TECHNICAL MEMORANDUM

PULLMAN-MOSCOW REGIONAL AIRPORT ENVIRONMENTAL ASSESSMENT

CONSTRUCTION FEASIBILITY ANALYSIS

July 25, 2014

INTRODUCTION

The purpose of this analysis is to evaluate the construction feasibility of the airside alternative identified for improvements at Moscow-Pullman Regional Airport. This analysis included evaluating the technical aspects of the project, along with cost implications and impacts to airport operations.

This analysis was completed using the following available information:

- Phase 1 & 2 Master Plan Report, prepared by Mead & Hunt and T-O Engineers.
- Associated technical data including:
  - AutoCAD drawings of the airport and surrounding areas.
  - Topographical information from AGIS project at the Airport.
  - Analyses, reports and cost estimates used in preparation of the Phase 1 & 2 of the Master Plan.
- Geotechnical report prepared as part of 'Phase 1B' of the Master Plan. This report was prepared by GeoEngineers and was completed in order to verify several key assumptions about the soils and terrain in the area of the airport. The primary purpose of the geotechnical investigation was to identify existing soil types, locate bedrock and record groundwater on the site.

The construction feasibility analysis was completed to determine and identify fatal flaws in the feasibility of the preferred airside alternative due to technical construction issues, costs or phasing. This analysis was not an engineering design and limitations to this analysis do exist that must be evaluated further during the design of the project. These limitations include:

- Survey information – AGIS survey data was utilized for this analysis. The aerial survey is accurate to ± one (1) foot. While very accurate for planning purposes this data is not considered adequate for design. A full topographic survey of the entire project area will be required before design.
- The geotechnical investigation utilized for this analysis was limited to the minimum information needed to identify important site conditions which may impact or impose limitations on the project. Additional geotechnical investigation will be required for final design.

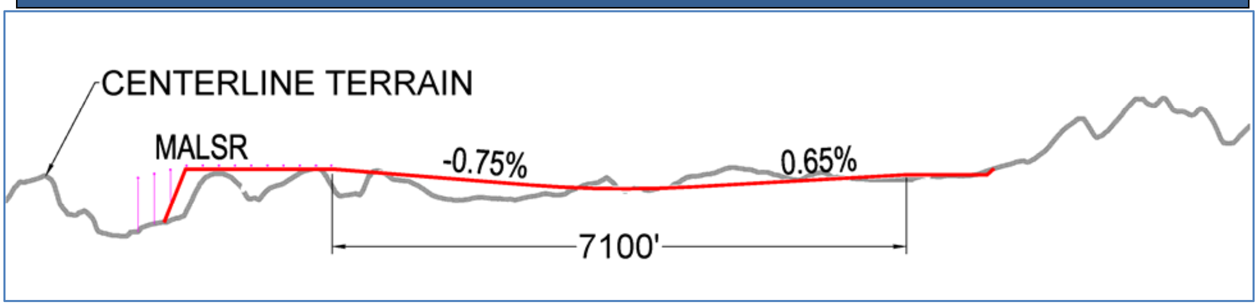
- Future unforeseen impacts including changes at the existing airport, unknown utilities, FAA guidance, etc.

Excluding these stated limitations, the construction feasibility analysis, based on current information, revealed no fatal flaws in the proposed airside alternative. Refinement to the limitations in the available data could result in changes in cost and construction timing, however no changes that would lead to a fatal flaw condition are anticipated.

