus additional length) as a future parallel taxiway by building the new Runway 15/33 240 feet to the west at FAA standard runway/taxiway separation. However, the ground elevation at S43 drops off between five and ten feet approximately 240 feet from the existing runway centerline, increasing fill requirements for the northern half of the new runway. SCC for Density Fringe stipulates, “the development that will displace floodwaters will not exceed two percent of the land areas of that portion of the lot.” The fill footprint limitation is calculated as two percent of the total property; Harvey Field property is 204.48 acres, making two percent 4.09 acres. A preliminary calculation of fill footprint for this Alternative clearly made this runway placement infeasible, relative to SCC Density Fringe fill limitations (see supporting document **Appendix P**).

Note: This placement for a new runway was examined again later in the planning process, once options for a shorter runway were being explored. However, even at a 2,400-foot runway length, Alternative 1 is infeasible because the fill requirement again exceeds the maximum allowable fill footprint allowed under SCC Density Fringe fill limitations in this specific location (see section **Alternative 4: Construct 2,400-foot Runway and Move Airport Way South***).*

6.4.2 Alternative 2: Use Partial Parallel Taxiway

Alternative 2 uses the recommended runway length of 3,400 feet for total operational needs. In order to work within the 2% density fringe code impacts, Alternative 2 tried to reduce the fill footprint associated with Alternative 1 (i.e. a fill area exceeding current SCC limits for Density Fringe) by placing a new runway centerline on higher ground 240 feet west of the existing partial parallel taxiway. Alternative 2 includes extending the partial parallel taxiway to a full parallel taxiway, illustrated in **Figure 6-3**. Although Alternative 2 reduces required fill (relative to Alternative 1), the BNSF tracks obstruct both the RSA and approach surface to Runway 15. Alternative 2 was deemed infeasible because it does not meet FAA airport design standards.

FIGURE 6-3 – ALTERNATIVE 2: USE PARTIAL PARALLEL TAXIWAY

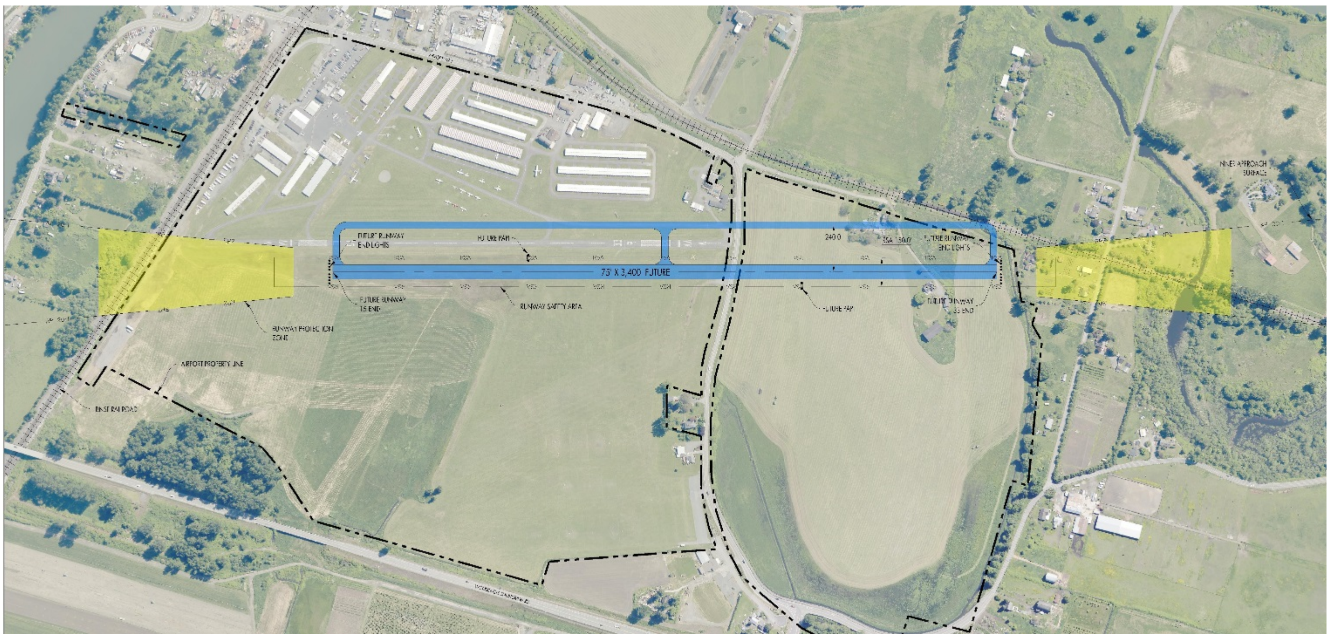


Source: Jviation

6.4.3 Alternative 3: Construct a 3,400-foot Runway and Move Airport Way South

Alternative 3 uses the recommended runway length of 3,400 feet for total operational needs. Given the immovable BNSF tracks north of Runway 15/33, a working estimate of locating Runway 15 threshold 660 feet from the tracks was calculated to clear the 20:1 approach surface. However, locating a 3,400-foot runway far enough south to clear the BNSF tracks left no room on Harvey Field property to relocate Airport Way, as shown in **Figure 6-4**. Airport Way is an important thoroughfare that ties into the local road network and cannot be vacated without a new acceptable location. The southern end of the new parallel taxiway would abut the abandoned railroad tracks, forcing any relocation of Airport Way to go off Harvey Field property.

FIGURE 6-4 – ALTERNATIVE 3: CONSTRUCT A 3,400-FOOT RUNWAY AND MOVE AIRPORT WAY SOUTH



Source: Jviation

Having established at this point that a 3,400-foot runway was infeasible, alternatives were re-examined to accommodate the recommended runway length (calculated using Pilot's Operating Handbook and FAA Approved Airplane Flight Manuals) and relocating Airport Way within County-owned ROW and Harvey Field property were considered. Viable alternatives for relocating Airport Way would factor significantly in determining the southerly-most option for the new Runway 33 threshold.

6.4.4 Alternative 4: Construct 2,400-foot Runway and Move Airport Way South

Moving the Runway 15 threshold south to avoid the BNSF tracks (for both a standard RSA and a clear 20:1 approach) left insufficient Airport property to construct a 3,400-foot runway and relocate Airport Way within County-owned ROW and/or Harvey Field-owned property. The challenge at this point was to identify alternative Airport Way routes on County ROW and/or Airport property that simultaneously:

- Allowed for a runway that meets an acceptable recommended runway length as identified in **Chapter 4**
  - Of sufficient length to serve existing and forecast activity without operational restrictions
  - Meeting FAA design standards
  - Not exceeding SCC Density Fringe limitations for fill
- Provided for a relocated Airport Way
  - That minimized Airport Way intrusion on RPZ
  - Met County road standards for grade, grade changes, curve radiuses, and intersection configuration
  - Could be constructed at or above the elevation of existing Airport Way
  - Did not exceed SCC Density Fringe limitation for public roadway fill

Thus, the alternatives process moved on to evaluate an approach using the 2600' recommended runway length. The process began with laying out alternative routes for relocated Airport Way. Shown in **Figure 6-5**, Option 1 extends as far south as possible, beginning south of 99 Avenue SE on County-owned ROW and continuing south on Airport property, thus allowing for the most southerly location of a new Runway 33 threshold and maximizing clearances in the RPZ. Option 1 curves back north, both avoiding delineated wetlands along Airport southern property line and providing a preferred perdendicular intersection with Airport Way/Springhetti Road.

Option 2 takes advantage of high ground, but does not minimize the road's intrusion on the RPZ.

Option 3 parallels the southern boundary of Airport property. This option was rejected due to impacts on wetlands and a substandard oblique (not perpendicular) intersection with Springhetti Road.

FIGURE 6-5 – AIRPORT WAY RELOCATION OPTIONS

Source: Jviation

Having determined both the runway centerline and a route for a relocated Airport Way that provided the best opportunity to meet both FAA and Snohomish County requirements, the next step was to determine the feasible runway length that still met S43's existing and forecast operational requirements.

The full 3,400-foot runway length was found to be infeasible due to:

- 4.09-acre fill footprint limitation, per SCC requirements.
- Limiting new Airport Way's intrusion on the new RPZ.
- Insufficient County ROW and Harvey Field property for a relocated Airport Way.
- Recalling that the 3,400-foot length had been determined by considering total operational needs of the entire fleet of propeller-driven aircraft weighing less than 12,500 pounds, the recommended runway length was re-evaluated by:
- **Step 1**: Iterative evaluation of the feasibility of constructing various runway lengths (2,850 feet, 2,575 feet, 2,400 feet) within the 4.1-acre fill footprint limit.
- **Step 2**: Comparing maximum feasible length against the runway length requirements of the most demanding specific aircraft using and forecast to use Harvey Field as documented in Chapter 4.

Step 1: Determine maximum runway length constructible with maximum 4.1-acre fill footprint.

Using three-dimensional engineering software, different runway lengths (2,850 feet, 2,575 feet, 2,400 feet) were evaluated using an iterative process of:

- Refining assumptions about north end runway threshold location and elevation (relative to BNSF tracks).

- Assuming various south end runway threshold locations and elevations.

Rough approximations of each runway length's fill footprint were based on threshold locations and elevations and refined through iterative adjustments.

At this stage, it was tentatively determined that 2,400 feet was the maximum runway length feasible relative to SCC fill footprint limitations in the Density Fringe. To make certain no feasible alternative for a 2,400-foot runway was overlooked, the option of locating the new runway centerline 240 feet west of the existing runway (thereby preserving the former runway pavement for a parallel taxiway) was re-examined (see paragraph **Alternative 1: Starting Point**). As stated in Alternative 1, even at the reduced 2,400-foot runway length, the fill requirement still exceeded the maximum allowable fill footprint allowed under SCC Density Fringe fill limitations.

