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

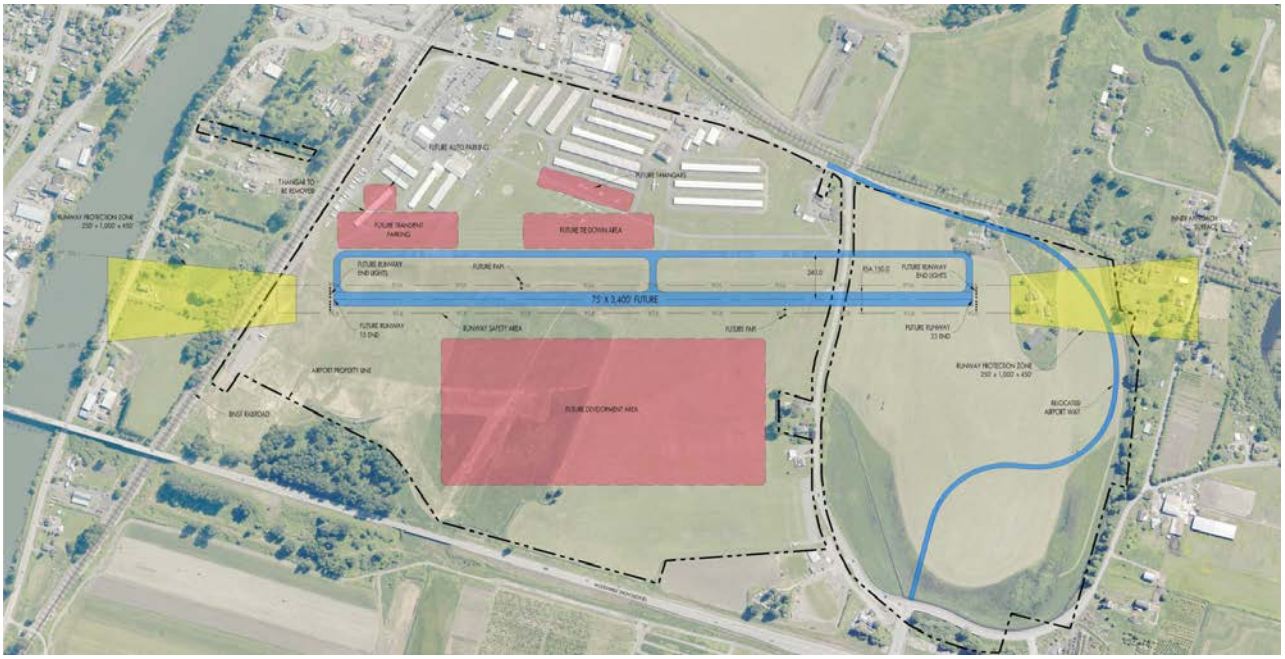
The facility requirements analysis presented in **Chapter 4** reflected what airport facilities would be needed to serve the fleet of small propeller driven aircraft with a maximum certificated takeoff weight of 12,500 pounds or less. The aircraft operating and forecast to operate at S43 over the 20-

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). C**hapter 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.

