Appendix D

Investigation and Analysis Report

D.1 Economic Analysis

Medford Irrigation District Joint System Canal Modernization Project Economic Analysis

1 Introduction

This appendix provides an economic analysis that evaluates the costs and benefits of the Medford Irrigation District (MID or District) Joint System Canal Modernization Project (Project). The analysis uses Natural Resources Conservation Service (NRCS) guidelines for evaluating economic benefits as outlined in the NRCS Natural Resources Economics Handbook and the U.S. Department of Agriculture's (USDA) Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines (PR&G) for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (DM 9500-013).

The Preferred Alternative represents the potential future with federal funding through Pub. L. No. 83-566. The Future Without Federal Investment (FWOFI) Alternative (or No Action Alternative) represents the future if the District does not receive federal funding through Pub. L. No. 83-566.

This economic analysis is divided into four sections. This first section provides a general overview of the project, location, purpose and need, and analysis parameters. The second section describes the conditions under the Future Without Federal Investment (No Action) Alternative. The third section presents the costs and benefits of the Preferred Alternative compared to the FWOFI. The last section provides a summary of the benefits and costs of the Preferred Alternative.

1.1 Project Location

The District is located within Jackson County, Oregon, within the Rogue River Basin, near the town of Medford. The District is 23,985 acres, of which roughly 12,000 acres are irrigated land used by approximately 1,350 patrons. The planning area is based on the irrigation problem area[1] and is identified as Jackson County (see Appendix B for a map). The project area is the portion of the planning area where the Project would occur. The project area, making up only a small portion of the District's total system, consists of the District infrastructure to be modernized along the Joint System Canal, areas where new infrastructure would be built, and associated easements where construction would take place (see Appendix B for a map).

1.2 Existing Conditions & Challenges

Along with Rogue River Valley Irrigation District (RRVID), MID diverts water from North Fork Little Butte Creek and South Fork Little Butte Creek and conveys the water to its patrons through the 12.9-mile Joint System Canal (JSC). Water conveyed through the JSC serves approximately 2,200 farms that irrigate approximately 21,000 acres in MID and RRVID. The JSC is jointly owned by MID and RRVID and MID is responsible for operating the canal. Costs to maintain the canal are high due to the length of the canal and the need to inspect and remove moss from the canal.

From 2000 to 2024, average annual precipitation during the irrigation season (April 15 – October 1) was approximately 3.5 inches (National Weather Service, 2025). In general, crops grown in the region require at least 29 inches of water to meet their evapotranspiration (ET) needs in an average year (Bureau of Reclamation, 2015). Given the low level of rainfall during the growing season, irrigation plays a critical role in crop production in the study area.

[1] The "planning area" referred to in the Plan-EIS is equivalent to the term "watershed area" as defined by the National Watershed Program Manual (NWPM) 506.60.TTT (NRCS 2015a). The term "planning area" is used in this Plan-EIS in an effort to reduce confusion between the NWPM 506.60.TTT watershed area definition and watershed areas as defined by hydrologic unit codes.

MID patrons have experienced unreliable and limited water supplies, which have negatively impacted agricultural producers and crop yields. Due to persistent drought, MID did not have a full reservoir storage allotment from 2014 to 2024 and in some years did not deliver irrigation water for the full length of the irrigation season. During 2020 to 2022, the District did not begin water deliveries until June or July, and the irrigation season ended in August. During these years, irrigators only had water for roughly a quarter (6 weeks) of their normal 24-week irrigation season. MID irrigators do not have other options for water supply; there are no other available surface water supplies and local groundwater tends to be marginal in quantity, so drilling of wells to supplement supplies is not a viable option (CH2M and Medford Water Commission, 2017).

Crop yields in the District have been negatively impacted by the unreliable and limited water related to drought conditions. For example, some orchard growers in the Rogue Valley have cut down fruit trees to conserve water for the remaining trees due to lack of water supplies. Other orchard growers have had enough water to keep trees alive but not enough to produce a marketable crop.

The JSC is an open canal first constructed in 1902 with improvements made in the 1950s. Due to the deteriorating condition of the JSC, water delivery reliability has been reduced for the water users who depend on JSC water for agricultural, residential, industrial, and recreational uses. Agriculture is an important part of the Rogue Valley economy, and agricultural production depends on reliable water deliveries. Irrigation water shortages and lack of reliability are exacerbated due to the aging and inefficient condition of the JSC. The JSC is susceptible to catastrophic failures due to its age and factors that affect its structural integrity (e.g., falling trees, flooding, rodent activity, and impacts from livestock crossing the canal).

Low streamflow in the Little Butte Creek watershed results in poor water quality (particularly high temperature) and poor aquatic habitat conditions. This watershed is one of the Rogue Basin's most important habitats and spawning tributaries for the Endangered Species Act (ESA)-listed Southern Oregon/Northern California Coast (SONCC) Coho Salmon, and low instream flows and resultant high temperatures are primary limiting factors imperiling this species (Oregon Department of Fish & Wildlife, 2021). The inefficient JSC system (which loses water to seepage, evaporation, and operational losses) results in more water being diverted from Little Butte Creek to meet a given level of irrigation demand, diminishing aquatic habitat conditions.

1.2.1 Future Conditions in MID

Drought severity in Jackson County has increased in the past three decades compared to historical conditions, and drought is expected to further increase in frequency, severity, and duration in the future. Climate models project an increased probability of extreme droughts, and the climatic water deficit (a measure of drought stress) is projected to at least double (Oregon Watershed Enhancement Board, 2023). Due to both rising temperatures and decreasing snowpacks, water supply shortages are expected to worsen in the coming decades, which are likely to exacerbate water shortages in MID.

MID's long-term water supply may also be reduced in the future if other, more senior water right users exercise their water rights and reduce supplies available to MID. MID has stored water rights in Fourmile Lake (a primary source of stored water for MID and RRVID) which are junior to the water rights of the Klamath Tribes. In 2023 when the Klamath Tribes exercised their senior water right in Fourmile Lake and instituted a call, releases from Fourmile Lake for MID and RRVID were delayed by a month. While this did not result in a significant disruption to MID and RRVID operations, future calls on Fourmile Lake by the Klamath Tribes may decrease the amount of stored

water available to MID and RRVID. The situation has the potential to further decrease MID's future water supplies.

The JSC is over 120 years old and is beyond its expected useful life. Key components of the JSC include three siphons, which are sections of buried pipe used to transfer irrigation water under or over a barrier. Each of the three existing JSC siphons (Lake Creek, Wyant, and Osborne), which were constructed in 1956, has a high likelihood of failure in the near future. Based on data from the Bureau of Reclamation (Reclamation) on failure risk of siphon infrastructure, we estimate a 20 percent annual probability that one of the three siphons in the JSC will fail this year, with a cumulative probability of almost certain failure (over 99.9 percent) in the next 17 years (see more explanation in Section 6.2) (Jermyn M. , 2021). Failure of the JSC could lead to flooding of adjacent properties and environmental damage to Little Butte Creek. A canal failure would require water deliveries to be stopped while the canal was fixed, which would leave approximately 4,800 acres in MID without water for days to weeks depending on the size of failure. A failure of any one of these siphons would also substantially reduce the water supply to roughly 13,700 acres in MID and RRVID. If this occurred during the peak irrigation months of June-August, it could have major detrimental effects on crop yield, crop quality, and farm income for the agricultural community.

Further, a canal failure could result in flooding of properties adjacent to the JSC, cause adverse habitat conditions in Little Butte Creek, and threaten public safety. The JSC traverses across steeply sloped terrain above the lands adjacent to Little Butte Creek. The land use below the JSC includes pastures, residences, other structures, and roads. A canal failure could result in large volumes of water flowing down the slope, which, depending on the location of the failure, would have the potential to cause flood damage to structures and roads and endanger anyone who happened to be in the path of the flow. The water also has the potential to carry nutrients and sediment from the pasture into Little Butte Creek, degrading water quality and harming the aquatic habitat.

Due to limited financial resources, in the FWOFI condition the District will face ongoing high operations and maintenance (O&M) expenses and threats to public safety, and likely increasingly frequent and costly water reliability shortages and flood damages.

1.2.2 Project Area Challenges and Opportunities

The following resource problems are experienced in the planning area and define the project needs:

- Insufficient agricultural water supply during drought conditions reduces agricultural production. The JSC loses water through seepage, evaporation, and operational spills, which exacerbates water shortages.
- Greater future reductions in agricultural water supply are anticipated due to forecasted changes in regional snowpack and rainfall and potential future calls for water from Fourmile Reservoir by the Klamath Tribes. Further, likely future failure of the JSC would reduce a significant portion of the MID and RRVID water supply.
- Rogue River tributaries within the study area have poor water quality due to low streamflow, which adversely impacts aquatic habitat, including for the ESA-listed SONCC Coho Salmon.

Opportunities in the planning area include modernization of irrigation infrastructure to improve agricultural water management by conserving water and improving water supply reliability to address resource concerns. Specifically, the following resource opportunities would be met through irrigation modernization:

- Improve irrigation water management by reducing JSC delivery system losses.
- Improve water delivery reliability to MID and RRVID irrigators.
- Increase water supply and drought resilience for MID and RRVID irrigators.
- Reduce crop damages due to insufficient water delivery.
- Improve aquatic habitat within the study area.
- Educate the public about water conservation.

1.3 Project Purpose and Need

The purpose of this watershed plan is to make the conveyance of irrigation water through the JSC more efficient and reliable. The project is needed to alleviate damages to irrigated agriculture and agricultural communities served by the JSC that stem from unreliable access to and inefficient delivery of irrigation water. The proposed purpose of this project falls under Public Law 83-566 Authorized Project Purpose (v), Agricultural Water Management.

1.4 Project Overview

The MID Joint System Canal Modernization Project is an agricultural water conveyance efficiency project. The Preferred Alternative would pipe and install three new siphons along 11.5 miles of the JSC and replace three existing siphons (in their existing alignments) that extend 0.3 miles in total.

1.5 Watershed Plan-EIS Alternatives

1.5.1 Future Without Federal Investment (No Action) Alternative

Under the FWOFI Alternative, federal funding through Pub. L. No. 83-566 would not be available to implement the Project. The District's conveyance system would continue to have seepage losses, leaving less water to support irrigation and food production (provisioning services) and fish and wildlife habitat (cultural services). Failure of district conveyance systems could also result in flooding (regulating service), which may pose a threat to property and human life.