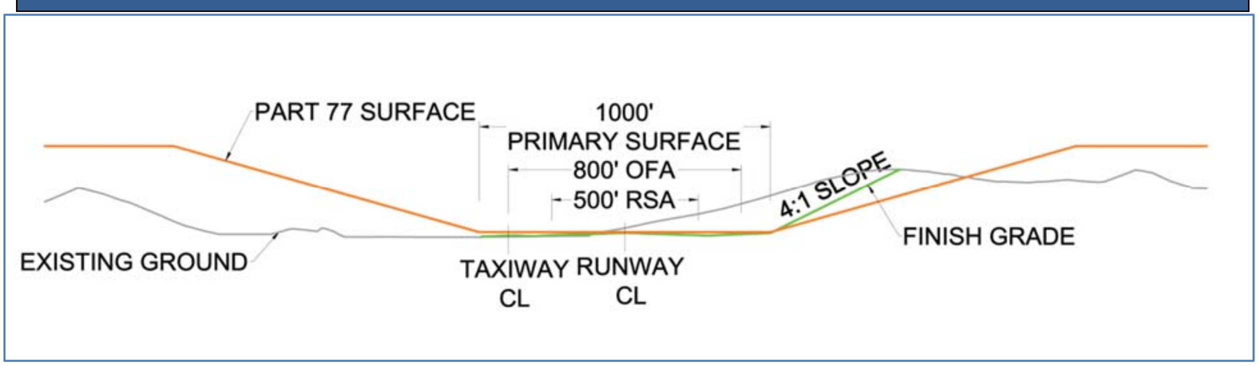
IDENTIFICATION OF AIRSIDE ALTERNATIVE

Multiple runway configurations were analyzed as part of Phase 1 and 2 of the Master Plan Study. The recommended alternative from Phase 1 was a runway that shifts southward and rotates the west end of the runway counterclockwise away from the existing runway alignment. Phase 2 of the Master Plan then evaluated multiple alternatives based on this new runway alignment. The "preferred" alternative developed from Phase 2 of the Master Plan consisted of a 7,100 foot long runway accessed by a parallel taxiway. The runway profile and grading of the airfield were then further analyzed and refined during the Environmental Assessment, from previous efforts made during Phase 2 of the Master Plan. The general runway profile and cross section is shown below:

Runway Profile



Runway Cross Section



CRITERIA

A number of criteria were used to complete this analysis. These criteria are found in FAA guidance, primarily, and are summarized in the following table.

Item	Criteria	
AC 150/5300-13A, Airport Design		
Runway		
Width	150’	
Shoulder Width	25’	
RSA Width	500’	
RSA Length Beyond Runway End	1,000’	
ROFA Width	800’	
ROFA Length Beyond Runway End	1,000’	
Transverse Grade, Runway Surface	1%-1.5%	
Transverse Grade, Shoulder Surface	1.5%-5%	
Transverse Grade, RSA Surface	1.5%-3%	
Longitudinal Grade	1.5% Max.	
Longitudinal Grade, First/Last ¼ of Runway Length	0.8% Max.	
Maximum Grade Change	1.5% Max.	
Vertical Curve Length	1,000’/1% Min.	
Taxiway		
Width	75’	
Shoulder Width	30’	
TSA Width	118’	
TOFA Width	186’	
Transverse Slope, Taxiway Surface	1.0%-1.5%	
Longitudinal Grade	1.5% Max.	
Maximum Grade Change	3% Max.	
Vertical Curve Length	100’/1% Min.	
Runway End Siting	West	East
Runway Type (Ref. Table 3-2)	7	6
Threshold Siting	34:1	20:1
Dimensional Standards (Ref. Figure 3-2)		
A	200’	200’
B	800’	800’
C	3,800’	3,800’
D	10,000’	10,000’
E	0’	0’
FAR Part 77/TERPS		
Part 77 Primary Surface Width	1,000’	
Part 77 Transitional Slope (Terrain Only)	7:1 (4:1 used for analysis)	
Part 77 Approach Surface	50:1	34:1
TERPS Departure Surface	40:1	

The criteria used during this feasibility analysis matched the applicable standard in nearly all areas. One exception to this involved the transverse grading under the Transitional Surface of the Part 77 airspace surface south of the preferred runway alternative. Grading in this area was analyzed with a 4:1 slope, instead of the 7:1 transitional slope criteria under Part 77. This modification was analyzed in an effort to control the overall costs of the project. Grading to the flatter 7:1 slope nearly doubles the amount of excavation required to grade the terrain south of the runway. As Part 77 does not technically refer to grading but to airspace, it was determined in coordination with the FAA that this criteria modification for grading was acceptable for this project. Evaluation of obstructions in all locations was performed with full Part 77 compliance in mind.

IMPACTS TO CONSTRUCTION

Several topics were evaluated during the analysis, which are described in the following paragraphs to determine the construction feasibility of the preferred airside alternative. The following items were estimated to have the greatest impact on construction feasibility and therefore have potential to create fatal flaws in the improvements.

