September 5, 2018

To: Basin Study Planning Team
From: Ray Hartwell, Summit Conservation Strategies
Re: Technical Memorandum – Multi-Criteria Evaluation of Alternatives and Scenarios

This memorandum summarizes criteria developed by the BSWG for evaluation of potential water resource alternatives and scenarios as well as the multi-criteria evaluation method used to apply those criteria to potential water management tools (alternatives) and hypothetical scenarios relative to the identified criteria.

The Basin Study presents modeled results for four water resource scenarios designed to illustrate the features of different water supply strategies. Each of these scenarios assumes investment in a different combination of water supply alternatives to meet different needs. Scenarios vary widely not only in terms of the cost and quantity of water provided, but also on several other criteria. The study uses a multi-criteria evaluation of scenarios to summarize, at a high level, some of the other important features of the scenarios with the goal of ensuring each scenario is understood in context. The high-level results of the evaluation are incorporated into the Upper Deschutes River Basin Study report. This memorandum describes the evaluation process and results in greater detail.

1. Methods

The multi-criteria evaluation seeks compare scenarios as objectively as possible on several evaluation criteria identified as important in the basin study – these criteria are presented in detail in the Evaluation Criteria section below (Section 2). Because each water management scenario is comprised of a portfolio of water supply alternatives, the evaluation began with the alternatives themselves, and then summarized results at the scenario level. Using reliability as an example criterion, a scenario will only be as reliable as the sum of its (water supply alternative) parts. If all of the water supply alternatives in a scenario are highly reliable, then the scenario will be highly reliable. On the other hand, if the scenario combines high and low reliability water supply alternatives, it may only offer average reliability in aggregate.

The foundation of the evaluation is scoring that evaluates each water supply alternative on all of the criteria. Many of the criteria are qualitative and hard to measure; to avoid false precision we used a simple 1-3 Likert scale to score each water supply alternative on each criterion. Continuing our example, a highly reliable water supply alternative such as conserved water from piping would score a 3 on reliability. The complete matrix of scores by criterion across water supply alternatives is presented in Section 3, Evaluation of Water Supply Alternatives.

Just as water supply alternatives are aggregated into scenarios, the performance of supply alternatives on evaluation criteria are aggregated into a score for each scenario. The scenario scores are simply the average of the water supply alternative criteria scores weighted by each alternative's contribution to the total water supplied in a scenario. For example, if half of a scenario's water came from piping (reliability score 3) and half came from water rights leasing (reliability score 2), then the scenario's overall reliability score would be 2.5. This process is applied across all criteria for each of the four scenarios and presented in Section 4, Evaluation of Water Management Scenarios.

The resulting matrix of weighted average scores for each criterion across the four scenarios is the basis for the multi-criteria summary evaluation for each alternative. To avoid overstating the precision of results, the scores themselves are not presented in the summary. Instead, a prose description briefly describes the how the scenarios compares to each other across criteria. The resulting summaries, one for each scenario, provide concise overviews of the scenarios in terms of cost, water supply provided under different hydrological conditions, and performance on other evaluation criteria.

The multi-criteria evaluation of alternatives is meant to provide a high level summary of important differences between scenarios. It does not provide complete detail on each scenario or water supply alternative, nor can it be relied upon as a single source of information on which to base policy decisions. Full detail on scenarios and their constituent water supply alternatives are found in the reports, technical memoranda, and other outputs of the basin study, and policymakers are encouraged to refer to this background to inform water resource planning.

2. Evaluation Criteria

The Basin Study Work Group Steering Committee developed an original set of evaluation criteria through an iterative process that ended in March 2016. The Steering Committee then refined the criteria prior to beginning the multi-criteria evaluation. The final criteria are presented below, along with a list and explanation of the criteria that were dropped prior to the evaluation. A single criterion was also added, and it is presented in the Added Criteria section.

2.1 Final Criteria

This table presents the final criteria used in the multi-criteria evaluation. It is a refined version of the original criteria developed in March 2016.