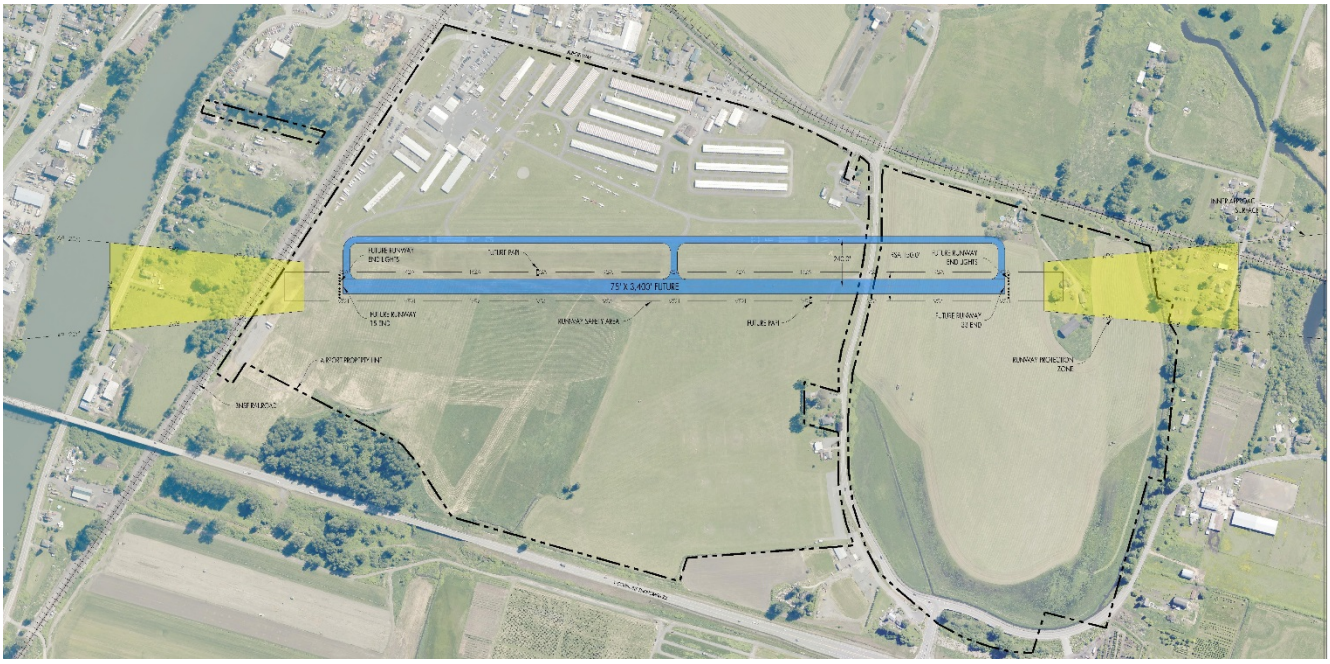
6.4 Design Process – Airside Alternatives Identification & Analysis

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

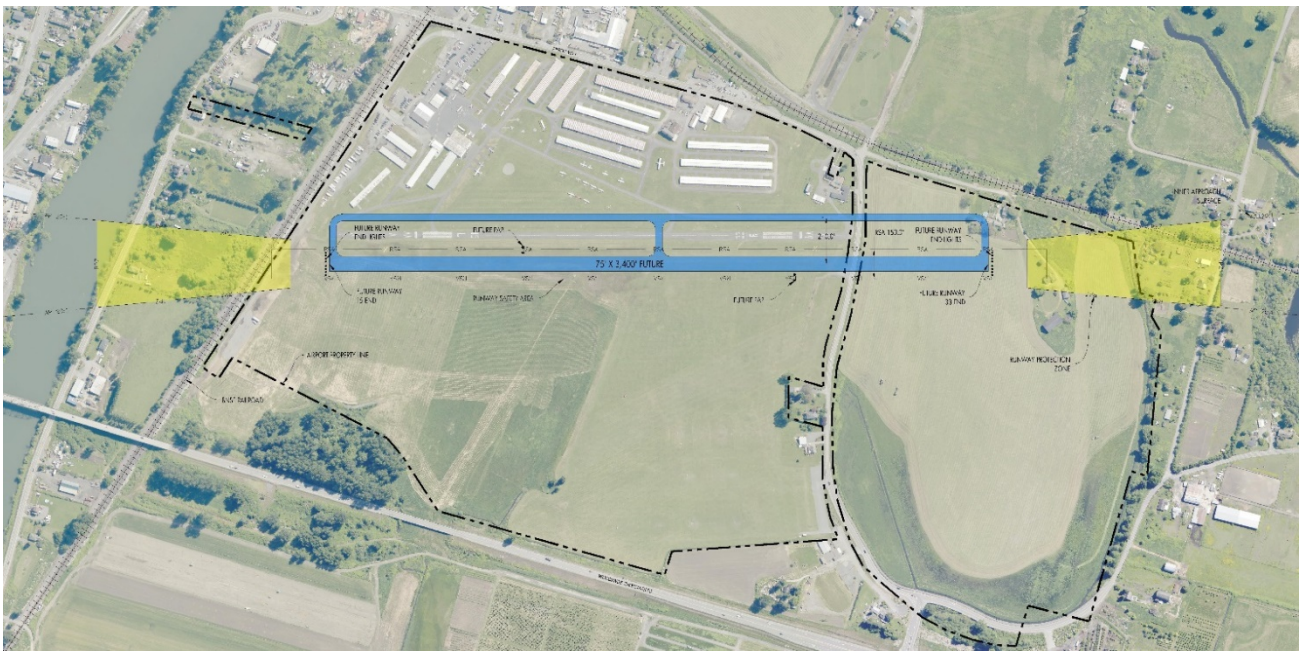
and ten feet approximately 240 feet from the existing runway centerline, increasing fill requirements for the northern half of the new runway. SCC for Density Fringe stipulates, "the development that will displace floodwaters will not exceed two percent of the land areas of that portion of the lot." 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