Threshold locations and elevations as well as centerline elevation profiles were refined for both the new runway and all taxiways, assuring that FAA standards for gradient and gradient changes—both longitudinal and traverse—were met and the SCC Density Fringe fill limitations were not exceeded.

Through this highly iterative process, it was concluded that a 2,400-foot runway located 240 feet west of the partial parallel taxiway was the maximum length feasible within the 4.09-acre fill footprint limit. Since both the 3400' and 2600' runway lengths were not feasible, the next step evaluated if a 2400' runway would accommodate the airport's existing and forecasting fleet mix.

Step 2: Evaluate 2,400-foot recommended maximum feasible runway length against operational runway length requirements.

Operations logs at Harvey Field show the most demanding, using S43. Critical runway length requirements were calculated as follows:

- Beechcraft King Air 250: 2,400 feet (takeoff)[1,2]
- DeHavilland DHC - 2 Beaver: 1,051 feet (takeoff)
- DeHavilland DHC-6 Twin Otter: 1,200 feet (takeoff)
- Cessna Caravan Blackhawk: 2,055 feet (takeoff)
- Socata TBM-700: 2,238 feet (takeoff)
- Quest Kodiak: 1,264 feet (takeoff)

Aircraft more demanding than those listed above are not forecast to use S43.

Note: Determining runway length with reference to specific critical aircraft is described in AC 150/5325-4B, *Runway Length Requirements for Airport Design*.

[1] King Air 250 is part of the larger fleet mix but does not operate daily. Using the annual daily average temperature of 58.8º vs. mean daily temperature of 74º

[2] The 2,400-foot runway will accommodate the King Air 250. See Appendix D for performance charts.

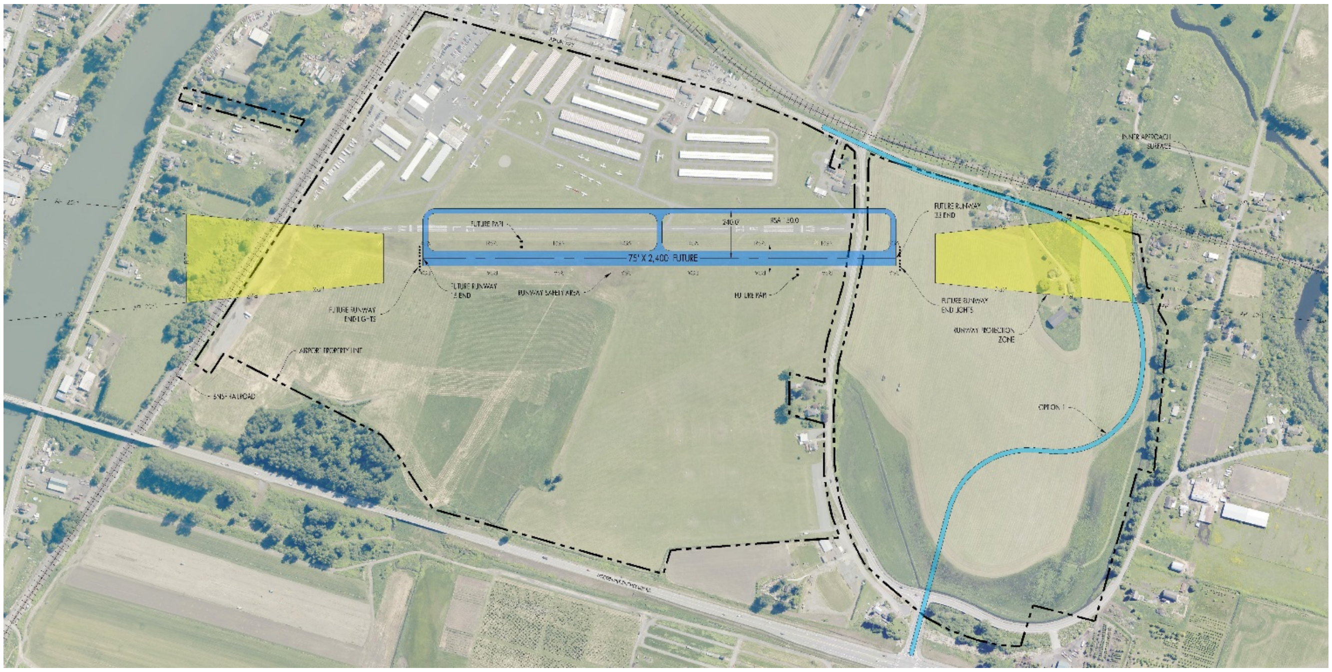
After evaluating operations manuals for these aircraft[i] it was determined that a 2,400-foot runway with clear approaches and meeting FAA design standards would:

- Be supported by the FAA AC 150/5325-4B runway length calculation methodology: As mentioned in **Chapter 4**, the runway length curves contained in AC 150/5325-4B Figures 2-1 and 2-2 are solving for 95% of the national fleet and include aircraft that don't perform well (these tend to be older and poorly performing models). Therefore, the curves are conservative and tend to produce longer lengths. In the case of Harvey Field, it is reasonable to use aircraft Pilot's Operating Handbooks and FAA Approved Airplane Flight Manuals to determine the recommended runway length of the specific fleet mix that is presently using, and forecasted to use, the airport.
- Accommodate almost all of the fleet mix, on most days of the year, based on local weather conditions: **Table 4-3** demonstrates the takeoff length or landing distance length of the fleet mix used to determine the recommended runway length for the critical aircraft grouping. Almost all in the fleet require a recommended runway length of less than or equal to 2,400 feet, with one exception – the King Air 250 has a takeoff length of 2,600 feet and a landing distance length of 2,100 feet. The takeoff length of 2,600 feet was determined using maximum takeoff weight and the mean daily maximum temperature of the hottest month; however, if you used the maximum takeoff weight and an annual daily average temperature, a recommended runway length of 2,400 feet is yielded. The annual daily average temperature is more indicative of weather conditions at the airport which indicates that the King Air 250 would rarely need to take a payload restriction in order to take off.
- Usefully serve and improve critical aircraft operations now and in the future.
- Could be designed to meet SCC Density Fringe requirements limiting fill.
- Sufficiently minimized new Airport Way's intrusion into the new runway's RPZ.

Snohomish County confirmed that the proposed alternative met the requirements under SCC Chapter 30 Density Fringe for the runway and taxiways and that proposed relocated Airport Way met the County's road design standards (see **Appendix O**).

The feasible alternative meeting operational requirements, FAA standards, and SCC requirements is shown in **Figure 6-6**.

FIGURE 6-6 – CONSTRUCT 2,400-FOOT RUNWAY AND MOVE AIRPORT WAY SOUTH



Source: Jviation

Summary and Recommended Runway Location

Alternatives for constructing a runway/taxiway system at Harvey Field were developed through an iterative design process, starting with an initial configuration and then successively modifying to address both design requirements and constraints. The Preferred Alternative, **#4, Construct 2,400-foot Runway and Move Airport Way South**, fulfills the following requirements:

- Accounts successfully for immovable BNSF tracks.
- Utilizes airport-owned property and County-owned right-of-way.
- Meets SCC Density Fringe requirements for runway construction (**Appendix F** provides West Consultant's analysis of density fringe and floodplain analysis for runway, taxiway and relocated road).
- Meets SCC road design standards meets FAA airport design standards, providing safe and efficient airport operations now and in the future.

6.5 Taxiways

An airport's taxiway system should provide for efficient aircraft movement on the ground requiring minimal changes in aircraft speed and direct routing to and from the runways, terminal area, and aircraft parking areas. Taxiway design principles include:

- Provide the primary runway with a full parallel taxiway, along with multiple exit taxiways, to minimize runway occupancy time and back-taxiing on the runway.
- Taxiways should provide a direct route between runways and the terminal area.

- Taxiways should have a bypass capability, or multiple access points, at runway ends with high levels of peak demand.
- Taxiways must comply with FAA's criteria in FAA AC 150/5300-13A, *Airport Design*, Chapter 4, Taxiway Design and confusing taxiway geometry is to be avoided.
- Avoid constructing taxiways in the approach ends of runways.

As stated in **Chapter 4**, S43's present taxiway configuration is generally adequate to serve the present operational activity at the Airport. However, the existing taxiways do not meet FAA taxiway design group (TDG) 1A standards for 25-foot width, 131-foot taxiway object free area (OFA) width, or 240-foot separation from runway centerline. As the buildings come to the end of their useful life, the airport will pursue landside redevelopment that meets airport design standards, subject to further planning.

The proposed parallel taxiway and taxiway connectors meet all FAA TDG 1A design standards.

Table 6-1 summarizes the four airside alternatives as well as a "No Action" option.