Upper Deschutes Basin Study
Final Assessment Criteria

	Criterion	Definition	Example(s) or Description
A.	**Reliability**	The degree of certainty that the alternative meets the desired outcomes.	
B.	**Flexibility/ Adaptability**	The ability of the alternative to change in response to different conditions,changing circumstances, evolving objectives, etc…	A leasing effort can be scaled and redirected annually as needed. The scope (and cost) of a pipe cannot be changed once constructed.
C.	**Duration/ Durability**	The length of time that the alternative/solution addresses the desired outcomes; is it temporary or permanent?	Water leases are temporary, allocation of conserved water to a municipality financing the project is permanent.
D.	**Legal/ Administrative Feasibility**	Is the alternative legal and feasible?	Conserved water projects are legal. Certain alternatives may have legal and administrative barriers that impact feasibility.
E.	**Timeliness**	How quickly can the alternative be implemented?	Are there permitting, compliance, construction, and regulatory timelines, or can the solution be deployed immediately? Optimization of reservoir operations can be enacted quickly, reservoir construction is a longer term proposition.
F.	**Externalities**	The extent to which the proposed alternative/solution avoids unreasonable new adverse impacts to other sectors/users.	Certain alternatives may adversely impact groundwater tables.
G.	**Viability as Mitigation**	The extent to which the proposed alternative/solution can provide a viable source of groundwater mitigation credits.	Water right transfers are a proven source of mitigation while conserved water is allowed by the mitigation program but unproven.
H.	**Transaction Cost**	Cost efficiency of the alternative and administrative effort used to enact it.	All costs besides water cost.
I.	**Financial Risk**	The risk of cost/price changes or overruns.	Lease costs could change over time. Hydropower revenues could change over time. A permanent purchase agreement has secure terms that are "locked in". Construction cost overruns can occur in large infrastructure projects.

2.2 Dropped Criteria

This table presents the list of original criteria (from March 2016) that were not include in the final multi-criteria evaluation. Generally, criteria were dropped if redundant, difficult to implement, or subjective. Criteria that were dropped from the analysis concern important topics in some cases, some of which were unfortunately not able to be addressed due to study limitations.

Criterion	Definition	Explanation
Scope	The size of the proposed alternative/solution; does it or can it address the full scope of the desired outcomes?	Already captured for each alterative (through kAF supplied)
Capital Cost/ Water Cost	The cost (for capital projects) or price (for water transactions) of the water acquired.	Already captured for each alternative (through the cost per AF metric)
Assessment/ Rate Impact	The impact of the alternative/scenario on municipal water rates or irrigation district assessments.	Unable to analyze without a financing plan for different alternatives/scenarios
Equity (Benefits)	Benefits are distributed equitably between stakeholders and citizens; neither costs nor benefits are overly concentrated.	Unable to analyze without a financing plan for different alternatives/scenarios
Distributional Equity (Cost)	Costs of alternatives are generally borne by the beneficiaries of those projects, there are no windfall outcomes, and responsible parties bear cost for addressing problems.	Unable to analyze without a financing plan for different alternatives/scenarios
Economic Efficiency	The impact of the alternative on economic utility/output in aggregate.	Unable to analyze without a full cost-benefit anaysis
Public Acceptance	The degree to which the selected scenario is accepted by the public.	Public comments and feedback were collected through several channels and are incorporated in prose summaries of Basin Study results.

2.3 Added Criteria

This table includes the one criterion, "viability as mitigation", that was added after the March 2016 original list of criteria was completed.

Criterion	Definition	Explanation
Viability as Mitigation	Is the alternative a viable source of mitigation? 3 = proven tool to generate mitigation, 2 = allowed by mitigation program but unproven tool to generate mitigation, 1 = not allowed by mitigation program.	Added to provide information on how alternatives/scenarios could general mitigation

3. Evaluation of Water Supply Alternatives

3.1 Comparison of Alternatives: Full Scoring Matrix

The table on the following page presents the evaluation matrix assessing each category of alternative using the final criteria. As described above, the matrix uses a simple 1-3 scoring to capture, at a high level, the characteristics of different alternatives; in all cases, 3 is preferred to 1. For example, a piping project is highly reliable and is denoted "3" accordingly, but is not flexible and scores a "1" on that criteria. The rationale for the assessment is presented in brief notes. A prose description in the rightmost column provides a simple description of the characteristics of different alternatives (also included in the following table).

It is important to note that the multi-criteria evaluation method does not attempt to differentiate between different water supply alternatives within a category, primarily owing to a lack of objective basis for development of alternative-specific scores. The result is that all like alternatives are characterized in the same way in the evaluation. For example, all of the different piping projects examined in the study will receive the same scores on a given criterion, even if there is in fact a range of performance across alternatives. On the criterion of reliability, all piping projects are deemed highly reliable and receive a score of "3" – this would be the case even if some projects are more reliable than others.

