PALOUSE BASIN
AQUIFER
committee

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May 19, 2022 Meeting Minutes

Moscow UI Facilities Services Center, Jack's Creek Meeting Room

Committee business conducted by motion is indicated in **** Business Decision**
For discussion details related to other agenda items, refer to the video recording of the meeting at https://www.youtube.com/watch?v=zSLo8pRT218 during the time period indicated within parentheses (HH:MM:SS)

Attendance
X: In-person attendance
V: Video attendance

V	UI: Tim Link, Professor of Hydrology	X	WSU: Jeff Lannigan, Facilities Services
X	UI: Rusty Vineyard, Director, Facilities Operations		WSU: Jason Sampson, Assistant Director, Environmental Services
X	UI: Brian Johnson Utilities Engineer / P3 Liaison	X	Pullman: Cara Haley (Chair), City Engineer
	Moscow: Tyler Palmer (Vice-Chair), Deputy Director Operations	V	Pullman: Shawn Kohtz, Director of Public Works
	Moscow: Gina Taruscio, City Council Member	X	Pullman: Eileen Macoll, City Council Member
	Moscow: Mike Parker, Water Utility Manager	X	Whitman County: Mark Storey, Public Works Director/County Engineer
V	Latah County: Paul Kimmell, Citizen/County Representative	V	Whitman County: Tom Handy, County Commissioner
V	Latah County: Tom Lamar, County Commissioner		

Visitors and Others:
See meeting video recording beginning at (00:00:17)

Call to Order: Cara Haley called the meeting to order at 2:01 PM.

1) **Introductions**
See meeting video at (00:00:17)

2) Approval of Meeting Minutes: April 21, 2022
See meeting video at (00:02:40)

*** * Motion passed to approve minutes**

3) Public Comment for Items not on Agenda - None

4) Presentations/Discussion –

- **Palouse Basin Boundaries – John Bush (00:04:00)**
  Note: Presentation slides and background document attached

5) Unfinished Business
See meeting video at (00:58:05)

- **PBAC Executive Director Position Vacancy (00:58:12)**
- **Basin Boundary Modifications (01:00:56)**

6) New Business - None

7) Subcommittee Reports (01:14:44)
- **Budget – No Report**
- **Communications (01:15:02)**
- **Research (01:18:04)**

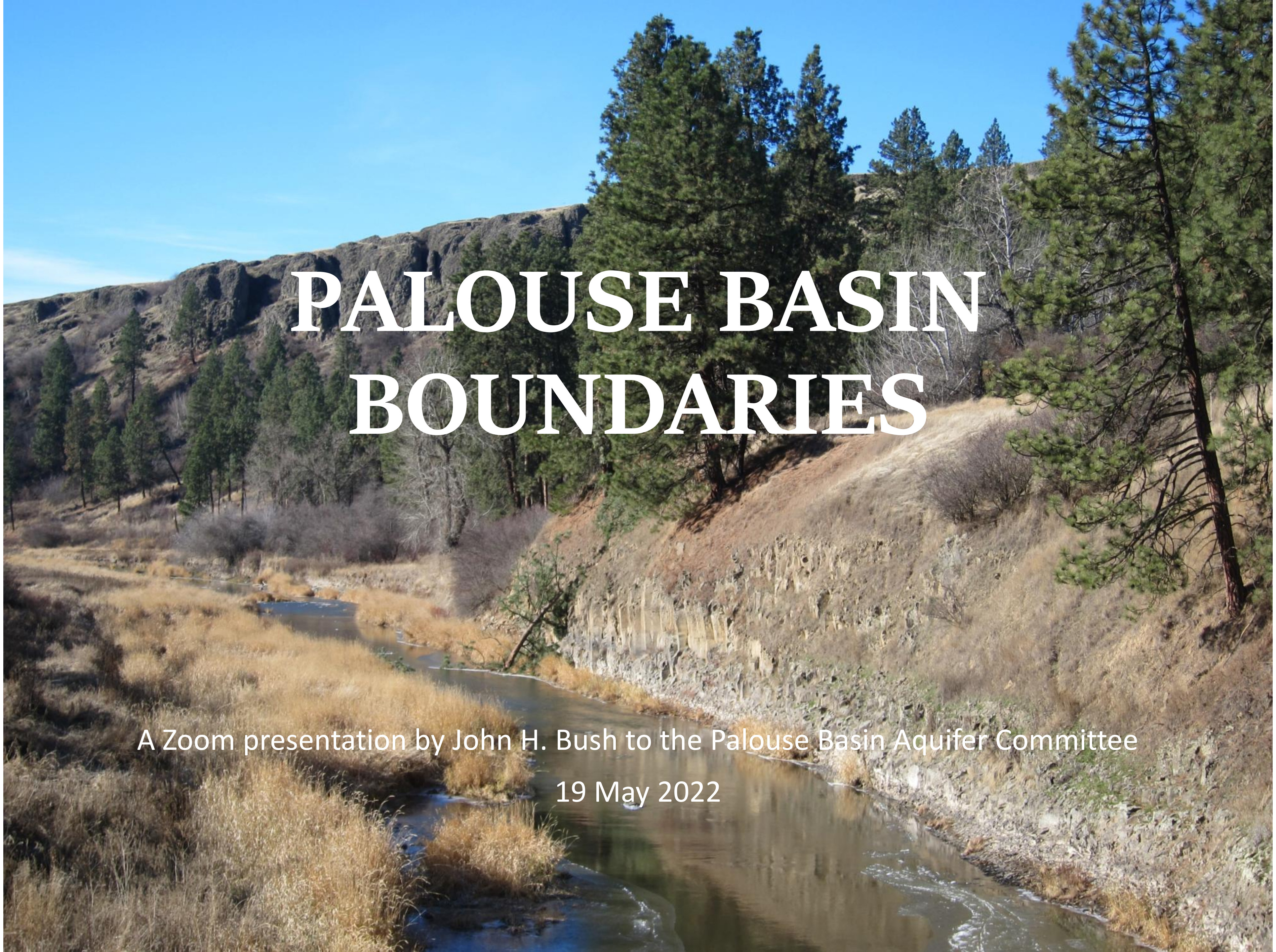
8) Other Reports and Announcements
See meeting video at (01:19:24)

- **Alternative Water Supply Project (01:19:26)**
  Note: Draft Report (without appendices) attached.
- **NSF Civic Planning Grant Proposal Letter of Support (01:32:55)**
- **Next PBAC Meeting – Thursday, May 19, 2022, 2:00 pm, UI (01:33:32)**
- **Good of the Order (01:33:56)**

9) Adjourn

**** Motion passed to adjourn meeting at 3:40 PM PDT (01:39:00)**

Minutes reviewed and approved at the June 16, 2022 PBAC meeting.



PALOUSE BASIN BOUNDARIES

A Zoom presentation by John H. Bush to the Palouse Basin Aquifer Committee

19 May 2022

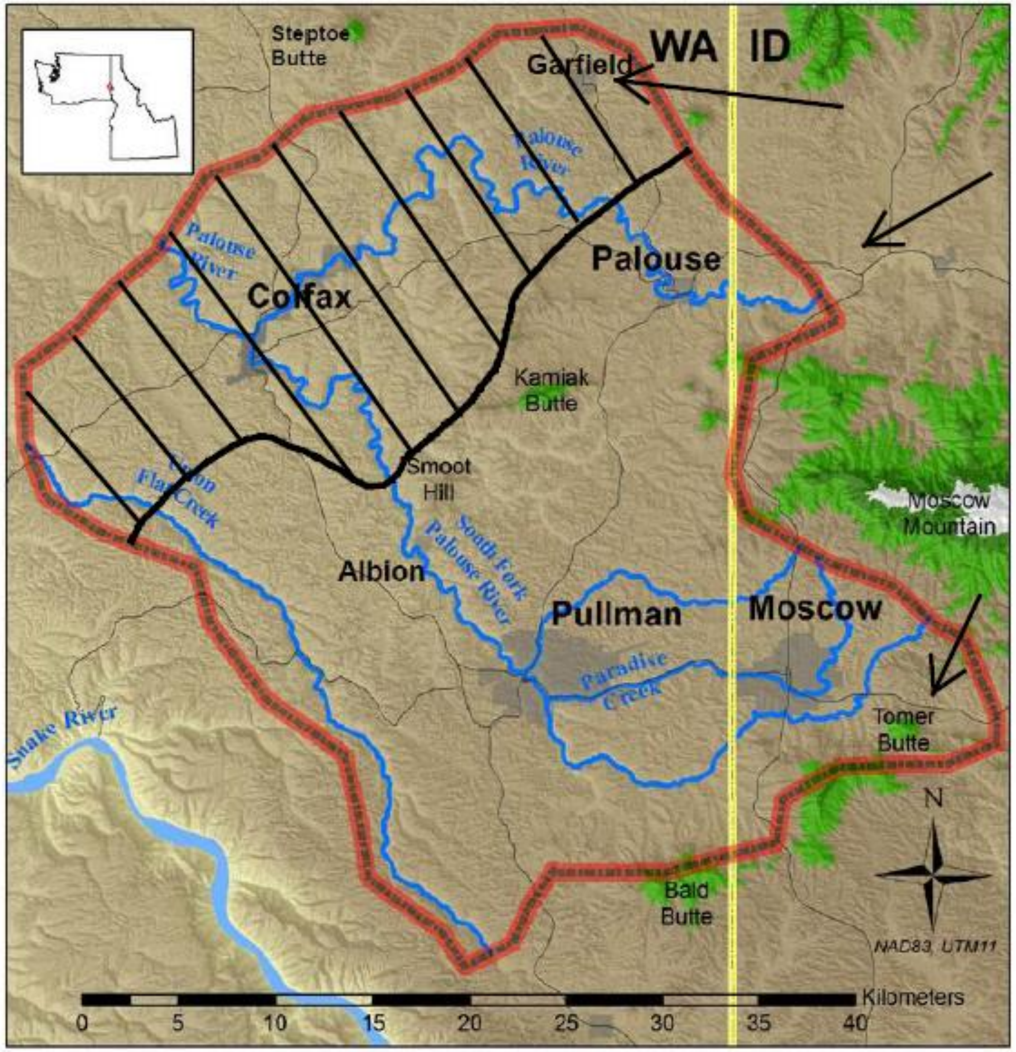
OUTLINE

- History of Name
- Present Map Extent
- Basis for the Proposed Map Extent
- Importance of Structure
- Moscow-Pullman Basin, Cities of Palouse and Colfax, Union Flat Creek Areas
- Conclusions

History of Name

- **Mid-1990s**: Name used for aquifer committee
- **Early 2000s**: Leek, Bush, Robischon, comments from experts, political input
- **2007–2013**: Numerous student theses; reports and publications
- **2013–2022**: Publications and reports began to drop the name

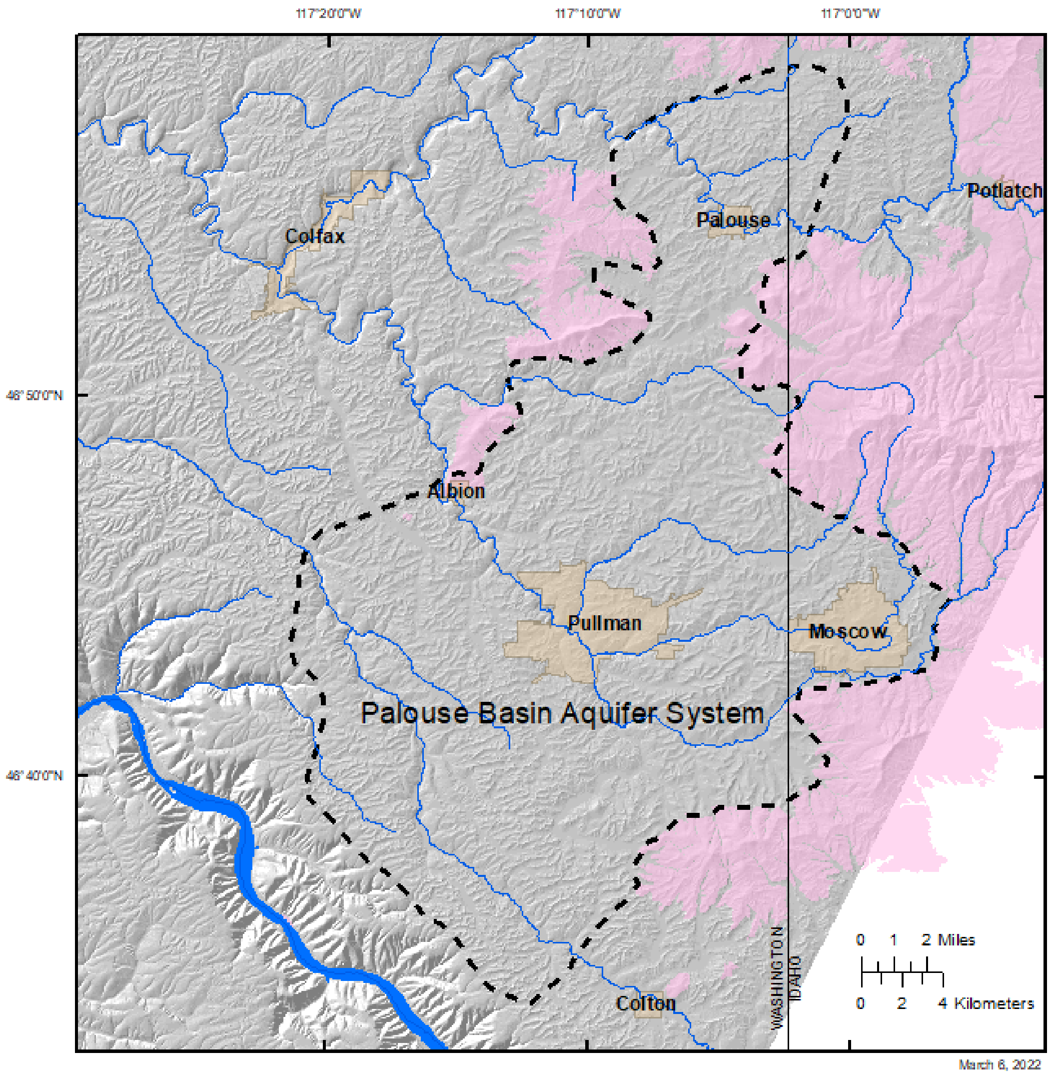
Present Extent – red outline



- Small errors – arrows
- Large errors – hachured

from Moran, 2011

Proposed Extent of the Palouse Basin Aquifer System – dashed outline

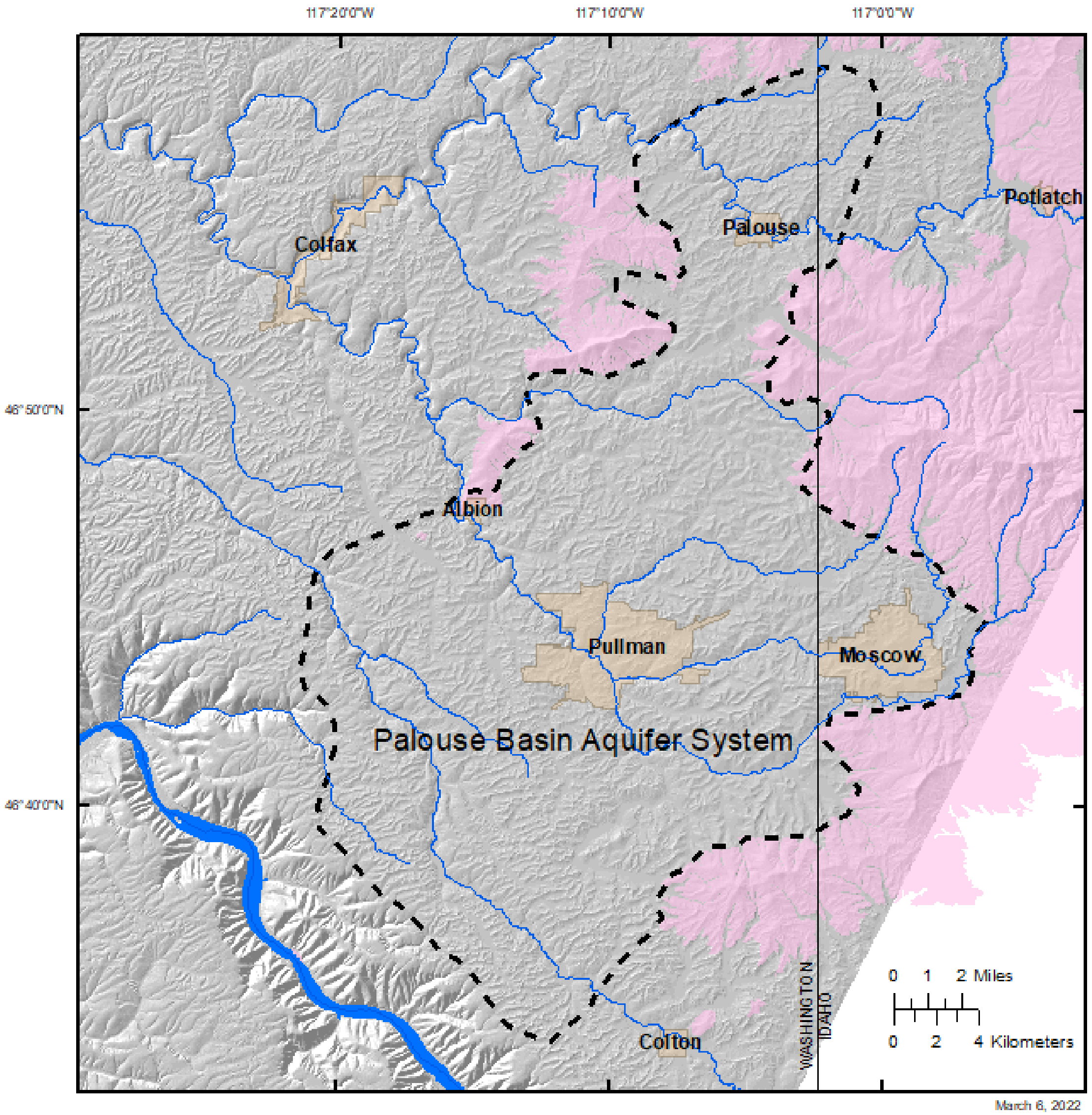


Basis for Proposed Map Extent

1. Lower Aquifer Only

2. Lower Aquifer Connections

3. Hydrological and Geological Comparisons



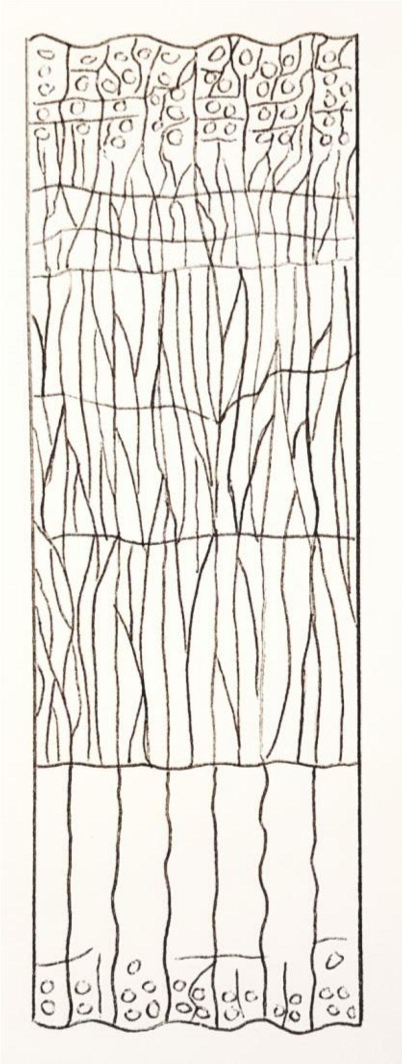
Importance of Structure

Where is the water??