The first major consideration is technical feasibility. This includes the various technical aspects of constructing a project of this size and scope. The purpose was not to solve each technical problem, but rather to identify the issues and determine if each problem is *solvable* and what the impacts to the cost and schedule of the project will be. Specific examples of technical issues include:

- Cut and fill construction: Will cut banks be stable and will the cut materials be suitable for construction of large fills required?
- Bedrock: Is there bedrock within the limits of proposed cuts that could drive costs and schedule?
- Groundwater: Is there groundwater within the limits of proposed cuts that will need to be drained, both during construction and after the work is completed?
- Drainage: The project will impact existing storm drainage, both in terms of induced drainage from construction and natural drainage that will be altered or impeded. How will this be dealt with and what impacts will that have on costs and schedule?

The second major consideration is operational. One of the major goals of the airport and local communities is to complete the project with minimum impact to operation of the existing airport. Evaluating the steps necessary to achieve this goal then impacts the project approach of various elements, especially construction phasing. Subsequently, these impacts may potentially require a project approach that is more costly or takes longer to complete.

Weather will have a significant impact on construction of this project and is the next major consideration. Pullman’s typical summer weather is excellent for construction: warm and dry. Unfortunately, typical weather at this location during the rest of the year is much wetter and colder. Based on available geotechnical information, soils vary little across the site and are not suitable for construction in wet weather. For this reason, it is assumed that primary earthwork will be constructed between June and October, with less weather dependent construction occurring during other parts of the year,with impacts to schedule and cost accordingly.

The final major consideration is funding. It is expected that Federal funding will be distributed over multiple years; with the yearly project goals adapting to negotiated funding levels.

Throughout the analysis, the various elements of the project have been evaluated relative to these considerations. The phasing and cost assumptions presented take each of the considerations into account.

CONSTRUCTION ISSUES

There are many issues related to the construction of a project of this size and scope. Many of the major issues were analyzed as part of this study, in order to assess the overall feasibility of the project and to accurately estimate probable construction costs. The goal of this analysis was not to solve each problem, but rather to ensure that a feasible solution exists and what the ramifications might be to the overall project. Various construction issues are discussed in the following sections.

LAND ACQUISITION

A significant amount of land acquisition will be necessary to construct the proposed improvements. Required land acquisition areas can be described in four areas:

1. **West Approach**: Significant fill is necessary on the west end of the airport to construct the runway to the desired elevation. This fill (and the runway itself) will require purchase of land, primarily from Washington State University. In addition to land that will be purchased fee simple, an avigation easement over Washington State University property west of Airport Road, for protection of the Runway Protection Zone for that runway end will be required.
2. **East Approach:** Significant cut is necessary on this end of the runway, and is required in order to protect the RPZ and grade the approach surface. This land will require fee simple purchase from three (3) private landowners.
3. **South Grading:** A large area is necessary in order to complete the side cut slope grading for the new runway. This land will also require fee simple purchase from six (6) private landowners.
4. **South Cut Disposal:** As discussed elsewhere in this memo, an extremely large quantity of excess cut material will need to be disposed of on or near airport property. Disposal areas that are within short haul distances and that allow the use of off-road construction equipment greatly reduce the overall cost of the project. Two areas on the south side of the airport have been identified as potential soil disposal locations. These areas were chosen because the topography in both locations will permit disposal of large amounts of material within close proximity to the cut areas. Purchase of this land may not be required. Instead, temporary easements to dispose of material in these locations could be obtained. However, it may prove more cost effective to purchase the land.

POWER LINE RELOCATION

An electrical transmission line owned by Avista currently runs in a general SE-NW direction across the hills south of the airport and then crosses under the existing Runway 5 approach before continuing northwest. This line must be relocated in order to accommodate the preferred airside alternative and associated grading.

Several alternatives for this relocation were evaluated and are discussed in detail in other sections of the EA. All of the alternatives come with significant cost and pose their own individual impacts to the airport and construction including but not limited to, phasing, penetrations to the Part 77 Airspace (Interim and Ultimate) and impacts to NAVAIDs (ILS & MALSR). Despite the relocation alternative eventually selected, installation of the new Avista facilities and demolition of existing structures will be a high priority to be completed early in the airport project to minimize delays to runway construction. It is expected that temporary relocations may be necessary for all alternatives, as the routes that are most compatible with the future condition, pose short term impacts to approach procedures and lower/alternate routing may be necessary until the new runway opens.