Alternative	AF	Cost/AF	A. Reliability	B. Flexibility/ Adaptability	C. Duration/ Durability	D. Legal/ Administrative Feasibility	E. Timeliness	F. Externalities	G. Viability as Mitigation	H. Transaction Cost	I. Financial Risk	Summary
	quantity potentially available	cost range of alternatives	3 = more reliable, 1= less reliable.	3 = more flexible, 1 = less flexible	3 = longer duration/greater durability, 1 = shorter duration, less durability	3 = completely legal and proven, 1 = unproven and/or requires legal/administrative change	3 = short time to implementation, 1 = long time to implementation	3 = few or no issues, 1 = major issues/contentious	3 = proven tool to generate mitigation, 2 = legal but unproven tool to generate mitigation, 1 = not legal for mitigation	3 = lower transaction cost, 1 = higher transaction cost	3 = less financial risk, 1 = greater financial risk	
Water Conservation												
Private Lateral Piping	35,000	$1,029	3	1	3	1	2	2	2	1	2	
notes:			fixed infrastructure	fixed infrastructure	permanent	authority questions	time to construction, but less design needed	aesthetic impacts, loss of canalside plants	unproven as mitigation source	coordination with owners	cost-overrun risk, change in materials	Private lateral piping is the most cost-effective piping alternative, offering reliable, long-term water supply at lower cost than other hard infrastructure investments. Private ownership entails coordination and authority challenges which must be addressed in implementation.
District-Owned Piping	123,000	$2,333 - $7,000	3	1	3	3	1	1	2	2	2	
notes:			fixed infrastructure	fixed infrastructure	permanent	proven	time to construction	aesthetic impacts, loss of canalside plants, property value impacts	unproven as mitigation source	planning and contracting	cost-overrun risk, change in materials	District-owned piping is a proven approach to securing reliable, long-term water supply. It is significantly more costly than private lateral piping in all cases, though there is also variation in cost across district-owned piping alternatives. District ownership simplifies implementation. Opposition from owners of adjacent property is possible.
On-Farm Upgrades	32,000	$3,800	2	2	2	2	2	3	2	2	3	
notes:				ability to ramp quickly	medium term	limited experiece	depends on quantity	no objections	unproven as mitigation source	coordination of scale program	stable market for equipment	On-farm upgrades to irrigation methods are another source of conserved water to meet basin needs. Though in some (but not all) cases more costly than canal and lateral piping projects, on-farm upgrades offer greater flexibility and are rarely opposed by community members. Savings from these upgrades require reinvestment to provide water in the long-term.
Water Rights Leasing	67,000	$132 - $685	2	3	2	3	2	2	3	2	2	
notes:			depends on volume	adaptable year to year	short to medium term	proven	some immediate, some requires program development/ system improvements	potential for weeds if unmanaged	proven mitigation source	OWRD process (if used)	change in lease cost	Significant supply of water can be generated cost-effectively through leasing water rights. A base level of water leasing is both reliable and extraordinarily low cost relative to other alternatives. As the quantity of leasing increases, costs are higher and the approach is less proven although it is still expected to be lower cost than other alternatives. Leasing is flexible and can be implemented at different scales as needs change. Costs could change over the long-term, and there may be constraints on leasing volume as a function of irrigation district delivery infrastructure. Leases are a proven source of mitigation, though they are not the preferred path of most municipalities due to their temporary nature. Leases do not typically spur opposition from community members.
Water Rights Transfers	15,000	$298	3	2	3	3	2	2	3	2	2	
notes:			seniority dependant	varies between instream vs. farm to farm	basically permanent	proven	lengthy process, incl. policy changes	potential for weeds if unmanaged	proven mitigation source	transfer process	change in water right cost	Water transfers are an effective, reliable, and proven approach to reallocation of existing water supplies. Costs are estimated to be lower than water conservation, though they can vary significantly with quantities acquired and irrigation district policies. Transfers to instream use are effectively permanent, limiting the flexibility of this approach. Transfers are also a proven source of mitigation. Irrigation districts are generally opposed to transfers except when development displaces agricultural land use.
Duty Reduction	50,000	$264 - $528	2	2	2	1	2	3	1	3	1	
notes:			design dependant	some techniques hard to reverse, but others very flexible	design dependant	largely untested in CO	program design			design dependant	untested economics	Voluntary duty reduction offers a significant source of low cost water to meet basin needs. Depending on the specific design of duty reduction initiatives, it can vary significantly in terms of reliability, permanence, and cost. Voluntary duty reduction programs generally do not raise concerns in the community. Duty reduction techniques are largely untested in Central Oregon, though they have been successfully implemented elsewhere.
Reservoir Storage	70,000	under review (high)	3	1	3	1	1	1	1	1	1	
notes:			fixed infrastructure	fixed infrastructure	permanent	many feasibility issues	time to construction	siting, impact to existing reservoirs		Federal planning process	cost-overrun risk, change in materials	Development of additional reservoir storage can generate reliable, permanent new water to meet basin needs. Implementation of this alternative is challenge due to the Federal planning process, potential siting issues, and extremely high cost.

3.2 Summary Comparison of Alternatives

This table presents prose summaries of each category of alternative. It is based on the scoring in the previous table but does not show the numbers.