There are three basic principles of basalt hydrology

- Center of individual basalt flows are dense and nearly impermeable
- Water collects in interflow zones
- Water moves down the slope of the interflow zones

Example of Flow Features and Density



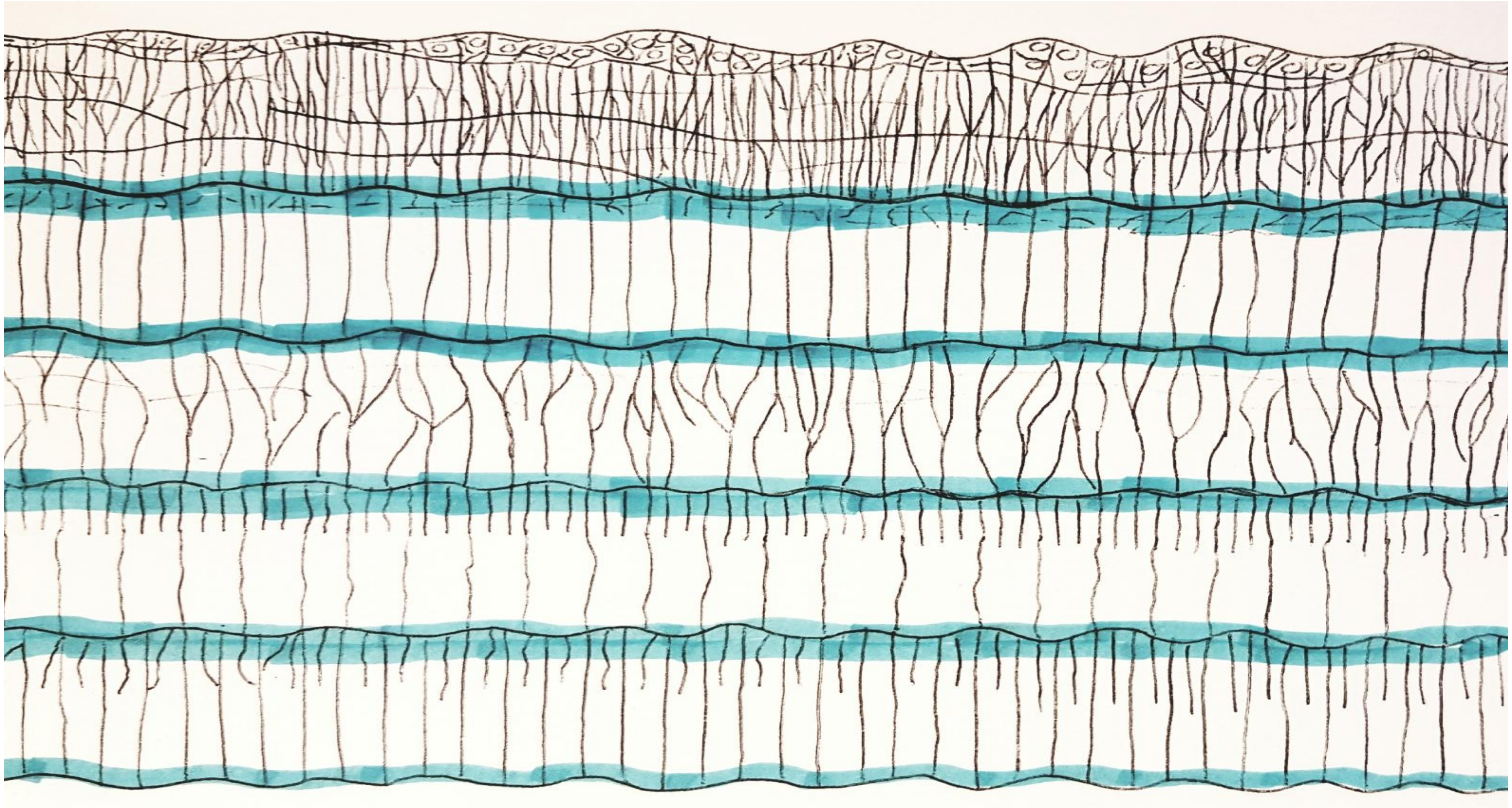
Flow top

Dense

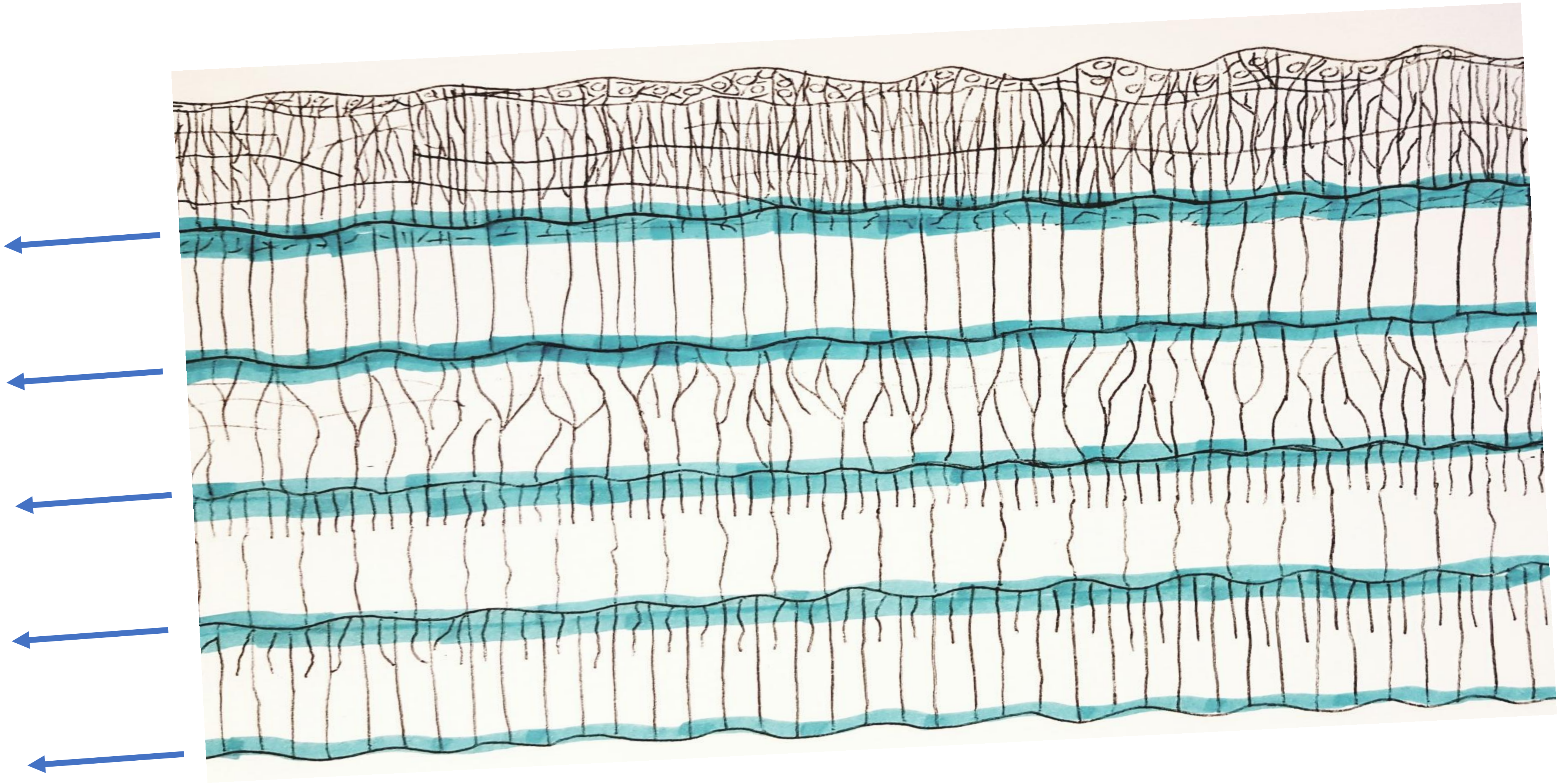
____

Flow bottom

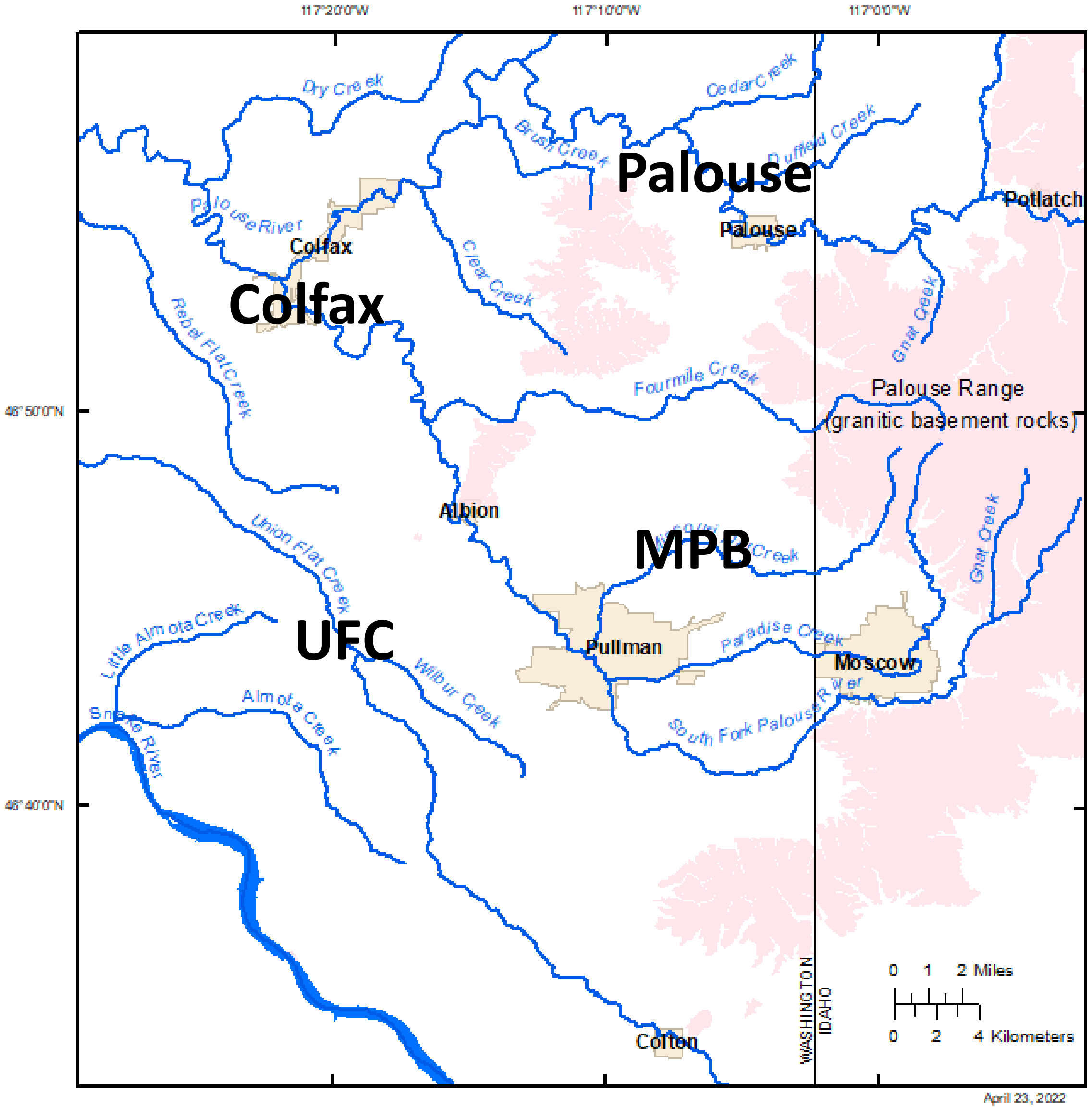
Water in Interflow Zones



Water Flows Downhill



Different Structural Blocks



Colfax – Colfax block

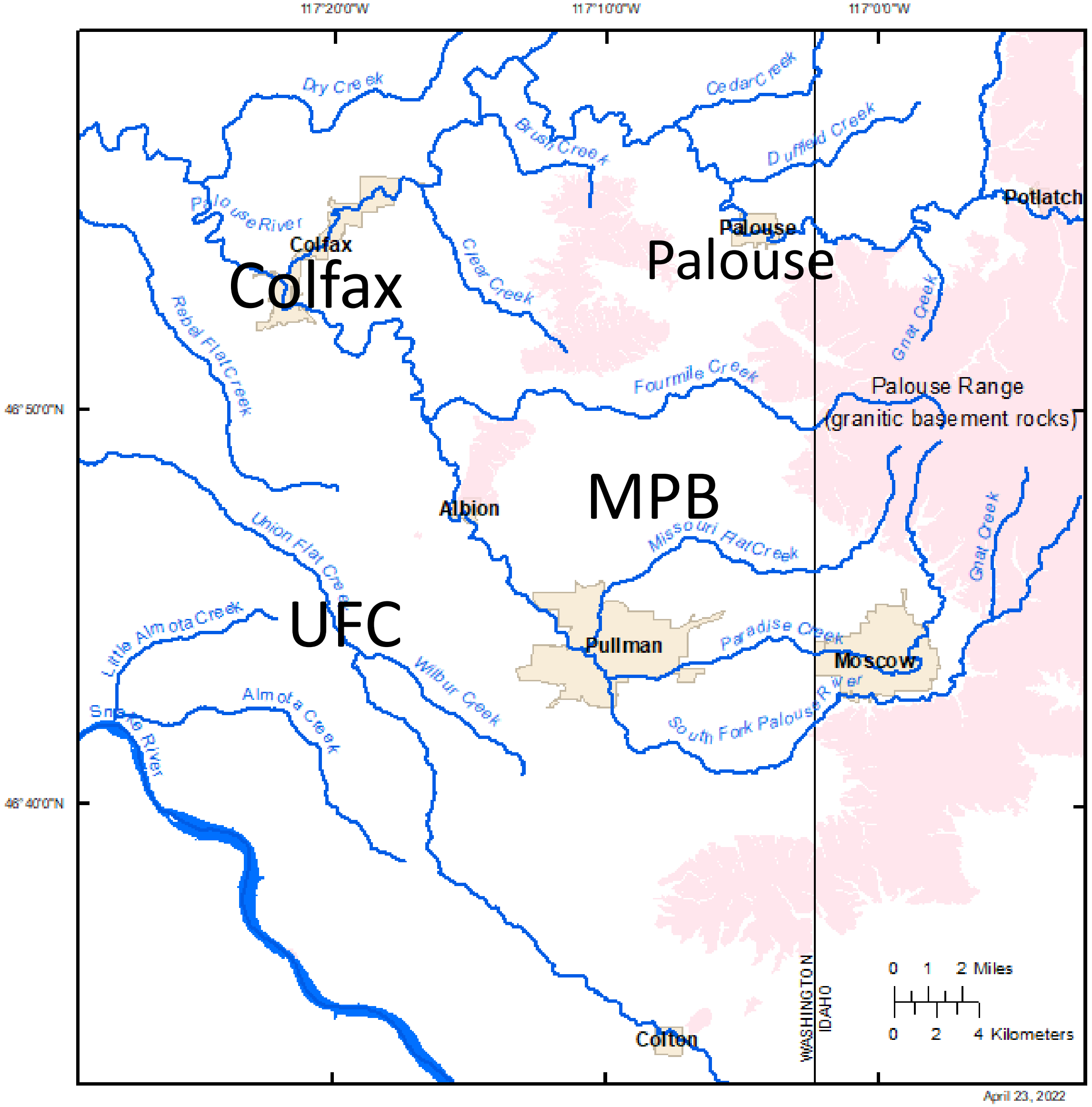
MPB – Moscow-Pullman basin

Palouse – Palouse block

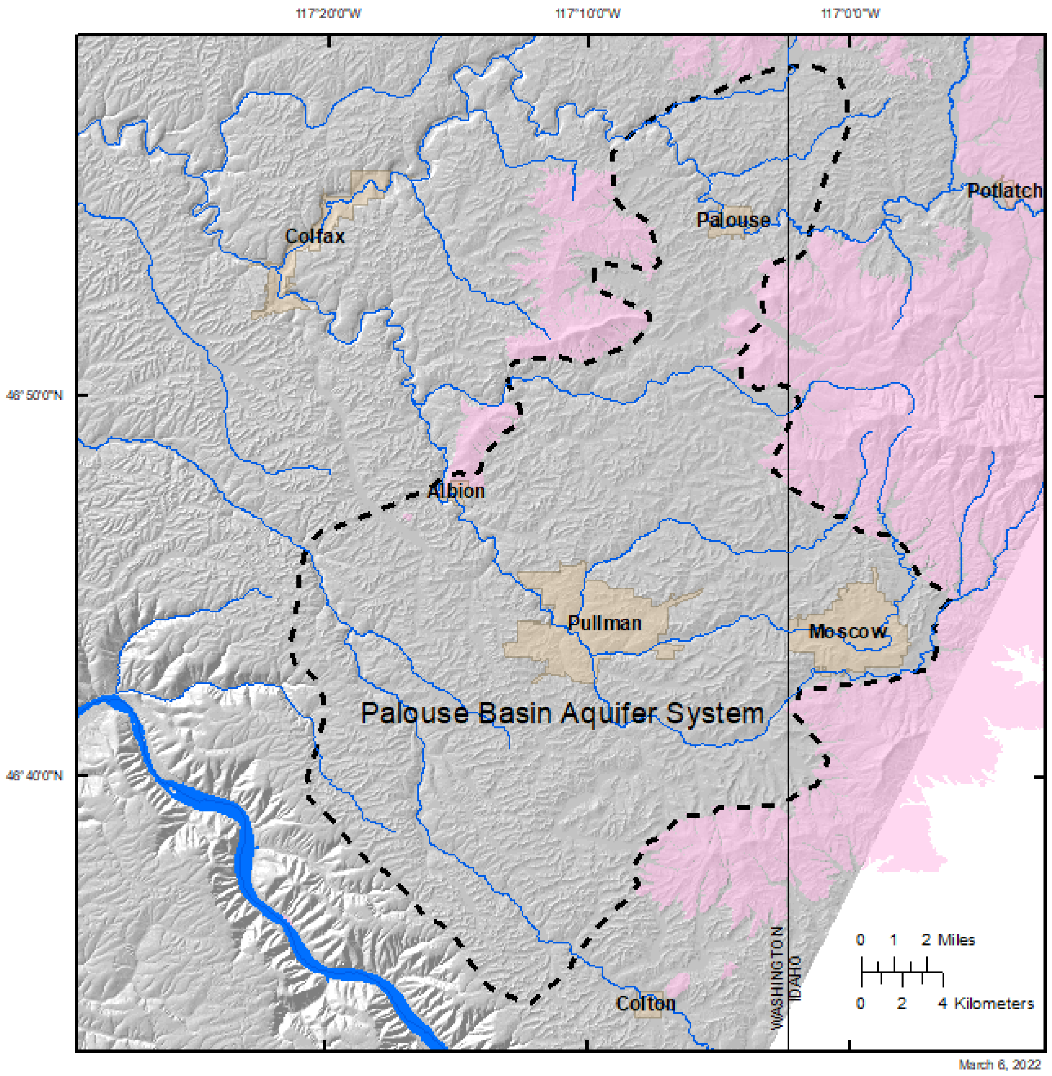
UFC – Union Flat Creek block

Brief Comparisons of Hydrology and Geology

- Moscow-Pullman Basin
- City of Palouse
- City of Colfax
- Union Flat Creek

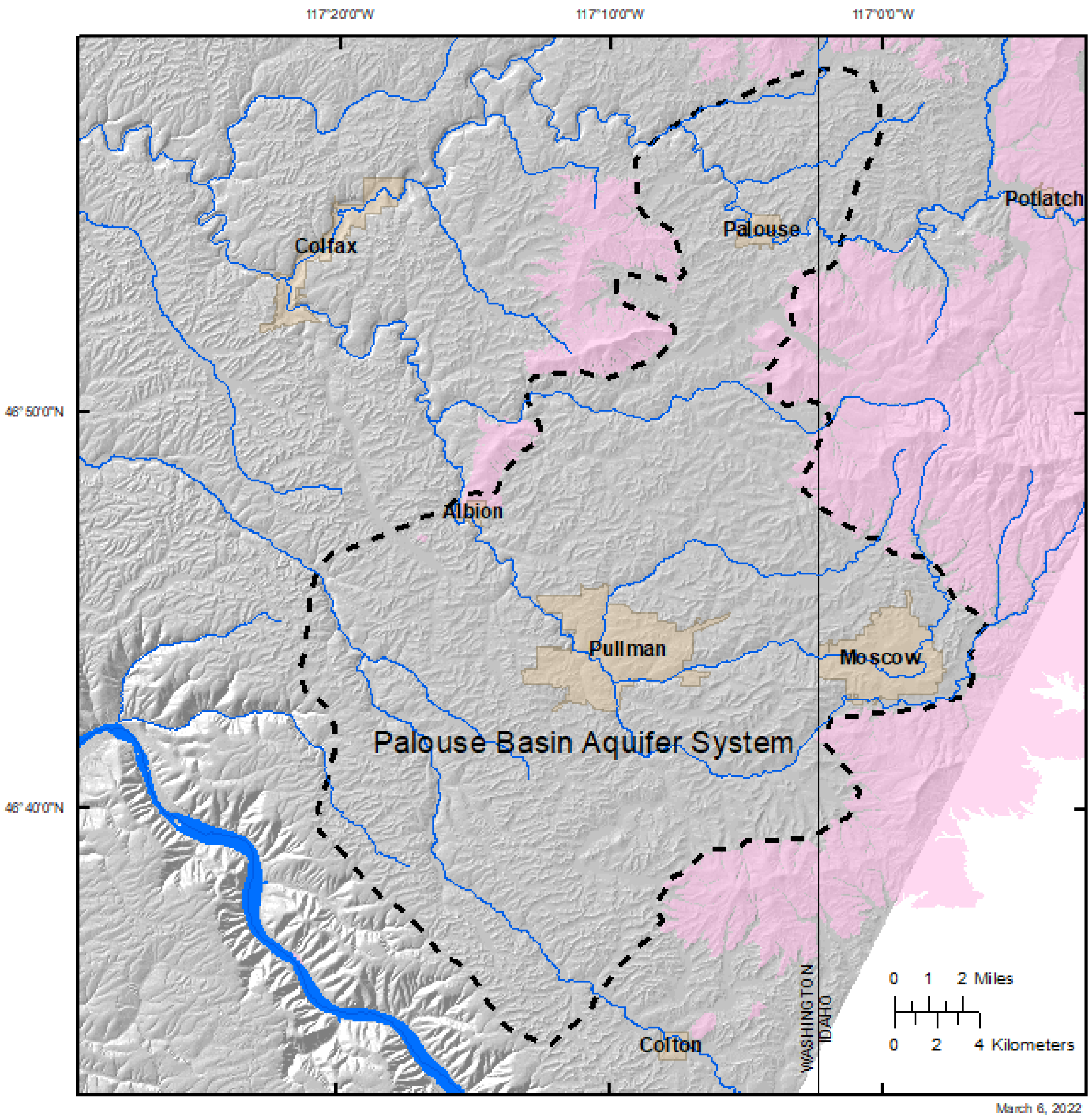


Proposed Extent of Palouse Basin Aquifer System



Conclusions

1. Boundaries include known areas of lower aquifer connections
2. Boundary no longer includes small errors
3. Proposed Palouse Basin boundaries are defendable as a hydrological basin



BOUNDARIES OF THE "PALOUSE BASIN" AQUIFER SYSTEM IN THE MOSCOW-PULLMAN AREA, IDAHO AND WASHINGTON

John H. Bush, Steve Robischon, and Pamela Dunlap

March 21, 2022

INTRODUCTION AND GOALS

The term "Palouse Basin" has been used in the Moscow-Pullman area for at least three decades to refer to the size and nature of its aquifer systems within Columbia River Basalt Group (CRBG) lava flows and associated sediments of the Latah Formation. The primary pumping centers are in Moscow and Pullman. Historic yearly water level declines have caused concerns since the late 1940s and hundreds of studies have been conducted on the geology and hydrology of the area. A portion of these studies are site specific, but most included parts or all of an aquifer system that has become known as the "Palouse Basin."

A problem has evolved in that many of the studies do not use the same boundaries. A committee formed from political and municipal entities has used the name "Palouse Basin Aquifer Committee" (PBAC) since the early 1990s. Four groundwater models and characterizations of the "Palouse Basin" (Barker, 1979; Lum et al., 1990; Leek, 2006; Medici et al., 2021) each have used data within different boundaries. PBAC illustrations continue to show boundaries (Figure 1) that were introduced by Leek (2006).

The purpose of this report is to review the illustrated and defined boundaries used for the term "Palouse Basin" and propose an updated version (Figure 2). The basic assumption followed in our review is that PBAC, scientists, engineers and the public have the same goal which is to determine the extent and nature of the aquifers connected to or affected by the pumping centers in Moscow and Pullman.

There are two major aquifers in the Moscow and Pullman area which are referred to as the lower (Grande Ronde) and upper (Wanapum) aquifers. Water level separation between the two aquifers is generally greater than 100 ft (30 m). The upper aquifer has variable water levels and production capabilities with limited hydrological connections over large areas of the Moscow-Pullman area. The connection between the upper and lower aquifer is considered to be minor (Bennett, 2009). Moscow is the only community where large production wells in the upper aquifer have been used for municipal purposes.

Presently, lower aquifer wells are the only sources being used for municipal water in Moscow and Pullman. Most domestic wells drilled between the two cities during the past two decades are located in the lower aquifer. All lower aquifer wells have similar water levels which indicate connections within the same aquifer system. Considerable pump test data exist to help evaluate the nature of these connections (Fielder, 2009; Moran, 2011; Folnagy, 2012). The extent of similar water levels in the lower aquifer was used as the primary basis in this review for determination of boundary locations for the "Palouse Basin." Geologic information on lower aquifer rocks was evaluated in concert with the focus on similar water levels. Modern stream patterns (Figure 3) were also used because they often reflect the tilt (slope) of the subsurface rocks which in turn control the direction of groundwater flow. For example, note the change from east-west-trending streams to northwest-trending streams in Pullman and the Union Flat Creek area. The rocks tilt to the northwest and the groundwater is considered to be flowing northwest in the Union Flat Creek area.