GRADING

This project is primarily a large earthmoving or grading project, creating a very large pad on which the proposed airfield will be constructed. Cuts of over 80 feet deep will be made in the hills south and east of the existing airfield and fills to depths in excess of 50 feet will be constructed on the west end of the new runway to build up that area to the elevation required for the western approach. It is anticipated that approximately 30-50 earthmovers/scrapers and 5-10 D-9 dozers will be utilized on site during peak earth moving operations of the project in addition to supporting haul trucks, graders, rollers, etc.

The quantities of earthwork are immense, as summarized in the following table (all values are given in millions of cubic yards):

Cut	Fill	Excess Cut
6.4	4.4	2.0

As noted in the table, a significant amount of cut material will need to be placed during the project. This excess material must be disposed of in a cost effective manner. If possible, on site locations are preferred, as the cost for disposal will be minimized. On-site locations will also allow for the use of off-road construction equipment (e.g., scrapers and bulldozers). Use of this equipment is much more efficient than loading the material in trucks and hauling over public roads to an off-site disposal landfill or other location. It is assumed that an access road and haul route will be developed to access the site from Highway 270 south of the airport in an effort to limit heavy construction traffic on smaller local roads around the airport and to minimize impacts to residential and commercial areas north of the airport.

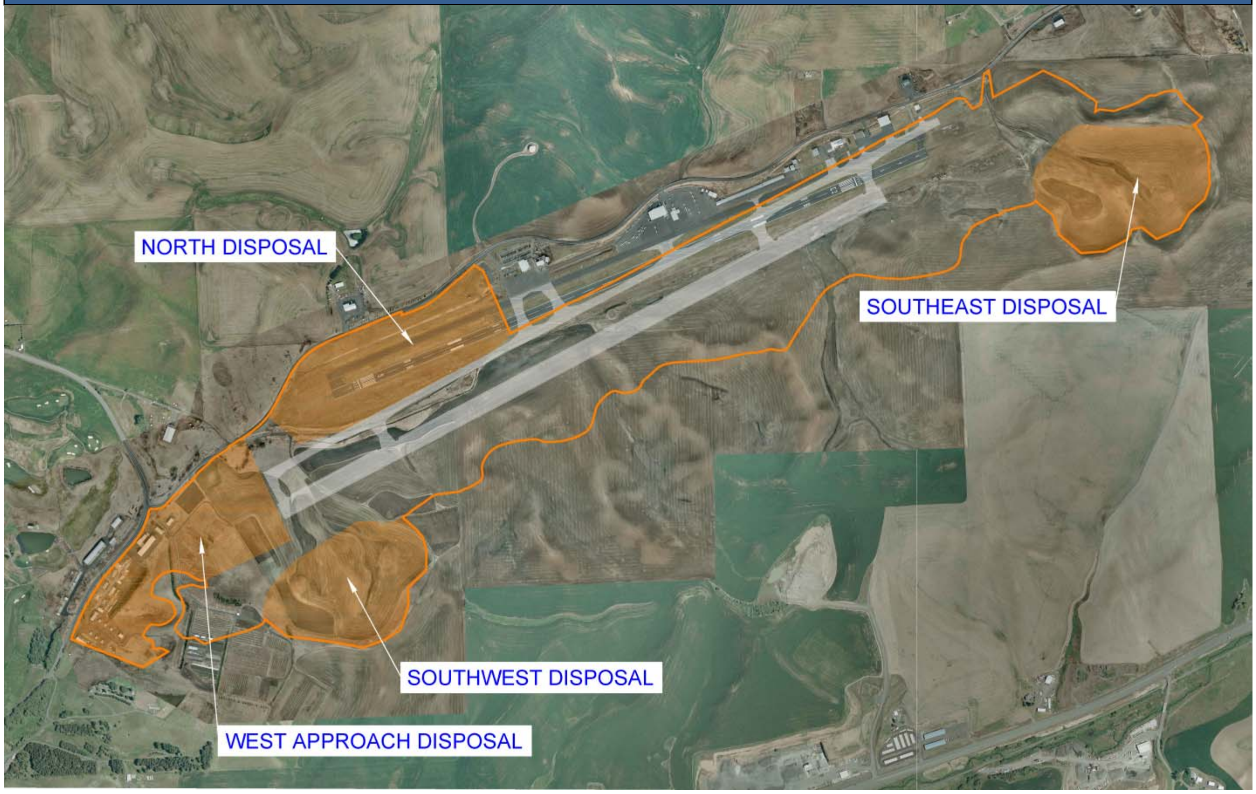
Several sites were evaluated as possible locations to dispose of the excess material, and three have been identified:

1. **North Disposal Area:** Prior to construction of the future Terminal building, as noted on the current ALP, the area will require a large amount of fill material to match the future parallel taxiway elevation. This area requires a longer haul route than the subsequent areas discussed below but provides a key benefit to future development of the airport.
2. **West Approach Disposal Area:** A significant amount of material could be disposed west of the proposed runway. This disposal area has a number of benefits, including being located on property that needs to be acquired by the airport for other reasons. Additionally, fill in this area will make installation of the approach lighting simpler and more cost effective. The exact amount of fill that can be placed will be dependent upon the final decision on the location of the Avista Energy Corridor.
3. **Southwest Disposal Area:** This area is located south of the west end of the proposed runway. A natural depression exists in the agricultural land at this location, which could be filled and restored for agricultural use. The land could either be purchased, or it may be possible to purchase an easement in order to dispose of material in this location. Approximately 2.6 million cubic yards could be disposed of in this area.
4. **Southeast Disposal Area:** South of the east end of the proposed runway, exists another location ideal for the placing extremely large cut quantities that are required in order to construct the east end of the runway and associated safety area. As with the Southwest Area, a natural depression exists here that is within a relatively short haul distance from the adjacent cut area. This area could hold up to 1.8 million cubic yards of excess cut.

Using all or portions of these areas, it is estimated that all of the excess cut material can be disposed of using off-road equipment, which is reflected in the cost and time estimates for the project.

Beyond disposal of the excess cut material, other potential problems associated with project grading are dust control, groundwater and the presence of bedrock within the cut limits. During hot dry months of the year when construction can be completed at the site, dust control will be an ever present concern as soils in the area are prone to wind erosion. The preliminary geotechnical information collected during "Phase 1B" of the Master Plan revealed minimal impacts to the project related to ground water and bedrock. However, a more extensive evaluation will be required during design to verify this, and an allowance for potential costs is reflected in the estimate.

Disposal Areas



PAVEMENT CONSTRUCTION

Preliminary pavement section designs were prepared for the proposed airfield construction in accordance with FAA Advisory Circular 150/5320-6E, *Airport Pavement Design and Evaluation.* Designs were prepared for both flexible pavement (hot mix asphalt, 'HMA') and rigid pavement (Portland cement concrete, 'PCC').

The aircraft fleet presented in Tables 2 and 3 of the November 19, 2010 Mead & Hunt, Inc. memo titled *PUW Master Plan Study Phase II – Runway Length Requirements* were utilized for this analysis. Several of the aircraft in the forecasted fleet weigh in excess of 100,000 pounds, therefore a stabilized base and subbase are required.

Due to local climate and soil conditions, pavement sections were analyzed for frost. Based on the limited geotechnical data available, it appears the native soil composition is very consistent across the site. With the consistency and soil type, the pavement was designed using the Limited Subgrade Frost Penetration (LSFP) design method, as described in AC 150/5320-6E. This design method results in a pavement section that protects the underlying soils from frost by constructing a section to 65% of the frost depth, using frost free materials. For this location, the frost depth is assumed to be 48-inches based on information from local agencies; therefore the total LSFP pavement section thickness is 31 inches.

Due to the frost conditions and soil types at the site, subsurface drainage will be necessary in the pavement section, to remove trapped moisture. A system to accomplish this is included in the cost estimates for the project.

Flexible Pavement

Using FAARFIELD design software and the criteria outlined in Chapter 3 of AC 150/5320-6E, the LSFP flexible pavement section used for this analysis is as follows:

HOT MIX ASPHALT (HMA)	P-401	5”
STABILIZED BASE COURSE	P-401 (ASSUMED)	5”
BASE COURSE	P-209	8”
SUBBASE COURSE	P-154	14”
NATIVE SUBGRADE	P-152	

Rigid Pavement

Again using FAARFIELD design software and the criteria outlined in Chapter 3 of AC 150/5320-6E, the LSFP rigid pavement section used for this analysis is as follows:

PORTLAND CEMENT CONCRETE	P-501	14”
STABILIZED BASE COURSE	CEMENT TREATED	6”
SUBBASE COURSE	P-154	12”
NATIVE SUBGRADE	P-152	