Alternative	AF	Cost/AF	Summary
	quantity potentially available	cost range of alternative	
Water Conservation			
Private Lateral Piping notes:	35,000	$1,029	Private lateral piping is the most cost-effective piping alternative, offering reliable, long-term water supply at lower cost than other hard infrastructure investments. Private ownership entails coordination and authority challenges which must be addressed in implementation.
District-Owned Piping notes:	123,000	$2,333 - $7,000	District-owned piping is a proven approach to securing reliable, long-term water supply. It is significantly more costly than private lateral piping in all cases, though there is also variation in cost across district-owned piping alternatives. District ownership simplifies implementation. Opposition from owners of adjacent property is possible.
On-Farm Upgrades notes:	32,000	$3,800	On-farm upgrades to irrigation methods are another source of conserved water to meet basin needs. Though in some (but not all) cases more costly than canal and lateral piping projects, on-farm upgrades offer greater flexibility and are rarely opposed by community members. Savings from these upgrades require reinvestment to provide water in the long-term.
Water Rights Leasing notes:	67,000	$132 - $685	Significant supply of water can be generated cost-effectively through leasing water rights. A base level of water leasing is both reliable and extraordinarily low cost relative to other alternatives. As the quantity of leasing increases, costs are higher and the approach is less proven although it is still expected to be lower cost than other alternatives. Leasing is flexible and can be implemented at different scales as needs change. Costs could change over the long-term, and there may be constraints on leasing volume as a function of irrigation district delivery infrastructure. Leases are a proven source of mitigation, though they are not the preferred path of most municipalities due to their temporary nature. Leases do not typically spur opposition from community members.
Water Rights Transfers notes:	15,000	$298	Water transfers are an effective, reliable, and proven approach to reallocation of existing water supplies. Costs are estimated to be lower than water conservation, though they can vary significantly with quantities acquired and irrigation district policies. Transfers to instream use are effectively permanent, limiting the flexibility of this approach. Transfers are also a proven source of mitigation. Irrigation districts are generally opposed to transfers except when development displaces agricultural land use.
Duty Reduction notes:	50,000	$264 - $528	Voluntary duty reduction offers a significant source of low cost water to meet basin needs. Depending on the specific design of duty reduction initiatives, it can vary significantly in terms of reliability, permanence, and cost. Voluntary duty reduction programs generally do not raise concerns in the community. Duty reduction techniques are largely untested in Central Oregon, though they have been successfully implemented elsewhere.
Reservoir Storage notes:	70,000	under review (high)	Development of additional reservoir storage can generate reliable, permanent new water to meet basin needs. Implementation of this alternative is challenge due to the Federal planning process, potential siting issues, and extremely high cost.

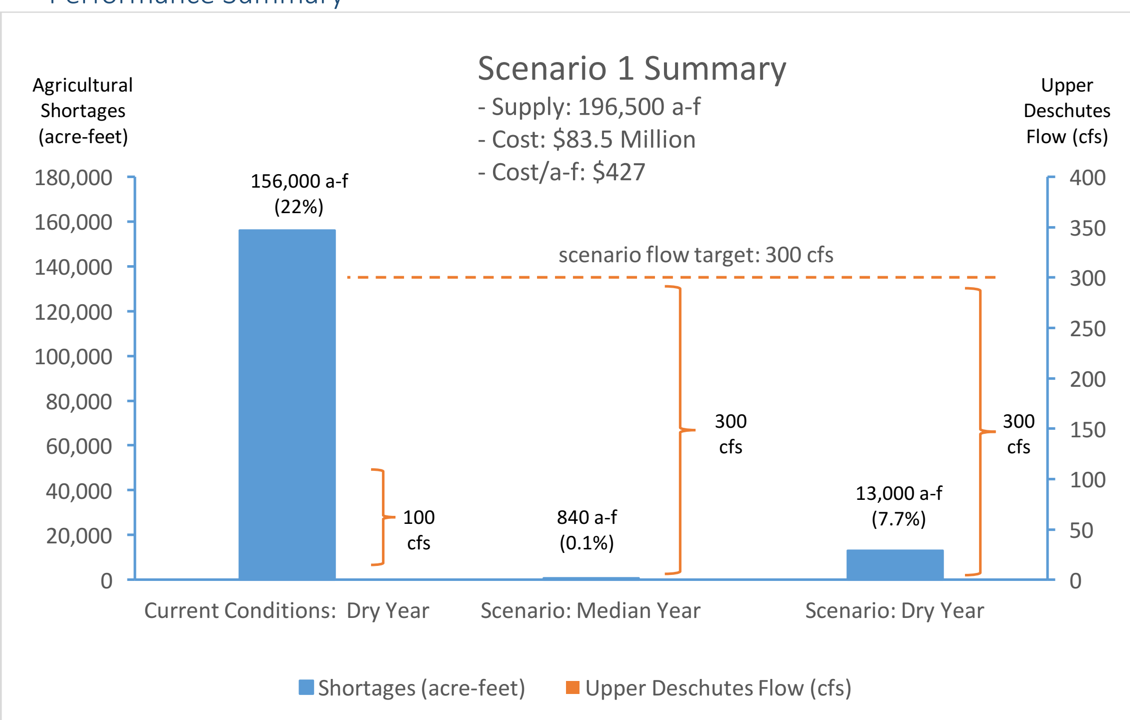
4. Evaluation of Water Management Scenarios