The terms "Grande Ronde aquifer" and "lower aquifer" have been used for the same aquifer in the Moscow-Pullman area. Aquifer names throughout the Columbia River flood basalt province typically have been derived from the formal geologic name of the basalt flows present in the system from which groundwater is obtained. The use of the same geologic name in two different locales does not mean that the aquifers have the same hydrologic characteristics and(or) are significantly interconnected.

MOSCOW-PULLMAN BASIN

Moscow and Pullman have some of the highest production wells from the Grande Ronde Basalt in the entire Columbia River flood basalt province. These wells, with similar water levels, are in the geographic area defined as the Moscow-Pullman Basin (MPB, Figure 4). The MPB has been considered by all researchers to be part of the aquifer system called the "Palouse Basin." Boundaries for the MPB were drawn where the basalts and associated sediments are in contact with the older, nearly impermeable rocks such as quartzite and granite. The lack of outcrops requires the use of water well reports which are based on drill cuttings for more precise contact determinations. Boundaries of basalt with quartzite are easy to locate because drill chips of basalt are dark colored and quartzite chips are light colored. Where sediments are present between basalt and quartzite, they tend to be quartz rich and well sorted. Determination of boundaries between granite and sediment however has been a problem in some places.

The contacts between the basalt, sediment and granite have been illustrated on four published geologic maps of the Moscow-Pullman area.[1] The authors of these maps relied on water well reports to establish contacts due to the rarity of outcrops. It is now apparent that both drillers and professionals for decades often had reported granite when they actually had encountered sediment. Drill cuttings from granite are very similar to cuttings from poorly-sorted sediments

[1] Four geologic maps of the Viola, Moscow East, Moscow West, and Robinson Lake 1:24,000 scale quadrangles are available from the Idaho Geological Survey (Bush et al., 1998a,b; Bush and Provant, 1998; Bush et al., 2000).

derived from nearby weathered granite. Grader (2012) used the available geologic maps and was the first to note that the contacts, in places, had not been correctly located. For this report, the proposed boundaries for the "Palouse Basin" near granitic areas are based on estimates of where the basalts end and the sediments and(or) granites begin. Some adjustments from the MPB boundaries of Bush et al. (2016) were made and additional minor ones are expected in the future.

The proposed boundaries in granitic areas for the lower aquifer are accurate enough for hydrological research. It should be noted that recharge into the lower aquifer via sediments and weathered granites does occur from higher elevations above and beyond the extent of the basalt flows (Dijksma et al., 2011; Candel et al., 2016; Duckett et al., 2019; Behrens et al., 2021).

The older impermeable rocks rise above lower aquifer rocks and define the semi-circular MPB. There are three gaps which make the boundaries discontinuous. These gaps are where the basalts and associated sediments extend between the older rocks and out of the MPB. The Fourmile and Kamiak Butte gaps on the northwest and north are narrow at approximately 1 mi (1.5 km) and 2.5 mi (4 km) across, respectively. The third gap, 10.5mi (16 km) across, is located along a line extending from the southern end of Smoot Hill at Albion (north of Pullman) to Chambers (south of Pullman).

A geologic cross-section, extending west from eastern Moscow through Pullman and out of the MPB into the Union Flat Creek area, illustrates the general geologic framework of the aquifer system of the "Palouse Basin"(Figure 5). There are three different geologic subsurface segments of the lower aquifer (Figure 5). Segment A, beneath Moscow, is dominated by fine- and coarse-grained sediments in close proximately to mountain highs. Segment B, the central area between Moscow and Pullman, is dominated by a vertical sequence of horizontal basalt flows which extend from near the Idaho-Washington state line westward to the eastern edges of Pullman. Segment C, beneath western Pullman and the Union Flat Creek area, is dominated by a stack of slightly deformed basalt flows that tilt (slope) to the northwest. There are hydrological differences in the lower aquifer across the Moscow-Pullman-Union Flat Creek area. Hydrological analyses by Fielder (2009), Moran (2011), and Folnagy (2012) concluded that the lower aquifer is very compartmentalized. The northwest tilted block and its associated structures in Segment C are believed to cause groundwater movement to change from a primarily east-to-west flow direction in segment B to a primarily northwest direction in Segment C (Foxworthy and Washburn, 1963; Leek, 2006). In spite of these cited differences, lower aquifer water levels are similar across all three segments and indicate connections beyond the western boundary of the MPB and into the Union Flat Creek area.

UNION FLAT CREEK AREA

The Union Flat Creek area west of Pullman is considered to be part of the "Palouse Basin." The basalts and sediments in the Union Flat Creek area that overlie the Grande Ronde Basalt include flows that are not present in Pullman and Moscow. Most domestic wells are in Wanapum Basalt and(or) Saddle Mountains Basalt, and there is a lack of deep wells into the lower aquifer. Three DOE test wells, completed in the lower aquifer, show that the uppermost Grande Ronde Basalt flows are the same as those at the top of the Grande Ronde in Pullman (Conrey et al., 2013). However, the upper Grande Ronde surface is much lower in elevation than in Pullman. For example, the top of the Grande Ronde in the DOE Landfill well is 220 ft (66 m) (Conrey et al., 2013) lower in elevation than an outcrop of the same surface along the South Fork of Palouse River near the two DOE City Yard wells in Pullman (Bush et al., 2016). This difference in elevation for the lower aquifer rocks requires the presence of a structural feature or features between the two areas.

Conrey et al. (2013) determined that there is a gentle rise in elevation of basalt contacts toward Pullman from the DOE Grange well to the DOE Flat Creek well located on the southwestern limb of an upfold in Pullman. The crest (top) of that fold corresponds to the outcrops along the South Fork of Palouse in western Pullman (Bush et al., 2016). In spite of the geological differences, the DOE wells have similar lower aquifer water levels as those in the MPB, which verifies that lower aquifer waters in the Union Flat Creek area are in some manner connected to the MPB area.

The southwest boundary of the Union Flat Creek area with the Snake River follows the crest of a northwest-trending upfold (anticline) on the north side of the river where basalt units dip (slope) into a northwest-trending downfold (syncline) that roughly follows Union Flat Creek (Swanson et al., 1980; Bush, 2008). Walters and Glancy (1969), Heinemann (1994) and Leek (2006) reported that deep wells near the north side of the Snake River are basically unproductive and that groundwater flows away from the river. Large springs are conspicuously lacking along canyon walls (Walters and Glancy, 1969) where more than 1,400 ft (427 m) of lower aquifer rocks are exposed. Barker (1979) produced a water level map that shows water levels decreasing in elevation with increasing distance away from the Snake River; these water levels are tracking the downward descent of basalt and sediment contacts of the northeast limb of the northwest-trending upfold (anticline). Our conclusion is that the upfold along the northeast side of the Snake River is a sharp groundwater boundary for the Palouse Basin. Leek (2006), Moran (2011), TerraGraphics Environmental Engineering, Inc. and Ralston Hydrologic Services (2011), and Folnagy (2012) all agree on this boundary.

The western boundary of the Union Flat Creek area was drawn west of the creek at the approximate structural change from basalts that tilt northwest to basalts that tilt southwest.

However, the deep well data base is sparse for large areas west of Union Flat Creek and until new well data are obtained, the western boundary of the "Palouse Basin" is considered to be debatable.

COLFAX AREA

The City of Colfax and areas north along the Palouse River have been considered to belong in the "Palouse Basin" by some researchers. We present several reasons, listed below, why we do not include the city and the areas north of the city in our proposed "Palouse Basin." They represent a combination of outcrop information, well comparisons, drillers reports, and hydrological analyses.

1) City of Colfax wells 2 and 3 are 600 (182.9) and 723 ft (220.4 m) deep, respectively, in Grande Ronde Basalt and associated sediments, and they produce about 600–711 gpm which is about one-third the production rate of the deep Grande Ronde wells in Pullman. Gravel sequences in both wells were dry and sealed off.

2) Lower aquifer rocks drop 340 ft (104 m) in elevation from Pullman outcrops to those in Colfax. The difference in elevation of the Grande Ronde rocks shows that there must be a structural feature or features between Colfax and Pullman. In contrast to the Union Flat Creek area where the lower aquifer water levels are similar to those in Pullman; the water levels in Colfax City wells are approximately 252 ft (83 m) lower than those in Pullman wells.

3) North of Colfax the Palouse River flows for 3 mi (4.8 km) on top of the uppermost Grande Ronde Basalt which dips to the southwest (Bush et al., 2016), but wells up to 500 ft (153 m) in depth near the river have variable water levels and generally only provide low yields. Wells in the lower aquifer between the river and Smoot Hill also have variable water levels and low production capacities. Folnagy (2012) reported low production lower aquifer wells in the Parvin area between Albion and Colfax.

4) Colfax is located on the southern end of a block of basalt flows that tilts to the southwest in contrast to the Union Flat Creek area which is located on a block of basalt flows that tilts to the northwest.

5) Lower aquifer interflow zones in the Colfax area are rarely traceable between wells. Dense parts of individual basalt flows show considerable changes in thicknesses from well to well.

6) Barker (1979) considered the area north and east of Colfax to be a barrier to groundwater flow from the Moscow-Pullman Basin.

7) Water level maps show a very steep gradient from Albion north to Colfax. Folnagy (2012, p. 99) stated this relatively large gradient "suggests that the long-term westward groundwater

flow out of the Palouse groundwater basin is slow." Porcello et al. (2009) noted that such steep gradients in CRBG aquifers may indicate the presence of a groundwater barrier.

8) Water level declines for the Clay Street well (Colfax City well 2) in Colfax (0.04 m/year) were much smaller than those in Pullman (1.18 ft/year, or 0.36 m/year) for the same 60-year period (Moran, 2011, p. 46).

The evidence indicates that the City of Colfax should not be included in the Palouse Basin. However, its location is near the border with the Union Flat Creek area; therefore, it should not be overlooked in any future studies. It is suggested that any groundwater modeling studies that include Colfax should at least lower the connection to the MPB by at least 70 percent and that areas north, northwest, and northeast of Colfax not be included in any iteration of the "Palouse Basin."

FOURMILE GAP

CRBG and associated sediments extend west out of the MPB between older rocks where Fourmile Creek flows westward between Smoot Hill and Kamiak Butte north of Albion. The Rod Mclntosh well, in the approximate center of the gap, is 235 ft (71.6 m) deep and encountered 140 ft (42.7 m) of Grande Ronde rocks. Basalt flows were emplaced from the west. One flow of the Roza Member of the Wanapum Basalt and one flow of the uppermost Grande Ronde Basalt both thin and pinch out east of the gap. Clay was deposited in front of and on top of these flows. Interflow zones generally are not traceable between low-production deep wells on either the east or west sides of the gap. The slope of the uppermost surface of the Grande Ronde surface dips steeply to the west toward the Palouse River indicating the presence of a structural feature west of the gap. Groundwater level maps show a steep downward gradient west of the gap for the lower aquifer. The drop in water level, the presence of clay between flows, the lack of traceable interflow zones and the existence of low-production wells west and east of the Fourmile gap has led to the conclusion that groundwater flow across the gap probably is not significant.

KAMIAK BUTTE GAP AND THE PALOUSE CITY AREA

The Kamiak Butte gap is important in that undeformed upper and lower aquifer rocks are believed to extend across this area (Bush et al., 2016) and connect the MPB with the Palouse city area. The upper aquifer north and south of the gap consists of the basalt of Lolo and the Vantage Member of the Latah Formation. The Grande Ronde was encountered at an elevation of 2,110 ft (643.1 m) in Palouse City well 3 where a high-production (about 800 gpm) lower aquifer well was established in 1999 and completed in 2000 (Ralston, 2000). In the DOE Butte Gap well, about 3.5 mi (5.8 km) south-southwest of Palouse, the top of the Grande Ronde was encountered at an elevation of 2,192 ft (668 m).

The 2000 city well replaced an older city well which was also completed in the upper Grande Ronde. Ralston (1996) noted that water level decline records for the older well appeared small for the withdrawal rates and concluded that there was a connection between the lower aquifer system in the Palouse city area and the pumping centers in Moscow and Pullman. Conrey et al. (2013) noted that the uppermost Grande Ronde Basalt in the DOE Butte Gap well belongs to the Meyer Ridge Member which is the same member as reported for the upper Grande Ronde in the Palouse City well 3 (Bush and Dunlap, 2018). Dale Ralston (written commun. to Kevin Gardes, 23 April 2013) stated that the information obtained from the DOE Butte Gap well indicated that the lower aquifer is continuous between the cities of Pullman, Moscow, and Palouse. Bush et al. (2016) illustrated (Figure 6) and discussed the geologic similarities between the Butte Gap well and Palouse City well 3. Bush et al. (2018) used palegeographic reconstructions to show that the ancestral Palouse River once flowed through the Kamiak Butte gap connecting the MPB with the Palouse city area. Piersol and Sprenke (2014) conducted an analysis of geophysical data across Kamiak Butte gap and concluded that the Grande Ronde basalts are in excess of 100 m (328 ft) thick and are likely continuous across the gap.

The water levels in Palouse City well 3 and DOE Butte Gap well are similar to those in the MPB which indicates that the Palouse area needs to be included within the boundaries of the "Palouse Basin." The lack of deep wells prohibits determination of the extent of the lower aquifer in the Palouse area. Aquifer test data from the Palouse City well 3 suggest that there are boundaries to groundwater flow probably due to the presence of older rocks that nearly encircle the city (Ralston, 2000). It is also possible that the Grande Ronde Basalt is restricted to canyon walls of the paleo-Palouse River.

Pump test analyses have been used to determine the possibility of lower aquifer connections between Palouse and the MPB to the south. Owsley (2003), McVay (2007), and Moran (2011) reported likely connections between Moscow, Pullman, and Palouse city wells. Folnagy (2012) believed this connection was questionable based on different seasonal water level trends in Palouse than those at pumping centers in Moscow and Pullman. These differences in seasonal trends are believed to be caused by the fact these cities are located in basins that have different configurations connected by a narrow gap.

The lack of deep wells makes it difficult to determine the precise depth and extent of the lower aquifers in the City of Palouse area. However, the evidence for a groundwater connection between MPB and Palouse via the Kamiak Butte gap is extensive. The Palouse city area is considered to be within the proposed boundaries of the groundwater "Palouse Basin."

SUMMARY

Research since the first regional map of the "Palouse Basin" by Leek (2006) shows that an updated map of the lower aquifer extent should be utilized by PBAC. The proposed boundaries presented herein are primarily based on research supported by PBAC and represent a smaller areal extent than the boundaries presently in use. The primary basis for a revised boundary at any location was where proven groundwater connections within the lower aquifer terminated. Our review indicates that the lower aquifer in the Colfax area is not, or at least not significantly, connected to the Moscow-Pullman pumping centers; however, it does show that the Palouse city area is likely connected. The lack of deep wells in the Union Flat Creek and Palouse city areas prohibits precise boundary locations in places, and adjustments are expected in the future as additional data becomes available. The boundaries presented in this proposal encompass an area that is defendable as one groundwater basin.

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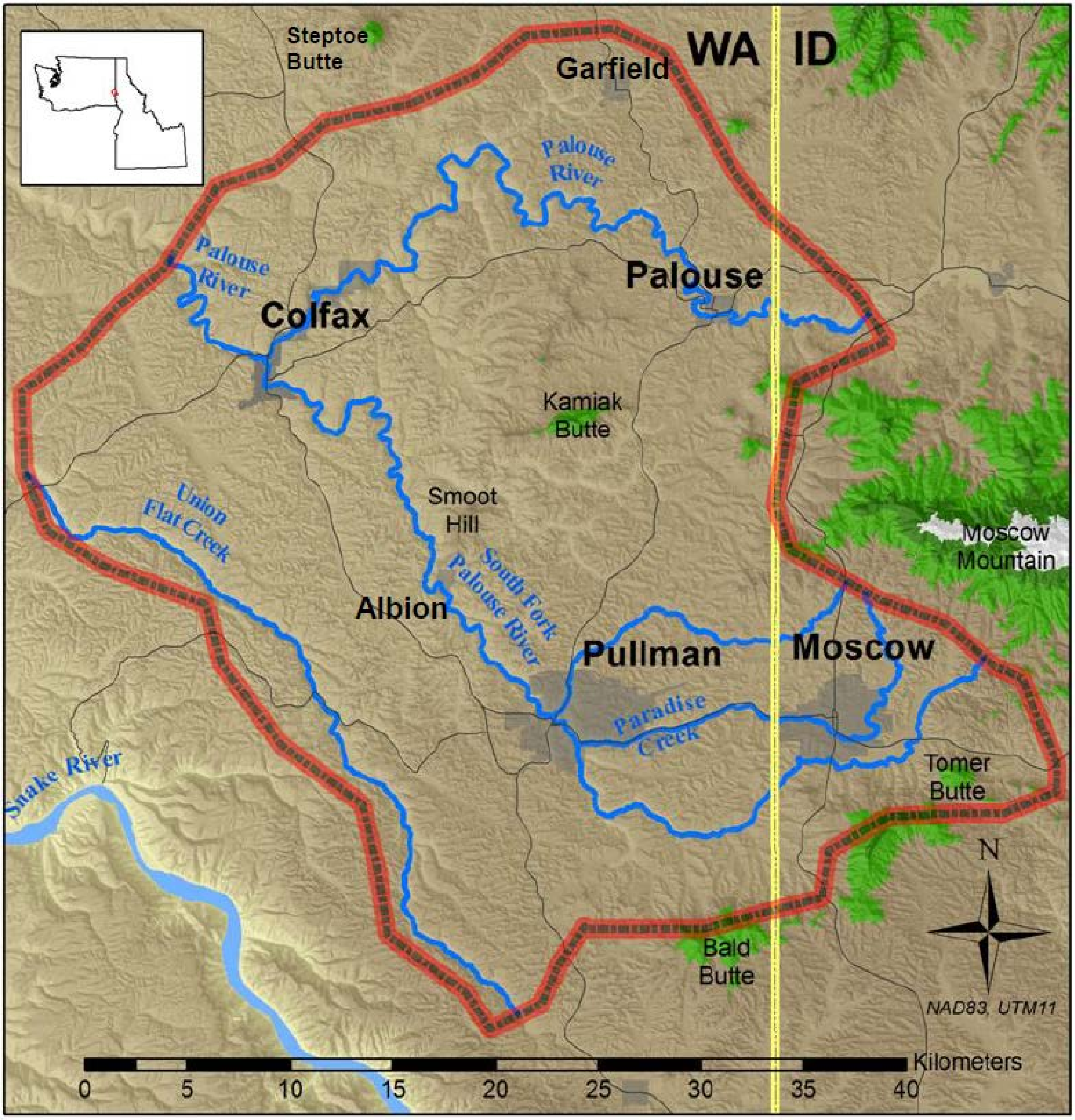


Figure 1. Map illustrating boundary of Palouse Basin (inside red highlighted dashed line) as presently used by Palouse Basin Aquifer Committee (from Moran, 2011).

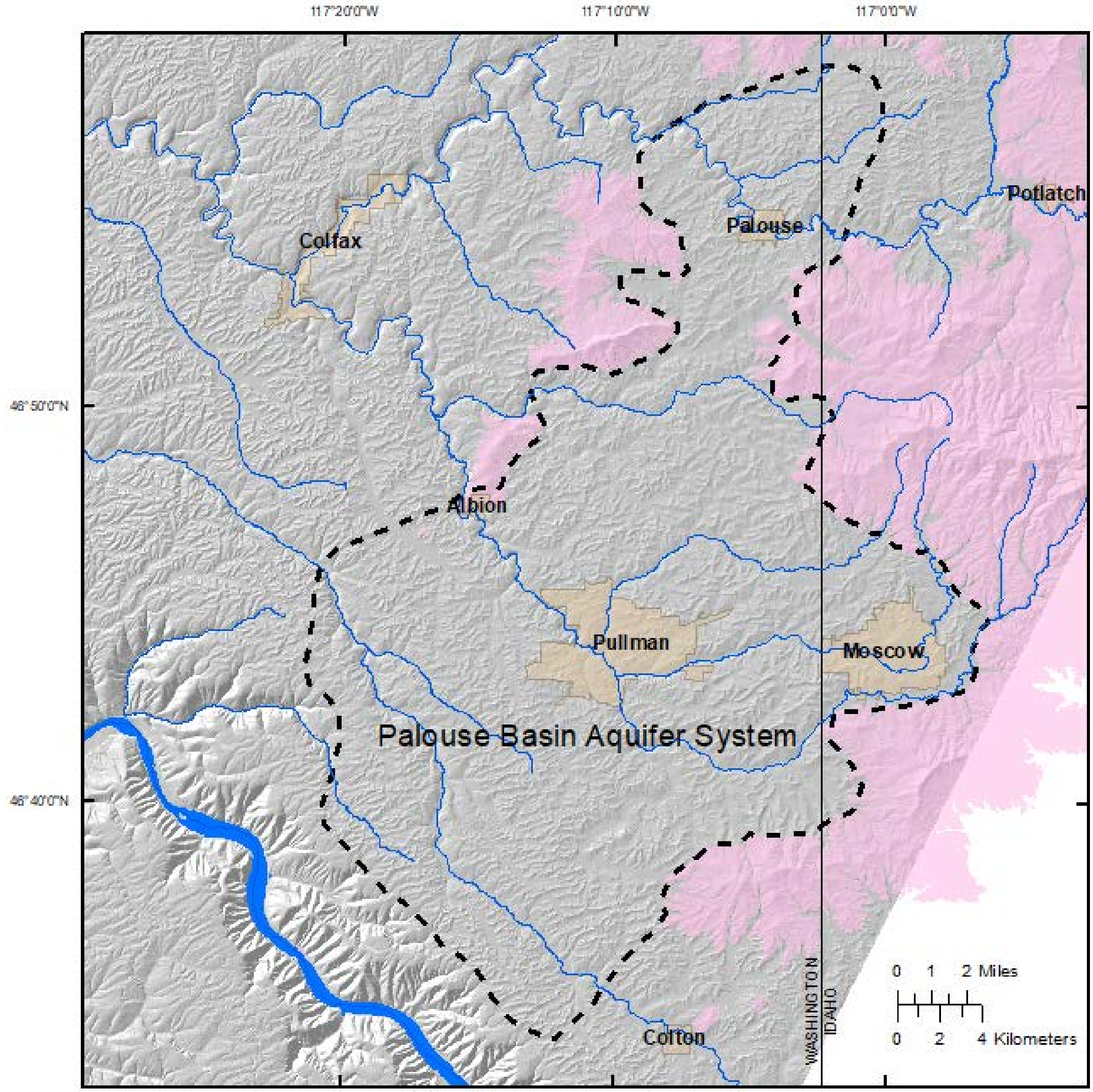


Figure 2. Physiographic map showing revised extent of the Palouse Basin aquifer system (inside black dashed line); Columbia River Basalt Group (gray), pre-Columbia River Basalt Group basement rocks (pink).