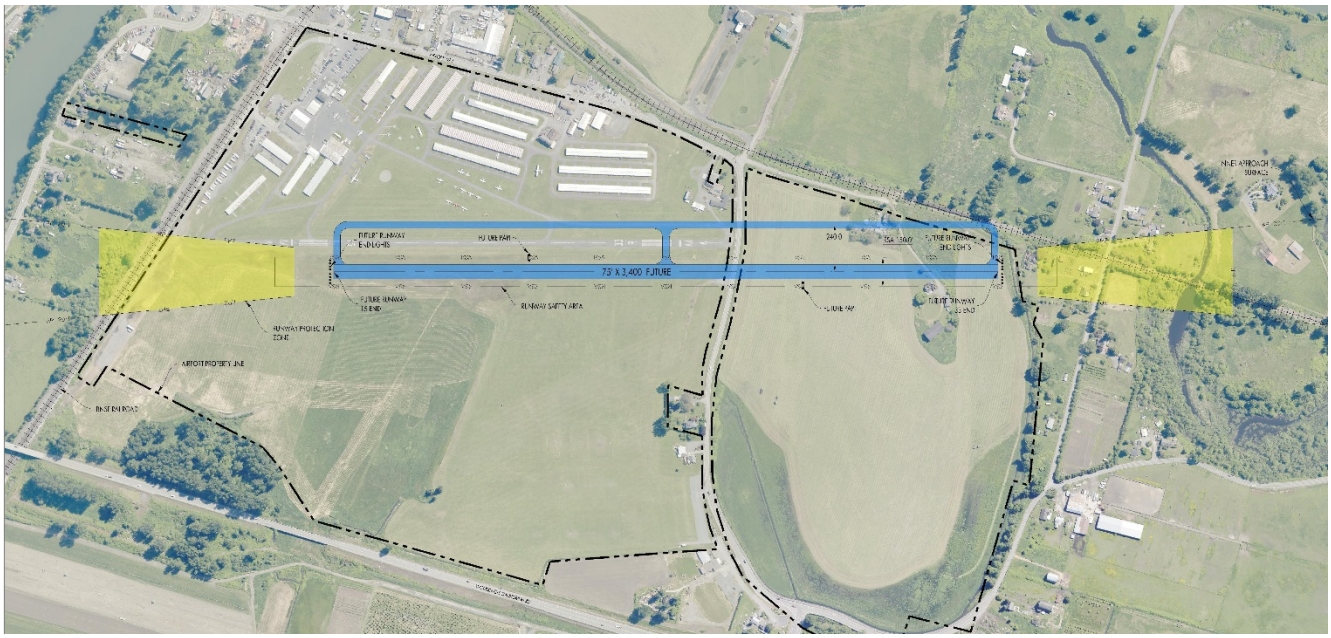


Source: Jviation

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 58.8° vs. mean daily temperature of 74°