TABLE 6-1 – AIRSIDE ALTERNATIVES AND DEVELOPMENT ANALYSIS

Option	No Action	Alternative 1: Starting Point	Alternative 2: Use Partial Parallel Twy	Alternative 3: New 3,400-ft Rwy & Move Airport Way South	Alternative 4: Preferred Alternative New 2,400-ft Rwy & Move Airport Way South
Description	Existing runway remains	New 3,400-ft Rwy 15/33 240' west of existing Rwy15L/33R	New 3,400-ft Rwy 15/33 240' west of existing partial parallel twy	New 3,400-ft Rwy 15/33 660' south of BNSF & relocated Airport Way	New 2,400-ft Rwy 15/33 & relocated Airport Way
Advantages	No cost Meets density fringe requirements	Meets runway length requirements for design category fleet Re-uses existing runway as parallel taxiway	Meets runway length requirements for design category fleet	Meets runway length requirements for design category fleet	Meets runway length requirements for existing and forecast aircraft Meets FAA design standards Meets SCC Density Fringe requirements Flood water storage capacity impact less than 0.00'. Flow blockage less than 15% limit. *
Disadvantages	Does not meet key FAA runway design standards (displaced threshold on both ends, obstructions)	Exceeds SCC limits for fill in Density Fringe.	Exceeds SSC limits for fill in Density Fringe	Exceeds SCC limits for fill in Density Fringe Does not allow for relocated Airport Way on County ROW/Harvey property	Does not re-use existing runway pavement as parallel taxiway
Feasibility	Displaced thresholds remain	Unlikely to receive permits from Snohomish County.	Unlikely to receive permits from Snohomish County	Unlikely to receive permits from Snohomish County.	SCC Density Fringe Fill permit feasible

Source: Jviation
* Calculations included all road, runway, and taxiway fill

6.6 Airfield Visual Aids

Chapter 4 recommends several improvements to the lighting and visual aids, to be installed when new Runway 15/33 is constructed:

- Install medium intensity runway lights (MIRLs) on new Runway 15/33. Maintain pilot activation through Unicom/CTAF radio (123.0 MHz). LED lights, which use less energy, last longer, and are brighter than standard lights were considered. However, LEDs are more expensive to purchase. Further, pilots using night vision goggles (NVG) find LED lights are too bright and may be distorted.
- Install medium intensity taxiway lights (MITLS), which can be activated by pilots through Unicom/ CTAF radio. A lower cost option is to install blue reflectors along the taxiway.
- Install Runway 15/33 threshold lights with red lenses in conformance with FAA standards.
- Install precision approach path indicator lights (PAPIs) at both runway ends.
- Install airfield signage in conformance with FAA guidance.

For the purposes of this analysis, there are only two alternatives: no-build and build. Due to the operational and maintenance advantages of improved runway lighting, it is recommended that MIRLs be installed. The blue medium intensity taxiway lights (MITLs) or lower-cost blue reflector poles should be installed. As the runway lights are today, the future MIRLs will also be pilot controlled via the Unicom (CTAF) radio frequency (123.0 MHz). **Table 6-2** summarizes S43's selected airfield elements to be included in the Preferred Alternative.

TABLE 6-2 – AIRSIDE FACILITIES INCLUDED IN THE PREFERRED ALTERNATIVE

Facility	Facilities Selected
Runway	– Replace Runway 15L-33R (2,671' x 36', with total threshold displacements of 693') with new Runway 15/33 (2,400' x 75') to meet recommended length and required width. – Meet runway safety area (150' wide x 300' beyond runway end), runway object free area (ROFA), and obstacle free zone (OFZ) standards. – Runway Protection Zone to be cleared of incompatible land uses to the best extent practicable.
Taxiway System	– Construct full parallel taxiway, 240' between new Runway 15-33 and taxiway centerlines. – Construct to Taxiway Design Group (TDG) 1A standards i.e. 25' wide. – Meet separation requirements (RW/TW, TW/Fixed Object, holding positions).
Airfield Pavement	– Design runway & taxiway pavement load bearing for 12,500 lbs.
Airfield Visual Aids	– Install MIRLs on Runway 15-33 – Install MITLs or reflectors on future parallel taxiway
Navigation Aids (NAVAIDs)	– Visual runway
Approaches/Obstruction Removal	– Obstructions to be mitigated to maintain a clear approach. A Circling-to-Land procedure is required, but a non-precision instrument straight-in procedure is preferred to accommodate the fleet.

Source: Jviation

6.7 Landside & Airport Support Facilities Alternatives Analysis

This section identifies development concepts and alternatives to address S43's existing and future needs for landside and airport support facilities within the 20-year planning period. The following sections provide overviews of the alternative analyses for several of the landside infrastructure requirements as reflected in **Table 6-3**. As noted in previous chapters, S43 is currently restricted by the SSC Density Fringe fill requirements. This limitation impacts the future development of landside facility projects.

TABLE 6-3 – LANDSIDE FACILITY REQUIREMENTS SUMMARY

Facility	Identified Requirement
Landside Facility Requirements	
Aircraft Hangar Requirements	– Construct additional hangars – Preserve / refine hangar development modules
Aircraft Parking Aprons	– Redesign and expand based and transient aircraft apron to meet sufficient space requirements (70,000') and meet separation requirements. – Relocate helicopter parking area to a less congested area.
Airport Support Facility Requirements	
Airport Security	– Construct security fence and perimeter road – Install access control – Establish Airport Security Committee

Source: Jviation

6.7.1 Aircraft Hangar Development

The existing 211 hangars at S43 are occupied. They constitute a mix of T-hangars, conventional box hangars, and shade hangars. The airport manager has a waiting list of 15 to 20 aircraft owners who want to lease or construct new T-hangars or box hangars. There is no demand for shade hangars. Additional hangar construction must meet current SCC Density Fringe requirements.

6.7.2 Terminal Apron Parking

The main aircraft parking apron adjacent to the FBO on the northeast side of Harvey Field is approximately 260 feet by 130 feet (33,800 square feet), providing permanent tie-down for the flight school fleet. No based or transient aircraft parking is provided in this area.

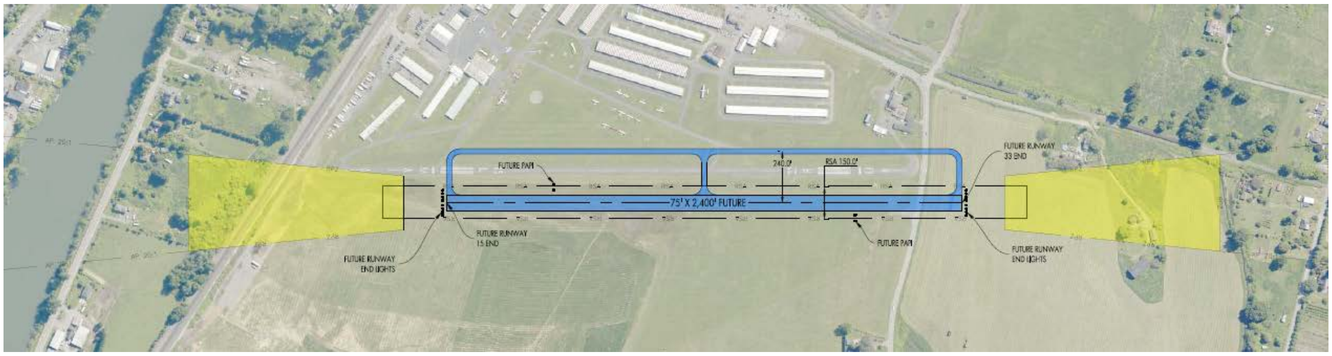
The transient day time ramp parking is limited and is located on the northwest ramp adjacent to the skydiving center and the aircraft maintenance facility.

As noted in **Chapter 4**, providing sufficient space for power-in, power-out parking on the main apron for approximately six aircraft of the size of the Piper Malibu, King Air 250, and Cessna 208B Caravan requires approximately 70,000 square feet, which is more than twice as large as the current apron. The optimal layout for transient aircraft using parking power-in, power-out parking is approximately 150,000 square feet.

Two parking apron and hangar expansion alternatives were identified:

Alternative 1, No Build: This alternative would leave the current parking apron in place. However, the current parking apron does not provide sufficient parking for either transient pilots, or based aircraft owners now wait-listed for hangars.

FIGURE 6-7 – TERMINAL APRON – NO BUILD



Source: Jviation

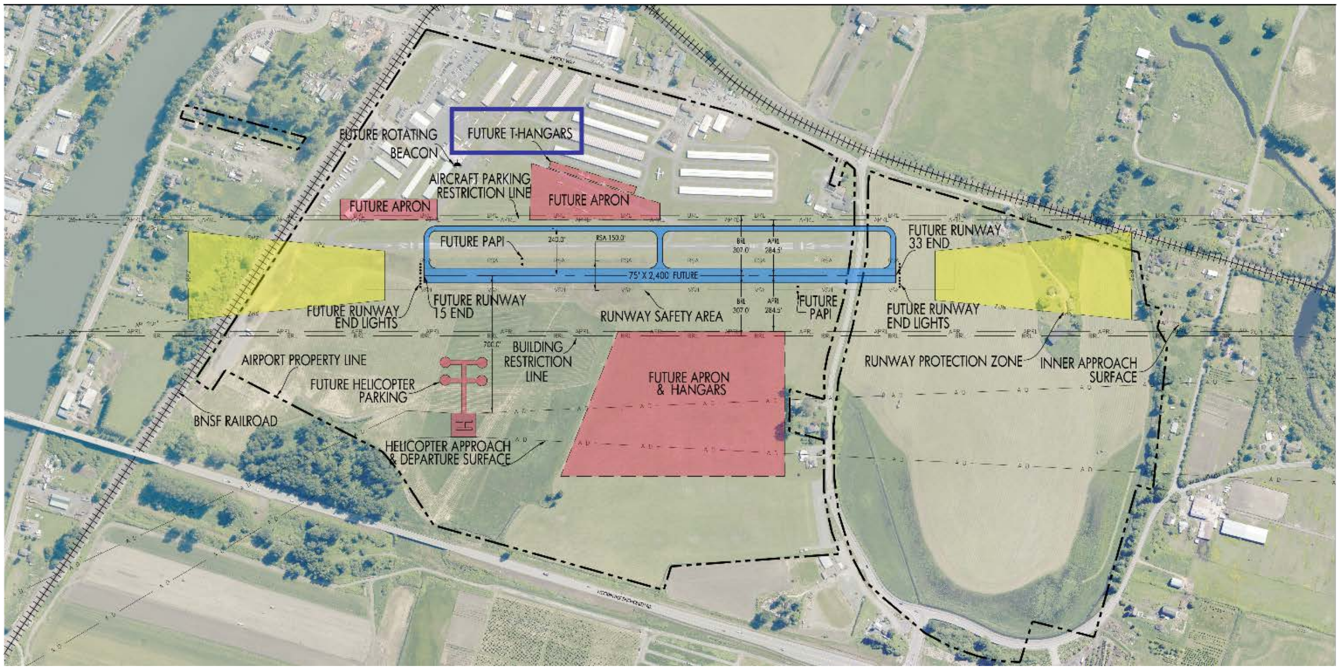
Alternative 2, Expand Apron and Construct Hangars: This alternative addresses current ground operations and parking congestion/capacity issues for based and transient fixed-wing aircraft and helicopters. New paved apron may be constructed at grade with a Land Disturbing Activity (LDA) permit that complies with SCC 30.63A drainage requirements. The critical LDA permit issue of storm and flood water runoff can be adequately addressed by the extensive sub-surface drainage system at S43. New hangar development may be permitted within the SCC Density Fringe by "tradeoffs," i.e. demolishing existing, but inefficient or unusable hangars as trade-offs for building new hangars. Given the age of the hangars as well as their location, any demolition and construction of new hangars will be determined by the Airport. There is no immediate plan at this time.