Under the FWOFI Alternative, the District would continue to replace aging infrastructure as needed and as available funding allows. The three existing siphons (Lake Creek, Wyant, and Osborne) have a high likelihood of failure in the near future. A failure of any one of these siphons would cut off all water to approximately 4,800 acres in MID and substantially reduce the water supply to roughly 13,700 acres in MID and RRVID. While the District's goal would be to replace the failed siphons, the expense of doing so may exceed the District's financial resources. For this reason, this analysis does not model replacement of the siphons after failure. Accordingly, under the FWOFI Alternative, the siphon failure results in damages associated with lost agricultural production. Modeling the FWOFI Alternative in this way provides a benefit-cost analysis of replacing the siphons (rather than comparing the benefits of federal funding versus other unknown, potential funding sources of siphon replacement in the FWOFI).

Under the FWOFI Alternative, modernization of the District's system would not occur and the purpose and need of the Project would not be met.

1.5.2 Preferred Alternative

The Preferred Alternative is MID's desired alternative. Under this alternative, federal funding through Pub. L. No. 83-566 would be available. The District would perform the following actions:

- Pipe and install three new siphons over 11.5 miles of the JSC (Grasshopper, Owens, and Eagle Gulch) in four phases (completing one phase per year)
- Replace three existing siphons: Lake Creek, Wyant, and Osborne in their existing alignments

Although the exact timeline of Project construction is uncertain, this analysis models the start of Project construction (Year 0) in 2027.

1.6 Analysis Parameters

All economic values are presented in 2026 dollars rounded to the nearest $1,000. Unless otherwise noted, all economic values are presented in average annual values (following the approach described in the NRCS Water Resources Handbook for Economics) using the 3.25-percent federal discount rate for federal water projects for fiscal year 2026 (U.S. Bureau of Reclamation, 2026). Under this method, all costs and benefits are evaluated at the 2026 price level. Future benefits and costs are discounted to a present value using the 3.25-percent federal discount rate.[2] Finally, each present value is amortized to average annual values over the evaluation period using the 3.25-percent rate.[3]

1.6.1 Funding

In the FWOFI Alternative, the District would continue operations, maintenance, and replacement (OM&R) of current infrastructure. Under the Preferred Alternative, Pub. L. No. 83-566 funding would be awarded. Pub. L. No. 83-566 funds would cover $70,401,000 (75 percent) of the total project installation/construction cost, and the remaining $23,808,000 (25 percent) would be funded by MID (through its own funds or other outside funding sources).

1.6.2 Evaluation Unit

The Preferred Alternative has five project groups (PG), which are the evaluation units for this analysis. Specifically, the project groups are:

1. PG 1 Piping: Pipe 1.89 miles of the JSC and install Grasshopper Segment Option 2 (0.08 miles long)
2. PG 2 Piping: Pipe 3.46 miles of the JSC and install Owens Segment Option 2 (0.11 miles long)
3. PG 3 Piping: Pipe 2.38 miles of the JSC and install Eagle Gulch Segment Option 2 (0.19 miles long)
4. PG 4 Piping: Pipe 3.4 miles of the JSC
5. PG 5 Upgrade three existing siphons: Lake Creek Siphon Option 2, Wyant Siphon Option 1, and Osborne Creek Siphon Option 2, with a combined length of 0.3 miles.

1.6.3 Implementation Timeline

Under the Preferred Alternative with Pub. L. No. 83-566 funds, District staff predict that construction of the five project groups would likely be completed over approximately four years, with some overlap in construction timing between project groups. For each project group, this analysis assumes that full benefits would be realized the year after construction is completed (e.g.,

[2] As directed in DM 9500-13 (Section 9a and 9f(5)), the National Resource Economics Handbook (Part 611 Water Resources Handbook for Economics, Section 611.0103), the Principles and Guidelines (Sections 1.4.11, 1.7.1(h), 2.1.3, 2.4.11, 2.4.14, and 8), and in Chapter III of the Principles, Guidelines, and Recommendations (Section v).

[3] As directed in DM 9500-13 (Section 9a and 9f(5)), the National Resource Economics Handbook (Part 611 Water Resources Handbook for Economics, Section 611.0103), the Principles and Guidelines (1.7.1(h), 2.1.3, and 2.4.14), and in Chapter III of the Principles, Guidelines, and Recommendations (Section v).

for Phase 1, which would be constructed in Year 0, full benefits would be realized in Year 1). This information is summarized in the table below.

Table D-1. Construction Timeline and Project Life for the Preferred Alternative, Rogue River Watershed, Oregon.

Works of Improvement	Construction Start Year	Construction End Year	Project Life Start Year	Project Life End Year
PG1 Piping	0	1	1	100
PG2 Piping	1	1	2	101
PG3 Piping	2	1	3	102
PG4 Piping	3	1	4	103
PG5 Replace Existing Siphons	0	2	2	101

Prepared August 2026

1.6.4 Period of Analysis

The period of analysis is defined as the implementation period plus the period of time over which any alternative would have meaningful beneficial or adverse effects (up to a maximum of 100 years). The analysis period is 104 years, which includes four years of project construction/installation and 100 years of project life, based on the expected life of the HDPE pipe (during which time it is expected to bring significant project benefits). Accordingly, the study period extends from Year 0 (construction start) to Year 103 (last year of potential useful life for the project).

2 Future Without Federal Investment Alternative

This section describes conditions under the FWOFI Alternative and the associated costs and benefits of these conditions. Conditions under the FWOFI Alternative include O&M activities and costs, agricultural damages from inadequate water supply, and flood damages from seepage and canal failures.

2.1 O&M

Under the FWOFI Alternative, current standard O&M activities are performed including operating and maintaining the JSC and repairing the JSC after failures. This section describes the O&M actions.

Currently, MID spends an average of roughly $111,500 to operate and maintain the JSC, both for MID and RRVID (Friend, 2025).[4] This includes the cost of ditchriding, inspecting the canals, and cleaning the canals (including moss removal) twice per year. Under the FWOFI Alternative, these costs would continue and could potentially increase as the JSC ages and requires more O&M to maintain its current level of service. This analysis models the costs continuing at their present level throughout the period of analysis.

The JSC experiences overtopping events roughly one out of every five years. Each time it overtops, the District spends an average of around $15,400 to fix the issue.[5] This results in average annual

[4] The District's original estimate was $108,778.78 in 2024 dollars (Friend, 2025). This amount was updated to 2026 dollars using the Bureau of Reclamation's O&M Cost Index (Bureau of Reclamation, 2026).

[5] The District's original estimate was $15,000 in 2024 dollars (Friend, 2025). This amount was updated to 2026 dollars using the Bureau of Reclamation's O&M Cost Index (Bureau of Reclamation, 2026).

costs of about $3,100 to address overtopping. These costs are expected to continue under the FWOFI Alternative. These costs are in addition to the annual JSC O&M ($111,500).

This analysis apportions the annual O&M costs ($111,500) and the annual risk of overtopping repairs ($3,100) according to the length of each piping phase. This apportionment is shown in the table below. When discounted, the annual average costs of O&M under the FWOFI Alternative are roughly $109,000, as summarized in the table below.

Table D-2.Total O&M Costs under the FWOFI Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Length of Canal (miles)	Annual O&M Under FWOFI Alternative	Average Annual Cost of Canal Overtopping	Annualized O&M Costs
PG1 Piping	2.0	$19,095	$527	$20,000
PG2 Piping	3.6	$34,556	$953	$34,000
PG3 Piping	2.6	$24,854	$685	$24,000
PG4 Piping	3.4	$32,969	$909	$31,000
Total	**11.5**	**$111,475**	**$3,074**	**$109,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars

2.2 Inadequate Water Supply and Agricultural Damages

Currently, MID faces water supply shortages and associated agricultural damages. Inadequate water supply in MID results in fallowing of cropland, less agricultural production, and less agricultural net income. Additionally, large canal failures on the JSC open canal sections interrupt the water supply to patrons roughly one out of every 10 years, depriving crops of water and harming agricultural production. Water deliveries in MID also depend on siphon infrastructure in the JSC that has a high likelihood of failure in the future (approximately 20 percent annual probability currently that one of the three siphons will fail). If any one of these siphons were to fail, more than 20,000 acres of agricultural production would be negatively impacted. This section explores the agricultural damage associated with inadequate and unreliable water supplies under the FWOFI Alternative.

2.2.1 Water Shortages

The District experiences water shortages in most years. In the decade between 2015 and 2024, the District had to shorten the length of the irrigation season eight times due to inadequate water supply (Friend, 2025). As the table below shows, the season length was shortened between 16 and 67 percent. A 2017 Water Management and Conservation Plan (WMCP) estimated MID's total diversion needs to be 43,243 acre-feet per year (AFY) based on the District crop mix, evapotranspiration needs of crops, and conveyance efficiency (Newton Consultants Inc, 2017). Records from the Oregon Department of Water Resources indicate that between 2015 and 2024, MID's average total diversion was approximately 30,500 AFY (Oregon Department of Water Resources, 2024).[6] Given these data, MID experienced an average annual diversion shortage of about 12,800 AF (or about 30 percent of the total diversion need). MID's current conveyance

[6] This includes an average of approximately 12,000 AF from the North Fork of Little Butte Creek; 6,000 AF from the South Fork of Little Butte Creek; 8,500 AF from Bear Creek; and 4,000 AF from return flows (as estimated in the WMCP) (Newton Consultants Inc, 2017).

system is estimated to be approximately 80-percent efficient (meaning 20 percent is lost to seepage) (Newton Consultants Inc, 2017). Accordingly, the average annual delivery shortage is approximately 10,200 AFY.

The diversion and estimated shortage data are summarized in the table below along with the irrigation season length reductions. The estimated percentage reductions in water shortage and irrigation season length are closely correlated[7] but are not equivalent. This could be for a few reasons. First, MID's conveyance management tools are imprecise, which makes reducing the season length an imperfect index of available water supplies. For example, in some years, the District had a full water supply but still had to ration water (Friend, 2025). In this way, the length of season reduction does not perfectly reflect the supply shortage. This could explain why the District did not ration water in 2016 but shortened the season by 20 percent in 2024 despite having an additional 4,000 AF (compare the second and last columns in the table below for those years). Second, MID's water demand fluctuates each year depending on cropping patterns (the type of crops planted and the area fallowed) and climatic factors (temperature and precipitation). The actual shortage in each year likely differed from the estimated shortage, which is based on a fixed estimate of total water demand (43,243 AF). Despite being imperfect, these measures offer the best available estimates of MID's recent water shortages, and both measures support the fact that MID's water shortages have been both frequent and severe, averaging approximately 25 to 30 percent of demand.