Economic Analysis

The final decision regarding which material is used will need to be made during design, based on a number of factors. Not the least of these factors is the availability of initial construction funds. In addition to financial considerations, other factors may influence the final decision of which pavement material to use. One significant example is construction timing. As discussed in the phasing section below, operational phasing of the project will be complicated and it may be more desirable to use HMA pavement in some areas where faster construction is required, such as the connecting taxiways. Other factors that will weigh in this decision are maintenance considerations, such as airport manpower, budget and impacts to airport operations due to maintenance projects during the life of the pavement. These issues (and others) will need to be addressed during design of the project.

DRAINAGE

Construction of the new runway will alter drainage in the valley the airport is located in and significant analysis was completed on the drainage impacts of the project. These impacts include alteration of existing watersheds and streams, stormwater runoff from new and existing airport pavement and wetland mitigation. A general discussion of these impacts is included below. Detailed analysis of the Airport Creek Relocation and Wetland Mitigation are covered in separate sections of the EA.

Stream and Watershed Impacts

One existing stream, Airport Creek, runs in a southwesterly direction parallel to Airport Road on the north side of airport prior to crossing the existing runway west of the existing airport terminal. After crossing the runway, Airport Creek continues in a westerly direction until leaving airport property and crossing under Airport Road, eventually flowing into Paradise Creek south of the airport.

Of the multiple alternatives evaluated, the preferred alignment shifts the creek south and parallel to the proposed runway. The creek will then enter an underground structure to route it around the proposed runway prior to emptying back into the existing creek channel west of the airport. This reduces runway and taxiway crossings beneath pavement; accommodates future landside development, provides temporary surface storage of peak flows and allows for construction of the future airside improvements.

The Airport Creek drainage area totals over 3,100 acres of predominately rolling, rural farmland. Over half of this drainage area feeds Airport Creek from the north side of the airport. The other half of the drainage area drains from the south towards the future runway. Both portions of the drainage area will need to be managed accordingly to allow for construction of the airside alternatives. The new runway location will disrupt the natural drainage from the south and will require significant analysis during final design stages. Whereas the existing drainage facilities that currently accommodate drainage from north of the airport will require modifications to route runoff towards the new Airport Creek alignment.

Stormwater

The existing airport complex constitutes the major developed area within the Airport Creek drainage upstream of the location where the creek currently crosses Airport Road west of the airport. Construction of the new airfield will add over 60 acres of impervious area. The increased runoff from this additional area will require mitigation in a way that both treats the runoff and controls its discharge to pre-development flows. FAA drainage standards are the primary design standard and supplemented by local, state, and other federal requirements. To date, the City of Pullman references the Eastern Washington Stormwater Manual and National Pollutant Discharge Elimination System (NPDES) for stormwater design and implementation.

Flat-bottomed grassy swales located adjacent to the runway and parallel taxiway will be the most efficient and cost effective means to accomplish the required stormwater management. Properly maintained grassy swales are an accepted Best Management Practice for treatment of runoff from pavement. Swales with flat bottoms provide storage as well as increase time of concentration, thereby decreasing initial runoff from the site. The largest swales will be required on the south side of the future runway where runoff from half of the runway as well as from the land south of the airfield will converge. Adequate space will be necessary between the edge of the Runway Safety Area and the limits of grading for the FAR Part 77 Primary Surface for construction of these swales.

A storm sewer system will be required to convey stormwater overflow from swales. The proposed piping on the new airfield has been separated from the re-routed creek so that these localized flows can be managed separately from the creek flows. The only airfield flows which drain to the re-routed creek are from existing development and those noted above. The inlets should be spaced in a manner to maximize time of concentration and treatment of runoff from the grassy swales, while considering the consolidation of runoff along swale bottoms. FAA requirements restrict standing water within the RSA. Limiting water depth so that it will not hinder growth of swale grass and preventing impoundment of water which could attract wildlife near the airfield all will need to be considered to determine proper inlet spacing.

Wetlands

As noted previously, Wetland Mitigation is discussed in detail in other sections of the EA. For purposes of this construction feasibility memo it should be noted that multiple wetland areas were identified on and surrounding the airport within the anticipated impact area of the runway realignment project. These areas include riverine, depressional, and sloped wetlands of varying quality. Phasing and execution of wetland mitigation will be imperative to the runway relocation project and must be completed prior to beginning construction of the new runway to allow for earth moving operations to begin in the areas.