This section presents the summary results of the multi-criteria evaluation of each of the four water management scenarios modeled by the study. For context, a high-level performance summary provides a view of key aspects of each scenario including water supply generated, cost, increases in Upper Deschutes River winter flows, and reduction in agricultural water shortages. The multi-criteria evaluation for each scenario follows.

As described above, the evaluation of scenarios flows directly from the evaluation of water supply alternatives – for each scenario, the score on a given criterion flows directly from the contribution of a given alternative to that scenario. A weighted average approach is used to compare the performance of each water management scenario relative to the others. These scores, while unimportant in themselves, provide an objective way to compare scenarios against each other on different metrics. The comparison itself relies on numerical scoring for each scenario and criterion, but results are presented in qualitative terms in order to avoid inappropriate interpretation of the scores themselves. Narrative descriptions are provided for the overall scenario as well as with respect to each criterion.

4.1 Scenario 1

Performance Summary



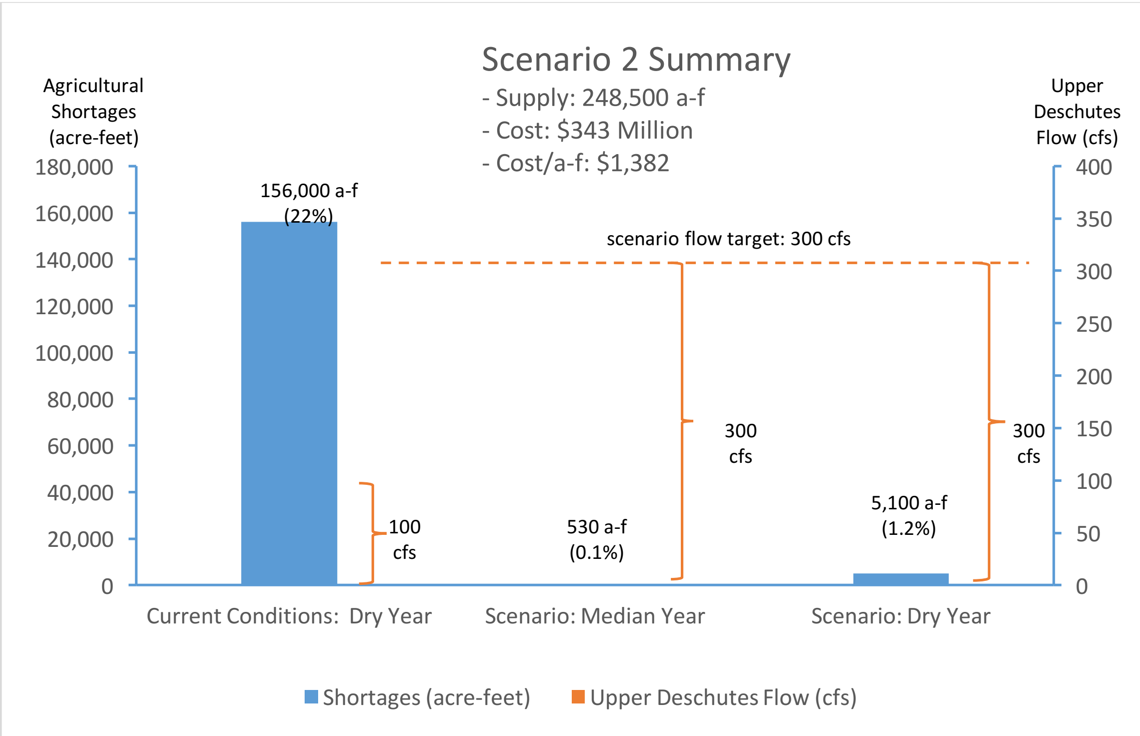
Multi-Criteria Evaluation

		Scenario 1	
		Median Year [1]	**Dry Year [2]**
Shortage Target (AF)		100,000	Up to 265,000
Modeled Flow Target [3]			300
Supply (AF)			196,500
Cost			$83.5M
Cost/AF			$427
		Modeled Scenario	
	Dry Year (Current) [4]	**Median Year [1]**	**Dry Year [2]**
Agricultural Shortages			
Acre-Feet [5]	156,000	840	13,000
Percent [6]	22.0%	0.1%	7.7%
Upper Dechutes Flow (cfs) [7]	100	300	300