Table D-3. Historical Water Supplies and Estimated Shortages in MID, 2015-2024, Rogue River Watershed, Oregon

Year	Total Diversion (AF)[1]	Estimated Diversion Shortage (AF)[2]	Estimated Delivery Shortage (AF)[3]	Estimated Percentage of Diversion Shortage[4]	Irrigation Season Length Reduction[5]
2015	27,416	15,827	12,662	36%	18%
2016	35,254	7,989	6,392	18%	0%
2017	37,327	5,916	4,733	14%	0%
2018	34,014	9,229	7,384	21%	23%
2019	36,855	6,388	5,111	15%	16%
2020	34,482	8,761	7,009	20%	24%
2021	16,939	26,304	21,044	60%	67%
2022	17,026	26,217	20,974	60%	64%
2023	25,932	17,311	13,849	40%	25%
2024	39,634	3,609	2,888	8%	20%
Average	**30,488**	**12,756**	**10,204**	**29%**	**26%**

1/ Source: (Oregon Department of Water Resources, 2024) Prepared August 2026
2/ Based on a total diversion need of 43,243 AFY, estimated by (Newton Consultants Inc, 2017)
3/ Equal to the diversion shortage multiplied by the system efficiency (80 percent)
4/ Calculated by dividing the estimated shortage by the total diversion need (43,243 AF)
5/ Derived from MID records of irrigation season length, with a full season extending from April 1 to October 1 (Friend, 2025)

[7] The two datasets have a Pearson coefficient of 0.87. The Pearson coefficient measures how closely correlated two datasets are, with a value of 1 indicating perfectly correlated datasets.

To model the economic cost of water shortages and the benefit of conserved water from the Project, this analysis uses a crop budget method described in detail in Section 6.1. This method models the costs and returns of producing two of the District's most common crops: pasture and alfalfa hay. As shown in the table below, the results of this analysis indicate that the marginal value of water to pasture production is approximately $85 per AF and the marginal value to alfalfa hay production is around $245 per AF. The District also has acreage in pears and some other high-value crops, but these crops are relatively limited in acreage and orchard acreage has been declining in recent years due to market conditions. As such, the analysis focuses on alfalfa and pasture.

Table D-4. Summary of Crop Budget Method Results, Rogue River Watershed, Oregon, 2026 dollars

Metric	FWOFI Alternative Pasture	FWOFI Alternative Alfalfa	Preferred Alternative Pasture	Preferred Alternative Alfalfa
Net returns per acre per year [1]	$9	$133	$38	$206
Marginal net returns ($/acre/year)	N/A	N/A	$29	$73
Additional water under Project (AF/acre)[2]	N/A	N/A	0.34	0.30
Marginal returns to water ($/AFY)	N/A	N/A	$85	$245

1/ Based on Highland Economics analysis summarized in Section 6.1. Prepared August 2026
2/ The AF/acre differs between the two crops because we estimate the delivery increase based on the current proportion of irrigation water demand by each crop (76% to pasture and 24% to alfalfa, and assume this is the allocation of conserved water) and then divide the conserved water allocated to each crop by the acreage of each crop.

Based on the District's crop mix and the relative irrigation needs of each crop, we estimate that 76 percent of any additional water would go to pasture and 24 percent would go to hay.[8] By weighting the marginal value of water for each crop by the percentage of additional water going to each crop, we estimate a weighted average marginal value of water of $123 per AFY. These calculations are summarized in the table below.

[8] This is based on CropScape data (U.S. Department of Agriculture, 2024) indicating that of the acreage planted to pasture and alfalfa, approximately 71% of acres are pasture with irrigation demand of 4.2 AF/acre while approximately 26% of acres are in alfalfa using 3.7 AF/acre.

Table D-5. Summary of Crop Water Requirements and Historic Water Shortages by Crop, Rogue River Watershed, Oregon, 2026 dollars

Variable/ Calculation	Metric	Pasture	Hay	Weighted Average
A	Evapotranspiration needs of crop (in acre-feet per acre)[1]	2.4	3.0	-
B	Average precipitation during the irrigation season (in feet)[2]	0.3	0.3	-
C=A-B	Remaining consumptive water need (in acre-feet per acre)[3]	2.1	2.7	-
D	Irrigation efficiency [4]	50%	75%	-
E=C/D	Applied water demand (in acre-feet per acre)[5]	4.2	3.7	-
F	Percentage of the total crop mix[6]	71%	26%	-
G = F x E / 3.9	Estimated allocation of additional water use[7]	76%	24%	-
H	Marginal net returns of additional water[8]	$85	$245	-
∑G x H	Weighted average marginal value of additional water	-	-	$123

1/ Source: (Bureau of Reclamation, 2015) Prepared August 2026
2/ Average between April 15th and September 30th from 2000 to 2024. Source: (National Oceanic and Atmospheric Administration, 2025)
3/ Equal to total ET requirement minus the water provided by precipitation
4/ Most pasture in the District is flood irrigated (which has a general efficiency of 40% to 60%) while hay is more often sprinkler irrigated (which is roughly 75% efficient).
5/ Equal to the remaining consumptive need divided by the irrigation efficiency
6/ Based on a geographic information systems (GIS) analysis of CropScape data (U.S. Department of Agriculture, 2024). Hay was used to represent hay, pear, grape, and yard acres.
7/ Calculated by multiplying the representative percentage in the crop mix by the applied water demand and dividing by the weighted average applied water demand for all crops (71% x 4.2 AF/acre + 26% x 3.7 AF/acre = 3.9 AF/acre).
8/ Estimated using the crop budget method described in Section 6.1 and Table D-4.

Because this analysis uses hay to represent higher-value crop acreage (including pears, grapes, and lawn), the estimated marginal value of water in MID ($123 per AF) is likely an underestimate of the value of additional water to District patrons. As a result, this analysis likely understates the damage to agricultural production under the FWOFI Alternative and underestimates the benefits of additional water under the Preferred Alternative.

At a value of $123 per AF, MID's average annual delivery shortage (estimated at about 10,200 AF, as described above) results in damages of approximately $1,255,000 annually. Under the FWOFI Alternative, these average annual damages are expected to continue or worsen as the area experiences more frequent and severe drought conditions.

2.2.2 Water Supply Interruptions

Infrastructure failures of the JSC result in water interruptions to MID and RRVID patrons. In roughly one out of every 10 years, a major failure of the JSC typically results in two days with no water being conveyed and an additional one to two weeks when the water moving through the JSC is reduced by 40 to 50 percent (Friend, 2025). On average from 2010 to 2024, the JSC transported 18,400 AFY (Oregon Department of Water Resources, 2024). At 169 days per irrigation season (April 15 to October 1), the JSC transports 109 AF per day on average. At this rate, the typical large

failure incident would result in an interruption of approximately 732 AF.[9] Using the estimated marginal value of water to agriculture in MID ($123 per AF), the reduced water delivery during the typical large failure of the JSC would result in losses of roughly $88,000 (we apply the same value of water to agriculture in MID to RRVID patrons experiencing water shortages from JSC failure as RRVID irrigated acreage is also predominantly pasture and hay). Because these incidents happen in about one out of every 10 years, the expected annual probability of a large failure is 10 percent and the expected annual loss would be about $8,800 (undiscounted). These failures are expected to continue and even worsen under the FWOFI Alternative as the JSC continues to age. Absent data on how failure risk may increase in the future, this analysis models the costs of water interruptions remaining at the same level in the FWOFI future.

We apportion these damages among the piping project groups according to length, shown in the table below. When discounted to account for the timing of the construction and associated benefits received, the average annual agricultural damages due to water supply interruptions are around $9,000.

Table D-6. Annualized Damages from Water Supply Interruptions Under the FWOFI Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Length of Piping (miles)	Apportionment by Project Group	Apportioned Annual Damages from Supply Interruptions	Discounted Damages from Water Supply Interruptions
PG1 Piping	2.0	17%	$1,508	$2,000
PG2 Piping	3.6	31%	$2,729	$3,000
PG3 Piping	2.6	22%	$1,963	$2,000
PG4 Piping	3.4	30%	$2,604	$2,000
PG5 Replace Existing Siphons	0.0	0%	$0	$0
Total	**11.5**	**100%**	**$8,804**	**$9,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars

2.2.3 Infrastructure Failure

The Project area currently contains three siphons (Lake Creek, Wyant, and Osborne) that are key components of the JSC. The siphons were constructed in 1956 (making them almost 70 years old) and have exceeded their useful life. According to a report from the Bureau of Reclamation (Jermyn 2021), siphons of this type (prestressed concrete cylinder), size (over 36 inches in diameter), and construction period (built before 1964) have a mean time to failure of 36.8 years (Jermyn M. , 2021). The fact that the siphons are almost twice this age indicates a high likelihood that they will fail in the near future.

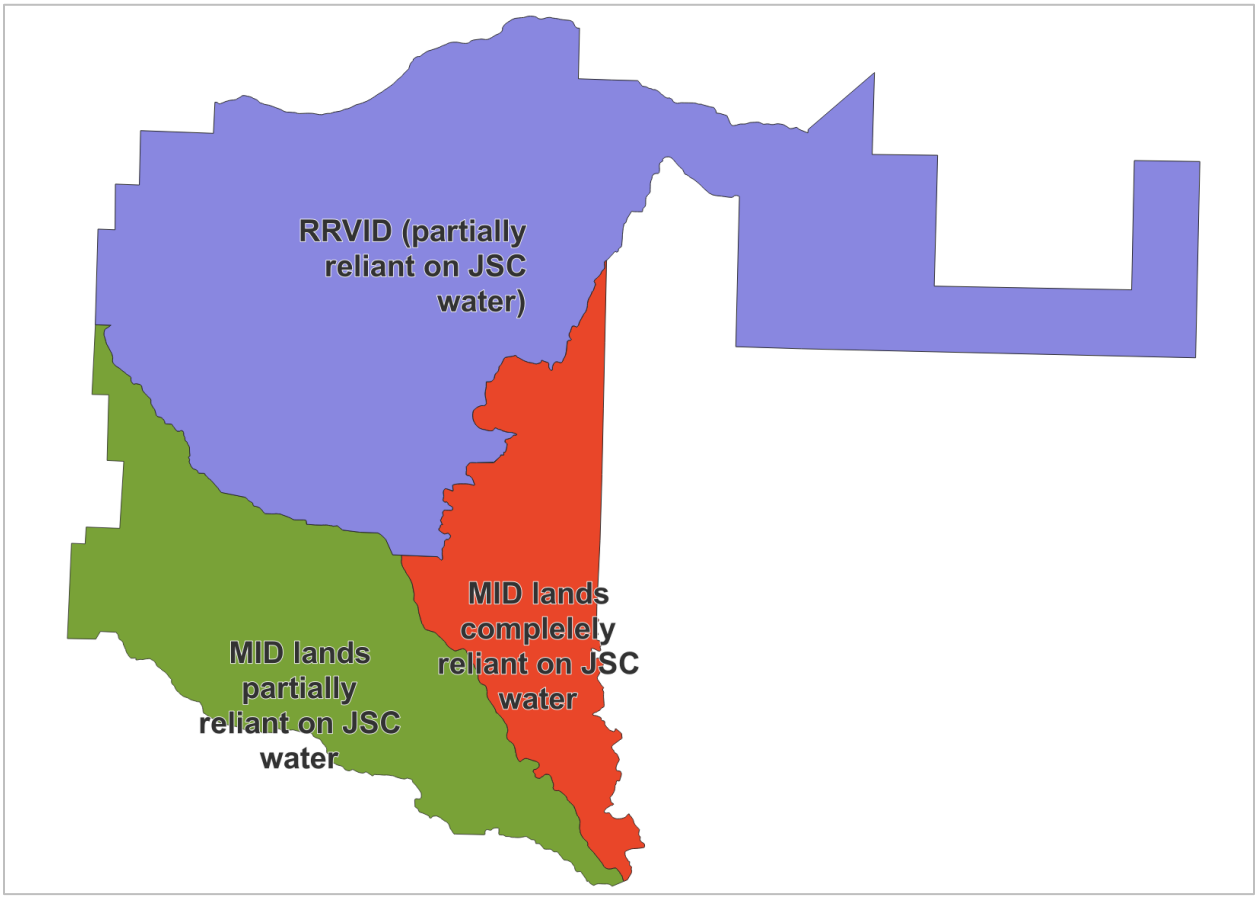
Each of the siphons is essential for transporting water through the JSC. If any one of them were to fail, all lands served by the JSC would no longer receive JSC water. This land includes:

[9] Two days of complete water loss at 109 AF per day and an average of 10.5 days of 45 percent water loss. 2 x 109 + 10.5 x 0.45 x 109 = 732 AF.