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

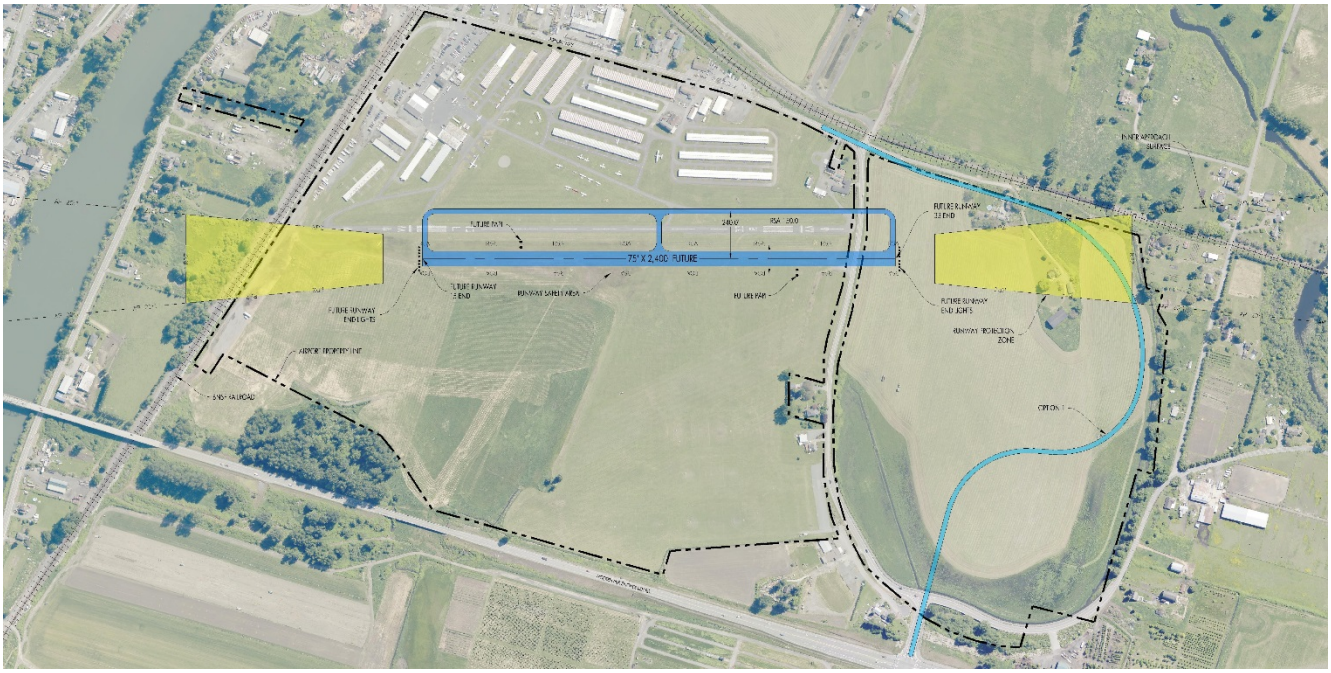
After evaluating operations manuals for these aircraft[i] it was determined that a 2,400-foot runway with clear approaches and meeting FAA design standards would:

- 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.

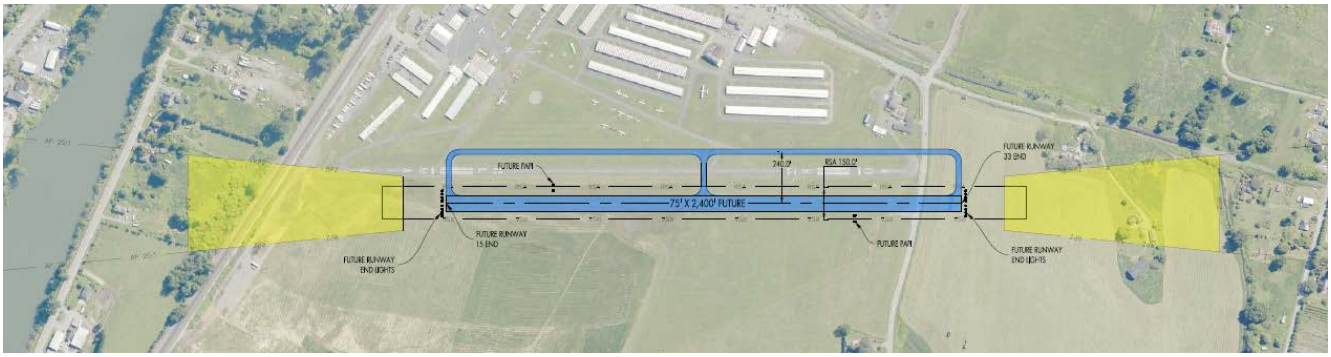
The transient day time ramp parking is limited and is located on the northwest ramp adjacent to the skydiving center and the aircraft maintenance facility.