Summary	Scenario 1 maximizes cost-effectiveness through reliance primarily on leasing, transfers, and duty reduction to address the lower (up to 265,000 AF) supply target. The scenario's total cost is roughly 1/4 of that of scenario 2. Unit costs are similarly low. The scenario provides a maximum of 196,500 AF in a drought year, a supply sufficient to meet 99.9% of identified needs in a median year. Modest shortages equivalent to 7.7% of agricultural demand are projected to occur in dry years under this scenario. Implementation of this scenario may be constrained by operational issues. Scenario 1 illustrates the feasibility of addressing most of the basin's needs without incurring outsize costs. When compared with scenario 2, it can inform planning around investments in developing a water system that avoids minor shortages in dry years.
A. Reliability	Less reliable than other scenarios due to relatively high contribution from water rights leasing and duty reduction.
B. Flexibility/ Adaptability	More flexible than other scenarios due to the relatively high contribution from water rights leasing and duty reduction.
C. Duration/ Durability	Shorter duration than other scenarios due to relatively high contribution from water rights leasing and duty reduction.
D. Legal/ Administrative Feasibility	Lower feasibility than other scenarios due to signficant contributions from private lateral piping and duty reduction.
E. Timeliness	Shorter timeline to implementation than other scenarios due to relatively high contribution from water rights leasing relative to capital construction projects.
F. Externalities	Fewer challenges related to externalities among scenarios due to smaller contribution from potentially controversial piping and reservoir projects.
G. Viability as Mitigation	Greatest viability as a source of mitigation among alternatives due to greater incorporation of leasing and transfers.
H. Transaction Cost	Transaction costs are higher than other scenarios due to greater contribution from private lateral piping.
I. Financial Risk	Financial risk is higher than other scenarios due to potential lease price change.

4.2 Scenario 2

Performance Summary



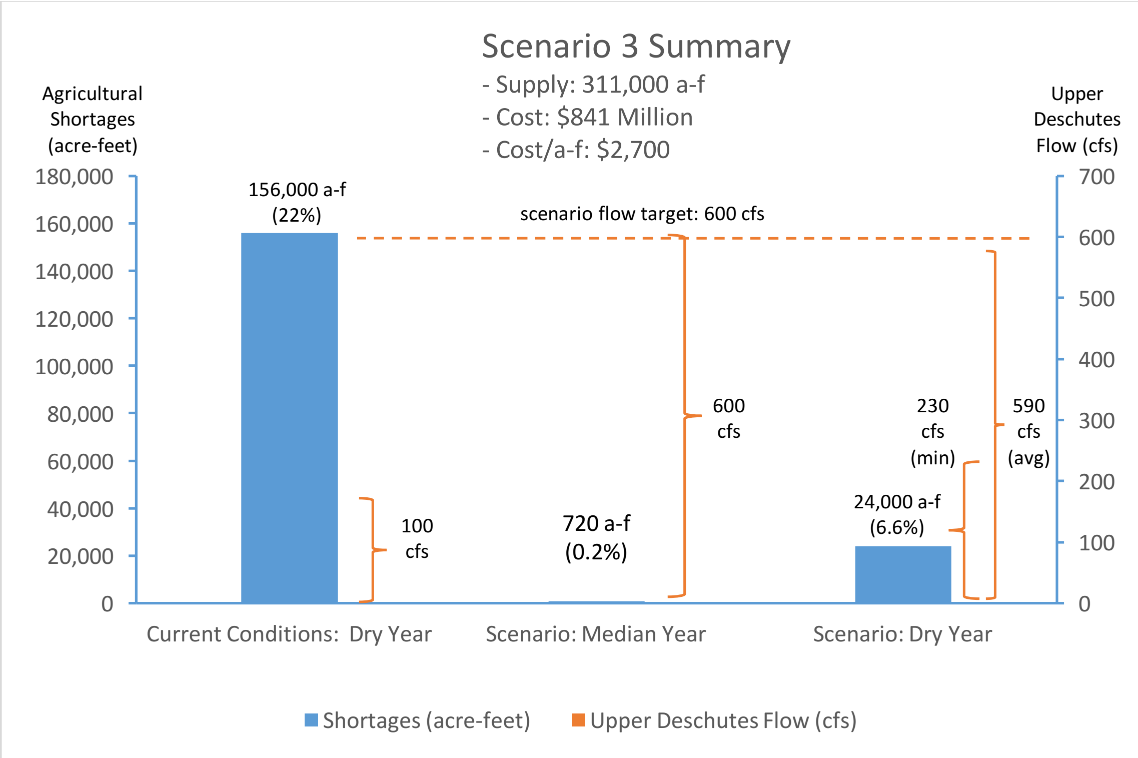
Multi-Criteria Evaluation

	Scenario 2		
		Median Year [1]	**Dry Year [2]**
Shortage Target (AF)		100,000	Up to 265,000
Modeled Flow Target [3]			300
Supply (AF)			248,500
Cost			$343M
Cost/AF			$1,382
		Modeled Scenario	
	Dry Year (Current) [4]	**Median Year [1]**	**Dry Year [2]**
Agricultural Shortages			
Acre-Feet [5]	156,000	530	5,100
Percent [6]	22.0%	0.1%	1.2%
Upper Dechutes Flow (cfs) [7]	100	300	300