- Approximately 4,550 acres in MID completely dependent on the JSC for their irrigation water.[10]
- Roughly 6,850 acres in MID receiving approximately one-third of their water from the JSC.[11]
- Around 9,300 acres in RRVID receiving approximately two-thirds of their water from the JSC (Hampson, 2025).

This section estimates the potential costs of siphon failure for these three geographically distinct areas (shown in the map below) under the FWOFI Alternative. The siphon failure costs to each area that are outlined in this section are mutually exclusive and do not overlap. Because there is no guarantee that MID would be able to finance repair of siphons, this analysis assumes in the FWOFI Alternative that siphons are not replaced/repaired, and no water is delivered by the JSC after failure.[12]

Figure D-1. Map of Areas Reliant on JSC Water



[10] Based on a GIS analysis of MID's Place of Use water right data provided by OWRD (Oregon Department of Water Resources, 2024).

[11] Based on a GIS analysis of MID's Place of Use water right data provided by OWRD (Oregon Department of Water Resources, 2024).

[12] Modeling the FWOFI Alternative in this way provides a benefit-cost analysis of replacing the siphons (rather than comparing the benefits of federal funding versus other unknown, potential funding sources of siphon replacement in the FWOFI). To deliver JSC water to MID and RRVID, the siphons are necessary. There is no alternative delivery mechanism.

Growers that are completely dependent upon JSC water (Figure D-1) would experience two types of costs under a siphon failure: costs in the year of failure and costs in the years after failure. In the year of failure, growers would lose the remaining irrigation water for the season and any crop yields and associated revenues that would have been generated from the lost water. However, they would avoid paying for part of their variable costs of production, such as harvest costs. For perennial crops (which include pasture and hay), the growers would lose the remaining crop establishment investment. This analysis assumes that, on average, half of gross revenues would be lost under a failure, half of variable costs would be avoided, and half of the crop establishment value would be lost.

In the years after failure, the analysis assumes that with no access to water, growers would convert to dryland pasture production, the primary dryland crop in the region.[13] The resulting economic loss would equal the reduction in net income associated with converting from irrigated production to dryland production. This loss would be experienced each year starting in the year following the failure to the end of the evaluation period.[14]

To estimate the losses both in the year of failure and in the years following the failure, we use the crop budget analysis described in Section 6.1 that estimates the net returns for pasture and hay. Table D-7 below summarizes the method used to calculate the economic loss in the year of failure for lands in MID completely dependent on the JSC for irrigation water. As the last row in the table shows, the total net loss in the failure year is about $945,600 for pasture and $649,300 for hay. The total net loss for both crops in the failure year is estimated to be around $1.6 million.

Table D-7. Summary of One-Time Economic Losses in the Year of Siphon Failure, MID Lands Served Only by JSC, Rogue River Watershed, Oregon, 2026 dollars

Variable/ Calculation	Metric	Pasture	Hay
A	Representative percentage of impacted acres[1]	73%	27%
B = A x 4,550	Acres impacted by siphon failure[2]	3,340	1,210
C	Establishment costs per acre[3]	$437	$519
D	Gross revenues per acre[3]	$440	$803
E	Variable costs per acre[3]	$311	$250
F = (C+D-E)/2	Per-acre net loss of failure in failure year[4]	$283	$536
G = F x B	Total net loss in failure year by crop	$945,600	$649,300

1/ Source: Based on a GIS analysis of CropScape data (U.S. Department of Agriculture, 2024) Prepared August 2026
2/ The area impacted is 4,550 acres based on a GIS analysis of CropScape data (U.S. Department of Agriculture, 2024).
3/ Estimated using the crop budget method described in Section 6.1.
4/ Per-acre costs consist of half of gross revenues and establishment costs minus half of variable costs.

Table D-8 below shows the calculations used to estimate the annual economic losses that begin after the failure year. For MID lands that are completely reliant upon JSC water, these losses are estimated to be roughly $171,900 annually.

[13] MID patrons do not rely on groundwater for irrigation and pasture comprises approximately 60 percent of the non-irrigated acreage in Jackson County (USDA National Agricultural Statistics Service, 2026).

[14] Establishment investment is the cost paid by farmers to establish a perennial crop and typically includes land preparation and planting.

For MID and RRVID lands that receive non-JSC sources of water (in addition to JSC water), a siphon failure would result in a substantial reduction in irrigation water but not a complete loss of water supply. The loss of JSC water would cause water shortages and yield reductions on these lands. Accordingly, this analysis estimates the reduction in net income using the estimate of the AF of reduced water and the marginal value per AF of water described in Section 2.2.1: $123 per AFY. In MID, approximately 6,850 acres receive irrigation water from both the JSC and Bear Creek.[15] These 6,850 acres receive about one-third of their water from the JSC, equating to about 4,647 AF delivered.[16] At $123 per AFY, the loss of this water would have an economic cost of around $571,800 annually. We model this cost occurring each year after siphon failure. Because these lands would likely lose water in the year of failure (with the amount depending on the timing of the failure in the irrigation season) and this analysis does not include potential impacts to these lands in the year of failure, this method understates the potential economic loss from a siphon failure to these areas.

If one of the siphons were to fail and JSC water deliveries stopped, RRVID would lose a substantial portion of its total water supply. Historically, RRVID has received approximately two-thirds of its water from the JSC (Hampson, 2025). OWRD records indicate that, on average between 2015 and 2023, RRVID diverted approximately 7,700 AF annually through the JSC (Oregon Department of Water Resources, 2024). Conveyance losses in the MID system are approximately 20 percent (Newton Consultants Inc, 2017). At this rate, the average amount of water delivered to RRVID fields from the JSC would be roughly 6,140 AFY. Because the irrigated land in RRVID is primarily pasture, this analysis uses the marginal value of water to pasture to estimate the economic losses under siphon failure ($85 per AF, as shown in Table D-5). At this value, the loss of 6,140 AFY would result in annual damages of about $518,900. We model these damages occurring each year after siphon failure under the FWOFI Alternative. Similar to MID, because there would likely be water lost in the year of failure, this method understates the potential economic loss from a siphon failure to RRVID.

Table D-8 summarizes the annual economic losses that occur each year beginning after the year of failure, including MID lands that are completely reliant on JSC water ($171,900 annually), MID lands that are partially reliant on JSC water ($571,800 annually), and RRVID lands ($518,900 annually) (Figure D-1). In total, an estimated $1.26 million in economic losses would occur each year after the year of siphon failure.

[15] Based on a GIS analysis of MID's Place of Use water right data provided by OWRD (Oregon Department of Water Resources, 2024).

[16] Based on analysis of MID's water supply and demand. MID manages its water with the goal that all acres in the District receive the same amount of water (Friend, 2025). MID's average annual diversion of 30,500 AF (see Section 2.2.1) supplies about 11,900 acres (based on water right Place of Use data, reports from the District, and the 2017 WMCP). This equates to an average delivery rate of 2.67 AF per acre. At this rate, 6,850 acres would have an associated diversion volume of 18,319 AF from all sources. Average annual diversions from Bear Creek were approximately 8,500 AF between 2015 and 2024 (Oregon Department of Water Resources, 2024). Return flows comprise an estimated 4,000 AFY (Newton Consultants Inc, 2017). Subtracting the return flows and Bear Creek water from the total diversion volume, the 6,850 acres have an associated diversion of approximately 5,800 AF from the JSC. After accounting for conveyance losses (estimated at 20 percent), the area would receive about 4,647 AF in water delivered from the JSC.

Table D-8. Summary of Annual Economic Losses in the Years Following Siphon Failure, All Lands Served by JSC, Rogue River Watershed, Oregon, 2026 dollars

Variable/ Calculation	Metric	Pasture	Hay	Pasture and Hay
I	Net income per acre from irrigated production[1]	$9	$133	-
J	Net income per acre from dryland pasture[2]	$4	$4	-
K = I - J	Per-acre net loss of failure in years following failure	$5	$129	-
L = K x B	Total annual net cost after failure year by crop[3]	$15,800	$156,000	-
M = ∑L	Total annual net cost after failure year for MID lands that are completely reliant on JSC water	-	-	$171,900
N	Total annual net cost after failure year for MID lands that are partially reliant on JSC water	-	-	$571,800
O	Total annual net cost after failure year for RRVID lands	-	-	$518,900
P = M+N+O	Total annual net cost after the year of failure for all impacted lands (MID and RRVID)	-	-	$1,262,600

1/ Estimated using the crop budget method described in Section 6.1. Prepared August 2026
2/ Estimated as the average pasture rental rate ($31.87/acre) minus liability insurance ($25.01/acre) and property taxes ($2.75/acre). The average is the normalized average[17] pasture rental rate in Jackson County from 2017 to 2025 (USDA National Agricultural Statistics Service, 2026). The liability insurance and property taxes were adopted from the pasture crop budget.
3/ Calculated by multiplying the per-acre net loss of failure in the years following failure by the acres impacted by failure shown in Row B of Table D-5.

To summarize, if any one of the three siphons were to fail, it would cause damages in the year of failure estimated to be over $1.59 million, and each year afterwards would result in damages of roughly $172,000 to MID lands that are completely dependent on JSC water; $572,000 in damages to MID lands that have other sources of water; and $519,000 in damages to RRVID. In total, the annual damages in the years following siphon failure would be approximately $1.26 million. As such, in all years, the year of failure, and each subsequent year, the total net cost for agricultural damages is estimated at approximately $1.26 million. Both MID and RRVID grow higher-value crops (including pears and grapes). If these crops are negatively affected by a siphon failure, the resulting economic losses could be higher than those presented in this analysis.