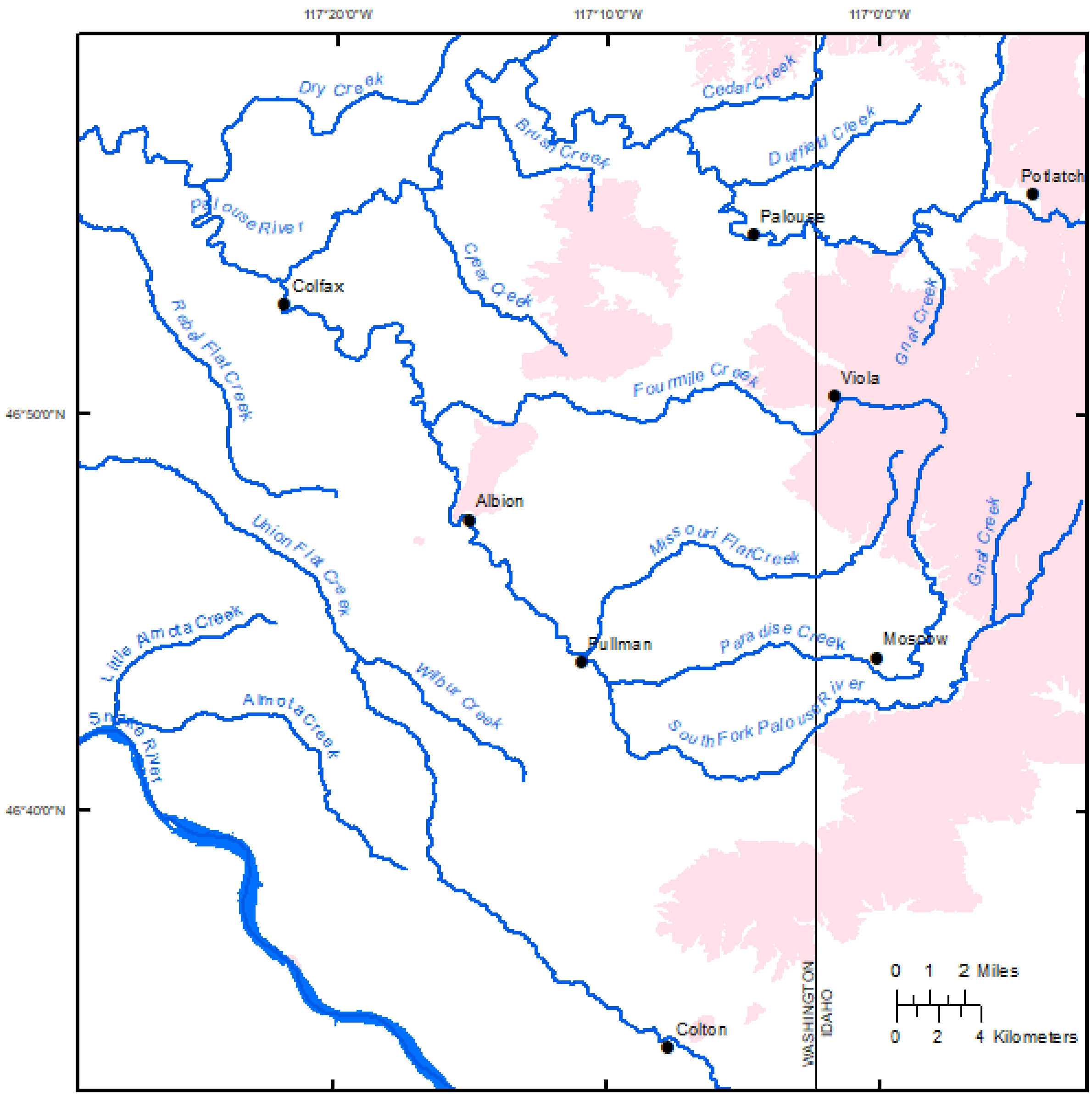


Figure 3. Map showing rivers and streams in the greater Moscow-Pulllman area; towns (black dots), basement rocks (pink). Note the northwest-trending streams west of Pullman; they are flowing in the direction of regional dip of the rocks.

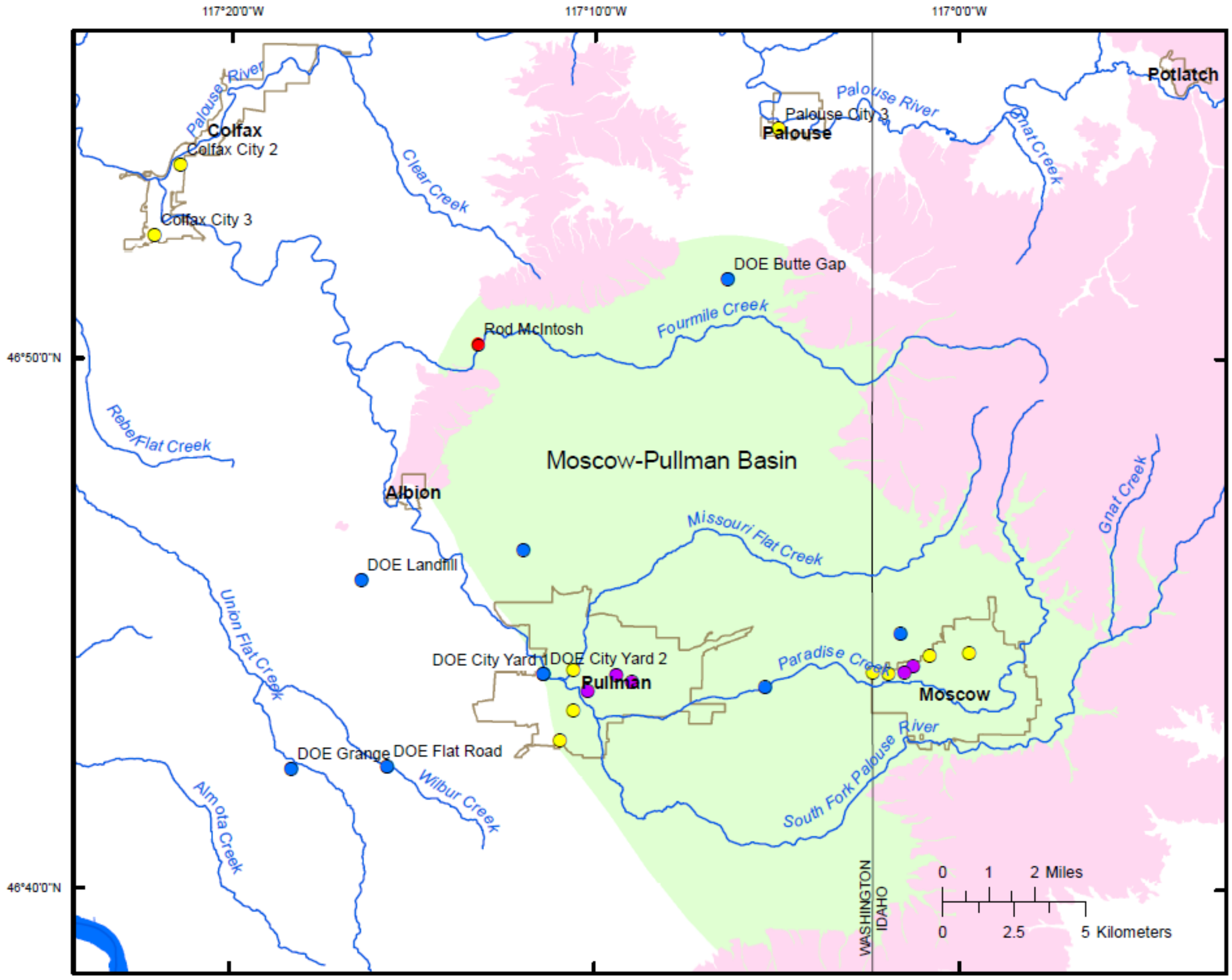
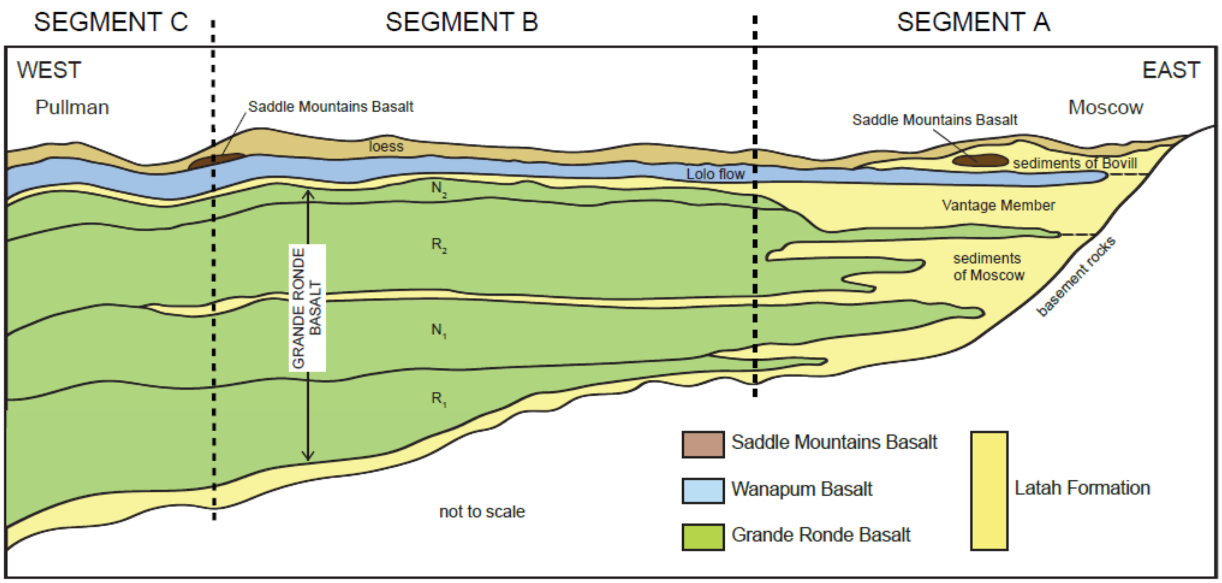


Figure 4. Map showing extent of the Moscow-Pullman Basin (green) as defined by Bush et al. (2018) and being made up of basalts and sediments; pre-Columbia River Basalt Group basement rocks (pink); wells (dots), domestic (red), municipal (yellow), test (blue), university (purple).



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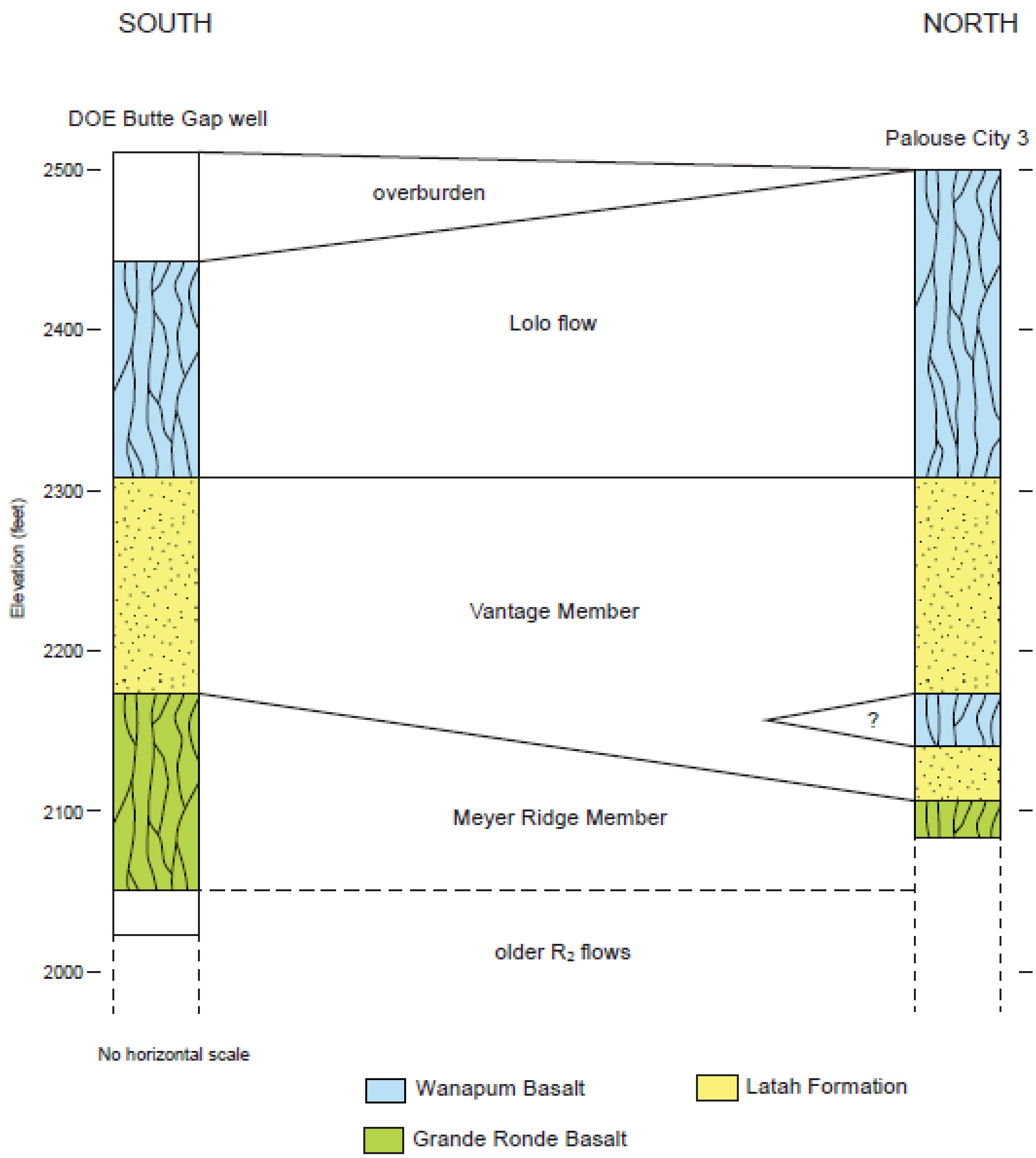

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Science & Engineering, Inc.

Jacobs

SPF WATER ENGINEERING

McCORMICK WATER STRATEGIES

DRAFT REPORT

Prepared For:
Palouse Basin Aquifer Committee

Palouse Groundwater Basin Water Supply Alternatives Report

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Acronyms and Abbreviations

Alta	Alta Science & Engineering, Inc.
AR	aquifer recharge
ASR	aquifer storage and recovery
IDFG	Idaho Department of Fish & Game
IDWR	Idaho Department of Water Resources
IWRB	Idaho Water Resource Board
Ecology	Washington Department of Ecology
ENR CCI	Engineering News-Record Construction Cost Index
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
O&M	operations and maintenance
PBAC	Palouse Basin Aquifer Committee
SEG	Stakeholder Engagement Group
SEPA	State (Washington) Environmental Policy Act
UI	University of Idaho
USFWS	U.S. Fish & Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WSU	Washington State University
WTP	water treatment plant
WWTP	wastewater treatment plant

Units

AF	acre feet
$/AF	cost per acre foot
MGY	millions of gallons of water per year
MG	millions of gallons

Executive Summary

The Palouse Groundwater Basin is the sole source of drinking water for the communities of Moscow, Idaho; Pullman, Washington; and Palouse, Washington; as well as the University of Idaho (UI) and Washington State University (WSU). Water is obtained from the deeper of two aquifers (lower aquifer), which has a current rate of water-level decline of 0.77 feet per year. Although the rate of decline has decreased over the last 30 years, the aquifer level continues to drop as the demand exceeds supply.

In response to declining water levels in 2017, PBAC determined the target water supply for the Palouse Basin for the next 50 years and identified four preliminary water supply alternatives to help meet the future demand and stabilize groundwater levels. These four alternatives include:

1. **Snake River Diversion**: surface water diverted and conveyed to a treatment plant. Treated water would be conveyed to Pullman and Moscow for direct use Alternative 1 is estimated to provide 85% of the water supply target.
2. **Paradise Creek or South Fork Palouse River:** surface water diverted and conveyed to a treatment plant. Treated water would be used to recharge the aquifer in Moscow. **North Fork Palouse River:** surface water diverted and conveyed to a treatment plant. Treated water would be conveyed to Pullman and Moscow for direct use. Alternative 2 is estimated to provide 82% of the water supply target.
3. **South Fork Palouse River:** surface water diverted and conveyed to a treatment plant. Treated water would be conveyed to Pullman for direct use. **Flannigan Creek:** constructing a reservoir and diverting the stored water to Moscow for direct use after treatment. Alternative 3 is estimated to provide 100% of the water supply target.
4. **South Fork Palouse River:** surface water diverted and conveyed to a treatment plant. Treated water would be used to recharge the aquifer in Pullman. **Paradise Creek**: surface water diverted and conveyed to a treatment plant. Treated water would be used to recharge the aquifer in Moscow. **Pullman Wastewater Reuse**: Class A reclaimed water used for irrigation in Pullman. **Moscow Wastewater Reuse:** Class A reclaimed water used for passive aquifer recharge in Moscow. **Additional water conservation**: a 15% increase in conservation. Alternative 4 is estimated to provide 81% of the water supply target.

In 2020, PBAC commissioned this current work to refine the four water supply alternatives and distill them into to one or two alternatives that can help meet future demand, stabilize aquifer levels, and have the greatest opportunity of successfully being implemented. The process of refinement includes conducting public outreach, filling water rights data gaps, identifying fatal flaws with water rights and fisheries, developing interim steps and evaluating the alternatives, and investigating a funding strategy.

Outreach

Outreach was a significant component of the alternatives refinement process which included an outreach plan, campaign, awareness polling, posting on social media, funding a Palouse Basin revisioning tool thesis project, formulating and engaging with a Stakeholder Engagement Group, engaging with the state agencies, and presenting to special-interest groups.

The outreach activities are raising awareness in the community and within the agencies. It is organically growing given the late stage of this project as more people become aware with increasing interest. State and tribal agency engagement with this project is helping identify processes and concerns, and keeps them apprised of the project.

Water Rights Investigation

Acquiring sufficient water rights is a key component to the water supply alternative implementation. The legal availability of water appears to be present with the alternatives based on the preliminary water rights investigations (Snake River was not included in the investigation). The alternatives require new water rights because there are insufficient existing water rights available to purchase to fulfill the supply target.

Water Rights and Fisheries Fatal Flaws Evaluation

The alternatives refinement investigation did not reveal any fatal flaws during the water rights investigation. However, Nez Perce tribal water rights claims in the Palouse Basin in Idaho, if approved, could potentially impact water availability for the projects with water from Idaho.

The alternatives refinement investigation did not reveal any fatal flaws in discussions with the various state and fisheries agencies. State fisheries agencies expressed concerns with the smaller water bodies having sufficient availability to meet both flows for aquatic needs and needs of the water supply alternative. The agencies need to review this report and provide comments to PBAC soliciting discussions for next steps.

Interim Steps

The four alternatives were divided into interim steps to provide a mechanism for implementing larger projects in phases over time, offering flexibility to adapt with the water supply needs and funding. During this process a new Modified Alternative 4 is introduced to replace Alternative 4. Modified 4 is more cost effective and incorporates feedback from the public.

- **Modified Alternative 4** - **South Fork Palouse River:** surface water diverted and conveyed to a treatment plant. Treated water would be conveyed to Pullman for direct use. **Paradise Creek**: surface water diverted and conveyed to a treatment plant. Treated water would be conveyed to Moscow for direct use. **Additional water conservation**: a 15% increase in conservation. Modified Alternative 4 is estimated to provide 80% of the water supply target.

There is no clear front-runner water supply alternative. A decision matrix is therefore used to compare the alternatives and rank them. The ranking order from highest to lowest is Modified 4, 3, 2, and 1.

Alternative 1 has the highest capital cost, operations and maintenance (O&M) cost, and total present value cost per acre foot of annual supply. It ranks the lowest in the decision matrix. This alternative had preliminary favor with the state fisheries agencies due to the volume of water in the river compared to the proposed withdrawal amounts.

Modified Alternative 4 had the lowest capital cost, O&M cost, and total present value cost per acre foot of annual supply. It ranks highest in the decision matrix. This option has the lowest reliability of water availability. Until instream flows are determined, it is unknown whether there is sufficient physical availability of water as determined by the state fisheries agencies.

Funding Strategies

There are opportunities for funding the alternatives. Upon selection of an alternative and governance structure, a funding strategy can and must be developed. The strategy is likely to include a blend of funds and revenue that will need to consider the communities' ability-to-pay, revenue sources, and external funding sources.

Recommendations

Alta recommends moving forward with Modified Alternative 4 (highest rank) followed by Alternative 3 (second highest rank). The purpose of bringing two alternatives along is to continue with forward progress in the event a fatal flaw is found or a significant change is needed with Modified Alternative 4 (ex. insufficient water supply).

Alta recommends a water utility rate study to evaluate community affordability. The outcome may help determine the preferred alternative.

Near-Term Next Steps

Based on the findings of the water supply alternatives refinement project, PBAC will conduct a workshop to discuss and plan the near-term next steps. These steps will include dissemination of this report and discussions with community leaders, state and tribal agencies, and the public. Outcomes of the discussions reaching critical decision points which form the foundation of the project include selection of the alternative(s) to move forward, governance, funding strategy, agreements, and planning documents.

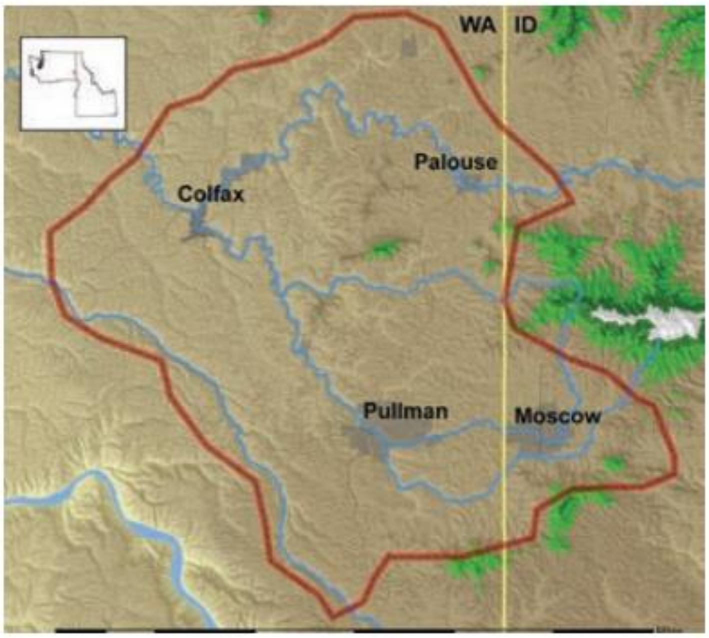
Section 1 Introduction

The Palouse Groundwater Basin is the sole source of drinking water for the communities of Moscow, Idaho; Pullman, Washington; and Palouse, Washington; as well as the University of Idaho (UI) and Washington State University (WSU). The Basin covers a small portion of western Idaho with the bulk of the Basin in eastern Washington (Figure 1). In addition, hundreds of residences obtain water from the basin in rural Latah and Whitman counties. The cities and universities obtain water from the deeper of two aquifers (i.e., Grande Ronde Aquifer, lower aquifer).

