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**

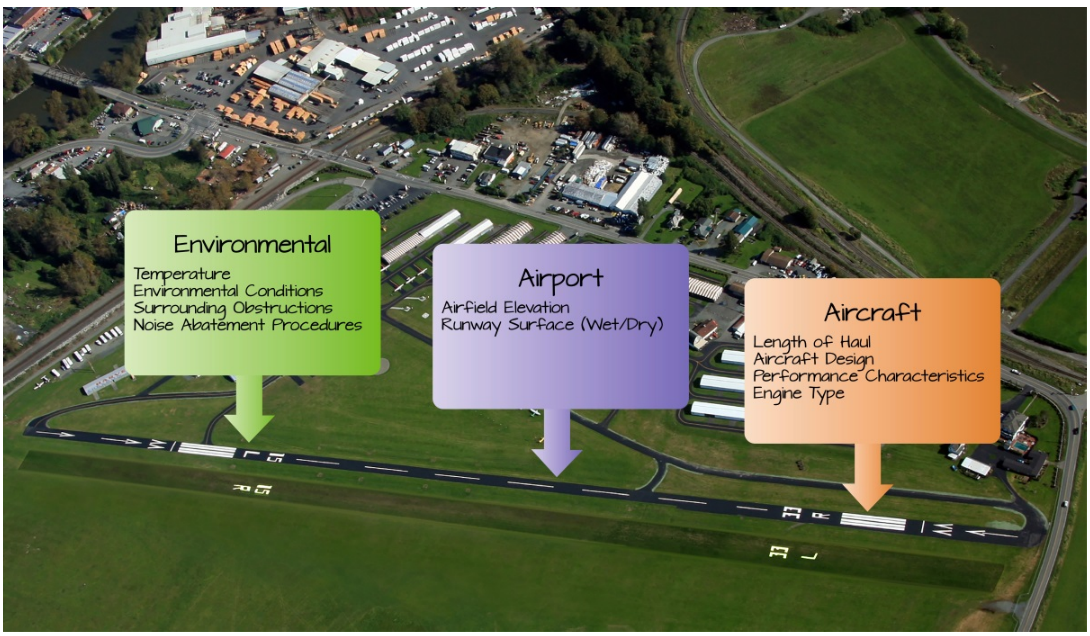
recommended runway length that is appropriate to serve the Airport's existing and future critical aircraft operations.