In order to accommodate aircraft parking demand, T-hangar #7 (loss of nine spaces) is proposed to be demolished to accommodate future tie-down spaces. A new T-Hangar #64 will be constructed to provide for additional capacity, approximately 18 to 20 spaces.

In order to relieve congestion in the existing aircraft fueling area (as discussed in **Chapter 4**), a helicopter Final Approach and Takeoff area (FATO) and helicopter parking can be sited on the west side of the airport. This FATO site de-conflicts helicopter and fixed-wing aircraft patterns. The FATO is located 700 feet west of the new runway centerline, the FAA standard separation for large helicopters (AC 150/5390-2C, *Heliport Design*), and will be built at grade. As with other parking apron, the helicopter FATO and parking apron may be constructed under an SCC LDA permit.

The rotating beacon is proposed to be installed on the roof of Building 21. **Figure 6-8** depicts areas for new and/or reconfigured apron.

FIGURE 6-8 – POTENTIAL AREAS FOR NEW AND/OR RECONFIGURED APRON



Source: Jviation

Note: The Building Restriction Line at 307 feet from runway centerline is based on a 25-foot structure at the same elevation as runway centerline. 20-foot-high Hangar 7, abutting the BRL, clears the Part 77 Transition Surface and is proposed to remain in place.

6.7.3 Airport Support Facilities

Chapter 4 discusses the Airport's need for additional Jet A fuel storage capacity. One additional above-ground 10,000-gallon fuel storage tank would accommodate anticipated demand. The storage tank needs ground access for the wholesale fuel supply trucks, as well as by the airport's mobile fuelers. It could be located adjacent to the existing fuel storage area. To further relieve congestion on the existing main ramp, relocating the 100LL fuel tank to the future paved ramp on the east side of the runway should be considered.

All fuel tanks must meet current building and fire codes, as well as pertinent environmental regulations.

Additional vehicle parking is also recommended in Chapter 4. Approximately 50-84 vehicle parking spaces are projected to be needed within the planning period.

6.8 Pavement Management Recommendations

Appropriate pavement maintenance is critical to ensure the operational and financial sustainability of any airport. Because of the significant financial commitment required to maintain pavement, a long-term preservation and maintenance plan is critical. This plan includes annual inspections, regular crack sealing, fog sealing every four years, and ultimate pavement rehabilitation or reconstruction no sooner than 20 years after the pavement's last rehabilitation or reconstruction (the 20-year requirement is current FAA policy).

6.8.1 Equipment Replacement Schedule

The Airport has provided an equipment list and indicated the condition of each. At this time, no replacement date for equipment has been identified. Equipment will be replaced as needed.

TABLE 6-4 – AIRPORT EQUIPMENT LIST

Make/Model	Use	Condition
Chevrolet	Fuel truck (100LL)	Good
Ford 5000	Tractor	Average
Ford F350	Fuel truck (Jet A)	Excellent
Ford/F150	Flatbed utility truck	Good
Ford/F150	Utility with dump bed	Good
Ford/F150	Service pick-up (red)	Good
Ford/F150	Service pick-up (white)	Excellent
Ford/F150	Service pick-up (burgundy)	Excellent
Ford/Expedition	Courtesy SUV (black)	Excellent
Ford/Expedition	Expedition (White)	Excellent
Ford/Fusion	Courtesy car (burgundy)	Excellent
EZ-Go	Golf cart w/cover	Good
Yamaha	Golf Cart	Excellent
Tank	Trailer w/spray tank (500gallons)	Good
Hyster	Fork lift	Good
Lektro	Aircraft tug	Good
Lektro	Aircraft tug	Good
FOD Boss	Runway/Taxiway sweeper	Excellent
John Deere/JD1435	Riding mower	Excellent
John Deere/JD1435	Riding mower	Excellent
John Deere/JD3235C	Riding Mower	Excellent
Land Pride	3-deck mower	Good
Land Pride	3-deck mower	Good
John Deere	Gator	Excellent
Caterpillar/D4C	Dozer/Crawler	Good
Kubota	Backhoe	Good
Kubota	Front loader	Good
Kubota	Sweeper	Good

Make/Model	Use	Condition
Kubota	Post hole digger	Good
Kubota	Auger	Good
Kubota	Tractor-open cab	Excellent
Kubota	Tractor- closed cab	Excellent
Landa	Commercial pressure washer	Good
Woods	Brush	Good
Motorola	2-way Ground comm. Radios	Good
Icom-IC-Allo	unicom advisory base station + hand held radios	Good
HM-WN7071D12 4-Aircraft	Aircraft Transport Trailers	Good
Various	small tools, landscape + buildings maint. Equipment	Replace as needed
Various	Vending equipment	Replace as needed

Source: Harvey Field

6.9 Facility Requirements Analysis and Recommended Development Plan

During the master plan scoping process, key environmental issues were identified to be included in the development alternatives analysis so that the alternatives would avoid and minimize impacts on sensitive resources. The master plan alternatives analysis process analyzed the environmental impacts of all projects needed to fulfill the facility requirements identified in Chapter 4; a range of alternatives were analyzed from a purely aeronautical perspective. Based on a planning analysis, Alternative #4 was selected as the Preferred Alternative to meet existing and future demand at the Airport.

Additional analysis was undertaken to evaluate the effects of the alternatives to provide a technical basis to determine whether the Preferred Alternative was viable. The alternatives were subjected to a detailed evaluation of estimated environmental impacts and potential mitigation to determine if all elements of the Preferred Alternative were feasible, and may proceed into formal environmental review. The additional factors considered in the evaluation resulted in the following:

Evaluation of wetland impacts: Wetlands are anticipated to be impacted by the preferred location for the relocated Airport Way. It was determined that these impacts did not make the Preferred Alternative not viable. A total of three wetlands were identified; however, only one was delineated south of the Airport since improvements to this area are the focus of the master plan. Snohomish County requires buffers to be applied to the delineated boundary of these features. Any proposed direct impacts to wetlands would require permitting from local, state, and federal agencies. Impacts to associated buffers of these features would also be regulated by Snohomish County.

Evaluation of impacts to endangered species: A biological assessment summary completed on the Preferred Alternative indicated that the relocation of Airport Way and the new runway location were most likely to adversely affect threatened and endangered fish species. Compliance with Section 7 of the Endangered Species Act will be required, but was not determined to make the Preferred Alternative not viable. According to a preliminary review of Priority Habitat and Species Data available from Washington Department of Fish and Wildlife, there are no ESA-listed terrestrial species in the vicinity of Harvey Field, including the topographically low area south of Airport Way. However, multiple threatened or endangered fish species are documented in the Snohomish River and Batt Slough, including Chinook salmon, steelhead, and bull trout. Steelhead and bull trout rearing is documented in the Snohomish River, while the presence of all three species is documented or presumed in Batt Slough. A fish screen is present over the inlet to the culvert at the east end of the Wetland A ditch (beneath the railroad tracks). This screen functions as a complete migration barrier to any of the salmonid fish species mentioned above. Furthermore, water quality in the permanently inundated portions of the ditch is likely too poor to support salmonid fish species. Therefore, the presence of any salmonid fish species in Wetland A can likely be discounted. However, since the ditch associated with Wetland A drains directly to Batt Slough and the Snohomish River, any direct impacts to Wetland A or any areas draining directly to Wetland A, including stormwater impacts, would necessitate assessing the effects on the listed fish species above.

Hydraulic modeling: Based on this additional technical analysis, it was determined that Snohomish County Code (SCC) Density Fringe regulations in place to administer FEMA requirements proved to be a constraint on several projects in the Preferred Alternative. The fill limitations in the SCC Density Fringe designation for S43 property are discussed in detail in section **Alternative 1: Starting Point**. Because the proposed new runway and taxiway will exhaust the 2% fill coverage and 15% flow blockage limitations imposed by the Density Fringe designation, projects requiring fill (beyond the limited grading allowed under a Ground Disturbing Activity permit) must await either 1) compensating removal of previously approved fill, or 2) Snohomish County adoption of other appropriate flood mitigation restrictions, such as balanced cut and fill. This constraint rendered some of the projects in the Preferred Alternative not viable. **Table 6-5** presents the viability of the projects from the Preferred Alternative based on this analysis.