Water levels in the lower aquifer have declined over time. Although the rate of decline has decreased over the last 30 years to the current rate of decline (0.77 feet per year), the current aquifer withdrawals are not sustainable. Therefore, the communities need a supplementary water supply to stabilize aquifer levels and allow for future growth.

The Palouse Basin Aquifer Committee (PBAC) hired Alta Science and Engineering, Inc. (Alta) and their team from Jacobs, McCormick Water Strategy, and SPF Water Engineering to refine the top four water supply alternatives developed in 2017 by conducting outreach activities, filling water rights data gaps, developing project phases, and investigating potential financing. The purpose of this report is to present the findings and to identify the most viable options for a sustainable water supply for the Basin.

Figure 1. Working Boundary of the Palouse Groundwater Basin



From PBAC (2020)

The remainder of the report is structured as follows:

Section 2 – Background summarizes the water supply alternatives from 2017 (Anchor QEA et al.).

Section 3 – Outreach describes the outreach plan and outreach conducted.

Section 4 – Water Rights Data Gap Filling summarizes the water rights investigation for Idaho and Washington related to the water supply alternatives.

Section 5 – Fisheries Agencies Discussions summarizes conversations with the national and state fisheries agencies.

Section 6 – Water Supply Alternatives Interim Steps describes potential interim steps for each alternative and the updated costs.

Section 7 – Water Supply Alternatives Matrix and Ranking presents the decision matrix and subsequent ranking of each alternative.

Section 8 – Funding Strategy Development summarizes potential funding sources and planning information.

Section 9 – Conclusions provides conclusions on the water supply alternatives.

Section 10 – Recommendations provides recommendations on the water supply alternatives.

Section 11 – Next Steps presents the next steps of the process to advance a water supply alternative.

Section 2 Background – Previous Water Supply Investigation

From 1958 to 2013, various agencies (ex. Moscow, Pullman, US Army Corps of Engineers) investigated and developed approximately 38 water supply alternative options for the Palouse Basin. From 2015 to 2017, PBAC developed the regional supplemental water supply target, review and evaluate the existing water supply alternative project options, develop updated alternative project costs, and develop the top alternatives to move forward in the next project phase (Anchor QEA 2017). The 2017 report contains the following two main outcomes:

- The Palouse basin needs an estimated supplemental supply target of 2,324 millions of gallons per year (MGY) to stabilize the aquifer levels and meet future water use demand
- There are four potentially viable water supply alternatives that could stabilize aquifer levels and meet the future water-use demand

This work is summarized below and detailed in the 2017 report.

2.1 Supplemental Supply Target

The 2017 report indicates the Palouse Basin needs an additional 2,324 million gallons per year to meet future demand and stabilize the aquifer level. This volume of water is referred to as the supplemental supply target. The regional supplemental supply target incorporates a future need component and an aquifer stabilization component broken out as:

- Future need (1,588 MGY): Estimated water demands incorporating historical and average 2013-2015 water use and a projected need in 50 years with a population growth of 1% with the current level of conservation.
- Aquifer stabilization (735 MGY): Estimated to be the average 2013 – 2015 basin irrigation amounts. Although the stabilization value is not known, the rate of water level decline has been decreasing over the last 30 years. The aquifer stabilization volume offset is expected to reduce the rate of decline and may stabilize aquifer water levels.

The communities are expected to continue pumping groundwater. Table 1 is a summary of the projected supplemental supply target and Palouse Groundwater Basin demands.

Table 1. Summary of Projected Palouse Groundwater Basin Demands (Anchor QEA et al. 2017).

Year/Type of Demand	Moscow (MGY)	Pullman (MGY)	WSU (MGY)	UI (MGY)	Palouse (MGY)	Total (MGY)	Total (AF)
Baseline Demands (2013-2015 average)							
Irrigation	241	278	153	46	17	735	2,256
Non-Irrigation[1]	623	637	322	106	40	1,728	5,304
Total	864	915	475	152	57	2,464	7,561
Baseline Projection (Existing Baseline with Currently Projected Conservation + 1% Annual Growth)							
2065[2]	1,422	1,505	781	250	94	4,052	12,434
50-year Projected Increase[3]	557	590	306	98	37	1,588	4,874
Aquifer Stabilization[4]	241	278	153	46	17	735	2,256
Supplemental Supply Target[5]	798	868	459	143	54	**2,324**	7,130

[1]Average use November – February

[2]50-year projection total need

[3]Projected increase is the difference between the 2065 projected demand and the baseline demand.

[4]Aquifer stabilization is equal to the estimated baseline irrigation demand.

[5]Supplemental supply target is equal to the projected increase plus the aquifer stabilization amount.

2.2 Water Supply Alternatives

PBAC's consultant reviewed 38 water supply alternatives projects. They formulated and analyzed the alternatives using a matrix. Four alternatives rose to the top as the most viable projects. The 2017 report describes the evaluation criteria and methods including lifecycle cost analysis assumptions, modeling uncertainty and risk, cost and schedule uncertainty, and yield uncertainty. 0 lists the top four alternatives and percent of the water supply target.

Table 2. 2017 Report Water Supply Alternatives.

Alternative Number	Alternative Description	% of Projected Basin 50-Year Demand
1	**Snake River Diversion:** surface water pumped and conveyed to treatment plant near Pullman. Treated water conveyed to Pullman and Moscow for direct use.	85
2	**Paradise Creek or South Fork Palouse River:** surface water pumped and conveyed to treatment plant in Moscow. Treated water injected into aquifer recharge wells in Moscow. **North Fork Palouse River:** surface water pumped and conveyed to treatment plant north of Pullman. Treated water conveyed to Pullman and Moscow for direct use.	82
3	**South Fork Palouse River:** surface water pumped and conveyed to treatment plant near Pullman. Treated water conveyed to Pullman for direct use. **Flannigan Creek:** dam, reservoir stored water pumped and conveyed to treatment plant near Moscow. Treated water conveyed to Moscow for direct use.	100
4	**South Fork Palouse River:** surface water pumped and conveyed to treatment plant near Pullman. Treated water conveyed to Pullman for active injection in aquifer storage and recovery (ASR). **Paradise Creek:** surface water pumped and conveyed to treatment plant in Moscow. Treated water injected into aquifer recharge wells in Moscow. **Pullman wastewater reuse:** Class A reclaimed water pumped to new water reuse system for irrigation at reuse sites in Pullman. **Moscow wastewater for infiltration:** Class A reclaimed water discharged to shallow infiltration area to enhance recharge of the upper aquifer. **Conservation:** a 15% increase in conservation.	81

PBAC's consultant also conducted follow-on work and filled data gaps. This work is documented in the following memoranda:

- Draft Water Rights Evaluation – February 2018 (Anchor QEA 2018a)
- Ecology and IDWR meeting summary – April 2018 (Anchor QEA 2018b)
- North Fork Palouse River Surface Water Treatability – February 2018, October 2019 (Anchor QEA and HDR 2018; HDR 2019a)
- Clearwater Alternative – November 2019 (HDR 2019b)
- Fisheries Agencies correspondence documentation –October 2019, February 2020 (Anchor QEA 2019a, b)
- Endangered Species Act permitting and strategy development – February 2020 (Anchor QEA 2020)

Section 3 Outreach

PBAC recognizes the importance of community engagement with the water supply alternatives. The purpose of conducting outreach is to educate the public about their drinking water source and the need for a water supply alternative, provide details about the alternatives, and gather and incorporate input and feedback. This section describes the outreach planning and documents the outreach activities performed from 2021 to 2022. The outreach is raising awareness in the community and within the agencies. It is organically growing given the late stage of this project, as more people become aware, and with increasing interest.

3.1 Outreach Plan

To enhance outreach success, Alta prepared an outreach plan specifically for the water supply alternatives. Appendix A contains the Outreach Plan. Objectives include identifying key stakeholders, leadership roles and responsibilities, and communication methods; developing a foundation of content for outreach presentations, general schedule, and feedback loop; and establishing metrics to ensure progress will be made.

Outreach is an important component of the water supply alternatives refinement and is in alignment with PBAC's overarching organizational goals listed below from PBAC's Communication Action Plan (DH 2017):

1. Build community awareness and understanding of the Palouse Basin's groundwater supply.
2. Engage the community and build public support of and involvement in PBAC's mission to ensure a quality, long-term water supply.
3. Strengthen PBAC's reputation and credibility as the Palouse Basin Groundwater Authority

The goals of outreach activities during the water supply alternatives refinement process are to inform, educate, solicit, incorporate feedback, and gain informed consent for a selected alternative(s).

3.2 Outreach Campaign

PBAC developed an outreach campaign booklet that was used for developing outreach materials and as a blueprint for PBACs social media campaign. Outreach planning efforts resulted in development of the tag line, "Conserve, Stabilize, Thrive." The booklet also describes the social media campaign and provides a "how-to". Appendix B contains the "Conserve, Stabilize, Thrive" campaign booklet.

3.3 PBAC Awareness Poll

PBAC developed a Palouse Basin Awareness Poll in fall 2021 using a Google polling platform. The purpose of the poll was to:

- Gain understanding of public knowledge of the aquifers and water conservation
- Better understand how residents access information on water matters
- Better shape messaging and effectively use social media

- Increase community engagement through PBAC's "Conserve, Stabilize, Thrive" campaign

The poll was open from September 8 – October 8, 2021. Poll advertising occurred on PBAC's website and social media, the cities' websites, during outreach presentations, and in a press release in the Moscow-Pullman Daily News.

A total of 306 people took the poll and answered 18 questions. Poll outcomes included:

- 82% of participants live in Moscow or Pullman.
- Participant ages range varied widely with the under 18 years old making up the smallest age group with the remaining age groups distributed somewhat evenly. Nearly 60% of participants were female. 58% of participants were employed full time, and nearly 90% have some college or a graduate degree.
- Over 125 participants through social media; the other sources were each mentioned by fewer than 50 participants.
- 72% of participants knew about PBAC and 80% know their water is sourced from groundwater, and about 82% know water levels in the lower aquifer are declining.
- 84% of participants believe they either use an average or below average amount of water in comparison to others.
- 95% of participants expressed water conservation is important to them. 66% of the participants said they were either aware of the cities' water conservation programs or expressed interest in learning about them.
- 52% of respondents said they want to be more involved in water matters.
- Comments ranged from wanting to know how much water is left, to concerns about water use, to new developments, to appreciation for the work PBAC is doing.

Appendix C contains the PBAC Awareness Poll Findings summary document.

3.4 Social Media

PBAC created Facebook, Instagram, and Twitter accounts in March of 2021. Within the last year of having the social media accounts, they went from zero followers on Twitter to 27 followers, zero followers on Instagram to 128, and 90 followers on Facebook to 200. Appendix D contains the social media analytics through February 28, 2022.

From March 2021 to July 2021, PBAC posted three times a week on Instagram, Twitter, and Facebook to gain traction quickly. From August to October, they switched to posting once weekly on each platform to create consistency for their audience. In November and December 2021 PBAC had just finished the Google poll (described in 3.3), so they posted less frequently to ensure they and the stakeholders had time to review the poll results and decide how to share them.

The accounts growth plateaued after the poll but started to show steady increase with consistent weekly posts. PBAC continues posting on each platform a few times per month.

One of the key takeaways of the PBAC awareness poll (Section 3.3) is that people are interested in conservation, so that is what they structured the content around in January and February 2022 where they went back to the once weekly for each platform with conservation content.

Results from the PBAC awareness poll suggest the majority of residents get PBAC information through social media. Social media tools appear to be an effective method for spreading awareness, although this was bias to the feedback from only the polling population.

3.5 Palouse Basin Revisioning Tool

PBAC funded Lauren Kirkpatrick's master's thesis project at Washington State University to gain insight in better visual tools for outreach. Her thesis title is *Improving Public Perceptions of Water Resource Policies Through the Use of Online Simulations and Visual Design* (Kirkpatrick 2022). Lauren updated a previous web-based model called the Palouse Basin Revisioning Tool. The Revisioning Tool provided information on hydrogeology, the Palouse Basin aquifers, the water supply alternatives, and conservation. Lauren provided two web-based interfaces for users and then solicited feedback on the interfaces. She also asked viewers which of the four alternatives they preferred. The preferred alternative was Alternative 4 (Modified Alternative 4 was not available at the time of the study). The full results of the study are provided in her thesis.

3.6 Stakeholder Engagement Group

PBAC established a charter for a Stakeholder Engagement Group (SEG) in 2020 and launched the SEG in early 2021. The SEG's purpose is to provide input to PBAC through dialogue among a broad range of interested parties focusing mainly on the four water supply alternatives and associated engineering and environmental evaluations and analyses, research activities, and public involvement efforts. Input from the SEG plays a critical role in public engagement and helps guide outreach activities.

Currently SEG has approximately 15 members representing a variety of backgrounds and interests, although more people are invited to participate if they are interested. The group met in February 2021, April 2021, and February 2022. PBAC and Alta presented progress updates to the group, generating dialogue. The SEG recommended developing a tag line, which resulted in the "Conserve, Stabilize, Thrive" campaign described in Section 3.2. PBAC will continue to engage with the SEG throughout the water supply alternatives progress.

3.7 Entity Engagement

Alta regularly provided project updates at the PBAC meetings where representatives from the Washington Department of Ecology (Ecology) and the Idaho Department of Water Resources (IDWR) attended. In addition, they met with other agencies throughout the project.

Washington Department of Ecology

PBAC and Alta's team met with staff from Ecology on June 7, 2021 to provide an update on the project and to solicit feedback. Appendix E provides a summary of this discussion. Ecology made it clear that the Agency follows the recommendations on physical availability of water from the Washington Department of Fish and Wildlife (WDFW). Ecology recommended the team meet with state and national fisheries agencies to gather insight and identify potential concerns regarding the water supply alternatives. Section 5 describes the meetings held with PBAC, Alta's team, the National Marine Fisheries Service (NMFS), US Fish and Wildlife (USFW), WDFW, and Idaho Department of Fish and Game (IDFG).

PBAC and Alta again met with Ecology staff (Brook Beeler, Patrick Cabbage, Chris Beard, Stephanie May, and Jamie Short) on April 7, 2022 to provide an update on the fisheries meetings and alternatives refinement. Ecology stated ASR is easier to permit than direct use and reiterated the water supply alternative must meet the legal and physical availability of water as defined by the state.

Idaho Water Resource Board

PBAC provided project updates to Neely Miller at the Idaho Water Resource Board (IWRB) approximately every other month. The purpose was to update the Board on the progress of the water supply alternatives project, milestones, outreach, polling results, and PBAC governance. Feedback was positive with the progress made and the project remains on their list for upcoming water supply projects needing funding.

Congressional Delegates

PBAC had discussions with state and federal congressional delegates. They met with Washington and Idaho federal delegations as well as state legislators from WA District 9 and Idaho District 5/6 over the duration of the project. These were general conversations about the size and scope of the water supply alternative projects and that federal and state funding would need to be part of any water supply project.

Nez Perce Tribe

The Nez Perce Tribe's aboriginal territory extends into the Palouse Basin. PBAC and Alta's team also met with members/staff of the Nez Perce Tribe on January 25, 2022 with Ken Clark (head of the Water Resources Department), Allison Lebeda (water rights), Emmit Taylor (fisheries), and Bobby Hills (fisheries) to discuss the status of the Palouse Basin water levels and water supply alternatives. They didn't identify any major concerns during the call but stated that they would like to continue being engaged and have an opportunity to review documents related to future environmental assessments.

3.8 Other Outreach Conducted

To further PBAC's goal of engaging with the community on the water supply alternatives, PBAC and Alta presented water supply alternative project updates at the following events throughout the duration of this project. Many of these were advertised in the Moscow-Pullman Daily News:

- PBAC Leadership Roundtable – September 2021
- American Water Resources Association Washington Section Conference – October 2021
- Palouse Basin Water Summit – October 2021
- Moscow League of Women Voters – November 2021
- Moscow Finance Committee (Poll results) - January 2022
- Pullman City Council (Poll results) – February 2022
- Moscow League of Women Voters – March 2022
- Pullman League of Women Voters – April 2022
- Whitman County Realtor's Association – May 2022

3.9 Community Feedback

Feedback received from during outreach through the variety of methods (personal communications, meetings, emails, a PBAC poll, and opinions in the local newspaper) resulted in three primary concerns that include:

1. The rapid increase in land development and the increase in population growth further taxing the aquifer.
2. Potential negative impacts of emerging contaminants by injecting treated surface water into the aquifer, despite the water being treated to drinking water standards.
3. The length of time to implement an alternative. They want to see continued progress.

Section 4 Water Rights Data Gap Filling

Additional water rights are needed for any of the water supply alternatives to be viable. Our team investigated water rights on surface water bodies related to the water supply alternatives in Idaho and Washington. The team examined existing water rights; looked for opportunities, constraints, fatal flaws; and investigated implications of claims in the Palouse Basin Adjudication in Idaho.

Idaho water rights investigation key takeaways:

- The entities can seek new water appropriations or purchase existing water rights.
- Existing water rights do not pose significant constraints.
- PBAC's water supply goals likely exceed existing surface water rights.
- Recommend PBAC seek new appropriations by applying for a water right permit
- Tribal minimum streamflow claims are pending in the Palouse Basin Adjudication. This will potentially impact the Idaho alternatives.
- Monitoring the claim negotiation process is recommended.

Washington water rights investigation key takeaways:

- PBAC can seek new water appropriations or purchase existing water rights.
- For new appropriations, water availability is limited to demonstrating biological needs are met.
- Existing appropriations:
  - Snake River: transfer from willing sellers is limited to Lower Granite Pool and upstream into OR and ID (note that evaluation of existing Snake River water rights and assessment of water acquisition feasibility was not conducted).
  - Other surface water sources: transfer from willing sellers, may require upstream sellers.
  - Estimated cost to purchase existing water rights is \$3,000 – \$5,000 per acre-feet (AF)/year.
- PBAC's water supply goals exceed existing surface water rights for Alternatives 2-4, on paper.
- Acquisition of water rights may rank higher than new water right appropriations.

- Transactional certainty is higher with existing water rights.
- Biological consultation and reliance on negotiated water availability for new appropriations has more challenges.

Appendix F contains the Idaho water rights investigation and Washington water rights investigation memoranda. The estimated costs in the Washington water rights memorandum assume all of the water can be purchased, but in reality, there are insufficient water rights to purchase and new water rights would still be needed.

Section 5 Fisheries Agencies Discussions

PBAC and Alta's team met with four fisheries agencies to engage in preliminary discussions regarding the supplementary water supply alternatives. The purpose was to identify areas of concern not previously identified. Our team met with staff from the following agencies:

- National Marine Fisheries Service (NMFS)
- U.S. Fish and Wildlife Service (USFWS)
- Washington Department of Fish and Wildlife (WDFW)
- Idaho Department of Fish and Game (IDFG)

Based on discussions with the services (NMFS and USFWS) and the state (WDFW and IDFG), capturing flows directly from the Snake River is preferred, followed by Flannigan Creek. From the services perspective, their preference is based on the volume of flows being proposed for use as contributing to less reduced relative volume and reduced thermal concerns for fish. WDFW and IDFW were more specific in their concerns related to meeting instream flow requirements and that sufficient flows, with instream flow requirements in place, may not be available in any alternative with the exception of Alternative 1 and possibly Alternative 3B (Flannigan Creek). Appendix G contains details of the fisheries agencies' discussions.

Section 6 Water Supply Alternatives Interim Steps

Breaking down the water supply alternatives into interim steps provides a mechanism for implementing larger projects in phases over time. Implementing in phases provides flexibility to adapt with the water supply needs and funding. All four of the 2017 alternatives were refined into possible interim steps for this report. This refinement provides updated costs and schedules for the four alternatives.

The next subsections describe the interim steps, costs, and schedule. Details of the original alternatives can be found in the 2017 report. Appendix H contains the *Water Supply Alternatives Interim Steps Technical Memorandum* including a description of the phases, capital costs and schedule, and the *Water Supply Phased Alternatives – Annual Operations and Maintenance (O&M) Cost Allocations* memorandum which describes the annual O&M.

During the alternative refinement process and after submission of the interim steps memoranda, Alta developed an Modified Alternative 4 project with interim steps. Modified Alternative 4 is described in the following subsections.

6.1 Alternatives and Phases Descriptions

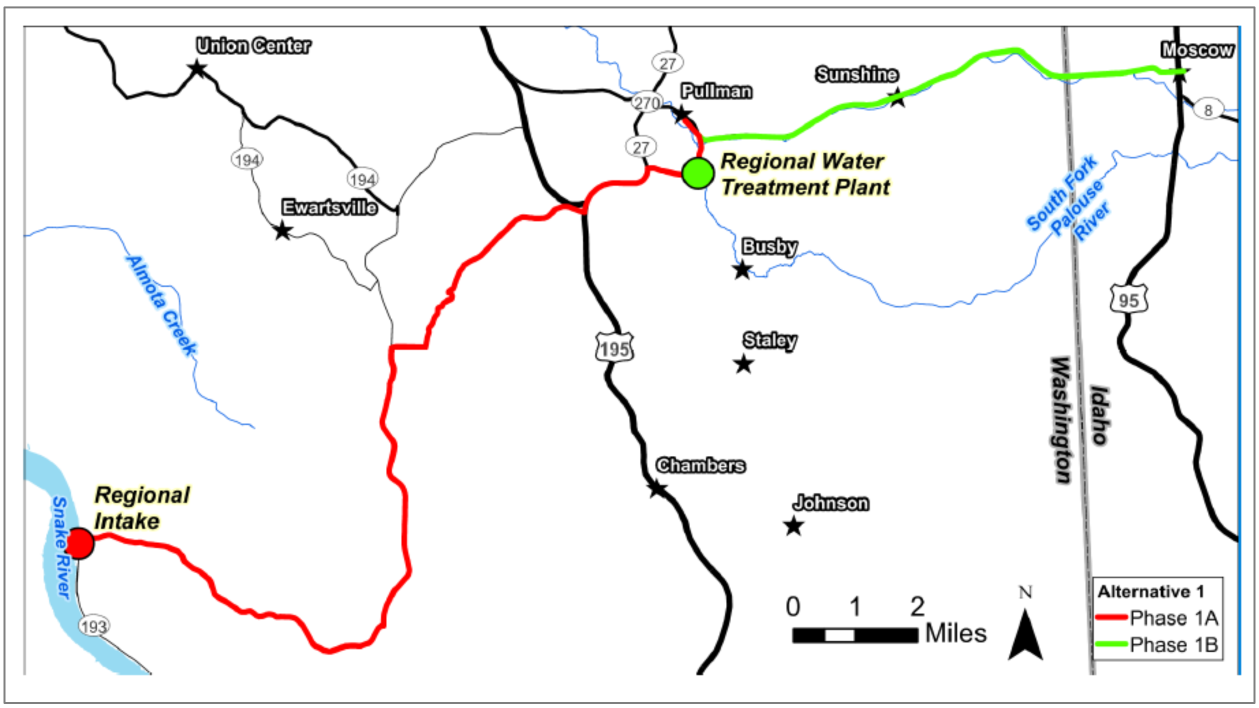
Alternatives 1 and 2 have project components that are interconnected whereas Alternatives 3, 4, and Modified 4 have distinct project components. Each alternative interim step has a number and letter designation (ex. Phase 1A) representing the alternative number and phase letter. The phases are grouped into bid packages to allow similar construction work to be bid and constructed by contractors that specialize in that type of work. Assigning bid packages also allows for a greater degree of flexibility for design, bid, and construction where one bid package can be advanced more quickly for construction work that can and/or needs to occur earlier while other design and construction requires more time or needs to occur later once the early construction is completed. The bid packages have an alpha numeric designator as well as aligned with the phased alternative. Appendix H provides description of bid packages for each alternative.