PROJECT PHASING

Due to the size and scope of the project, phasing of the various elements will be complicated. As discussed previously, the project must be phased to accommodate a number of factors, including the mitigation requirements, limited construction season, funding constraints, airport operations and airport safety. Many of the construction elements will require completion sequentially(e.g., earthwork must be completed before paving) which will drive the overall phasing of the project. This discussion is general in nature -- a more detailed plan will need to be developed during final design.

Design, Land Acquisition, Wetland Mitigation, Power Line Relocation

Once the EA is complete and approved, design may begin in earnest. Design will likely continue through subsequent phases, developing individual projects for each year's construction.

The land and easement acquisition process will include appraisals, negotiations, purchase agreements. The future runway approach and departure surfaces on the east end of the runway will impact some existing facilities on the airport as well, which may need to be relocated. After land is purchased, construction of perimeter fence can begin to delineate the property line and secure the airfield. This could also be delayed in some areas, if desired or necessary.

Wetland mitigation will require extensive agency coordination and permitting. The existing wetlands located within the construction limits cannot be disturbed until the entire mitigation process is complete and approved by appropriate authorities.

Concurrently, Avista will need to begin design of the power line relocation, followed by construction of the new line and removal of the existing facilities. This process will include purchase of access road construction, tower installation, and line installation. Land and easement acquisition for the Avista relocation will be included and completed under the runway relocation land acquisition process. The new transmission line must be in place and fully functional prior to removal of any existing transmission facilities. It is assumed that design and construction of these facilities will be conducted by Avista and their selected subconsultants and qualified contractors. This process is normally administered through a reimbursable agreement between the airport and utility provider however the actual implementation procedure will need to be established early in the process to minimize delays to the overall airport project.

Initial Site Preparation

Once the wetland mitigation and land acquisition are complete, work may begin to prepare the site for the new runway. Significant earthwork may begin at this time at the eastern end of the project, away from the creek and the power line. A very large amount of cut is required at this end, which can be disposed of nearby without impacting the other areas of the project.

Work may also begin to relocate Airport Creek. Installation of the culvert will be a high priority to complete in a timely manner. The depth of the structure will have impacts to construction of runway embankment. The remaining portion of the new creek alignment will flow over land until it enters the new culvert and can also be constructed concurrently.

Upon completion of the initial Airport Creek relocation, earth moving activities on the west end can begin. The initial focus for cut and fill in this area during this phase will be the area inside the RSA of the new runway so that the runway can be paved early in the subsequent phases. Portions of the storm water management system will need to be installed at the same time (all elements within the proposed RSA).

Prior to winter shutdown each year, thorough temporary erosion control measures will be required on all disturbed areas. This will involve straw wattle installation, hydroseed, and stabilization mat installation on all disturbed regions.

Pavement Construction & Continued Earthwork

This phase would consist of construction of the pavement section, lighting and signage items, regulator vault building, MALSR, stormwater piping and miscellaneous grading of the future runway and parallel taxiway outside of the existing runway OFZ to allow for the existing runway to remain operational while the work is completed. Exceptions to this would include temporary closures to construct access points to existing facilities. The goal is to complete the majority of the future runway work while minimizing disruptions to airport operations.

The majority of the work will be concentrated within the new runway RSA and at the intersection with the existing runway OFZ. Once the fill is to grade, the new pavement section can be constructed while additional grading outside of the future RSA will continue to progress with disposal areas located along the length of the project. Necessary runway and taxiway lighting and signage will be installed as well as subsurface edge drains and other related items. The new regulator vault building and related electrical items will be installed. The MALSR system will be installed off the west end and additional fill will be placed accordingly for installation of this item. All vertical guidance systems and the ASOS relocation will be completed during this phase as well. It is expected the MALSR and vertical guidance construction will require a majority of the construction season to complete. Grading on the east of the runway will need to be completed to allow for use of the full runway length or a temporary relocated threshold may be required until this grading is completed.