As part of the master plan process, WEST was tasked with running a numerical model to simulate the hydraulic effects of proposed land changes. Jviation provided WEST with a spreadsheet of potential earthwork quantities for a proposed condition in which Airport Way is moved to the south, embankment fill is placed to meet County criteria for roadway drainage, and S43's existing runway and taxiway were extended towards the south.

The results of WEST's models of the existing conditions and proposed conditions, when compared to two decimal places, showed no increases in flood elevations during the 100-year flood.

The biggest factor controlling water surface elevations in this area (including SA#2, SA#3, SA#9, and Marshlands) is the amount of water that would overtop the Snohomish River levees during a flood event. As the proposed project has no effect on water levels in the Snohomish River from Monroe to Snohomish, the amount of water entering SA#9, which includes Harvey Field and Airport Way, would be unchanged. Water can exit SA#9 through bridges to Marshlands, and the small loss of storage in SA#9 would be spread out over a much larger area that includes SA#2, SA#3, and Marshlands.

The model results show that the proposed project on its own would cause negligible changes in water surface elevations (0.00-foot rise) during the 1% annual exceedance (100-year) event. Provided the storage area remains hydraulically connected by openings in the roadway embankment, the project would work hydraulically.

This subset of projects from the recommended Preferred Alternative will have clear approaches, meet FAA airport design standards, meet existing demand, and provide needed services. Harvey Field is a unique facility that can accommodate skydiving, banner towing, hot air ballooning, and flight training. These projects will enable the Airport to meet FAA safety design standards for these and other demanding aeronautical activities—activities that cannot be readily served at other Puget Sound area airports.

TABLE 6-5 – VIABILITY ANALYSIS OF THE PREFERRED ALTERNATIVE

Required Facility	Proposed Alternative	Viability
Runway	A 2,400' x 75' runway meeting all FAA design standards.	Can meet all SCC Density Fringe requirements. The associated project to relocate Airport Way also meets all Density Fringe requirements.
Circle-to-land visual approach ≥ 1 mile visibility	Accommodating this procedure would require meeting a 250-foot primary surface and removing additional off-airport Part 77 obstructions.	Viable
Non-precision instrument approach ≥ 1 mile visibility	Accommodating this procedure would require meeting a 500-foot primary surface and removing additional off-airport Part 77 obstructions.	Fill would be required to meet the additional primary surface distance. This is not viable at this time due to Density Fringe. However, the Airport should continue to protect this surface.
Runway Strength	Runway constructed to meet the FAA recommended strength for 12,500-lb single-wheel gear.	Can meet all SCC Density Fringe requirements.
Obstruction Removal	RW 15/33 requires a clear approach. This requires removing penetrations to the 20:1 surface which are off-airport property.	A Circling-to-land visual ≥ 1 mi visibility approach is viable with owner agreement to mitigate penetrations.
Taxiway System	A parallel taxiway east of the proposed 2400' runway that meets FAA design standards.	Can meet all SCC Density Fringe requirements.
Airfield Lighting, Signage [/a/]	MIRLs, MITLs, PAPI	Viable
General Aviation/Transient Apron	Doubling paved parking to 70K sf needed for power in/power out parking to accommodate existing demand Constructing additional paved parking to 150K to accommodate future demand.	Existing & forecast demand will be partially addressed with some additional grass tie-downs. The entire amount of parking needed will not meet SCC Density Fringe; this element is viable if limited.
Helicopter Parking	Relocating helicopter parking (6) recommended.	This does not meet SCC Density Fringe and is not viable.
Aircraft Hangar Storage	Does not meet current (20 on waiting list) or forecast demand.	Density Fringe. Constructing efficient hangar storage may be feasible with demolition of existing, inefficient structures. As existing hangars and taxilanes come to the end of their useful life, they must meet FAA design standards. This may limit the number of aircraft parking spaces/storage that can be built.
Construct Student Dorms	Housing for 20 additional flight school students.	Additional housing doesn't meet SCC Density Fringe – not viable
Construct 10,000-square-foot Aircraft Maintenance Hangar	Inefficient and insufficient capacity.	Additional capacity doesn't meet SCC Density Fringe – not viable

Required Facility	Proposed Alternative	Viability
Remodel and enlarge the airport office building and the flight school*	Inefficient and insufficient capacity.	Additional capacity doesn't meet SCC Density Fringe
Vehicle Parking & Airport Access	Does not meet current or forecast demand for paved parking.	Density Fringe limits paving; existing gravel parking to remain.
Fuel Storage Requirements	Site consistent with solution to de-conflict fueling and helicopter operations.	The associated apron project is impacted by Density Fringe – not viable.
Snow Removal Equipment	Not available on site	Viable

Source: Jviation
Notes: [/a/]LIRL: low intensity runway lighting; MIRL: medium intensity runway lighting; PAPI: precision approach path indicators. Consideration of Density Fringe limitations is captured by the term "Density Fringe."
*This project is not within the airport boundary.

6.10 Subset of Projects from S43's Recommended Alternative

The basic elements of the subset of projects from the Preferred Alternative demolishes existing primary Runway 15L/33R (paved) and eliminates the existing additional Runway 15R/33L (turf) in order to construct a new 2,400-foot-by-75-foot Runway 15/33 to meet Runway Design Code B-II standards if funding can be obtained. Key features are summarized below.

Construct New Runway 15/33

- The runway will be constructed to 2,400 feet located 240 feet to the west of the existing partial parallel taxiway.
- The future Runway Protection Zone (RPZ) for Runway 33 end will be contained entirely on airport property with no incompatible land uses; the future RPZ for Runway 15 end will be partially contained on airport property. It will include a railroad, but this incompatible land use exists in the current RPZ and isn't viable to move.
- The runway will be constructed to 75 feet to meet ADG II standards.
- The runway will have medium-intensity runway lights (MIRLs) installed, associated markings and airfield signage, and precision approach path indicator lights (PAPIs) at both runway ends. The future MIRLs will be pilot-controlled via the Unicom (CTAF) radio frequency (123.0 MHz).
- Airspace protections and building setbacks required to accommodate a circle-to-land visual approach with ≥ 1-mile approach visibility minimums on Runway 15/33 will be developed.
- Off-airport penetrations (trees) to the 20:1 approach surfaces of both runway end will be removed.
- The existing RW 15L/33R (paved) will be removed as part of the new runway project.

Relocate Airport Way

- Remove/vacate a section of existing Airport Way, as shown on **Figure 6-5**.
- Construct new alignment of Airport Way beginning south of 99 Avenue SE on County-owned ROW and continuing south on Airport property as shown on **Figure 6-6**. The new

road will have a preferred perpendicular intersection with Airport Way and Springhetti Road.

Parallel Taxiway

- The new parallel taxiway will be constructed to 2,400 feet located 240 feet east of the new RW 15/33 with three 90-degree exit taxiways connected to the runway.
- The taxiway will have blue medium-intensity taxiway lights (MITLs) or lower-cost blue reflector poles installed.

Landside

- A new tie-down apron will be constructed with approximately 23 airplane tie-downs east of the new parallel taxiway.
- An additional smaller tie-down apron will be constructed to the north east of the new parallel taxiway accommodating approximately eight new airplane tie-downs. Existing T-hangar #7 will be demolished to accommodate this apron with tie-downs.
- A new Hangar #64 will be constructed east of the larger new tie-down apron. This hangar will accommodate approximately 18 to 20 airplane parking spaces.
- Taxilanes will meet ADG II configuration.

6.11 Environmental Review of Near-Term Projects

The environmental review is not intended to fulfill the requirements of environmental review required by National Environmental Policy Act (NEPA) or provide a definitive determination of what level of environmental review pursuant to NEPA will be required. The purpose of this environmental summary is to inform the community, airport sponsor, and regulatory agencies of the importance of minimizing the environmental impacts of proposed airport development and to provide a general indication of the likely need for further investigation.

Table 6-6 provides an indication of the likely need for further environmental analysis to determine the exact impacts, if any, that are associated with the proposed improvements. At the appropriate time, the FAA would decide whether and to what extent any additional investigation would be required. Appropriate environmental documentation in accordance with *FAA Order 5050.4B, NEPA Instructions for Airport Actions* and *FAA Order 1050.1F, Environmental Impacts: Policies and Procedures* is required to be completed prior to commencing with project actions.