Because the timing of siphon failure is uncertain, the estimated damages under a failure are weighted by the probability that a failure will occur. As described at the beginning of this section, the siphons have exceeded the estimated mean time to failure for similar siphons by 32 years. The actual remaining service life of the siphons depends on their condition, which can only be accurately determined with an electromagnetic inspection, which is expensive and has not been performed on the MID siphons (Jermyn M. , Bureau of Reclamation Materials Engineer, 2025; Friend, 2025).

We estimate the probability of siphon failure using a Weibull distribution, which is used to model the probability of failure for equipment and infrastructure (ScienceDirect, 2025). We describe in detail this model and its application to the siphons in the Appendix Section 6.2. In the current year, the probability of any one of the siphons failing is approximately 7 percent, and the probability of one of the three siphons failing is approximately 20 percent. As explained in that section, the

[17] The normalized average omits the minimum and maximum values in a dataset and takes the mean of the remaining values.

cumulative probability of at least one siphon failing increases from Year 0 through Year 16, after which a siphon failure is expected to be near certainty. Accordingly, from Year 17 through the end of the period of analysis, the analysis models annual damages of roughly $1.26 million. Table D-25 shows the expected damages for each year of the analysis.

When discounted, the annualized expected damages from siphon failure under the FWOFI Alternative are approximately $1,134,000, as shown in the table below. The value is less than the $1.26 million in annual expected damages after failure because the probability of failure, while high, is less than 100 percent prior to Year 17.

Table D-9. Annualized Damages from Siphon Failure Under the FWOFI Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Annualized Siphon Failure Costs
PG1 Piping	$0
PG2 Piping	$0
PG3 Piping	$0
PG4 Piping	$0
PG5 Replace Existing Siphons	$1,134,000
Total	**$1,134,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars

2.2.4 Total Agricultural Damages

The total damages to agricultural production under the FWOFI Alternative include the damages due to shortages in the water supply, short-term interruptions in the water supply, and the potential long-term water supply lost from JSC siphon failure. As described in Section 2.2.1, water supply shortages cause average annual damages of roughly $1.26 million in MID alone. While seepage in the JSC contributes to these water shortage damages, most of MID's water shortages are not directly caused by the JSC and are not divisible by project group, so they are not displayed in the table below. Annual agricultural damages from water supply interruptions ($9,000) and potential future failure of siphons ($1,134,000) can be apportioned by project group and are shown in the table below.

Table D-10. Annualized Damages from Infrastructure Failure Under the FWOFI Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Discounted Damages from Water Supply Interruptions	Annualized Siphon Failure Costs	Annualized Infrastructure Failure Costs
PG1 Piping	$2,000	$0	$2,000
PG2 Piping	$3,000	$0	$3,000
PG3 Piping	$2,000	$0	$2,000
PG4 Piping	$2,000	$0	$2,000
PG5 Replace Existing Siphons	$0	$1,134,000	$1,134,000
Total	**$9,000**	**$1,134,000**	**$1,143,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars

In total, including water shortage damages ($1,255,000) in MID and JSC infrastructure failure damages ($1,143,000), the FWOFI Alternative is expected to result in average annual agricultural damages of approximately $2,398,000 in MID and in areas served by JSC infrastructure.

3 Preferred Alternative

This section describes the costs and benefits of the Preferred Alternative.

3.1 Costs of the Preferred Alternative

Costs of the Preferred Alternative include the costs of installation and OM&R. There are no expected other direct costs over the FWOFI Alternative.

3.1.1 Project Installation Costs

Project installation costs include mobilizing and staging construction equipment; delivering pipe to construction areas; excavating trenches; fusing pipelines; placing pipe in trenches, some of which would be below the grade of the canal; compacting backfill; cultural mitigation[18]; restoring and reseeding disturbed areas; and any costs associated with obtaining easements. The total cost of installation/construction of the Preferred Alternative is estimated at $94,209,000. This includes the costs of construction, engineering (estimated at 10 percent of construction costs), contractor markup (estimated at 14 percent of construction costs), contingency costs (estimated at 30 percent of the subtotal of other cost components), and permitting (estimated at 3 percent of total construction and engineering costs).

The total costs also include project administration costs for MID and NRCS (7 percent of the subtotal of previously mentioned cost components), and technical assistance from NRCS (estimated at 8 percent of the subtotal of previously mentioned cost components). The costs of project installation are provided in Tables 8-4 and 8-5 of the Plan-EIS (which correspond to NWPM 506.11 Economic Table 1 and NWPM 506.12 Economic Table 2, respectively).

[18] Cultural mitigation costs are for creating a website to provide information and display photos regarding cultural resources in the area.

3.1.2 OM&R Costs

Siphons installed and replaced under the Preferred Alternative have a useful life that is less than the period of analysis and would therefore need to be replaced during the period of analysis. The Reclamation study (mentioned in Section 2.2.3) states that the average service life for siphons over 36 inches in diameter is 65 years (Jermyn M. , 2021). We adopt this as the useful life of the siphons installed or replaced under the Preferred Alternative. For the costs of replacement, we use the estimated costs of installation or replacement under the Preferred Alternative, including construction, engineering, construction management, and contingency. The costs and replacement schedule are summarized in the table below. When discounted, the annualized cost of replacing siphons under the Preferred Alternative is approximately $37,000. This is also the total OM&R cost of the Preferred Alternative.

Table D-11. Siphon Replacement Costs and Schedule under the Preferred Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Cost of Replacement per Occasion	Years of Replacement	Discounted Annualized Replacement Costs
PG1 Piping	$1,305,800	66	$5,000
PG2 Piping	$1,448,700	67	$6,000
PG3 Piping	$2,702,400	68	$10,000
PG4 Piping	N/A	N/A	$0
PG5 Replace Existing Siphons	$4,077,200	67	$16,000
Total	**N/A**	**N/A**	**$37,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars

3.1.3 Other Direct Costs

The Preferred Alternative is not expected to result in any long-term adverse effects on water, fish and aquatic resources, or recreation. The Project may impact unknown cultural resources; however, no impacts are expected. Minor short-term adverse impacts are expected on soils, vegetation, and wildlife during Project construction. Minor long-term impacts are expected for nearby artificial wetland areas and riparian areas (and the wildlife that depends on them) that would be affected by the loss of water from canal seepage. Because of the uncertainty regarding the likelihood and magnitude of negative project externalities, we do not model other direct costs associated with the Preferred Alternative. See the Plan-EIS for a more in-depth analysis of these resources.

3.1.4 Summary of Costs under the Preferred Alternative

Installation costs of the Preferred Alternative would occur over multiple years, and the timing of installation differs by project group. For this reason, the annual construction costs are discounted to present value prior to annualizing.

The costs of the Preferred Alternative are equal to the estimated average annual installation/construction costs ($3,014,000) plus the OM&R costs ($37,000 annually). The OM&R costs would be incurred by MID and are not covered by federal funding. There are no anticipated other direct costs of the Preferred Alternative.

In total across all project groups, the average annual Project costs are $3,051,000. These costs are summarized in Table 8-6 of the Plan-EIS, which corresponds to NWPM 506.18 Economic Table 4.

3.2 Benefits of the Preferred Alternative

This section describes the benefits of the Preferred Alternative compared to the FWOFI Alternative. Benefits included in the analysis of the Preferred Alternative consist of on-site benefits in the form of the avoided damage to agricultural production, which includes both efficiency gains and increased production value, and off-site benefits from improvements to aquatic habitat due to water conservation. This section also describes benefits of the Preferred Alternative that were considered but not included in the analysis, which include improvements to water quality and wildfire protection.

3.2.1 Benefits Included in the Analysis

3.2.1.1 Agricultural Damage Reduction Benefits

As noted in the Water Resources Handbook for Economics, "The national economic development (NED) benefits are the value of increases in the agricultural output of the Nation and the cost savings in maintaining a given level of output. The benefits include reductions in production and in associated costs; reductions in damage costs from floods, erosion, sedimentation, inadequate drainage, or inadequate water supply; the value of increased production of crops; and the economic efficiency of increasing production of crops in the project area." (Natural Resources Conservation Service, 1998).[19] The Preferred Alternative results in several of these types of agricultural benefits, which are categorized in the Water Resources Handbook as agricultural damage reduction benefits related to increased net income. This section describes these agricultural damage reduction benefits, which include: 1) reduced agricultural damages from inadequate water supply, 2) reduced agricultural damage from avoided infrastructure failures, and 3) cost savings in maintaining a given level of output (i.e., efficiency gains from reduced production costs to deliver water in the District).

Quantified below are the economic benefits noted above related to reduced agricultural damages. However, by strengthening the resilience of agriculture in the region to drought and increasing the reliability of irrigation water deliveries, the Preferred Alternative also provides cultural and social benefits. Jackson County's principal industries have long been primarily natural resource-based, including agriculture, timber, and recreation. Irrigation water supply for lands in the District was developed in the late 1800s, and agriculture to this day continues to be an economic engine as well as a source of community pride and identity. The current agricultural community includes both commercial farms and smaller farms that support a rural lifestyle and maintain lands in agricultural and open space uses. The Preferred Alternative supports the continued provision of these cultural services.

3.2.1.1.1 Increased Agricultural Production Value

Piping the JSC under the Preferred Alternative would reduce agricultural damage by converting a portion of the water lost to seepage and evaporation into usable irrigation water, thereby increasing the water supply, reducing water shortages, improving crop yields, and increasing net income. In total, piping is expected to save approximately 5,057 AFY in avoided seepage (Farmers Conservation Alliance, 2024). MID plans to allocate 75 percent of the total water savings from the Project to augment irrigation supplies, equal to about 3,793 AFY. The District plans to dedicate the

[19] See Section 611.0200 (a) page 2-1, which describes the conceptual basis for agricultural benefits.

remaining water savings (1,264 AFY) to instream flow (discussed in Section 3.2.2). This section examines the benefits of the 3,793 AFY dedicated to reducing agricultural water shortages and the benefits of avoiding water losses from canal failures.

The breakdown of water savings under the Preferred Alternative by project group is provided in Table D-12 below. Because of losses due to seepage and evaporation, only a portion of the conserved water dedicated to irrigation will make it to growers' fields. MID's current conveyance system is estimated to be approximately 80-percent efficient (meaning 20 percent is lost to seepage) (Newton Consultants Inc, 2017). At this rate, of the 3,793 AFY dedicated to irrigation, 3,034 AFY would be delivered to farm fields. This is the amount of water we model for providing agriculture damage reduction benefits under the Preferred Alternative.