Alternatives 1, 2, 3, and Modified 4 have phases with direct use, meaning treated water from the water treatment plant is conveyed to the distribution system in the communities. Because the water supply alternatives target is based on a 50-year plan, all the water planned for the alternative may not be used until a later time when the population grows and demand increases. In addition, the amount of water supplied to a community is not proportional. The idea is any offset from groundwater pumping helps the Basin as a whole. For example, Alternative 3 is estimated to provide 100% of the targeted design amount for the Basin, yet Phase 3B Flannigan Creek will supply more water for Moscow/UI than the South Fork Palouse River will for Pullman/WSU.

6.1.1 Alternative 1 – Snake River: Pullman/Moscow

Figure 2 shows the Alternative 1 phasing.

Figure 2. Alternative 1 Phasing



Note exact locations for the diversion, pipelines, and water treatment plant will be vetted if the alternative moves forward.

Alternative 1 consists of a new Snake River diversion from the Lower Granite Dam pool anticipated near Wawawai in Washington. Surface water is pumped from a diversion intake structure and conveyed through approximately 25 miles of pipeline, and includes five pump stations, four storage tanks, and a treatment plant near Pullman. The treated water is then conveyed to Pullman/WSU and Moscow/UI for direct use in their existing water distribution systems.

Although Alternative 1 is one distinct project, there are two phases identified.

- **Phase 1A** consists of the system to the water treatment plant with conveyance to Pullman/WSU's distribution system. The pumps and water treatment plant would be constructed, and equipment installed to accommodate the first portion of design flow and to allow for capacity in the second phase.
- **Phase 1B** consists of flow and treatment expansions to the pump stations and water treatment plant, and conveyance system (pump station and pipeline) to Moscow/UI's distribution system. The supply amounts are assumed to be even for both communities.

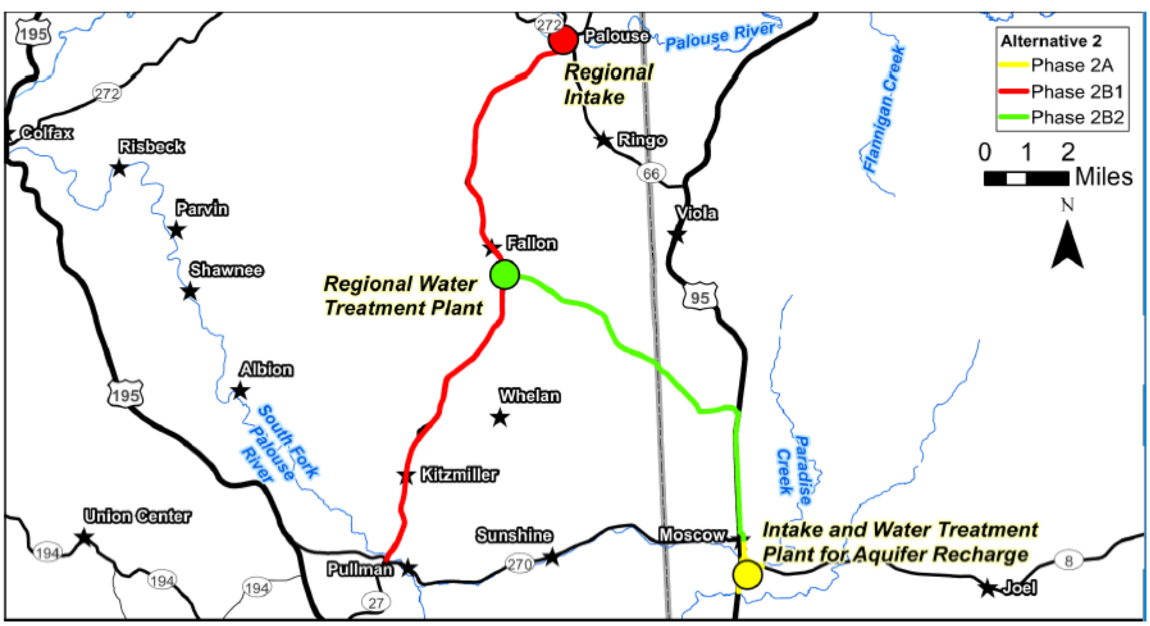
A local utility company is currently conducting a business case evaluation of a possible new off-channel pumped storage reservoir and hydropower facility that would be located along the Snake River. If a utility project were to be implemented, it presents the potential to benefit Alternative 1 by reducing the costs, potentially making Alternative 1 less expensive than other alternatives.

Idaho Congressman Mike Simpson, the tribes, and others had proposals that would result in the breaching of dams on the Snake River, including Lower Granite Dam, which would affect the river level at the proposed diversion site for Alternative 1. If Lower Granite Dam was breached, the alternative is still expected to be viable, but the diversion pipeline elevation would likely be lowered (i.e., a longer pipeline).

6.1.2 Alternative 2 –South Fork Palouse River/Paradise Creek: Moscow; North Fork Palouse River: Pullman/Moscow

Figure 3 shows the Alternative 2 phasing.

Figure 3. Alternative 2 Phasing



Note exact locations for the diversions, pipelines, and water treatment plants will be vetted if the alternative moves forward.

Alternative 2 consists of two distinct project elements.

A. **South Fork Palouse River or Paradise Creek Moscow Aquifer Recharge –** This project consists of a new South Fork of the Palouse River or Paradise Creek diversion near Moscow. Surface water is pumped from a diversion intake structure and conveyed through a pipeline, and includes a pump station and water treatment plant. The treated water is then injected into the aquifer via recharge well(s).

B. **North Fork Palouse River Pullman/Moscow Direct Use –** This project entails a new North Fork of the Palouse River diversion anticipated near Palouse, Washington. Surface water is pumped from a diversion intake structure and conveyed through a pipeline, and includes two pump stations, one storage tank, an energy recovery system, and water treatment plant anticipated between Palouse and Pullman. The treated water is then conveyed to Pullman/WSU and Moscow/UI for direct use in their existing water distribution systems.

Alternative 2A is not divided further given it is a discrete project, although there is an opportunity to phase the construction of the water treatment plant and recharge wells if there is a strategic reason to do so.

Alternative 2B may be implemented in two phases.

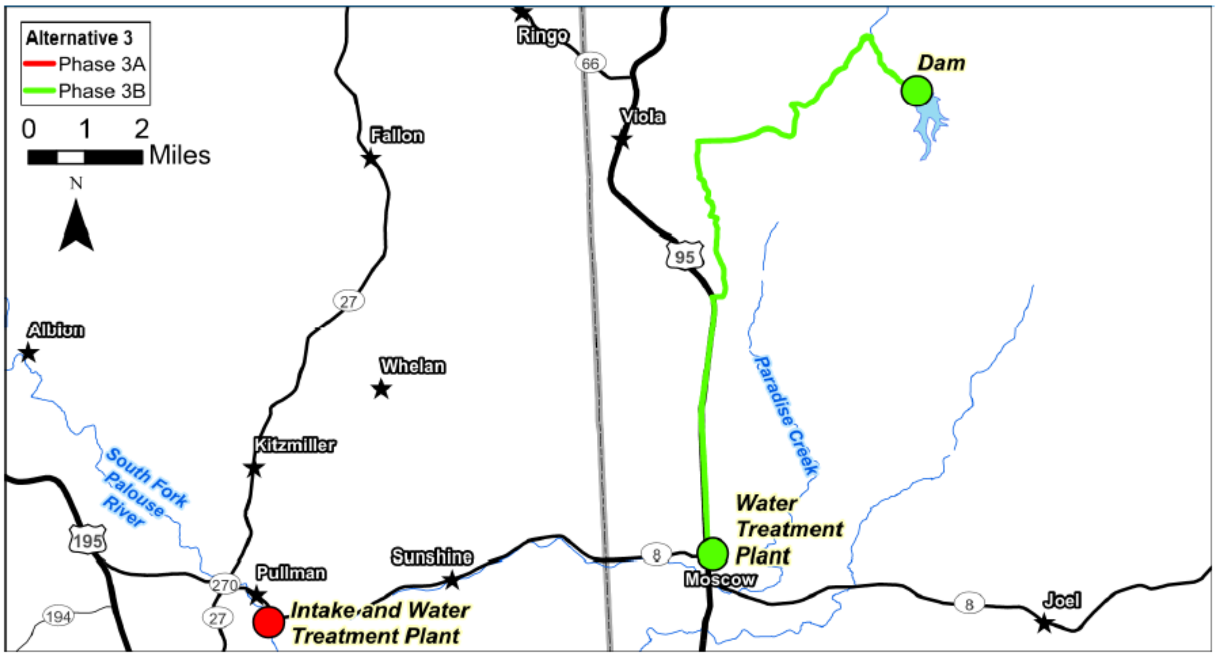
- **Phase 2B1**
  - River intake and pump station
  - Conveyance to the WTP
  - The WTP
  - Conveyance system for water delivery to Pullman/WSU's distribution system
- **Phase 2B2**
  - Increasing pumping capacity at the intake pump station
  - Increasing treatment capacity at the WTP
  - Increasing pumping capacity for conveyance to Moscow
  - Conveyance system for water delivery to Moscow/UI's distribution system

The supply amounts are assumed to be even for both communities.

6.1.3 Alternative 3 – South Fork Palouse River: Pullman; Flannigan Creek Storage Reservoir: Moscow

Figure 4 shows the Alternative 3 phasing.

Figure 4. Alternative 3 Phasing



Note exact locations for the diversions, pipelines, dam, and water treatment plants will be vetted if the alternative moves forward.

Alternative 3 consists of two distinct project elements.

A. **South Fork Palouse River Pullman Direct Use –** This project consists of a new South Fork of the Palouse River diversion near Pullman. Surface water is pumped from a diversion intake structure and conveyed through a pipeline, and includes a pump station and water treatment plant. The treated water is then conveyed to Pullman/WSU for direct use in their existing water distribution systems.

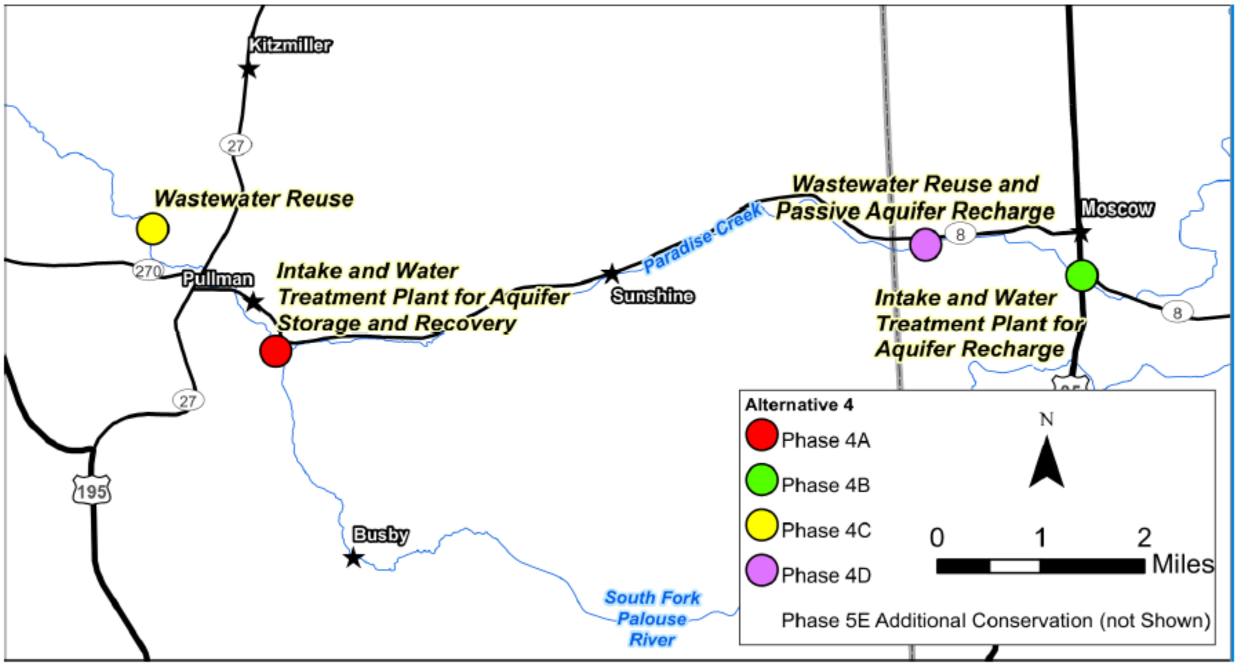
B. **Flannigan Creek Storage Reservoir Moscow Direct Use** – This project consists of a new Flannigan Creek reservoir. Water in Flannigan Creek is stored behind a new 102-foot-tall dam creating 6,600 AF of storage. This project includes a reservoir outlet works, two pump stations, one storage tank, approximately 13 miles of pipeline, energy reduction in-line hydropower generation facility, a water treatment plant, and conveyance to Moscow/UI for direct use in their existing water distribution systems.

Alternative 3 does not contain any further phasing of these two projects.

6.1.4 Alternative 4 – Paradise Creek: Moscow; South Fork Palouse River Pullman; Wastewater Reuse Pullman and Moscow; Additional Conservation

Figure 5 shows the Alternative 4 phasing.

Figure 5. Alternative 4 Phasing



Note exact locations for the diversions, pipelines, and water treatment plants will be vetted if the alternative moves forward.

Alternative 4 consists of five distinct project elements.

A. **Paradise Creek Moscow Aquifer Recharge–** This project consists of a new Paradise Creek diversion near Moscow. Surface water would be pumped from a diversion intake structure and conveyed through a pipeline, and includes a pump station and water treatment plant. The treated water would then be injected into the aquifer via recharge well(s) for aquifer recharge.

B. **South Fork Palouse River Pullman ASR –** This project consists of a new South Fork of the Palouse River diversion near Pullman. Surface water would be pumped from a diversion intake structure and conveyed through a pipeline, and includes a pump station and water treatment plant. The treated water would then be injected into the aquifer via recharge well(s) for aquifer storage and recovery.

C. **Pullman Wastewater Reuse –** This project entails using treated wastewater for Pullman/WSU irrigation. It includes an upgrade to the Pullman Wastewater Treatment Plant to produce Class A reclaimed water, reclaimed water pump station, storage tank, and distribution pipes.

D. **Moscow Wastewater Reuse –** This project entails using treated wastewater for passive recharge into the upper aquifer. It includes upgrades to the Moscow Wastewater

Treatment Plant to produce Class A reclaimed water, reclaimed water pump station, conveyance pipeline, and infiltration basins for passive infiltration.

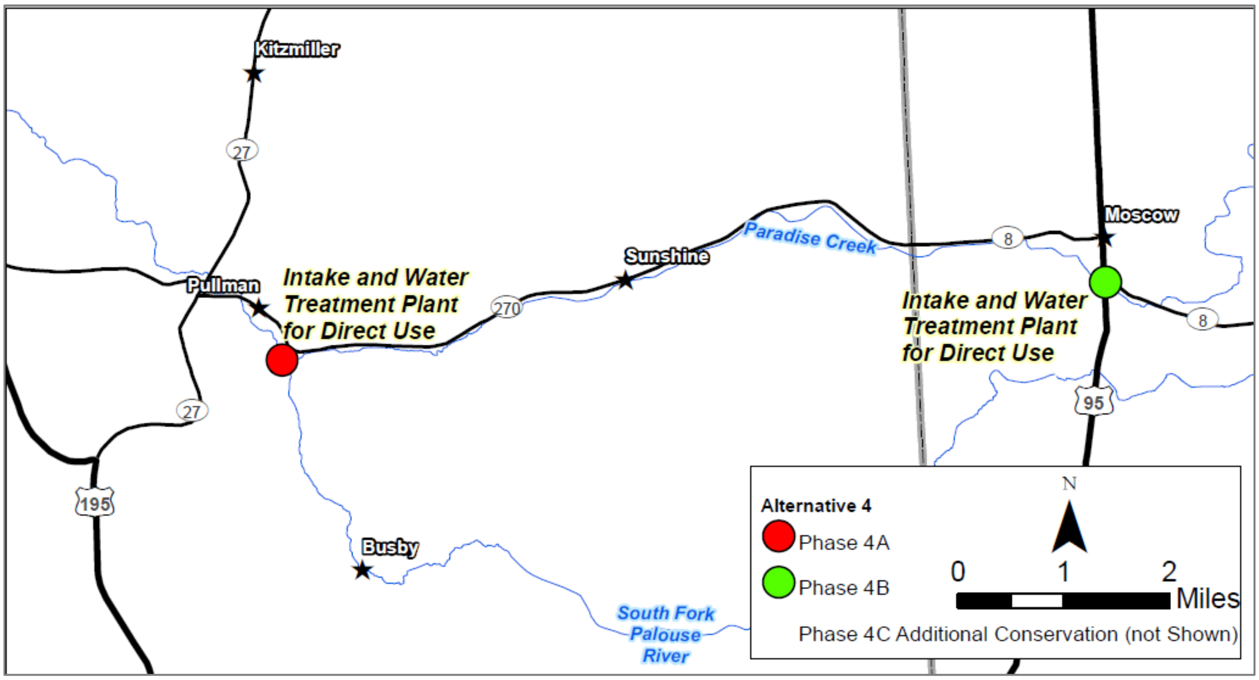
E. **Additional Conservation –** This project entails increasing conservation resulting in an additional 15% savings from the baseline projection.

Alternative 4 does not contain any further phasing of these five projects.

6.1.5 Modified Alternative 4 – Paradise Creek: Moscow; South Fork Palouse River; Pullman; Additional Conservation

Figure 6 shows the Modified Alternative 4 phasing.

Figure 6. Modified Alternative 4 Phasing



Note exact locations for the diversions, pipelines, and water treatment plants will be vetted if the alternative moves forward.

Alta further evaluated Alternative 4 to determine potential options for increasing the supply, reducing the cost, and incorporating feedback from the public and agencies. This evaluation resulted in a Modified Alternative 4. The high cost, relatively small water supply, and concerns of South Fork Palouse River in-stream summer flows in Pullman by the WDFW resulted in the removal of the wastewater reuse options (Alternatives 4C and 4D). Based on feedback PBAC received from the public regarding the injection of treated surface water (see Section 3.9), Alternatives 4A (Paradise Creek Moscow) and 4B (South Fork Palouse River Pullman) are modified for direct use. In modifying Alternative 4, the South Fork Palouse River Pullman phase has an increased supply similar to Alternative 2A. This addition addresses the supply gap from removing the wastewater reuse options. 0 shows the estimated supply. The Modified Alternative 4 consists of three distinct project elements.

A. **Paradise Creek Moscow Direct Use –** This project consists of a new Paradise Creek diversion near Moscow. Surface water would be pumped from a diversion intake structure and conveyed through a pipeline, and includes a pump station and water treatment plant. The treated water would then be conveyed through the existing distribution system to Moscow/UI for direct use.

B. **South Fork Palouse River Pullman Direct Use –** This project consists of a new South Fork of the Palouse River diversion near Pullman. Surface water would be pumped from a diversion intake structure and conveyed through a pipeline, and includes a pump station and water treatment plant. The treated water would then be conveyed through the existing distribution system to Pullman/WSU for direct use.

C. **Additional Conservation –** This project entails increasing conservation resulting in an additional 15% savings from the baseline projection.

Modified Alternative 4 does not contain any further phasing of these three projects.

6.2 Alternatives and Phases Costs

Alta's team evaluated the Water Supply Alternative costs provided in the 2017 report. The costs were dissected into the interim steps (phases) and updated to May 2021 dollars. Costs were escalated through application of the Engineering News-Record Construction Cost Index (ENR CCI) numbers to account for inflation and other market price adjustments.

Modified Alternative 4 was developed after the interim steps and O&M memoranda in Appendix H were finalized. The only change to the remaining alternative phases is the direct use of water instead of aquifer recharge for Paradise Creek. The cost was not expected to differ significantly for these phases. A summary of the capital and O&M costs are described below. Appendix H contains details of these costs.

6.2.1 Capital Costs

Water supply alternatives capital costs include:

- capital construction
- contingency
- engineering
- permitting
- water rights
- It does not include property acquisition unless otherwise stated.

Engineering judgement was used to determine portions of the phased facility costs (e.g., Water Treatment Plant). In addition, there are two changes and additions to the costs in the 2017 report.

1. Increasing the engineering allowance from 15% in the original report to 25%.
2. Adding the cost for environmental permitting, estimated at about 25% of the engineering cost.

The costs associated with water rights are from the 2017 report indexed to 2021 dollars. The Washington water rights memorandum in Appendix F estimated costs were not used because 1) costs were only developed for alternatives in Washington and 2) the costs assume there are sufficient water rights to purchase. 0 shows the interim steps and updated capital costs.