TABLE 6-6 – REVIEW OF ENVIRONMENTAL RESOURCE CATEGORIES AT HARVEY FIELD AIRPORT

FAA Resource Category	FAA Threshold of Significance	Potential Concerns
Air Quality, including Greenhouse Gases (GHGs) and Climate	For air quality: Potentially significant air quality impacts associated with an FAA project or action would be demonstrated by the project or action exceeding one or more of the National Ambient Air Quality Standards (NAAQS) for any of the time periods analyzed. For GHGs and climate: Federal standards for aviation-related GHG emissions are still being developed.	The Airport is located in Snohomish County, which is designated as being in attainment status for all parts of the county for all criteria. An air quality analysis will be required as part of future NEPA review.
Coastal Resources	No specific thresholds have been established; however, if a local Coastal Development Permit cannot be issued due to a lack of consistency with a local coastal program, the FAA typically will not make a Federal coastal consistency determination either	Harvey Field is located with Washington Coastal Zone Management program. Any federal activities that affect land use, water use or natural resources of the coastal zone must comply with Coastal Zone Management Plan. As such, the proposed projects will need to be reviewed under Shoreline Management Act and State Environmental Policy Act (SEPA).
Compatible Land Use	Compatible land use evaluations for airports must consider the land uses in the vicinity of an airport to ensure those uses do not adversely affect safe aircraft operations. In addition, if an airport action would result in impacts exceeding FAA thresholds of significance which have land use ramifications, such as disruption of communities, relocation of businesses or residences, and induced socioeconomic impacts, the effects of the land use impacts shall be discussed. Local land use policy inconsistencies may also indicate land use compatibility issues.	Most of the recommended development is planned for developed areas of the Airport and would not result in incompatibilities with adjacent off-airport land uses. A noise analysis was provided that showed that the vast majority of the 65 dnl was within property owned by the Harveys. Any incompatible land use etc will need to be reviewed as part of a subsequent NEPA review.
Construction Impacts	Construction impacts alone are rarely significant pursuant to NEPA. See significance threshold(s) for the resource(s) that construction could affect.	FAA-required best management practices (see Advisory Circular (AC) 150/5370-10G, Standards for Specifying Construction of Airports, Item P- 156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control), as well as State and local permits, would be implemented during construction projects at the Airport, as necessary
Department of Transportation (DOT) Act: Section 4(f)	When the action's physical use would be more than minimal or its constructive use substantially impairs the Section 4(f) property. In either case, mitigation is not enough to sustain the resource's designated use.	No direct impacts or substantial impairment (constructive use) of Section 4(f) resources were found as a part of the masterplan process. This will be reviewed as a part of any future NEPA review.

FAA Resource Category	FAA Threshold of Significance	Potential Concerns
Farmland	When the combined score on Form AD1006 ranges between 200 and 260. Impact severity increases as the total score approaches 260. NOTE: Form AD-1006 is used by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) to assess impacts under the Farmland Protection Policy Act (FPPA).	Most of the Airport is Urban or Built-up Land and would not be subject to the FPPA. However, as shown on Figure 5-4, there are undeveloped area on the Airport that are rated Farmland of Statewide Importance by the Web Soil Survey. Future development in this area of the Airport is likely to require an analysis of impacts to farmlands by the NRCS using Form AD-1006.
Fish, Wildlife, and Plants	For federally-listed species: When the United States Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service determines a proposed action would likely jeopardize a species' continued existence or destroy or adversely affect a species' critical habitat.	There are no ESA-listed terrestrial species in the vicinity of Harvey Field. However, multiple threatened or endangered fish species are documented in the Snohomish River and Batt Slough, including Chinook salmon, steelhead, and bull trout. Appendix E- Biological Assessment Summary indicates that the project components most likely to adversely affect listed fish species relate to stormwater generated from the new location of the Airport Way connector and extended runway. As such a project-specific evaluation under Section 7 of the Endangered Species Act (ESA) will be required.
Floodplains	Executive Order 11988, Floodplain Management directs federal agencies to "avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative"	Harvey Field lies entirely within a flood water "storage area", and not within any area where a flooding Snohomish River might significantly flow. Appendix shows the preferred alternative runway, parallel taxiway and relocated Airport Way would not cause any increase to the BFE. The proposed project does not increase the amount of floodwater that would otherwise enter the storage area when the Snohomish River experiences a major flood. Further coordination with Snohomish County will be required during the NEPA process to ensure floodplain and floodway compliance
Hazardous Materials, Pollution Prevention, and Solid Waste	For hazardous materials: When an action involves a property on or eligible for the National Priority List (NPL). Uncontaminated properties within an NPL site's boundary do not always trigger this significance threshold. For pollution prevention: See significance thresholds for water quality. For solid waste: There are no solid waste thresholds of significance established.	No NPL sites are located near Harvey Field. Appendix G provides guidance on ways to reduce waste and improve recycling and reuse at the Airport.

FAA Resource Category	FAA Threshold of Significance	Potential Concerns
Historic, Architectural, Archaeological, and Cultural Resources	When an action adversely affects a protected property and the responsible FAA official determines that information from the State and/or tribal Historic Preservation Officer addressing alternatives to avoid adverse effects and mitigation warrants further study.	Any areas at the Airport that would be disturbed by new development should be surveyed for cultural resources prior to ground disturbance and monitored during construction unless previously disturbed to the point that artifacts could no longer be intact. In the event that unknown resources are found during construction, all applicable State and Federal laws regarding such finds must be followed. Based on the historical inventory completed as part of this AMP, there are no historical resources that would be adversely affected by the AMP. However, A cultural resources survey and Section 106 and Government to Government consultation will need to be undertaken prior to any development.
Light Emissions and Visual Effect	For light emissions: When an action's light emissions create annoyance to interfere with normal activities. For visual effects: When consultation with Federal, State, or local agencies, tribes, or the public shows these effects contrast with existing environments and the agencies state the effect is objectionable.	For light emissions: All new lighting associated with the proposed AMP would remain on the airfield and other developed portions of the Airport. The relocated Airport Way could also change the visual appearance of the Airport from off-airport areas. All other proposed improvements would occur on airport property and would not change the overall appearance of the Airport from off- airport areas.
Natural Resources and Energy	When an action's construction, operation, or maintenance would cause demands that would exceed available or future (project year) natural resource or energy supplies	Planned development projects at the Airport are not anticipated to result in a demand for natural resources or energy consumption beyond what is available by service providers.
Noise	For most areas: When an action, compared to the No Action alternative for the same timeframe, would cause noise sensitive areas located at or above the 65 decibel (dB) Day-Night Equivalent Level (DNL) to experience a noise increase of at least DNL 1.5 dB. An increase from DNL 63.5 dB to DNL 65 dB is a significant impact.	The relocated runway and forecasted increase in operations results in the 65DNL extending slighting beyond the limits of airport property to the north and south. It is estimated that approximately six residences will be located within the 2034 65-69 DNL contour limits. A Noise analysis was performed (Appendix H). Subsequent noise analysis will be provided with any subsequent NEPA review.
Secondary (Induced) Impacts	Induced impacts will not normally be significant except where there are also significant impacts in other categories, especially noise, land use, or direct social impacts	In general, the recommended projects are being designed/planned to accommodate forecast aviation growth rather than proposing development that would induce growth at the Airport.

FAA Resource Category	FAA Threshold of Significance	Potential Concerns
Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks	For socioeconomic issues: When an action would cause: – Extensive relocation, but sufficient replacement housing is unavailable; – Extensive relocation of community businesses that would cause severe economic hardship for affected communities; – Disruption of local traffic patterns that substantially reduce the Levels of Service of roads serving the airport and its surrounding communities; – A substantial loss in community tax base. For environmental justice issues: When an action would cause disproportionately high and adverse human health or environmental effects on minority and low-income populations, a significant impact may occur. For children's health & safety risks: An action causing disproportionate health and safety risks to children may indicate a significant impact.	As a part of the masterplan, no impacted populations were found to be are located within the boundaries of the Harvey Field study area. Socioeconomic impacts, environmental justice and children's environmental health and safety risks will be provided as part of any subsequent NEPA review.
Water Quality	When an action would not meet water quality standards. Potential difficulty in obtaining a permit or authorization may indicate a significant impact.	Harvey Field is located within the Snohomish Watershed. The Airport does not currently have any stormwater permits. New development will comply with water quality standards.
Wetlands, jurisdictional or non-jurisdictional	When an action would: – Adversely affect a wetland's function to protect the quality or quantity of a municipal water supply, including sole source aquifers and a potable water aquifer. – Substantially alter the hydrology needed to sustain the affected wetland's values and functions or those of a wetland to which it is connected. – Substantially reduce the affected wetland's ability to retain floodwaters or storm runoff, thereby threatening public health, safety, or welfare. • Adversely affect the maintenance of natural systems supporting wildlife and fish habitat or economically-important timber, food, or fiber resources of the affected or surrounding wetlands. – Promote development that causes any of the above impacts. – Be inconsistent with applicable State wetland strategies	Wetlands were delineated as part of the master plan. Figure 5-12 identifies the 2 wetland areas. No wetlands are anticipated to be impacted by the preferred location for the relocated Airport Way. Future development will need to consider p otential impacts to wetland resources at the time that a specific site or grading plan is available. Compliance with Section 404 of the Clean Water Act will be required as well as approval by the Corps of Engineers and the Department of Ecology will be required as part of a subsequent NEPA review.
Wild and Scenic Rivers	No specific thresholds have been established	None. The closest wild and scenic river designated segment is Skagit River.