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

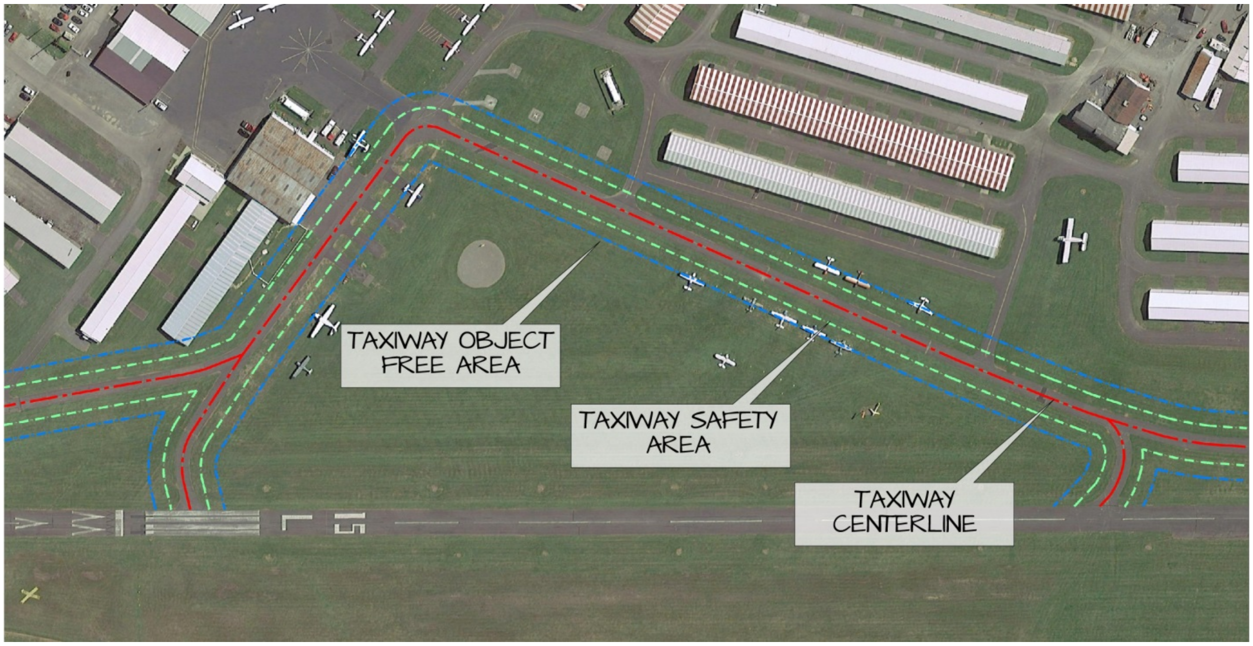
Criteria	ADG II TDG 1A Taxiway[a]	S43 Existing Taxiway & Connectors[a]
Width	25	16
Taxiway Safety Area Width	79	79
Taxiway Object Free Area Width	131	Non-standard[b]
Taxiway Centerline to – Runway Centerline – Fixed or Moveable Object	 240 65.5	 85-91 65.5
Taxiway Wing Tip Clearance	26	26
Taxiway Shoulder 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.

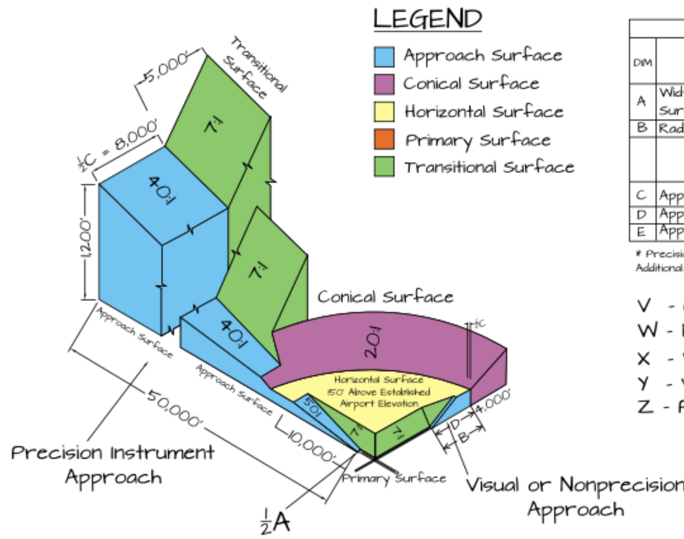
The following improvements are recommended:

- *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



DIM	Item	Dimensional Standards (Feet)					
		Visual Runway		Nonprecision Instrument Runway			Z
		V	W	V	W X	W Y	
A	Width of Primary Surface & Approach Surface Width at Inner End	250	500	500	500	1,000	1,000
B	Radius of Horizontal Surface	5,000	5,000	5,000	10,000	10,000	10,000
		Visual Runway		Nonprecision Instrument Runway			Z
		V	W	V	W X	W Y	
C	Approach Surface Width at End	1,250	1,500	2,000	3,500	4,000	16,000
D	Approach Surface Length	5,000	5,000	5,000	10,000	10,000	*
E	Approach Slope	20:1	20:1	20:1	34:1	34:1	*

* Precision Instrument Approach Slope is 50:1 for Inner 10,000, and 40:1 for an Additional 40,000'

V - Utility Runways
W - Runways Larger than Utility
X - Visibility Minimums Greater than ¾ Mile
Y - Visibility Minimum As Low As ¾ Mile
Z - Precision Instrument Approach Slope

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