Table 3. Supply and Costs for the Water Supply Alternatives Phases

Alternative #	Phase # (Matching Phase #)	Project Type	Project Title	Project Description	Estimated Supply and % Demand: Estimated Annual Supply (MG)[1]	Estimated Annual Supply (AF)	% of Projected Palouse Basin 50-yr Demand[3]	2021 Cost Escalation & Recalculated: Capitol Cost to Implement ($)	% of Alternative Capital Cost	Capitol Cost to Implement ($/AF of Annual Supply)	Annual Operating Cost[4] ($)	Present Value of Costs (2021): Present Value of Annual Operating Costs[4] ($)	Total Present Value (Capital Cost + Annual Operating Cost) ($)	Total Present Value ($/AF of Annual Supply)
1		Surface Water Alternative	Snake River (Pipeline to Pullman and Moscow) Direct Use	Direct diversion from Snake River; Surface water pumped and conveyed to treatment; Treated surface water delivered to Pullman and Moscow potable water system	1,967	6,040	85%	$ 109,851,689		$ 18,187	$ 6,044,000	$ 293,398,000	$ 403,249,689	$ 66,763
	1A		WTP, Pipeline to Pullman		984	3,020	42%	$ 88,780,510	81%	$ 29,398	$ 3,980,000	$ 193,204,000	$ 281,984,510	$ 93,372
	1B		WTP expansion, Pipeline to Moscow		983	3,020	42%	$ 21,071,179	19%	$ 6,977	$ 2,064,000	$ 100,194,000	$ 121,265,179	$ 40,154
	2A	Aquifer Recharge	Moscow: Paradise Creek and/or South Fork Palouse River AR	AR with in-city surface water diversion; Treatment; Active injection of treated water in Moscow AR wells during spring runoff	358	1,100	15%	$ 19,218,829	25%	$ 17,472	$ 773,000	$ 37,524,000	$ 56,742,829	$ 51,584
	2B	Surface Water Alternative	Pullman & Moscow: North Fork Palouse River Direct Use	Direct diversion from NF Palouse River in WA; Surface water pumped and conveyed to treatment north of Pullman; Treated water conveyed to both City of Pullman and City of Moscow potable water systems	1,550	4,760	67%	$ 57,768,786	75%	$ 12,136	$ 1,674,000	$ 81,262,000	$ 139,030,786	$ 29,208
	2B1		WTP, Pipeline to Pullman		775	2,380	33%	$ 43,656,490	76%	$ 18,343	$ 1,264,000	$ 61,359,000	$ 105,015,490	$ 44,124
	2B2		WTP expansion, Pipeline to Moscow		775	2,380	33%	$ 14,112,296	24%	$ 5,930	$ 410,000	$ 19,903,000	$ 34,015,296	$ 14,292
2	**Total**				**1,908**	**5,860**	82%	**$ 76,987,615**			**$ 2,447,000**		**$ 195,773,615**	**$ 33,408**
	3A	Surface Water Alternative	Pullman: SF Palouse River Direct Use	Direct Diversion Using Winter/Spring Runoff Direct Diversion from SF Palouse River; Treatment; Delivery to City of Pullman Water System during late winter and spring runoff	894	2,743	38%	$ 28,776,452	27%	$ 10,491	$ 864,000	$ 41,942,000	$ 70,718,452	$ 25,781
	3B	Surface Water Alternative	Moscow: Flannigan Creek/reservoir Direct Use	Flannigan Creek; Reservoir stored water pumped and conveyed to treatment; Treated water discharged directly to City of Moscow potable water system	1,430	4,400	62%	$ 76,239,792	73%	$ 17,327	$ 3,152,000	$ 153,010,000	$ 229,249,792	$ 52,102
3	**Total**				**2,324**	**7,143**	100%	**$ 105,016,244**			**4,016,000**		**299,968,244**	**41,995**

Table 3. Supply and Costs for the Water Supply Alternatives Phases

Alternative #	Phase # (Matching Phase #)	Project Type	Project Title	Project Description	Estimated Supply and % Demand: Estimated Annual Supply (MG)[1]	Estimated Annual Supply (AF)	% of Projected Palouse Basin 50-yr Demand[3]	2021 Cost Escalation & Recalculated: Capitol Cost to Implement ($)	% of Alternative Capital Cost	Capitol Cost to Implement ($/AF of Annual Supply)	Annual Operating Cost[4] ($)	Present Value of Costs (2021): Present Value of Annual Operating Costs[4] ($)	Total Present Value (Capital Cost + Annual Operating Cost) ($)	Total Present Value ($/AF of Annual Supply)
	4A	ASR	Pullman: SF Palouse River ASR	ASR Using Winter/Spring Runoff Diversion from SF Palouse River; Treatment; Active injection of treated water during late winter and spring runoff	358	1,100	15%	$ 19,219,029	16%	$ 17,472	$ 773,000	$ 37,524,000	$ 56,743,029	$ 51,585
	4B	Aquifer Recharge	Moscow: Paradise Creek AR	Aquifer Recharge Using Winter/Spring Runoff Direct Diversion from Paradise Creek; Treatment; Active injection of treated water in Moscow Aquifer recharge wells	358	1,100	15%	$ 19,219,029	16%	$ 17,472	$ 773,000	$ 37,524,000	$ 56,743,029	$ 51,585
	4C	Water Reuse	Pullman/WSU: Waste Water Reuse Project	Water Reuse Project WWTP Upgrades, Class A reclaimed water supply pumped to new water reuse system for irrigation at reuse sites in Pullman	148	454	6%	$ 53,022,538	44%	$ 116,790	$ 205,000	$ 9,951,000	$ 62,973,538	$ 138,708
	4D	Passive AR	Moscow Waste Water Infiltration	Water Reuse for Infiltration Class A recycled water from Moscow WWTP discharged to shallow infiltration area to enhance Wanapum aquifer groundwater storage	420	1,300	18%	$ 4,089,164	3%	$ 3,146	$ 87,000	$ 4,223,000	$ 8,312,164	$ 6,394
	4E	Conservation Measures	Moscow Conservation Measures	Sum of all conservation measures from the 2015 Moscow Conservation Plan	104	319	4%	$ 25,772,446	21%	$ 13,789			$ 25,772,446	$ 13,789
		Conservation Measures	Pullman Conservation Measures	Sum of all conservation measures from the 2014 Pullman Water System Plan	9	27	0%							
		Conservation Measures	WSU Conservation Measures	Sum of all conservation measures from the 2008 WSU Water System Plan	14	43	1%							
		Conservation Measures		Other conservation (calculated so conservation = 609 MGY)	482	1,480	21%							
4		**Total**			**1,893**	**5,823**	81%	**$ 121,322,206**					**$ 210,544,206**	**$ 36,157.34**
	Mod 4A (3A)	Surface Water Alternative	Pullman: SF Palouse River Direct Use	Direct Diversion Using Winter/Spring Runoff Direct Diversion from SF Palouse River; Treatment; Delivery to City of Pullman Water System during late winter and spring runoff	894	2,743	38%	$ 28,776,452	39%	$ 10,491	$ 864,000	$ 41,942,000	$ 70,718,452	$ 25,781
	Mod 4B (Modified 2A)	Surface Water Alternative	Paradise Creek - Moscow	NEW - Direct Use	358	1,100	15%	$ 19,218,829	26%	$ 17,472	$ 773,000	$ 37,524,000	$ 56,742,829	$ 51,584
	Mod 4C (4E)	Conservation Measures	Moscow Conservation Measures	Sum of all conservation measures from the 2015 Moscow Conservation Plan	104	319	4%	$ 25,772,446	35%	$ 13,789			$ 25,772,446	$ 13,789
		Conservation Measures	Pullman Conservation Measures	Sum of all conservation measures from the 2014 Pullman Water System Plan	9	27	0%							
		Conservation Measures	WSU Conservation Measures	Sum of all conservation measures from the 2008 WSU Water System Plan	14	43	1%							
		Conservation Measures		Other conservation (calculated so conservation = 609 MGY)	482	1,480	21%							
Mod 4		**Total**			**1,861**	**5,712**	80%	**$ 73,767,727**					**$ 153,233,727**	**$ 26,826.63**

Table 3. Supply and Costs for the Water Supply Alternatives Phases

					Estimated Supply and % Demand			2021 Cost Escalation & Recalculated				Present Value of Costs (2021)		
Alternative #	Phase # (Matching Phase #)	Project Type	Project Title	Project Description	Estimated Annual Supply (MG)[1]	Estimated Annual Supply (AF)	% of Projected Palouse Basin 50-yr Demand[3]	Capitol Cost to Implement ($)	% of Alternative Capital Cost	Capitol Cost to Implement ($/AF of Annual Supply)	Annual Operating Cost[4] ($)	Present Value of Annual Operating Costs[4] ($)	Total Present Value (Capital Cost + Annual Operating Cost) ($)	Total Present Value ($/AF of Annual Supply)

Notes:

Base table from Anchor QEA et al. (2017)

1. Estimated annual supply is the amount of additional water supply that will reliably (at least 50% of the time) be made available by implementing the proposed project.
2. The average annual yield is the estimated average annual yield of the watershed captured by a proposed reservoir or tributary to a proposed diversion location.
3. The projected demand used as a basis for comparison are projected demands without additional conservation. Local system demand includes just the projected demand for the local system that would receive most or all of the water supply.
4. No annual operating costs were provided in Anchor QEA et al. (2017) for conservation and thus none were moved forward in this study.

AF: acre-feet

ASR: aquifer storage and recovery

AR = aquifer recharge

MG: million gallons

MGY: million gallons per year

NF: north fork

SF: south fork

WSU: Washington State University

WWTP: wastewater treatment plant

WTP: water treatment plant

6.2.2 Operating and Maintenance Costs

Water supply alternative costs also include O&M costs. These include materials and energy, equipment maintenance, and operational labor. The cost escalation from 2016 to 2021 is 14.9%.

The water treatment plant O&M costs are apportioned between two phases (e.g., Alternative 1 and 2B).

- 85% of the O&M cost applied to the Phase 1 operations
- 15% of the O&M cost applied to the follow-on Phase II operations

For example - **Alternative 1** would have 85% of the O&M appropriated to the Pullman operations (Phase 1), with the remaining 15% appropriated to the later build out to Moscow (Phase I). A majority of the site and water treatment infrastructure would be in place following completion of Phase I construction, thereby requiring a substantial portion of the total O&M costs to run the facility. When the Phase II treatment capacity increases are implemented, additional staff will be required, and additional utility expenses will be incurred.

Pump station O& M costs were apportioned between the initial Phase 1 operations and follow-on Phase II increased pumping operations.

0 shows the interim steps 2021 present value costs.

6.2.3 Interim Steps Cost Comparison

This section presents the comparison of costs as well as costs versus supply.

Figure 7 is a chart of the capital costs. From most expensive to least expensive, capital costs are ranked:

1. Alternative 4 (most expensive)
2. Alternative 1
3. Alternative 3
4. Alternative 2
5. Modified Alternative 4

Figure 7. Capital Cost for the Water Supply Alternatives.

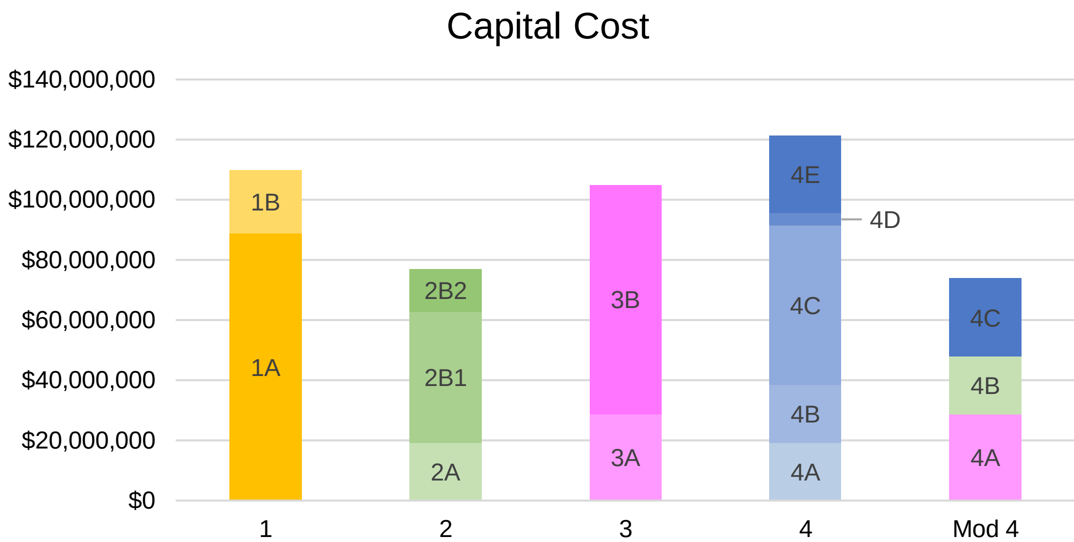


Figure 8 is a compilation of total capital cost versus anticipated design supply graphs for each alternative. The alternative phases with the greatest return on cost for supply are listed first. These graphs allow a comparison showing which alternatives and phases can be implemented with the lowest cost. Alternative Phases 2A and 4B (both South Fork Palouse River or Paradise Creek Moscow) are the lowest cost.

0 is a chart of the annual O&M costs. From most expensive to least expensive, O&M costs are ranked:

1. Alternative 1 (most expensive)
2. Alternative 3
3. Alternative 2
4. Alternative 4
5. Modified Alternative 4

Figure 8. Graphs of Capital Cost Versus Anticipated Supply Amounts for Each Water Supply Alternative.

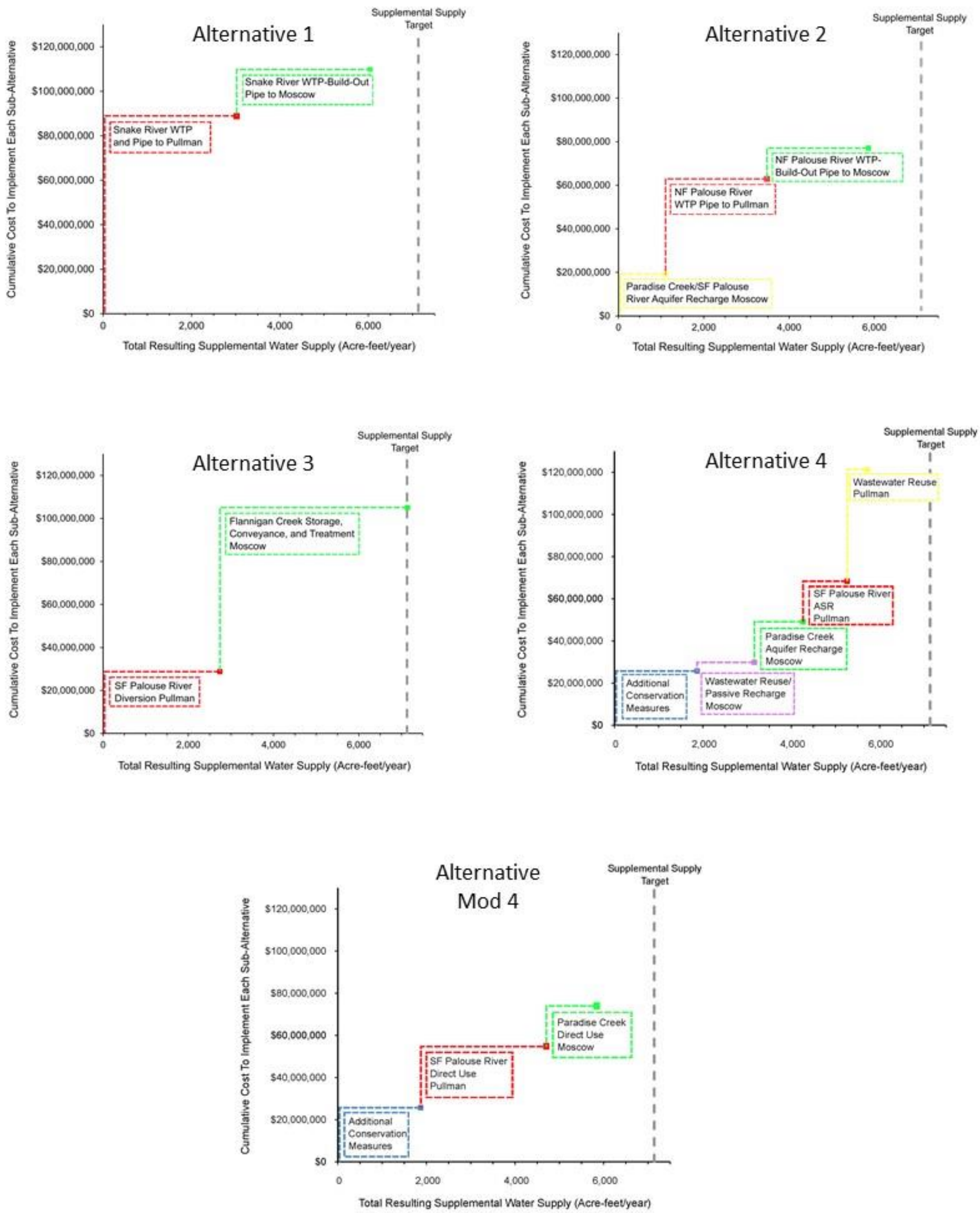
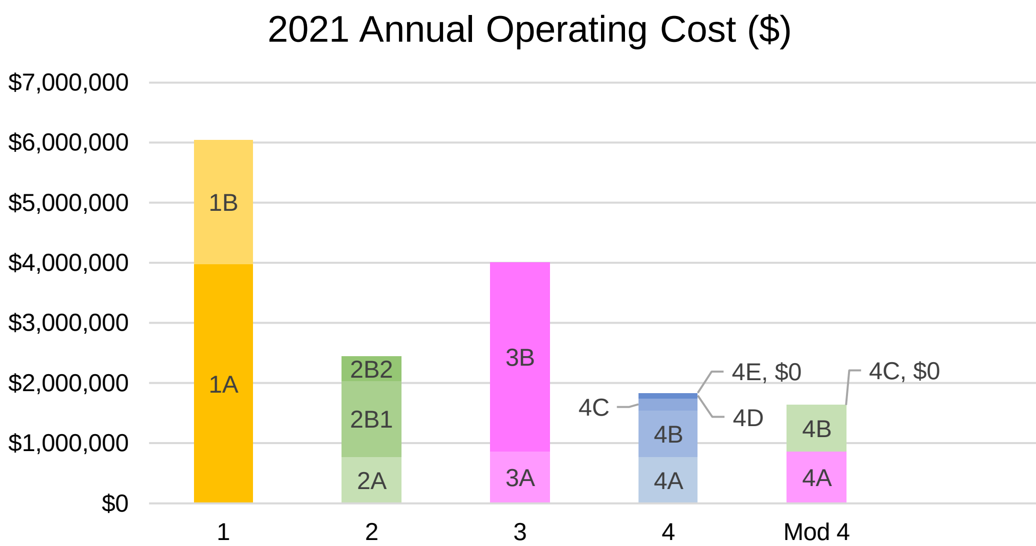


Figure 9. Annual O&M Costs for the Water Supply Alternatives.

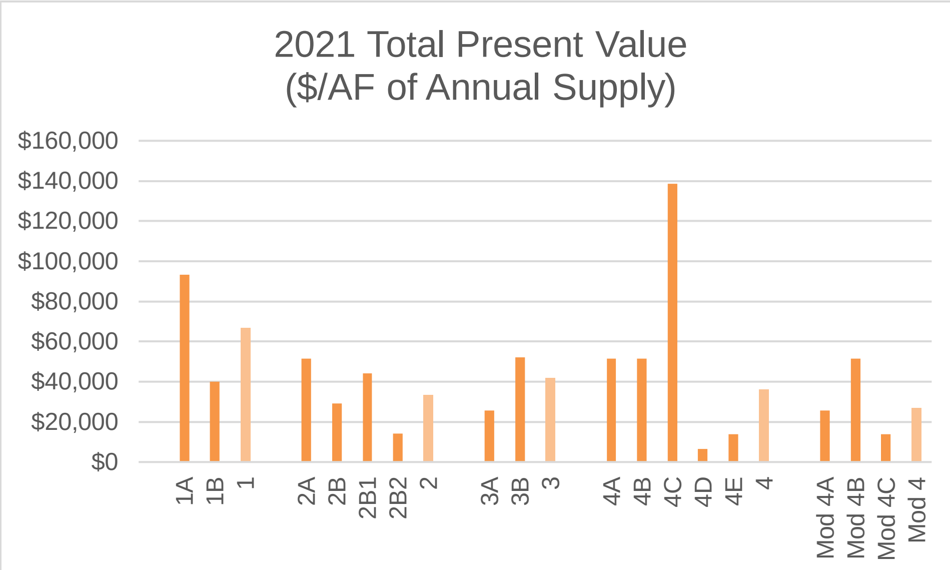


Total capital costs and annual O&M costs are incorporated into the 2021 total present value cost per acre foot ($/AF). Figure 10 is a chart of 2021 total present value cost per AF of annual supply for each alternative and interim step or phase. The costs are not additive for each alternative and is the reason for separating the interim steps from the alternative as a whole. For the main alternatives, from most expensive to least expensive, the ranking is:

1. Alternative 1 (most expensive)
2. Alternative 3
3. Alternative 4
4. Alternative 2
5. Modified Alternative 4

For the alternative phases, 4C (Pullman Wastewater Treatment Plant [WWTP] reuse) and 1A (Snake River – diversion to Pullman) were the highest cost per AF, whereas Alternative Phase 4D (Moscow WWTP passive recharge) had the lowest cost per AF, followed by 4C (South Fork Palouse River or Paradise Creek Moscow) and 2B2 (NF Palouse River to Moscow).

Figure 10. 2021 Total Present Value $/AF of Annual Supply for Each Water Supply Alternative and Interim Step.



6.3 Phased Project Implementation Activities and Durations

Implementation activities are identified for each project phase and given a project duration. These activities are based on engineering experience and judgement, and are listed below.

- Pre-construction Funding
- Construction Funding Commitment
- Water Rights Acquisition
- Water Quality Data Collection
- Feasibility / Route Study / Site Selection (5%)
- Preliminary Environmental Review
- MOA and Land/Easement Acquisition
- Survey/Bathymetry and Geotechnical Field Work
- Preliminary Design (30%)
- National Environmental Policy Act (NEPA) / State (Washington) Environmental Policy Act (SEPA) / EID
- Secure Final Funding
- Final Design
- Permitting
- Bid / Award / Contracting
- Equipment / Material Manufacturing & Delivery
- Construction

- Facility Start-up and Operations

The first ten activities are considered preliminary work and occur prior to the bid packages. This sets the stage prior to the phased alternatives. Some of these activities have linkages and dependencies while others do not.

Preliminary work for each alternative is estimated to be six years. Excluding additional conservation, total project durations range from 11 to 12 years if all interim steps are implemented concurrently. Table 4 lists the approximate project durations.

Table 4. Water Supply Alternatives Project Durations Summary

Alternative #	Alternative Description	Estimated Years to Implement
1 start	Preliminary Work Prior to Bid Packages: Stage set for either 1A or 1B	6
1A	Snake River: Diversion, WTP, Conveyance to Pullman	6
1B	Snake River: Conveyance to Moscow	3
	Minimum Total Years	12
2A	Paradise Creek/South Fork Palouse River: Diversion, WTP, Aquifer Recharge in Moscow	12
2B start	Preliminary Work Prior to Bid Packages: Stage set for either 2B1 or 2B2	6
2B1	North Fork Palouse River: Diversion, WTP, Conveyance to Pullman	6
2B2	North Fork Palouse River: Conveyance to Moscow	3
	Minimum Total Years	12
3A	South Fork Palouse: Diversion, WTP, Conveyance to Pullman	11
3B	Flannigan Creek: Diversion, Storage, WTP, Conveyance to Moscow	11
4A	South Fork Palouse: Diversion, WTP, ASR in Pullman	11
4B	Paradise Creek: Diversion, WTP, aquifer recharge in Moscow	12
4C	Water Reuse Pullman	9
4D	Water Reuse Passive Recharge Moscow	9
4E	Additional Conservation	6
Mod 4A	South Fork Palouse: Diversion, WTP, Conveyance to Pullman	11
Mod 4B	Paradise Creek: Diversion, WTP, Conveyance to Moscow	12
Mod 4C	Additional Conservation	6

AR = aquifer recharge
ASR = aquifer storage and recovery
WTP = water treatment plant

Appendix H contains the details of these activities and details of the durations, including the bid packages.