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

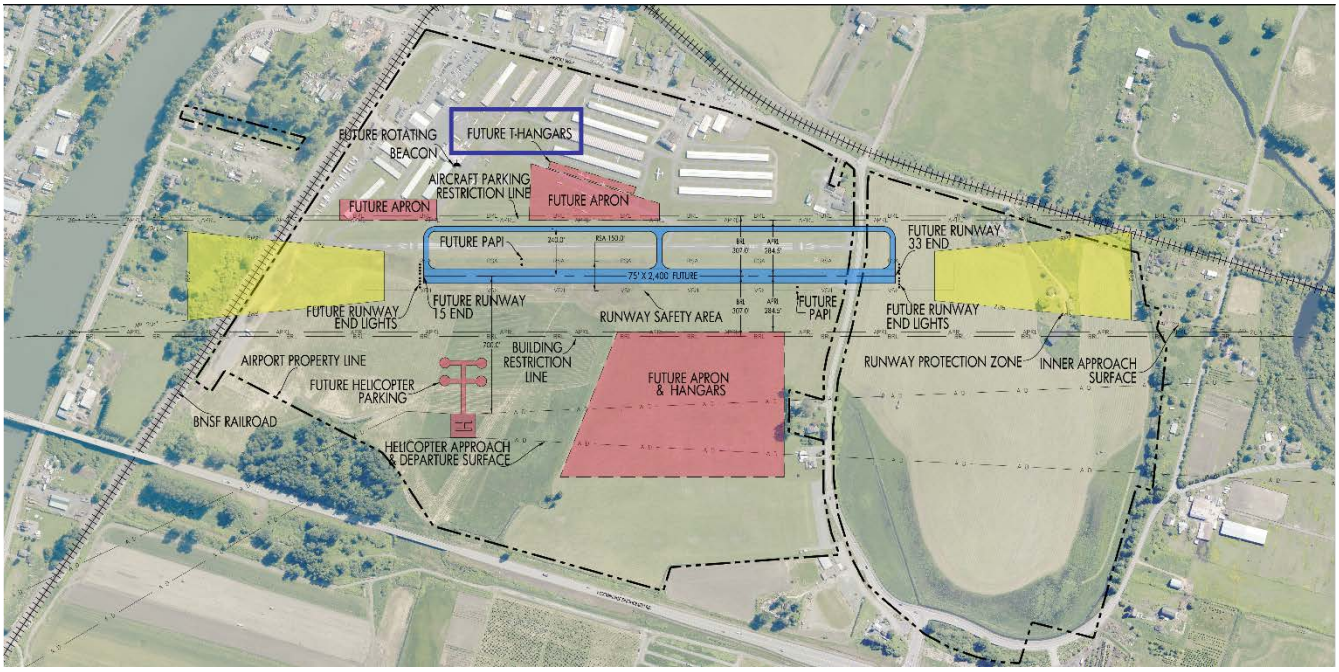
Alternative 2, Expand Apron and Construct Hangars: This alternative addresses current ground operations and parking congestion/capacity issues for based and transient fixed-wing aircraft and helicopters. New paved apron may be constructed at grade with a Land Disturbing Activity (LDA) permit that complies 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