The value of water savings, as presented in Section 2.2.1, is estimated at approximately $123 per AFY in net agricultural income. At this value, the conserved water that is delivered to farms (3,034 AFY) would generate agricultural damage reduction benefits of $373,000 per year (or $354,000 discounted). As described in Section 2.2.1, MID currently experiences average annual agricultural damages from supply shortages estimated at $1,255,000. The Preferred Alternative would reduce these annual damages by roughly $373,000, leaving around $901,000 in water shortage damages that would continue on average each year under the Preferred Alternative.

The breakdown of water savings under the Preferred Alternative by project group is provided in Table D-12 below.

Table D-12. Agricultural Damage Reduction Benefits of Conserved Water under the Preferred Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Conserved Water Dedicated to Irrigation (AFY)	Additional Water Deliveries to Farms (AFY)[2]	Undiscounted Benefit of Conserved Water	Annualized Agricultural Damage Reduction Benefits
PG1 Piping	635	508	$62,000	$62,000
PG2 Piping	1,156	925	$114,000	$110,000
PG3 Piping	984	788	$97,000	$91,000
PG4 Piping	1,017	814	$100,000	$91,000
PG5 Replace Existing Siphons	0	0	$0	$0
Total	**3,793**	**3,034**	**$373,000**	**$354,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars amortized over 100 years at a discount rate of 3.25 percent.
2/ Eighty percent of the conserved water dedicated to irrigation to account for system losses, as explained above.

As described in Section 2.2.2, JSC failures are currently resulting in water supply interruptions that cause average annual agricultural damages estimated at $9,000. With the JSC in the Preferred Alternative, these failures would be avoided, as would the associated damage. Accordingly, this analysis models $9,000 in damage reduction benefits from avoiding water supply interruptions due to JSC failures.

Section D.2.2.3 describes the potential future agricultural damages that could occur if any one of the three existing siphons fails. The expected annual value at risk is estimated to be about $1,134,000. PG5 Replace Existing Siphons under the Preferred Alternative would eliminate this risk by replacing

these siphons, thereby generating $1,134,000 in annual damage reduction benefits (note that the replacement cost of these siphons during the 100-year analysis period is included in Section 3.1.2). Accordingly, this analysis models $1,134,000 in annual benefits to PG5 Replace Existing Siphons.

Table D-13 shows the total agricultural damage reduction benefits (from both conserved water and avoided infrastructure failure) under the Preferred Alternative. Combined, the total annualized benefit of reducing agricultural damages under the Preferred Alternative would be around $1,497,000.

Table D-13. Agricultural Damage Reduction Benefits from Increased Agricultural Production Value of the Preferred Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Benefits of Conserved Water	Benefits of Avoided Water Interruptions	Benefits of Maintaining Productivity (Siphon Replacement)	Benefits of the Preferred Alternative Over the FWOFI Alternative
PG1 Piping	$62,000	$2,000	$0	$64,000
PG2 Piping	$110,000	$3,000	$0	$113,000
PG3 Piping	$91,000	$2,000	$0	$93,000
PG4 Piping	$91,000	$2,000	$0	$93,000
PG5 Replace Existing Siphons	$0	$0	$1,134,000	$1,134,000
Total	**$354,000**	**$9,000**	**$1,134,000**	**$1,497,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars amortized over 100 years at a discount rate of 3.25 percent.

3.2.1.1.2 Production Cost Savings

The Preferred Alternative would also provide production cost savings in the project area by reducing District costs to convey irrigation water to growers' fields (relative to the FWOFI Alternative), resulting in lower costs for the same level of water delivery and associated agricultural production.[20] The Preferred Alternative is expected to reduce the majority of canal O&M costs that would occur in the FWOFI Alternative3.1.2. This section addresses reductions in OM&R costs of District operations that would otherwise continue in the absence of the Preferred Alternative, and that are not required with the infrastructure installed under the Preferred Alternative. Note that these cost savings are not incorporated in the farm-level net income agricultural analysis (i.e., no change in District irrigation assessments is included in the crop budgets), so there is no double counting of this benefit.

As described in Section 2.1, MID spends an average of roughly $111,500 to operate and maintain the JSC. Under the Preferred Alternative, the District estimates that JSC OM&R costs will fall by 75 percent since a piped system will require fewer inspections and significantly less cleaning and maintenance (Friend, 2025). Based on this estimate, the annual average OM&R for the JSC would be approximately $27,870 under the Preferred Alternative ($26,000 when discounted). As under the

[20] In fact, it is reduced cost of delivery for an increased amount of water delivered, since the piping would also increase water conveyed and delivered by reducing seepage. The value of this increased delivery of water is described above.

FWOFI Alternative, we apportion these costs to the piping project groups according to length. This would represent an annual savings of roughly $83,600. When discounted, the annual O&M savings would be about $78,000.

Similarly, the FWOFI Alternative would have annual repair costs associated with canal failure totaling $3,100 (discussed in Section 2.1). These costs of production would also be eliminated under the Preferred Alternative and therefore are also an efficiency benefit.

Because the same—or, in fact, a higher—level of water delivery is produced at a reduced cost, this efficiency gain is a benefit of the Preferred Alternative. The table below summarizes the different types of efficiency gains that would occur under the Preferred Alternative. These efficiency gains result from the same level (or slightly higher level) of water delivery and associated agricultural production being achieved at lower production cost.

Table D-14. Avoided Agricultural Damages from Reduced Production Costs of the Preferred Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Avoided Routine Canal Maintenance Costs	Avoided Canal Failure Repair Costs	Total Production Cost Savings of the Preferred Alternative
PG1 Piping	$14,000	$1,000	$15,000
PG2 Piping	$25,000	$1,000	$26,000
PG3 Piping	$17,000	$1,000	$18,000
PG4 Piping	$22,000	$1,000	$23,000
PG5 Replace Existing Siphons	$0	$0	$0
Total	**$78,000**	**$4,000**	**$82,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars amortized over 100 years at a discount rate of 3.25 percent.

3.2.1.1.3 Total Agricultural Damage Reduction Benefits

The table below summarizes the different types of agricultural damage reduction benefits that would occur under the Preferred Alternative, including both increased production value and decreased production costs. In total, the Preferred Alternative is expected to generate annual agricultural damage reduction benefits of roughly $1,579,000.

Table D-15. Total Avoided Agricultural Damages (Increased Production Value and Reduced Production Costs) of the Preferred Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Increased Production Value (Conserved Water & Updated Siphons)	Reduced Production Costs	Total Agricultural Damage Reduction of the Preferred Alternative
PG1 Piping	$64,000	$15,000	$79,000
PG2 Piping	$113,000	$26,000	$139,000
PG3 Piping	$93,000	$18,000	$111,000
PG4 Piping	$93,000	$23,000	$116,000
PG5 Replace Existing Siphons	$1,134,000	$0	$1,134,000
Total	**$1,497,000**	**$82,000**	**$1,579,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars amortized over 100 years at a discount rate of 3.25 percent.

3.2.2 Support to Instream Flow

The Preferred Alternative would result in water savings by eliminating seepage and evaporation from the JSC. In this way, the Project would conserve an estimated 5,057 AFY. Of this, the District would dedicate an estimated 1,264 AFY to augment instream flow. The additional 1,264 AFY from the Project is expected to increase streamflow in the South Fork of Little Butte Creek by approximately 6.37 cubic feet per second (cfs) during the months of August and September on average. While the amount of instream flow increase could vary year-to-year, the additional water would reduce stream temperatures and increase dissolved oxygen concentrations and would be a significant increase to allow connectivity/migration and cooler water benefits to fish. Fish biologists with the Oregon Water Resources Department and Trout Unlimited who were interviewed for this study emphasized that the project would be extremely valuable for enhancing fish habitat, and particularly critical for recovery of SONCC salmon (Gerdes & Buckmister, 2025) (Cymore, 2025). This section examines the value of this additional instream flow.

Waterbodies in the study area are home to a variety of aquatic species, some of which have state or federal protected status. These include ESA-listed SONCC salmon, spring and fall Chinook salmon, summer and winter steelhead, Pacific lamprey, and Northwestern Pond Turtle (Oregon Department of Fish and Wildlife, 2021). Rogue River, Little Butte Creek, North Fork Little Butte Creek, South Fork Little Butte Creek, and Lake Creek are listed as Essential Salmonid Habitat and as Essential Fish Habitat for Chinook and coho salmon (National Oceanic and Atmospheric Administration, 2025; Department of State Lands, 2025).

Fish biologists with the Oregon Water Resources Department and Trout Unlimited who were interviewed for this study emphasized that Little Butte Creek flow and habitat restoration is critical in terms of the SONCC recovery (Gerdes & Buckmister, 2025) (Cymore, 2025). Flow restoration in the South Fork of Little Butte Creek is in the highest priority tier because there are many miles of fish habitat in the Little Butte Creek system, but more flow is imperative to support fish migration and enable fish to access the habitat and achieve ecological benefit as the current low flows downstream of the South Fork Little Butte Creek diversion (RM 1.1) create a migratory barrier for fish populations (Gerdes & Buckmister, 2025).

Little Butte Creek has long been recognized as a critical watershed for salmonid recovery. The Oregon Department of Fish and Wildlife's (ODFW) *Rogue-South Coast Multi-Species Conservation and Management Plan* states that insufficient instream flows are a key limiting factor affecting populations of steelhead, coho salmon, and cutthroat trout in the Upper Rogue River Basin (Oregon Department of Fish & Wildlife, 2021). The National Marine Fisheries Service identifies it as a "core" watershed for coho recovery in southern Oregon (Jackson County Soil & Water Conservation District, 2021). The *Final Recovery Plan for the Southern Oregon/Northern California Coast (SONCC) Evolutionarily Significant Unit of Coho Salmon* lists increasing streamflow in Little Butte Creek as one of the key strategies to restoring populations of coho salmon in the Upper Rogue River Basin (National Oceanic and Atmospheric Administration, 2014).

Between 1998 and 2018, more than 30 restoration projects were implemented in the watershed at a cost of roughly $4.33 million (Oregon Watershed Enhancement Board, 2023).[21] These projects included removing or modifying fish passage barriers, installing or upgrading fish screens, acquiring or leasing instream water rights, modifying irrigation diversions, improving riparian areas, and conducting in-channel habitat improvements (Oregon Watershed Enhancement Board, 2023). Collectively, these efforts demonstrate both the ecological importance of the stream and the ongoing commitment of public agencies and nonprofits to support its recovery.