Summary	Scenario 2 incorporates leasing, duty reduction, and transfers but relies heavily on district-owned piping to address the lower (up to 265,000 AF) supply target. Through this approach, the scenario avoids shortages under all water conditions. While reliable and durable, the piping has a longer timeline to implementation and much higher cost at roughly 4 times that of scenario 1. Through comparison with scenario 1, it can inform planning around investments in developing a water system that avoids minor shortages in dry years.
A. Reliability	High reliability due to large contribution from piping.
B. Flexibility/ Adaptability	Larger contribution from piping projects reduces flexibility relative to scenario 1.
C. Duration/ Durability	Longer duration than scenario 1 due to greater inclusion of piping.
D. Legal/ Administrative Feasibility	High feasibility due to heavy reliance on proven strategies like leasing and district-owned piping.
E. Timeliness	Longer timeline to implementation due to greater contribution from capital construction projects.
F. Externalities	Greater reliance on piping entails risk of opposition from adjacent landowners.
G. Viability as Mitigation	Moderate viability as a source of mitigation due to a larger reliance on conserved water (piping) relative to leasing and transfers.
H. Transaction Cost	Lower transaction costs relative to other scenarios due to larger contribution from district-owned piping.
I. Financial Risk	Financial risk is moderated slightly by inclusion of more piping relative to other alternatives.

4.3 Scenario 3

Performance Summary



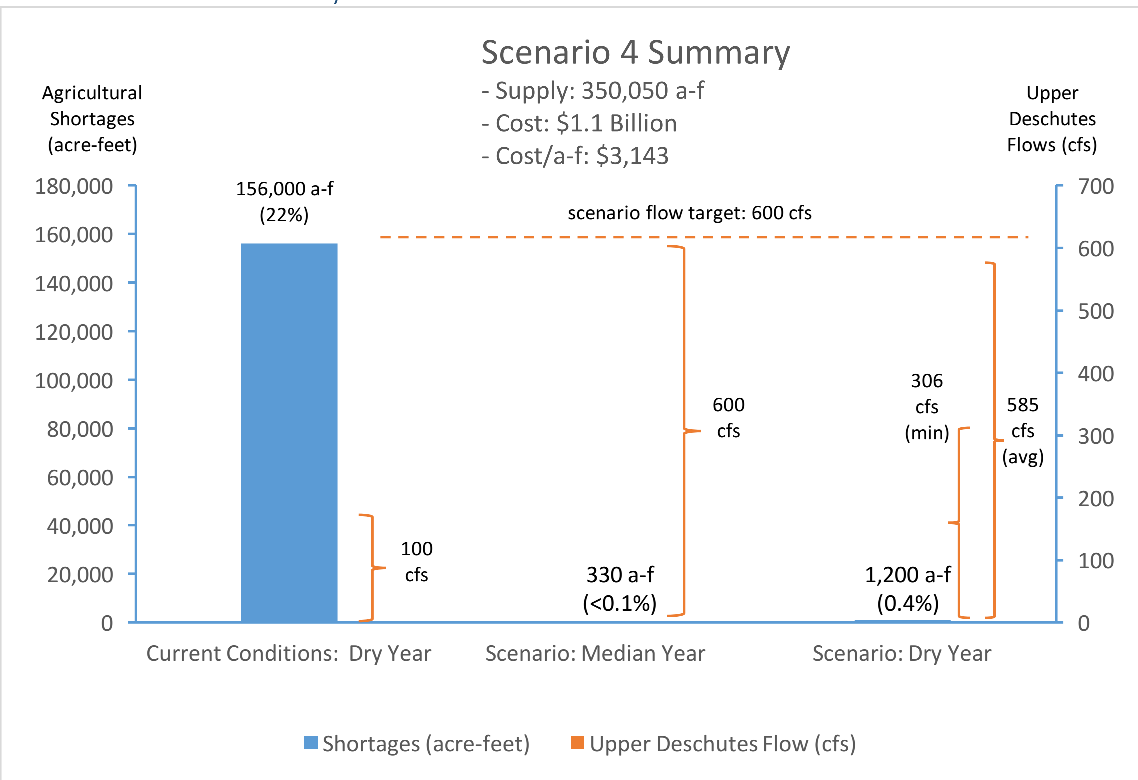
Multi-Criteria Evaluation

		Scenario 3	
		Median Year [1]	**Dry Year [2]**
Shortage Target (AF)		210,000	Up to 370,000
Modeled Flow Target [3]			600
Supply (AF)			311,000
Cost			$841M
Cost/AF			$2,700
		Modeled Scenario	
	Dry Year (Current) [4]	**Median Year [1]**	**Dry Year [2]**
Agricultural Shortages			
Acre-Feet [5]	156,000	720	24,000
Percent [6]	22.0%	0.2%	6.6%
Upper Dechutes Flow (cfs) [7]	100	600	230 (min) 590 (avg)