Closure of the existing runway will be required to prepare and construct connecting taxiways to allow aircraft to access the existing terminal apron as well as for an exit/entry taxiway on the east end of the new runway. All connecting taxiways will be constructed, at a minimum, to the outer edge of the RSA of the new runway to avoid future runway closures. The new runway and taxiway lighting and signage system will need to be connected to the lighting system in order to be activated and allow for the new runway to be opened.

Temporary erosion control measures will be required on all disturbed areas during this phase as well as previous phases that may need additional measures installed prior to winter shutdown. Periodic inspections and remediation will be necessary throughout the winter shutdown period.

Parallel Taxiway

Once the new runway is constructed and open for use, work outside of the new RSA can be completed. Grading will be required to complete the parallel taxiway construction. Earthwork cut material from previous phases will be placed as embankment in the disposal area north of the existing Runway 5 end. This material will help prepare the site for future terminal development and will limit haul routes of excavated material.

Demolition of the asphalt and utilities along the existing runway can begin as well. The remaining new taxiway lighting, signage, and subsurface edge drains will be installed. The connecting taxiways previously constructed may require additional grading modifications to account for the final taxiway design. This will be completed while the remaining portion of the parallel taxiway is constructed. During this construction, on the east end of the project, many existing hangars will be without direct access to their facilities. These aircraft can be temporarily accommodated on the public apron until construction is complete in this area.

ESTIMATED CONSTRUCTION COSTS

Construction costs for the project have been estimated based on the completed analysis and cost data gathered from similar projects in the region of the airport. The purpose of these estimates is budgetary and due to the large number of variables (unknowns about final design, oil prices, inflation, etc.), the estimates will need to be continually revised during design and development of the project. The estimates have been prepared conservatively, to take into account the large number of unknowns. Overall project construction costs by category are summarized in the following table.

Description	Cost
Land Acquisition	$12.0 million
Wetlands/Stream Relocation	$1.2 million
Floodplain Relocation	$9.6 million
Power Line Relocation	$8.9 million
Mobilization, Etc.	$6.7 million
Site Prep/Earthwork	$29.2 million
Drainage Earthwork	$2.5 million
Pavement	$28.4 million
Drainage	$10.2 million
Airfield Lighting	$4.4 million
NAVAIDs/ASOS	$3.4 million
Fencing	$1.3 million
Deicing System Improvements	$1.2 million
TOTAL	**$119.0 million**

It should be noted that these costs only include estimated airside construction costs, developed through the analysis described in this memo. All related project costs including permits, engineering, and taxes are included in this estimate.

An estimate of probable cost was completed during Phase II of the Airport Master Plan. The estimate was $66.6 million in 2011 dollars. The following are the project changes that have influenced the increase in project cost:

- Inflation has resulted in an 11.1% increase from 2011-2015 (based upon Construction Price Indeces, and projected inflation). The project is estimated to begin in 2015 and be completed in 2019 with costs increasing with inflation throughout.
  - 11.1% increase from 2011-2015
  - A 9% increase was projected from 2016-2019 based upon recent economic indicators
- FAA design standards for runway width increased from 100' to 150'. This results in a 50% increase in pavement, storm water capacity, and grading required for the runway.
- Avista utility relocation was anticipated to be an in-kind replacement of above ground facilities. During the EA, it was determined that a partial underground alternative needed to be considered. This cost estimate includes the partial underground alternative for budget planning purposes because it is the most expensive alternative.
- The floodplain for the Airport is unmapped by FEMA. During the planning process it was assumed that a similar floodplain and storm water management technique being utilized today would be sufficient. However, after modeling the floodplain during the EA, it was determined that a more comprehensive storm water management system was needed to avoid flooding of the terminal building and aircraft storage areas. Results of this effort will be coordinated with FEMA and the COE as appropriate.
- Land acquisition cost estimates during planning were based on limited information within the WSU agricultural research area west of the Airport. A detailed analysis was completed during the EA and determined that the land acquisition costs would be higher due to the nature of the research activities occurring in this location.

CONCLUSION

Based on current information evaluated during the construction feasibility analysis no fatal flaws have been identified in the preferred airside alternatives. Refinement to the limitations in the available data could result in changes in cost and construction timing, however contingencies are included within estimates to account for the variances that are expected when constructing a project of this magnitude. Due to the size and variety of elements involved in the airside improvements, phasing and coordination of these elements will be paramount to achieving a successful project that is completed in a timely manner. The elements and their impacts to the project will need to be continually evaluated as design and construction is completed.