Experts interviewed for this study reinforced the importance of instream flow restoration in these waterbodies. Biological and hydrological experts from ODFW emphasized that additional summer flow in Little Butte Creek (the waterbody benefitting from the Preferred Alternative) would provide critical cold-water refugia for salmon and steelhead, reducing mortality during hot months (Gerdes & Buckmister, 2025). Trout Unlimited noted that increasing flow is one of the most cost-effective ways to support habitat restoration because it improves water temperature, oxygen levels, and connectivity simultaneously (Cymore, 2025). The Rogue River Watershed Council highlighted that while habitat projects such as riparian plantings and fish screen installations are valuable, without adequate flow these projects cannot fully achieve their goals. Additional water dedicated instream is therefore an important complement to past and ongoing restoration investments (Wyss, 2025). Experts from each of these organizations stated additional instream flow in the Little Butte Creek system (and especially the South Fork of Little Butte Creek that the Project would benefit) is very important to supporting ESA-listed salmonids.

This section provides several types of information on the value of instream flow. First, the section presents available water market data for values paid by environmental or governmental groups to purchase water rights for instream flow. These values represent the cost of increasing instream flow and may significantly underestimate the full value of instream flow augmentation. While these values are in fact costs rather than a measurement of benefit, the amounts paid to enhance instream flow represent the minimum value to the funding entities of enhanced instream flow (benefits as perceived by funding entities are expected to at least equal costs, or funding would not be provided) and represent value only to funding entities and not all beneficiaries.

Data on arms-length, open market water right transactions in the Rogue River Basin were not available for this study. However, prices of water rights are often based on the value of water to agriculture (as agriculture is the most common seller of water rights for environmental or other water uses). We therefore present market information on the value of water rights to irrigators in

[21] All project costs were converted to 2026 dollars using the Implicit Price Deflator for Gross Domestic Product (IPDGDP) (Bureau of Economic Analysis, 2026).

MID, as this indicates the potential cost of purchasing water rights from these irrigators to augment instream flows in the Project area.

Taking into account the available data on the value of water transactions and the value of water to irrigators provided in the following discussion, we estimate that the economic benefit of instream flow augmentation would be at least $85 per AFY. As discussed above, on average, the increase in instream flow from the Preferred Alternative is expected to be 1,264 AFY. Accordingly, the expected value of enhanced instream flow is estimated to be approximately $108,000 per year (1,264 AFY multiplied by $85 per AFY) once the Project is complete under the Preferred Alternative ($102,000 when discounted and annualized). As most water right transactions for environmental purchases are to enhance fish habitat, this value is expected to be a conservative proxy for the value to the public of enhanced fish habitat and fish populations. The full measure of the economic benefit of enhanced instream flow is the benefit to the public of enhanced fish and wildlife populations, water quality, ecosystem function, etc.

Values published in the economic literature are often quite high for enhancements to salmon and other fish and wildlife populations (see Table D-16), such as those that would benefit from the instream flows provided by the Preferred Alternative. In addition to these values to the general population, salmonid restoration is very important to local tribes. There are seven tribes (Hoopa Valley Tribe, Karuk Tribe, Quartz Valley Indian Reservation, Round Valley Tribes, Smith River Rancheria, Wiyot Tribe, and Yurok Tribe) partnering with NOAA Fisheries on the recovery effort for the SONCC coho salmon (NOAA Fisheries, 2025) who hold cultural and traditional values for this and other fish species that would benefit from the enhanced instream flow.

As quantitative information on how instream flows would improve fish and wildlife populations in the Project area is not available, the analysis is not able to directly measure the economic benefit of enhanced instream flow. As such, the value of conserved water is estimated in this section using the prices of water from transactions for environmental water in the western United States. Table D-17 shows the estimated average annual benefits of enhanced instream flow for the Preferred Alternative.

Table D-16. Example Studies and Values of Fish Enhancement in the Pacific Northwest

Author(s)	Study Year	Original Value Per Household (Dollar Year)	Value Per Household Adjusted to 2026 dollars	Enhancement Location	Fish Enhancement	Survey Respondents
Layton, Brown, & Plummer	1999	$119 - $250 (1998$)	$227 - $477	Eastern WA and Columbia River; Western WA and Puget Sound	Annual WTP per household to increase migratory fish populations by 50%	Households in WA
Layton, Brown, & Plummer	1999	$171 - $186 (1998$)	$326 - $355	Eastern WA and Columbia River; Western WA and Puget Sound	Annual WTP per household to increase freshwater fish populations by 50%	Households in WA
Bell, Huppert, and Johnson	2003	$78 - $122 (2000$)	$136 - $212	Coastal areas in WA	Annual WTP per household to increase coho salmon populations by 100%	Households in Grays Harbor and Willapa Bay, WA
Bell, Huppert, and Johnson	2003	$24 - $116 (2000$)	$42 - $202	Coastal areas in OR	Annual WTP per household to protect coho salmon populations from extinction	Households in Tillamook Bay, Coos Bay, and Yaquina Bay, OR
Loomis	1996	$80 - $98 (1994$)	$157 - $192	Elwha River, WA	Annual WTP per household to increase salmon and steelhead populations 600%	Households in Clallam County, WA; WA state; and the U.S.
Lewis, King, Dundas, & Lew	2022	$0.08 - $0.19 (2022 $)	$0.09 - $0.22	Oregon coast Coho salmon	Annual WTP per household for every 1,000 increase in coho fish population	Oregon and Washington households

Sources: (Bell, Huppert, & Johnson, 2003) ; (Layton, Brown, & Plummer, 1999); (Dalton, Bastian, Jacobs, & Wesche, 1998) (Lewis, Kling, Dundas, & Lew, 2022).
WTP = Willingness to Pay Prepared August 2026

Table D-17. Estimated Instream Flow Value of the Preferred Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Group	Dedicated Instream Flow (AFY)	Undiscounted Annual Benefit of Additional Instream Flow	Discounted Annualized Benefit of Instream Flow
PG1 Piping	212	$18,000	$18,000
PG2 Piping	385	$33,000	$32,000
PG3 Piping	328	$28,000	$26,000
PG4 Piping	339	$29,000	$26,000
PG5 Replace Existing Siphons	0	$0	$0
Total	**1,264**	**$108,000**	**$102,000**

Note: Totals may not sum due to rounding. Prepared August 2026
1/ Price Base: 2026 dollars amortized over 100 years at a discount rate of 3.25 percent.

This value of $85 per AFY is based on the following information (see Table D-18):

1. *Prices paid for water by environmental buyers throughout the Western United States*. In the period 2000 to 2009, the purchase price of environmental water varied from just over $0 to $2,427 per AFY, with an average permanent sale transaction price of $332 per AFY. Among the 51 permanent water right purchases with the sales price and volume recorded in a water transaction database published by the UC Santa Barbara Bren School, the permanent sales price value in 30 transactions (59 percent of transactions) was above $85 per AFY. As discussed in detail below, these values are expected to provide a low range estimate of instream flow value to society.
2. *Value of water to irrigators in the Rogue River Basin*. Low-value crop irrigators are likely the first to sell water for environmental purposes, which makes the value of water to low-value crop irrigators a key factor determining water sales and lease prices to environmental buyers in the Project area (i.e., the value of water to agriculture determines the willingness of the agricultural sellers to accept a price for water). As analyzed in detail in the following section, the marginal value of water (the value of each additional AF of water) to irrigators in MID is estimated to range from approximately $85 (marginal value of water to pasture) to $245 per AFY (marginal value of water to hay). However, the average value of water is estimated to range from approximately $4 to $63. These values are important, as the value of water to local agriculture is a key factor determining water sales and lease prices to environmental buyers in the Project area (i.e., the value of water to agriculture determines the willingness of the agricultural sellers to accept a price for water).

Table D-18. Value per AFY of Water (Market Prices and Value to Agriculture), Rogue River Watershed, Oregon, 2026 dollars

Type of Value	Low Value	High Value	Median Value	Average Value	Marginal Value
Permanent water right transaction in western U.S., 2000 to 2009 (*Converted to Annual Values*)	~$0	$2,427	~$120	$332	-
Marginal value of water to Rogue River Basin hay and pasture irrigators (*Income Capitalization Approach*)	$85	$245	-	-	~$123
Average value of water to Rogue River Basin hay and pasture irrigators (*Income Capitalization Approach*)	$4	$63	-	~$35	-

Past Costs Paid as a Proxy for Value

Water rights can be purchased or leased in Oregon. It is important to note that the value paid per AF depends on many variables, including the value of water to the seller, funding available to the buyer, characteristics of the affected stream/river (including current flow levels, flow targets, and presence of threatened or endangered species), characteristics of the water right (seniority, time of use, point of diversion, etc.), and the size of the water right.

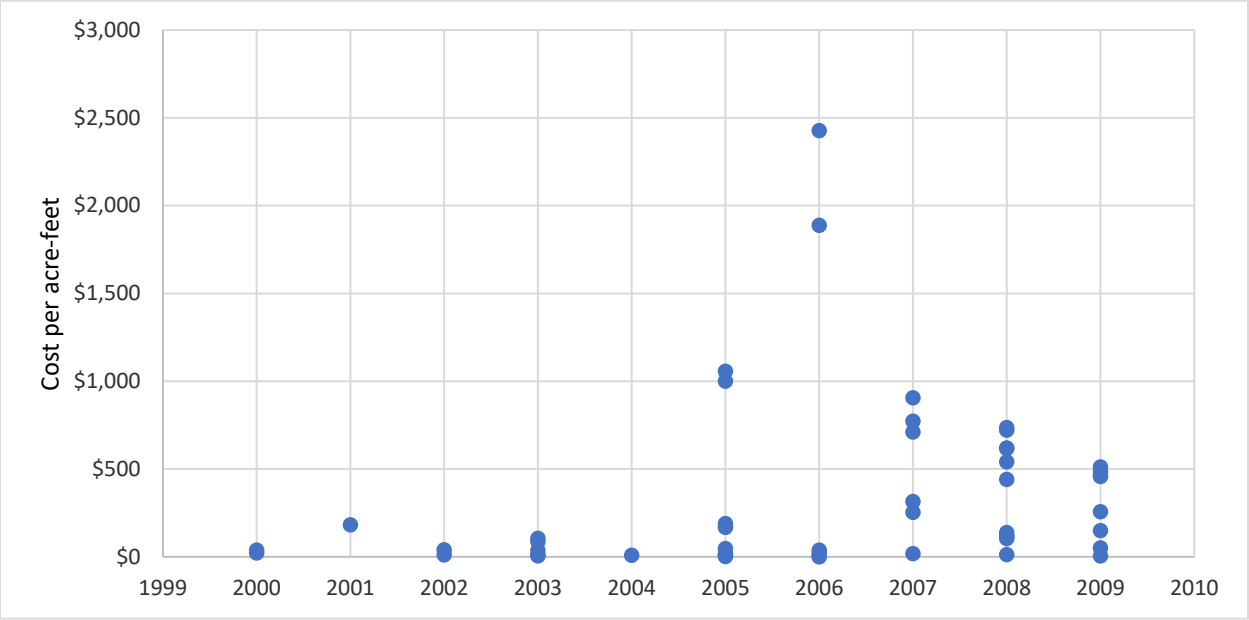
Water right leases and purchases for environmental purposes across the Western United States were analyzed in a 2003 paper (Loomis, Quattlebaum, Brown, & Alexander, 2003). During the period between 1995 and 1999, five water right purchases averaged $457 per AF in Oregon, while six water right leases averaged $215 per AFY.[22] The paper also shows lease and purchase price by environmental use, including for riparian areas, wetlands, recreation, and instream flow. For instream flows in the Western U.S., the average purchase price across 18 transactions per AF was $1,417, while across 35 lease transactions the annual price was $86 per AF.