Summary	Scenario 3 maximizes piping to address the higher (up to 370,000 AF) supply target. The scenario identifies 311,000 AF of supply which is sufficient to meet all needs in X% of years. Modest shortages equivalent to 5.9% of agricultural demand are projected to occur in dry years under this scenario. Both total and unit costs are much higher than in scenarios 1 and 2 due to the need to include high cost alternatives to approach the ambitious supply target; the scenario is 10 times the cost of scenario 1. The extensive infrastructure investment results in a reliable and durable supply of water through proven approaches.
A. Reliability	High reliability due to large contribution from piping.
B. Flexibility/ Adaptability	Larger contribution from piping projects reduces flexibility relative to scenario 1.
C. Duration/ Durability	Longer duration than scenario 1 due to greater inclusion of piping.
D. Legal/ Administrative Feasibility	High feasibility due to heavy reliance on proven strategies like leasing and district-owned piping.
E. Timeliness	Longer timeline to implementation due to greater contribution from capital construction projects.
F. Externalities	Greater reliance on piping entails risk of opposition from adjacent landowners.
G. Viability as Mitigation	Moderate viability as a source of mitigation due to a larger reliance on conserved water (piping) relative to leasing and transfers.
H. Transaction Cost	Lower transaction costs relative to other scenarios due to larger contribution from district-owned piping.
I. Financial Risk	Financial risk is moderated slightly by inclusion of more piping relative to other alternatives.

4.4 Scenario 4

Performance Summary



Multi-Criteria Evaluation

	Scenario 4		
		Median Year [1]	**Dry Year [2]**
Shortage Target (AF)		210,000	Up to 370,000
Modeled Flow Target [3]			600
Supply (AF)			350,050
Cost			$1.1B
Cost/AF			$3,143
		Modeled Scenario	
	Dry Year (Current) [4]	**Median Year [1]**	**Dry Year [2]**
Agricultural Shortages			
Acre-Feet [5]	156,000	330	1,200
Percent [6]	22.0%	<0.1%	0.4%
Upper Dechutes Flow (cfs) [7]	100	600	306 (min) 585 (avg)

Summary	Scenario 4 invests heavily in both piping and development of reservoir storage to generate a large and extremely reliable supply of water towards the higher (up to 370,000 AF) supply target. The scenario identifies over 350,000 AF through included alternatives, an amount sufficient to meet substantially all needs even in dry years. This robust water supply comes at a very high cost of $1.1 billion, over 13 times that of scenario 1. Cost and feasibility issues notwithstanding, scenario 4 demonstrates that tools exist to secure large amounts of additional water supply potentially needed under some scenarios.
A. Reliability	High reliability due to large contribution from piping coupled with reservoir development.
B. Flexibility/ Adaptability	Larger contribution from piping projects and reservoir development reduces flexibility relative to scenario 1.
C. Duration/ Durability	Longer duration than scenario 1 due to greater inclusion of piping and development of new storage.
D. Legal/ Administrative Feasibility	High feasibility due to heavy reliance on proven strategies like leasing and district-owned piping. Reservoir development is one less feasible element of scenario 4.
E. Timeliness	Longest timeline to implementation due to greater contribution from capital construction projects, including reservoir development.
F. Externalities	Greater reliance on piping entails risk of opposition from adjacent landowners. Reservoir siting and development can also be controversial.
G. Viability as Mitigation	Lowest viability among scenarios as a source of mitigation due to a larger reliance on conserved water (piping) relative to leasing and transfers.
H. Transaction Cost	Higher transaction costs driven largely by Federal reservoir planning process.
I. Financial Risk	Financial risk is moderated slightly by inclusion of more piping relative to other alternatives.

Note:

[1] Modeled Upper Deschutes flow target (cfs)

[2] Conditions in a dry (10th percentile) year under current basin infrastructure and operations

[3] Median (50th percentile) water year

[4] Dry (10th percentile) water year

[5] Modeled aggregate unmet irrigation demand

[6] Modeled aggregate unmet irrigation demand as a percentage of total irrigation demand

[7] Lesser of average daily instream flow or modeled instream flow target