Section 7 Water Supply Alternatives Matrix and Ranking

To further refine the alternatives, Alta and PBAC participated in a workshop on February 17, 2022 to discuss and establish the water supply alternatives decision matrix. A summary of that meeting is provided in Appendix I. Using the 2017 report matrix as a starting point, the group decided to keep this matrix with some modifications described below.

7.1 Matrix

The previous water supply alternatives project documented in the 2017 report used eight criteria for comparing projects, intended to address the primary benefits and challenges associated with the water supply alternative projects considered. Each criterion has a scoring scale ranging from 0 to 3, with 3 being the most favorable score. Each criterion had weights assigned ranging between 0 and 10, with 10 being the influential. This allowed some criteria to more strongly influence the selection and prioritization of projects. The scores were then multiplied by the weights to calculate a project priority score to develop a water supply alternative ranking.

Based on discussions during the February 2022 PBAC workshop, the 2017 matrix is carried forward in this project with two additional criteria (I and J) and slight weighting adjustments. Table 5 lists the screening criteria and weights. Only Criterion A is naturally a quantitative value; the remaining criteria take qualitative information and attempt to quantify it in order to be able to rank the alternative projects. Appendix J contains a description of the screening criteria and scale details, and also includes the 2017 weights for comparison.

Table 5. Decision Matrix Screening Criteria and Weights

	Screening Criteria	Weights
A	Unit cost of supply (Capital cost and O&M)	9
B	Long-Term Supply Reliability	10
C	Technical Certainty of Success	6
D	Property Acquisition	6
E	Permitting Complexity – Water Rights	6
F	Permitting Complexity – Environmental	6
G	Extent of Regional Agreements Required	4
H	Public Acceptability	8
I	Surface Water Quality Impacts	6
J	Aquifer Water Quality Impacts	6

Each alternative phase is scored in the matrix with the exception of the individual phases with conveyance to both Pullman and Moscow (Alternatives 1 and 2B). These are not scored individually because 1) the cost of the first phase is significantly higher than the second phase (impacting Criterion A), and 2) the scores for the other criteria are the same for both. For example, Alternative Phase 2B is scored, but not the individual Alternative Phases 2B1 and 2B2. Each alternative as a whole (ex. Alternative 1, 2, etc.) is then scored based on a weighted average of the individual alternative phase scores using the ratio of the estimated annual water supply for the alternative phase to the annual supply for the alternative as a whole.

Because the unit cost of supply criterion is based on the maximum cost of an alternative phase, there are two decision matrix results tables. Table 6 shows the decision matrix for Alternatives 1, 2, 3, and 4. 0 shows the decision matrix for Alternatives 1, 2, 3, and Modified 4.

7.2 Project Priority Scores and Ranking

Table 6 and 0 show the matrix decision project priority scores. These scores show the following alternative ranking for Alternatives 1, 2, 3, and 4, where Rank 1 is the highest rank (scores are shown in parentheses):

1. Alternative 3 (132)
2. Alternative 2 (122)
3. Alternative 1 (113)
4. Alternative 4 (95)

These scores show the following alternative ranking for Alternatives 1, 2, 3, and Modified 4, where Rank 1 is the highest rank (scores are shown in parentheses):

1. Modified Alternative 4 (150)
2. Alternative 3 (123)
3. Alternative 2 (115)
4. Alternative 1 (99)

The highest-ranking alternative is Modified Alternative 4, followed by Alternative 3.

7.3 Matrix Sensitivity

Matrix sensitivity is a means to evaluate the decision matrix outcomes and alternative ranking. To evaluate the sensitivity, each criterion is given a weight of 1) half the existing weight and then 2) zero, and the matrix is rescored. The resulting scores, and thus ranking, shows only when the Surface Water Quality Impacts criterion has a weight of zero does a change in the alternative ranking occur, and is thus the most sensitive criterion. In this instance, Alternative 2 scores and ranks higher than Alternative 3. This analysis not to say that modifying the weights of additional criteria wouldn't change the scores/ranking. However, the criteria and weights assigned are based on consensus with PBAC and the sensitivity analysis can provide additional confidence in the alternative ranking.

7.4 Uncertainty

There is inherent uncertainty with the costs, schedule, water yield, and Implementability of the alternatives examined in this study. The main objective of this study is to provide a comparative analysis of the four alternatives plus the modified alternative, and the uncertainty does not bias the comparison.

The 2017 report includes modeled uncertainty and risk, cost and schedule uncertainty, and yield uncertainty. Regarding uncertainty of the alternative scoring, one of the nine criteria has quantitative data (cost per AF), which has a percent of uncertainty added to the cost. The other eight criteria are based on attempting to quantify qualitative information, which also carries some degree uncertainty.

Table 6. PBAC Water Supply Alternatives Decision Matrix

Alternative #	Phase # (Matching Phase #)	Project Type	Project Title	Project Description	Screening Criteria: A. Unit Cost of Supply (based on $/AF)	B. Long-Term Supply Reliability	C. Technical Certainty of Success	D. Property Acquisition	E. Permitting Complexity – Water Rights	F. Permitting Complexity – Environmental	G. Extent of Regional Agreements Required	H. Public Acceptability	I. Surface Water Quality Impacts	J. Aquifer Water Quality Impacts	Total Score (Sum of Score x Weight)	Updated Rank for each Interim Step	Updated Rank by Alternative
				Weight (1-10):	9	10	6	6	6	6	4	8	6	6			
1		Surface Water Alternative	Snake River (Pipeline to Pullman and Moscow) Direct Use	Direct diversion from Snake River; Surface water pumped and conveyed to treatment; Treated surface water delivered to Pullman and Moscow potable water system	1.56	3	3	1.5	1	0	1	1	1	3	113	7	3
	1A		WTP, Pipeline to Pullman														
	1B		WTP expansion, Pipeline to Moscow														
	2A	Aquifer Recharge	Moscow: Paradise Creek and/or South Fork Palouse River AR	AR with in-city surface water diversion; Treatment; Active injection of treated water in Moscow AR wells during spring runoff	1.88	1.5	2	1.5	2	0	3	1	3	1	109.0	8	
	2B	Surface Water Alternative	Pullman & Moscow: North Fork Palouse River Direct Use	Direct diversion from NF Palouse River in WA; Surface water pumped and conveyed to treatment north of Pullman; Treated water conveyed to both City of Pullman and City of Moscow potable water systems	2.37	1.5	3	1.5	2	1	1	2	1	3	125.3	4	
	2B1		WTP, Pipeline to Pullman														
	2B2		WTP expansion, Pipeline to Moscow														
2		Total			2.28	1.5	2.8	1.5	2.0	0.8	1.4	1.8	1.4	2.6	122		2
	3A	Surface Water Alternative	Pullman: SF Palouse River Direct Use	Direct Diversion Using Winter/Spring Runoff Direct Diversion from SF Palouse River; Treatment; Delivery to City of Pullman Water System during late winter and spring runoff	2.44	1.5	3	1.5	2	1	3	2	3	3	146	2	
	3B	Surface Water Alternative	Moscow: Flannigan Creek/reservoir Direct Use	Flannigan Creek; Reservoir stored water pumped and conveyed to treatment; Treated water discharged directly to City of Moscow potable water system	1.87	1.5	1	1.5	2	0	3	2	3	3	123	5	
3		Total			2.09	1.5	1.8	1.5	2.0	0.4	3.0	2.0	3.0	3.0	132		1

Table 6. PBAC Water Supply Alternatives Decision Matrix

Alternative #	Phase # (Matching Phase #)	Project Type	Project Title	Project Description	Screening Criteria: A. Unit Cost of Supply (based on $/AF)	B. Long-Term Supply Reliability	C. Technical Certainty of Success	D. Property Acquisition	E. Permitting Complexity – Water Rights	F. Permitting Complexity – Environmental	G. Extent of Regional Agreements Required	H. Public Acceptability	I. Surface Water Quality Impacts	J. Aquifer Water Quality Impacts	Total Score (Sum of Score x Weight)	Updated Rank for each Interim Step	Updated Rank by Alternative
				Weight (1-10):	9	10	6	6	6	6	4	8	6	6			
	4A	ASR	Pullman: SF Palouse River ASR	ASR Using Winter/Spring Runoff Diversion from SF Palouse River; Treatment; Active injection of treated water during late winter and spring runoff	1.88	1.5	2	1.5	2	0	3	1	3	1	109.0	9	
	4B	Aquifer Recharge	Moscow: Paradise Creek AR	Aquifer Recharge Using Winter/Spring Runoff Direct Diversion from Paradise Creek; Treatment; Active injection of treated water in Moscow Aquifer recharge wells	1.88	1.5	2	1.5	2	0	3	1	3	1	109.0	9	
	4C	Water Reuse	Pullman/WSU: Waste Water Reuse Project	Water Reuse Project WWTP Upgrades, Class A reclaimed water supply pumped to new water reuse system for irrigation at reuse sites in Pullman	(0.00)	3	3	3	2	3	3	2	1	1	136	3	
	4D	Passive AR	Moscow Waste Water Infiltration	Water Reuse for Infiltration Class A recycled water from Moscow WWTP discharged to shallow infiltration area to enhance Wanapum aquifer groundwater storage	2.86	3	1	1.5	3	1	3	0	1	1	118.8	6	
	4E	Conservation Measures	Moscow Conservation Measures	Sum of all conservation measures from the 2015 Moscow Conservation Plan	2.70	3	1	3	3	3	3	3	3	3	186	1	
		Conservation Measures	Pullman Conservation Measures	Sum of all conservation measures from the 2014 Pullman Water System Plan													
		Conservation Measures	WSU Conservation Measures	Sum of all conservation measures from the 2008 WSU Water System Plan													
		Conservation Measures		Other conservation (calculated so conservation = 609 MGY)													
4		Total			2.22	1.6	1.3	1.3	1.7	0.6	2.2	0.7	1.6	0.8	95		4

Table 6. PBAC Water Supply Alternatives Decision Matrix

Alternative #	Phase # (Matching Phase #)	Project Type	Project Title	Project Description	Screening Criteria										Total Score (Sum of Score x Weight)	Updated Rank for each Interim Step	Updated Rank by Alternative
					A. Unit Cost of Supply (based on $/AF)	B. Long-Term Supply Reliability	C. Technical Certainty of Success	D. Property Acquisition	E. Permitting Complexity – Water Rights	F. Permitting Complexity – Environmental	G. Extent of Regional Agreements Required	H. Public Acceptability	I. Surface Water Quality Impacts	J. Aquifer Water Quality Impacts			
					Weight (1-10):												
					9	10	6	6	6	6	4	8	6	6			

Notes:

Base table from Anchor QEA et al. (2017)

AF: acre-feet

ASR: aquifer storage and recovery

AR = aquifer recharge

MGY: million gallons per year

NF: north fork

SF: south fork

WSU: Washington State University

WWTP: wastewater treatment plant

WTP: water treatment plant

Table 7. PBAC Water Supply Alternatives Decision Matrix

Anchor QEA Final Alt#	Alta/ Jacobs #	Anchor QEA 2017 ID Summary Table	Project Type	Project Title	Project Description	Screening Criteria: A. Unit Cost of Supply (based on $/AF)	B. Long-Term Supply Reliability	C. Technical Certainty of Success	D. Property Acquisition	E. Permitting Complexity – Water Rights	F. Permitting Complexity – Environmental	G. Extent of Regional Agreements Required	H. Public Acceptability	I. Surface Water Quality Impacts	J. Aquifer Water Quality Impacts	Total Score (Sum of Score x Weight)	Updated Rank for each Interim Step	Updated Rank by Alternative
					Weight (1-10):	9	10	6	6	6	6	4	8	6	6			
1		11	Surface Water Alternative	Snake River (Pipeline to Pullman and Moscow) Direct Use	Direct diversion from Snake River; Surface water pumped and conveyed to treatment; Treated surface water delivered to Pullman and Moscow potable water system	**(0.00)**	**3**	**3**	**1.5**	**1**	**0**	**1**	**1**	**1**	**3**	**99**	**7**	**4**
	1A			WTP, Pipeline to Pullman														
	1B			WTP expansion, Pipeline to Moscow														
	2A	14	Aquifer Recharge	Moscow: Paradise Creek and/or South Fork Palouse River AR	AR with in-city surface water diversion; Treatment; Active injection of treated water in Moscow AR wells during spring runoff	**0.68**	**1.5**	**2**	**1.5**	**2**	**0**	**3**	**1**	**3**	**1**	**98.1**	**8**	
	2B	8	Surface Water Alternative	Pullman & Moscow: North Fork Palouse River Direct Use	Direct diversion from NF Palouse River in WA; Surface water pumped and conveyed to treatment north of Pullman; Treated water conveyed to both City of Pullman and City of Moscow potable water systems	**1.69**	**1.5**	**3**	**1.5**	**2**	**1**	**1**	**2**	**1**	**3**	**119.2**	**4**	
	2B1			WTP, Pipeline to Pullman														
	2B2			WTP expansion, Pipeline to Moscow														
2			**Total**			**1.50**	**1.5**	**2.8**	**1.5**	**2.0**	**0.8**	**1.4**	**1.8**	**1.4**	**2.6**	**115**		**3**
	3A	16B	Surface Water Alternative	Pullman: SF Palouse River Direct Use	Direct Diversion Using Winter/Spring Runoff Direct Diversion from SF Palouse River; Treatment; Delivery to City of Pullman Water System during late winter and spring runoff	**1.84**	**1.5**	**3**	**1.5**	**2**	**1**	**3**	**2**	**3**	**3**	**141**	**2**	
	3B	1	Surface Water Alternative	Moscow: Flannigan Creek/reservoir Direct Use	Flannigan Creek; Reservoir stored water pumped and conveyed to treatment; Treated water discharged directly to City of Moscow potable water system	**0.66**	**1.5**	**1**	**1.5**	**2**	**0**	**3**	**2**	**3**	**3**	**112**	**6**	
3			**Total**			**1.11**	**1.5**	**1.8**	**1.5**	**2.0**	**0.4**	**3.0**	**2.0**	**3.0**	**3.0**	**123**		**2**

Table 7. PBAC Water Supply Alternatives Decision Matrix

Anchor QEA Final Alt#	Alta/ Jacobs #	Anchor QEA 2017 ID Summary Table	Project Type	Project Title	Project Description	Screening Criteria: A. Unit Cost of Supply (based on $/AF)	B. Long-Term Supply Reliability	C. Technical Certainty of Success	D. Property Acquisition	E. Permitting Complexity – Water Rights	F. Permitting Complexity – Environmental	G. Extent of Regional Agreements Required	H. Public Acceptability	I. Surface Water Quality Impacts	J. Aquifer Water Quality Impacts	Total Score (Sum of Score x Weight)	Updated Rank for each Interim Step	Updated Rank by Alternative
					Weight (1-10):	9	10	6	6	6	6	4	8	6	6			
3	3A	16B	Surface Water Alternative	Pullman: SF Palouse River Direct Use	Direct Diversion Using Winter/Spring Runoff Direct Diversion from SF Palouse River; Treatment; Delivery to City of Pullman Water System during late winter and spring runoff	1.84	1.5	3	1.5	2	1	3	2	3	3	141	2	
2	2A	14	Direct Use	Paradise Creek - Moscow	NEW - Direct Use	0.68	0.0	3	1.5	3	0	3	2	3	3	115.1	5	
4	4E	31	Conservation Measures	Moscow Conservation Measures	Sum of all conservation measures from the 2015 Moscow Conservation Plan	2.38	3	1	3	3	3	3	3	3	3	183	1	
		32	Conservation Measures	Pullman Conservation Measures	Sum of all conservation measures from the 2014 Pullman Water System Plan													
		33	Conservation Measures	WSU Conservation Measures	Sum of all conservation measures from the 2008 WSU Water System Plan													
			Conservation Measures		Other conservation (calculated so conservation = 609 MGY)													
Mod 4 (B)			Total			1.79	1.70	2.35	1.99	2.52	1.46	3.00	2.33	3.00	3.00	150		1

Notes:
Base table from Anchor QEA et al. (2017)
AF: acre-feet
ASR: aquifer storage and recovery
AR = aquifer recharge
MGY: million gallons per year
NF: north fork
SF: south fork
WSU: Washington State University
WTP: water treatment plant

Section 8 Funding Strategy

A funding strategy must be developed commensurate with the selection of the final alternative. Funding and financing options to implement a supplemental water supply alternative and recommended steps to further refine a preliminary financing strategy are provided the *Financing Investigation Memorandum* (Appendix K), including details of the funding strategy development. Key elements of the memorandum include:

- Four-step financial planning process for significant capital investment projects, with emphasis on the first two steps of the process critical to advancing financial planning for the project: Step 1 - Prioritizing Goals and Step 2 - Identifying Strategies and Options
- Preliminary findings on funding and financing mechanisms

There are four general potential funding sources:

- Grants
- Municipal agency or special purpose district funds
- State level funding
- Federal funding

PBAC and the entities need to make three key decisions to further advance the financing strategy:

1. Identify and weigh goals/objectives of a financing plan.
2. Determine which of the four alternatives will be implemented.
3. Decide which entity or combination of entities will be responsible for the financing; PBAC is not authorized to issue bonds or incur debt.

Section 9 Conclusions

The purpose of the water supply alternatives refinement project was to conduct outreach, refine the water supply alternative projects, and recommend the top one or two water supply alternatives. This was accomplished by conducting outreach, filling the water rights data gap, identifying fatal flaws related to water rights and fisheries, identifying interim steps, indexing costs to 2021 dollars, comparing the alternatives, and evaluating funding strategies. Conclusions from this effort are described below.

Outreach: The increased outreach efforts to the public providing education on the status of the aquifer and the water supply alternatives refinement project is raising awareness and interest. State and tribal agency engagement with this project is helping identify processes and concerns, and keeps them apprised of the project.

Water rights: The legal availability of water appears to be present with the alternatives based on the preliminary water rights investigations (Snake River was not included in the investigation). In addition, the alternatives would require new water rights because there are insufficient existing water rights available to purchase to fulfill the supply target.

Fatal flaws: The alternatives refinement investigation did not reveal any fatal flaws during the water rights investigation or in discussions with the various state and fisheries agencies, with the following items of note. Nez Perce tribal water rights claims in the Palouse Basin in Idaho, if approved, could potentially impact water availability for the projects with water from Idaho. State fisheries agencies expressed concerns with the smaller water bodies having sufficient availability to meet both flows for aquatic needs and needs of the water supply alternative. The fisheries agencies will review this report and provide comments soliciting discussions for next steps.

Interim steps: Each alternative has interim steps that are either distinct projects that different communities could implement or linked projects that could be phased as the supply need and funding increases. Communities would share a water source in the linked projects. In addition, a new Modified Alternative 4 is introduced to replace Alternative 4. Modified 4 is more cost effective and incorporates feedback from the public in that it does not include ASR or AR.

Current costs: 2021 costs for Alternatives 1, 2, 3, and Modified 4 for the alternatives as a whole:

- Capital costs (rounded to the nearest million): $74 – 110 Million
- Annual O&M costs (rounded to the nearest hundred thousand): $1.6 – 6.0 Million
- Total Present Value Costs/AF (rounded to the nearest thousand): $27 – 67 Thousand

Alternative comparison:

Alternative 1 has the highest capital cost, O&M cost, and total present value $/AF of annual supply, and it also ranks the lowest in the 10-criteria decision matrix (i.e., the lowest score), which includes a cost criterion. However, this option had preliminary favor with the state fisheries agencies due to the volume of water in the river compared to the proposed withdrawal amounts. The national fisheries agencies agreed the amount of water proposed for diversion from the Snake River is considered rather minimal.

Modified Alternative 4 had the lowest capital cost, O&M cost, and total present value $/AF of annual supply, and it also ranks highest in the decision matrix. However, this option has the lowest reliability of water availability, and until instream flows are determined, it is unknown if there is sufficient physical availability of water as determined by the state fisheries agencies. Though in-stream flow mitigation is possible, it would require additional cost and likely extend the schedule of the project.

Funding strategies: A funding strategy needs to be developed. There are opportunities for funding the alternatives, and upon selection of an alternative and governance structure, a funding strategy can be developed. The strategy is likely to include a blend of funds and revenue that will need to consider the communities ability-to-pay, revenue sources, and external funding sources.

Section 10 Recommendations

There is no single alternative that stands out appreciably. However, based on the ranking and feedback from the agencies, Alta recommends PBAC move forward with the two highest-ranking alternatives, Modified Alternative 4 (ranked first) and Alternative 3 (ranked second). Alternative 3 provides an additional alternative with a larger water supply which provides an option if it is determined there is an insufficient water supply with the top alternative. Alternative 1 is preliminarily favored with the state fisheries agencies, yet Alternative 3 ranked second in the matrix and is expected to contain a large supply of water which may also find favor with the fisheries agencies. The alternative that will ultimately be implemented is more likely to depend on funding, site-specific issues such as water availability and property availability, and the preference of local governments. If PBAC had to select only one Alternative to pursue at this point, Alta recommends Modified 4.

To evaluate the affordability of a water supply alternative for the communities, Alta recommends conducting a water utility rate study on the chosen alternative(s). The results of the study may influence the alternative selection.

Section 11 Near-Term Next Steps

Based on the findings of the water supply alternatives' refinement project, PBAC will conduct a workshop to discuss and plan the near-term next steps. These steps will include dissemination of this report, and discussions with community leaders, state and tribal agencies, and the public. Outcomes of the discussions reaching critical decision points which form the foundation of the project, include:

- Obtaining consensus amongst the PBAC members and their representative entities to decide which alternative(s) to move forward
- Obtaining consensus amongst the state agencies and determining the final authority over the project (i.e., who has the final say over which alternative moves forward)
- Determining a governance structure, utility, or Joint Powers arrangement to enable funding and regulatory negotiations and to determine responsibility for next steps with implementation
- Developing a funding strategy and evaluating how to equitably pay for the alternatives amongst the entities and their constituents
- Developing an implementation plan for the alternative that includes additional public engagement
- Creating a written agreement between the communities (ex. memorandum of understanding) for implementation of the preferred alternative
- If PBAC and the entities choose to move forward with Alternatives 1 or 2, seeking guidance from the states for how to legally move water from Washington into Idaho

Engagement is crucial for maintaining the momentum toward selection and implementation of a water supply alternative. PBAC will continue to spearhead the development of an alternative water supply project, and in keeping with their mission they will conduct education and outreach. The community can be certain they will have opportunities to provide feedback throughout the process.

Following the near-term next steps or somewhat in parallel, funding could be secured to conduct certain project preliminary work (ex. water utility rate study, route study, site selection). Development of longer-term planning steps (ex. project funding, water rights acquisition) will occur as the process progresses and after key decisions are made.

Section 12 References

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