Source: Jviation

[i] Runway performance data sources:

- TBM-700: Daher, *TBM 700 Pilot's Information Manual*, Section 5, Table 5.8
- Quest Kodiak: Quest Aircraft Company, *Kodiak 100 Series Aircraft, Airplane Information Manual*, Section 5, Table 5-7, and Business & Commercial Aviation, *Purchase & Planning Handbook*, May 2016, pg. 88
- Beechcraft King Air 250: Textron Aviation, *Beech King Air 250 Information Brochure*, pg. 15, and Business & Commercial Aviation, *Purchase & Planning Handbook*, May 2016, pg. 91
- De Havilland DHC- 2 Beaver: De Havilland Aircraft of Canada, Ltd., *DHC-2 Beaver Flight Manual*, 03/31/56, Appendix Operating Data Charts, Take-Off Distance Landplane, Landing Distance Landplane
- De Havilland DHC-6 Twin Otter: De Havilland Aircraft of Canada, Ltd., *DHC-6-Series 300 Twin Otter Flight Manual*, Section 4, Figure 4-8., Take-Off Total Distance To Clear 50' Landplane, Figure 4-15 Landing Total Distance from 50' Landplane
- Cessna Caravan: Cessna Aircraft Company, *Information Manual Grand Caravan Model 208B G1000*, Section 5, Performance, Without Cargo Pod and Business & Commercial Aviation, *Purchase & Planning Handbook*, May 2016, pg. 88
- Cessna Caravan EX C-280B: Cessna Aircraft Company, *Information Manual Grand Caravan EX Model 208B 875 SHP G1000*, Section 5, Performance, Without Cargo Pod, and Business & Commercial Aviation, *Purchase & Planning Handbook*, May 2016, pg. 88

7.0 CAPITAL IMPROVEMENT & AIRPORT FINANCIAL IMPLEMENTATION PLAN

7.1 Introduction and Background

Airport capital improvement plans (CIP) present a number of items:

- The list of capital improvement projects that are proposed to be accomplished
- The timing and sequence of the proposed projects
- The estimated cost for each project
- The potential funding sources for each project

The purpose of this chapter is to present the projects identified in the Airport Capital Improvement Program (ACIP) that have been developed and assembled based on the analyses conducted in the Facility Requirements and Development Alternatives chapters (Chapters Four and Six). The ACIP projects are summarized in **Table 7-1** later in the chapter. The ACIP is organized in short-, intermediate- and long-term periods that reflect both project prioritization and financial capabilities. Several factors were considered in determining project prioritization, including safety, forecast demand, the need to maintain/replace existing airfield facilities, and financial capabilities of both the Port and FAA to support the development program based on existing funding mechanisms.

The Harvey Field (Harvey Field or the Airport) Airport Master Plan recommends a number of airport improvement projects in order to meet projected demand and to comply with appropriate FAA design standards. Because Harvey Field is a privately-owned public-use airport, the Master Plan and the recommended improvements focused on the property owned by the Airport.

Although airport land and buildings are owned by Kandace Harvey, an individual, Harvey Field is a public-use reliever airport and is included in the FAA's National Plan of Integrated Airport Systems (NPIAS), as well as Washington DOT's Aviation System Plan. As such, Ms. Harvey is signatory to grants received from both FAA and WSDOT Aviation and is financially responsible for both local match and any project costs ineligible for or not otherwise covered by grant funds.

FAA Grant Assurances: Two key AIP grant assurances, as part of AIP planning grant 3-53-0070-003-2014 dated September 17, 2014, are described as follows:

- The portion of the Airport dedicated for airport use, as shown on the Property Map (**Appendix K**), must not be sold, exchanged, the title encumbered, or its use changed to non-airport use without the written consent of the FAA.
- The portion of the Airport NOT dedicated to airport use but financially contributing to the overall viability of the Airport, as shown on the Property Map, must continue to support the operation of the Airport for a period of 10 years from the date of the grant, i.e. September 17, 2014. At such time as FAA may provide funding under the AIP for development projects identified in this Master Plan, grant assurances will apply, for a minimum of 10 years, to the Airport's operational facilities and associated land, as identified on the Airport's Property

Map. Other property owned by Ms. Harvey is not and will not be considered airport property, for the purposes of grant assurances.

7.2 Proposed Project Implementation Plan

Implementing the recommended projects will be dependent on a number of factors including, among others, practical sequencing of contiguous and/or related facilities, availability of federal, state, and local funding, completing required environmental review process, and the actual aviation activity increases that warrant additional capacity.[1] As a result, the Airport will routinely review and update their CIP in coordination with WSDOT Aviation and the FAA.

There are three key factors that must be fully considered in the overall implementation process:

1. **Project priority.** The Owner, WSDOT Aviation, and FAA priorities shape the order in which development projects are funded. Generally speaking, the projects most critical to complying with safety and design standards are funded first (e.g. airfield projects). Projects with lower priority ranking may be funded with Owner funds or, if FAA funds are sought, after higher priority projects are funded. Because FAA funding does not cover all requests for funding, lower ranked projects may wait for an extended period of time before receiving FAA grants.
2. **Practical construction considerations**. For example, new runway construction must precede new taxiway construction in order to keep the Airport in operation while the new runway is being built.
3. **Time required to design and construct each project**, which includes:
    a. Practical project sequencing considerations
    b. Scheduling the necessary funding from various sources
    c. Environmental review and approval process
    d. Seasonal weather that limits the time period available to implement the development program.

7.3 Scheduling Considerations for Recommended Airport Projects

7.3.1 Airside Development

Near-term projects:

The near-term program contains work items of the highest priority. Priority items include improvements related to safety. Because of their priority, these items will need to be incorporated into the FAA's Airport Capital Improvement Plan (ACIP) managed by the FAA Seattle Airport District Office and the State Capital Improvement Program (SCIP) managed by WSDOT Aviation. To assist with this process, the near-term projects are scheduled in order of priority for the near-term, mid-, and long-term planning periods.

[1] See **Figure 6-5, Chapter 6**.

Near-Term projects:

- Prepare documents fulfilling the NEPA and SEPA requirements, in support of federal, state, and county project approvals.
- Construct New Runway 15/33, 2400 feet by 75 feet.
  - Note: The new runway centerline will be 240 feet west of the existing partial parallel taxiway and 150 feet west of existing Runway 15L/33R centerline. New connecting taxiways to tie to existing taxiway system. The new runway will be outside of the existing runway's Runway Safety Area (RSA), allowing for continued operations while the new runway is constructed. Early spring, late fall and nighttime construction is planned, in order to minimize impact to airport operations. Costs include runway edge lights, REIL, guidance signs.
- Construct new parallel taxiway, 2,400 feet by 25 feet.
  - Note: The new parallel taxiway will be on the same alignment as the existing partial parallel taxiway. Taxiway construction will be planned to minimize interruptions to airport operations. Costs include taxiway reflective markers, guidance signs, PAPI.
- Complete Airport Rotating Beacon Installation
  - Note: This project was previously-approved by the FAA.
- Pavement Maintenance/Limited Rehabilitation of Existing Primary Runway 15L/33R: excavate failed areas, backfill with select material, thin overlay, re-stripe
  - Note: Existing 15L/33R runway must last until new runway 15/33 is built. The proposal below to construct the new runway in 2024 is a very best case scenario, given the amount of funding required from owner, WSDOT, and FAA. Given the condition of the existing runway, pavement rehabilitation sufficient to keep the existing runway operational for another five to seven years is imperative.
- Pave East (SE) Transient Tie Down Apron, Phase 1: approximately 31,000 square feet
  - Note: Phase 1 will be configured to avoid obstructing existing taxi routes.
- Obstruction removal (trees) Projects 3 & 4 South
  - Note: Parcels 28052400101800 and 28052400101800. Project 3 completed with local funds. Project 4 is funded.
- Replace Perimeter Security Fence and Gates – Phase 1
  - Note: Main entrance to 99th Ave/Airport Way Corner.
- Construct Westerly Helipads
  - Note: Construct four helicopter parking pads to eliminate congestion at the intersection of Taxiway Alpha, Bravo and the skydiver drop zone.
- Pavement Maintenance - Taxiway Alpha and Taxilanes
  - Note: Crack seal, seal coat, restripe
- Construct 15 to 20 hangar units.
- Replace Perimeter Security Fence and Gates – Phase 2

- Note: 99th Avenue to 10530 Airport Way.
- Storm System/Airport Drainage Improvement
- Design new runway, parallel taxiway and new Airport Way along proposed route.
  - Note: The Airport coordinated extensively with both the Snohomish County Planning and Development Services and Snohomish County Public Works offices in planning and design for Airport Way relocation. This close collaboration will continue through the NEPA and SEPA processes, and through final design and construction.
- Replace Perimeter Security Fencing and Gates – Phase 3
  - Note: 10530 Airport North to Perimeter Access Road
- Obstruction removal (trees on Hwy 9 WSDOT right of way)

- Obstruction removal (trees and power line poles)
  - Note: Puget Sound Energy scheduling will factor into timing for power line pole relocation.
- Construct Airport Way
  - Note: Construction expected to extend over two years, for fill settlement.
- Replace Perimeter Security Fencing and Gates – Phase 4
  - Note: NW Perimeter Access Road East to Main Airport Parking Lot

Mid and Long term projects (6-20 years):

- Automated Weather Reporting Station
  - Note: Purchase and install automated weather reporting station - AWOS III PY System
- Pave Northeast (100 feet by 200 feet) Transient Tie Down Apron
- Pave East (SE) Transient Tie Down Apron – Phase 2 (approximately 60,000 square feet)
- Construct West (SW) Tiedown Ramp – Phase 1
  - Note: Pave Southwest Ramp – currently grass – 300 feet by 130 feet
- Construct West (SW) Tiedown Ramp – Phase 2 (approximately 42,000 square feet of total 84,000 square feet planned)
  - Note: Timing and scope for completing apron west of the new runway/taxiway will be driven by demand.
- Runway Maintenance – crack seal, sealcoat, repaint.
- Taxiway Maintenance – crack seal, sealcoat, repaint.
- Apron Maintenance – crack seal, sealcoat, repaint.
  - Note: SE ramp
- Apron Maintenance – crack seal, sealcoat, repaint
  - Note: NE ramp and main ramp with compass rose
- Apron Maintenance - crack seal, sealcoat, repaint.
  - Note: West ramp

- Rehabilitate/Reconstruct Runway as needed
- Rehabilitate/Reconstruct Taxiways as needed
- Rehabilitate/Reconstruct Aprons as needed

7.3.2 Landside Development

Near term projects:

- Construct Student Dorms to house maximum of 20 students
- Construct 10,000-square-foot Aircraft Maintenance Hangar
- Remodel and enlarge the airport office building and the flight school

Note: Landside development is covered by Owner funds, as these projects are not eligible for WSDOT or FAA funding. These projects are not part of the obligated airport property.

7.4 Funding Options for Capital Improvement Plan

Harvey Field prepares and updates their CIP on a regular basis. Once it is adopted, the Master Plan CIP will form the basis for future updates.

Even for capital improvements that are eligible for FAA and state participation, the airport sponsor must provide the local share of project costs. Sponsors can use revenue generated by rates and charges imposed on airport users, building and land leases, as well as general aviation entitlement grants. The FAA issues $150,000 in non-primary entitlement (NPE) grants to general aviation airports annually, and airports can "save" four years of NPE grants (for a total of $600,000) before it must be spent on FAA-eligible capital improvements. For capital improvements not covered by NPE grants, the Airport can apply for FAA discretionary grants. However, Harvey Field competes with other general aviation airports for discretionary grants, and there are typically more requests for FAA funding in each fiscal year than discretionary money available. As a result, the projects with highest priority ranking are funded first, and lower priority ranked projects are funded only if money is available.

FAA and WSDOT Funding Requirements: Harvey Field is a designated reliever airport to Seattle-Tacoma International Airport (Sea-Tac), providing general aviation pilots an alternative airport and minimizing air traffic congestion in the air space around Sea-Tac. As a designated reliever airport, Harvey Field is included in both the federal and state airport system plans and is eligible for both FAA and WSDOT Aviation airport development grants. Both the federal and state grant programs are funded strictly with aviation user fees and aviation user taxes.

WSDOT Aviation has supported Harvey Field through the years with several grants to help maintain runway and taxiway pavement and clear runway approach obstructions. FAA has supported the Airport with grants to prepare planning documents, such as this Master Plan. Since the feasibility of the Airport's proposed Airport Way and runway projects is predicated on future FAA funding, FAA funding requirements and priorities are summarized below and in **Figure 7-1** and **Figure 7-2**.

In general, airport facilities that are eligible for funding must be available for public use, without prior permission, and meet applicable FAA airport design standards. Projects that are eligible for state and federal funding are subject to priority ranking as well as funding availability.

The Washington State Legislature and the U.S. Congress pass laws authorizing state and federal airport aid programs, and amend those programs from time to time. The FAA's current AIP expired at the end of FY 2017 (September 30, 2017). The U.S. Congress is presently studying the reauthorization of the FAA's AIP, and it is possible that FAA funding levels could change, project eligibility may change, and FAA's priority ranking system may also change depending on new legislation. As a result, Harvey Field's CIP will need to be reviewed and updated as the FAA and state airport improvement programs are reauthorized or modified.

FIGURE 7-1 – FAA BASIC PROJECT JUSTIFICATION TESTS

The three basic tests to determine if a project is justified are…
a. **The Project Advances an AIP Policy.** The ADO must verify that the project advances at least one of the AIP policies contained in 49 USC § 47101. The basic goals and objectives in these policies include airport safety, airport security, airport capacity, meeting an FAA standard, preserving airport infrastructure through reconstruction or rehabilitation, protecting and enhancing the environment, minimizing aircraft noise impacts, and airport planning. AIP funds must not be used for a project that does not specifically advance one of the AIP policies.
b. **There is an Actual Need.** Per FAA policy, the ADO must determine if there is an actual need for the project at the airport within the next five years (per the definition near-term development per the current version of Advisory Circular 150/5070-6, Airport Master Plans). This includes all subcomponents of the project.
c. **The Project Scope is Appropriate**. The ADO must determine that only the elements that are required to obtain the full benefit of the project are included in the project scope. Any elements that do not meet these criteria must stand on their own separate merit and justification. The current version of FAA Order 5100.39, Airports Capital Improvement Plan, discusses this concept in further detail in the discussions on overall development objective.

Source: FAA Order 5100.38D, *Airport Improvement Program Handbook*, 09/30/14, Chapter. 3, Section 3

The following requirements must also be met for FAA to consider a project for AIP funding:

- The project sponsorship requirements have been met.
- The project is reasonably consistent with the plans of planning agencies for the development of the area in which the airport is located.
- Sufficient funds are available for the portion of the project not paid for by the Federal Government.
- The project will be completed without undue delay.
- The airport location is included in the current version of the NPIAS.
- The project involves more than $25,000 in AIP funds.
- The project is depicted on a current airport layout plan approved by FAA.

FIGURE 7-2 – EXAMPLES OF PROJECTS NOT MEETING THE BASIC JUSTIFICATION TESTS

For the following situation…	Is not justified because…
a. A sponsor has a runway shown on their ALP and would like to build it to increase capacity. However, the airport already has adequate capacity and will continue to have adequate capacity in the foreseeable future.	This project does not advance an AIP policy. The actual need does not exist.
b. A sponsor would like to build a runway extension to attract a new class of aircraft or for marketing purposes. In this case, the need is speculative and not based on documented future need.	The actual need does not exist.
c. A sponsor would like include dorm rooms and day rooms in an ARFF building expansion for an airport with a class of certification that does not require 24/7 ARFF personnel.	This project scope is not appropriate.
d. A sponsor would like to replace its existing asphalt pavement with concrete even though the pavement section has existing useful life.	The actual need does not exist.

Source: FAA Order 5100.38D, *Airport Improvement Program Handbook*, 09/30/14, Chp. 3, Section 3

7.5 Project Cost Estimates and Funding Sources

Jviation prepared cost estimates for each of the recommended projects shown on the Airport Layout Plan (ALP). The planning-level cost estimate worksheets are shown in **Appendix M, Cost Estimates**. The projects and cost estimates are shown below. The cost estimates are based on existing information—no survey, soils or pavement testing, or other engineering evaluation was performed as part of preparing these estimates. In addition, it is anticipated that unit costs and, project funding sources will change over time, as noted above. As a result, the cost estimates will need to be revised and updated with site-specific engineering data (survey, soils, utilities, etc.), and to reflect current prices at the time the project is to be constructed. The cost estimates in **Table 7-1** are not to be used for project specific engineering, design, or bid purposes.

TABLE 7-1 - RECOMMENDED PROJECTS & FUNDING

Time Frame/Project	Project Category & Timing Considerations	Total Project Cost
Near Term 1 - 5 years		
Obstruction Removal - RPZ	Standards - Maintain Safe Operations	$25,000
Obstruction Removal - Projects 1&2 North	Standards - Maintain Safe Operations	$31,772
Airport Signage	Standards	$12,500
Subtotal		
Complete Beacon Installation	Standards - Complete Ongoing Project	Funded
Limited Runway Rehab	Rehab - Preserve Failing Pavement	$167,500
Pave East (SE) Ramp	Capacity	$73,635
Obstruction Removal - Projects 3&4 South	Standards - Maintain Safe Operations	$42,545
Security Fencing - Phase 1	Standards - Prevent Airport Intrusions	$56,000
Construct West Helipads	Capacity - Reduce Terminal Area Congestion	$50,000
Subtotal		
NEPA Documentation	Environment - Pre-Req to Airport Way & Rwy Construction	$1.2 million
Pavement Maintenance – Taxiway Alpha & Taxilanes	Rehab - Preserve Failing Pavement	$94,230
Construct 15-20 Hangar Units	Capacity	$350,000
Security Fencing – Phase 2	Standards - Prevent Airport Intrusions	$56,000
Storm Drainage System Improvement	Standards	$38,900
Subtotal		
Design Runway/Taxiways/Airport Way	Standards	$768,000
Security Fencing – Phase 3	Security - Prevent Airport Intrusions	$56,000
Obstruction Removal (tree) on WSDOT ROW	Standards - Maintain Safe Operations	$200,000
Obstruction Removal (tree) & PSE Powerline Relocation	Standards - Maintain Safe Operations	$68,800
Subtotal		
Construct Airport Way	Standards - Pre-Req to Standard Rwy Construction	$3.9 million
Security Fencing – Phase 4	Security - Prevent Airport Intrusions	$35,000
Subtotal		
AWOS	Standards	$212,000
Subtotal		
Mid Term 6 – 10 years		
Construct New Runway & REIL	Standards	$3.9 million
Subtotal		
Construct Parallel Taxiway & PAPI	Standards	$2.2 million
Pave NE Ramp	Capacity	$48,200
Pave East (SE) Ramp – Phase 2	Capacity	$75,000
Subtotal		
Long Term 11 years +		
Pave West (SW) Apron – Phase 1	Capacity	$93,850

Time Frame/Project	Project Category & Timing Considerations	Total Project Cost
Subtotal		
Pave West (SW) Apron – Phase 2	Capacity	$108,000
Subtotal		
Runway Maintenance	Rehab	$300,000
Taxiway Maintenance	Rehab	$85,000
Apron Maintenance (East-Southeast)	Rehab	$65,000
Apron Maintenance (Northeast)	Rehab	$55,000
Apron Maintenance (West)	Rehab	$630,000
Total		
Rehabilitate Runway		$1.0 million
Rehabilitate Taxiways		$400,000
Rehabilitate Aprons		$3.8 million
Total		

Source: Jviation
Note: Existing data was used in cost estimates. No survey, soils, pavement condition, or other engineering data was used in developing cost estimates. Unit prices are subject to change. These cost estimates are not to be used for design, construction, or bid purposes. Costs across FAA, WSDOT and Owner may not add due to rounding.