The Bren School of Environmental Science and Management at the University of California, Santa Barbara, maintains a database of water transfers in the Western United States, and distinguishes between the terms of the transaction (i.e., sale or lease) and the sector of the buyer and seller (e.g., agricultural or environmental) (Bren School of Environmental Science & Management, University of California, Santa Barbara, 2017). The two graphs shown below in Figure D-2 and Figure D-3 show more recent (from 2000 to 2009) sales and leases of water rights by environmental buyers on a price per AFY basis. The figures show how water right transaction values vary widely, but sale prices (amortized to an annual price) typically are less than $500 per year while one-year leases typically fall below $800 per AFY (with several transactions showing prices rising over $4,000 per AFY). Among the 51 permanent water right purchases with the sales price and volume recorded in the database, the sales price value in 30 transactions (59 percent) was above $85 per AFY. However, it is also important to note that the amount paid per AF tends to decline with an increase in water volume

[22] Values were adjusted from 1999 dollars to 2026 dollars using the IPDGDP.

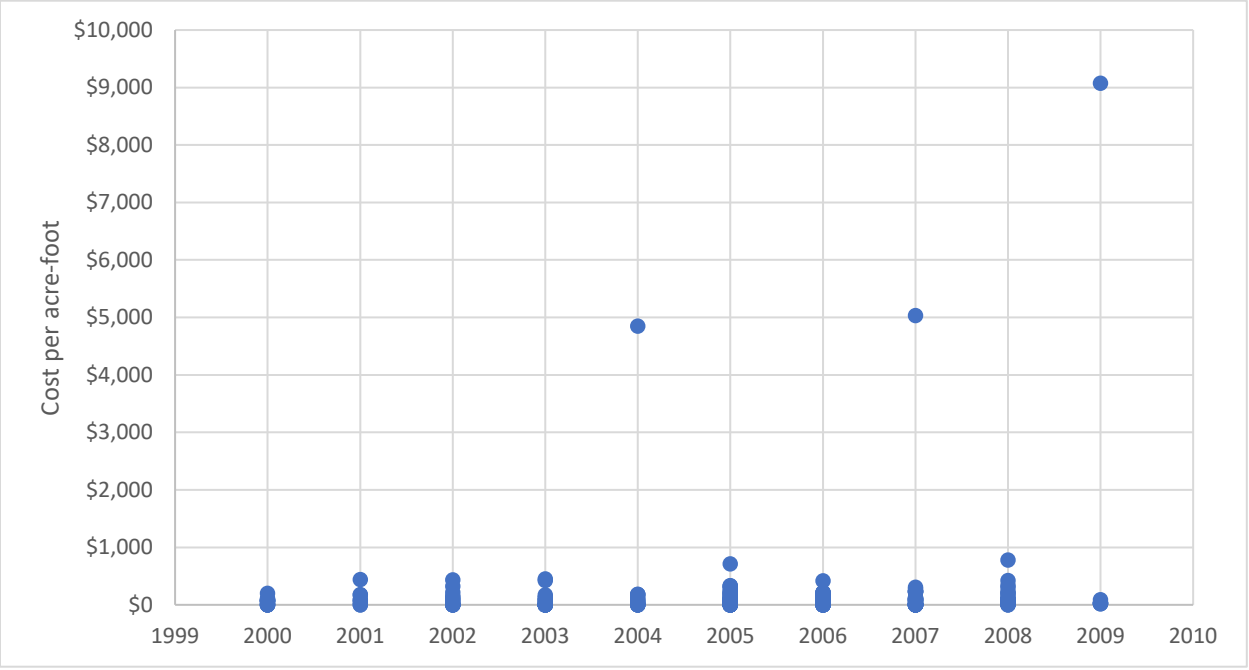
traded; weighting the purchase price by the water volume sold decreases the average permanent sale transaction price to $29 per AFY.

Figure D-2. Western water right purchases for environmental purposes, 2000 to 2009, price paid per acre-foot per year, 2026 dollars



Note: Purchase prices were adjusted to 2026 dollars using the Implicit Price Deflator for Gross Domestic Product (IPDGDP) and then amortized using a 3.25-percent interest rate and a 100-year period to derive dollar per AFY values (Bureau of Economic Analysis, 2026).

Figure D-3. One-year water leases for environmental purposes, price paid per acre-foot in Western United States, 2026 dollars



Note: Purchase prices were adjusted to 2026 dollars using the IPDGDP.

3.3 Benefits Considered but Not Monetized

3.3.1 Water Quality

Waterbodies in the study area fail to meet multiple water quality standards. The Oregon Department of Environmental Quality (DEQ) has identified water flow and quality challenges in several waterbodies that are influenced by MID operations, including the North and South Forks of Little Butte Creek, Lake Creek, Little Butte Creek, Rogue River, and Fish Lake. All of these waterbodies are included in Oregon's Integrated Report (previously Oregon's 303(d) list) for failing to meet one or more of the following state water quality standards: temperature, flow modification, habitat modification, *E. coli*, sedimentation, phosphorus, dissolved oxygen, biological criteria, methylmercury, chlorophyll-a, pH, and harmful algal blooms (Oregon Department of Environmental Quality, 2024). Table 4-9 in Section 4.12.2 of the Plan-EIS provides the impairments for each water body. Water management in the study area has altered seasonal streamflow patterns, largely reducing streamflow from historical levels. Low streamflow affects water quality by exacerbating temperature and dissolved oxygen problems.

Low streamflows are one factor that contributes to degraded water quality, which is part of the reason why the additional water instream would bring benefits under the Preferred Alternative (as described in the previous section). As noted in the Fish and Aquatic Species technical report (Parametrix, 2025): "Overall, improvements to water quality and increased flow in South Fork Little Butte Creek, North Fork Little Butte Creek, and Little Butte Creek would increase habitat availability and habitat quality in addition to improving migratory corridors for resident fish populations. Thus, piping the JSC would result in minor (North Fork Little Butte Creek and Little Butte Creek) to moderate (South Fork Little Butte Creek) long-term benefits to fish and aquatic species that occur within this waterbody." This section discusses other potential water quality benefits that could arise from the Preferred Alternative.

Runoff from agricultural land in the study area has contributed to poor water quality in nearby waterbodies. In the study area, most agricultural lands that surround waterbodies are irrigated using flood irrigation, which has a higher tendency to create tailwater discharge. Tailwater has also been shown to have elevated concentrations of nitrogen and phosphorus (Mchugh, Bhattarai, Lotz, & Midmore, 2008). Agricultural runoff (from irrigation or stormwater) can degrade the water quality of adjacent waterbodies by increasing temperature and turbidity, and by transporting nitrates, *E. coli*, and phosphates to the waterbodies. The process is exacerbated in areas that have reduced riparian zones. Canal seepage from the JSC likely also contributes to agricultural runoff in nearby waterbodies. As described in Section 4.12.3 of the Plan-EIS, it is likely that canal seepage acts as a nonpoint pollution source to tributaries of Little Butte Creek that are adjacent to the JSC such as Lake Creek, Wyant Gulch, Grasshopper Gulch, Owens Gulch, Eagle Gulch, and Unnamed Drainages 1 to 10.

The Preferred Alternative has the potential to improve water quality in waterbodies that are impacted by the JSC and by adjacent MID agricultural lands. By eliminating the seepage on 11.5 miles of the JSC, the Project could reduce the amount of runoff that travels into nearby waterbodies. By providing partial pressurization along this length of the JSC, the Project may also allow irrigators to convert their flood systems to more efficient systems such as sprinklers. This could reduce the amount of runoff from agricultural fields into water systems.

While it is likely that the Project will produce water quality improvements, there is significant uncertainty regarding the magnitude of these improvements. The Project will likely reduce runoff from JSC seepage, but because the amount of current runoff from seepage is unclear, so is the

amount of runoff reduction. As a result, any potential changes in water quality are also uncertain. The conversion from flood irrigation to more efficient systems depends on many factors, including the economic tradeoffs involved and individual farmer choice. The uncertainty in these factors makes it difficult to determine the rate and timing of potential conversion, as well as any associated reduction in irrigation runoff. For these reasons, we do not quantify the benefits of water quality improvements under the Preferred Alternative.

3.3.2 Wildfire Protection

The Preferred Alternative could provide benefits by increasing access to water used for firefighting. The Project will include standpipes on each mile of the JSC that is piped, which will allow firefighters to access JSC water in times of emergency. The area has experienced multiple serious and damaging wildfires in recent years. In 2020, the Almeda and South Obenchain fires burned through the Rogue Valley, destroying thousands of homes in one of the most destructive fires in Oregon's recorded history (Chavez, 2023). In June 2025, the Upper Applegate Fire prompted evacuation notices for more than 1,000 people in Jackson County southwest of Medford (OPB, 2025).

Access to JSC water could help to prevent fire damage to residences, commercial property, agricultural operations, and natural areas. It also has the potential to lower firefighting costs by providing more convenient access to water and avoiding the expense of transporting water in from elsewhere. By preventing the spread of wildfire, the Project could also improve water quality if it allowed firefighters to prevent hillsides from burning, which increases runoff into adjacent streams. In this way, the Project could provide damage reduction benefits that are not quantified in this analysis.

We do not quantify these benefits due to the uncertainty surrounding the change in outcomes that would occur under the Project. For example, it is not known what the likelihood of fires in the study area is. It is also uncertain to what degree JSC water would change any resulting damage from fire. For these reasons, we do not quantify the benefits of wildfire protection under the Preferred Alternative.

4 Summary of Benefits and Costs of the Preferred Alternative

This section compares the benefits and costs of the Preferred Alternative. Specifically, this section provides the estimated benefits and costs of the Preferred Alternative that exceed those in the FWOFI Alternative. Table 8-7 in the Plan-EIS (NWPM 506.20, Economic Table 5a) summarizes annual average benefits of the Preferred Alternative over the FWOFI Alternative. Across all project groups, the Preferred Alternative would provide annual average benefits of approximately $1.68 million at an annual average cost of roughly $3.05 million. The result is net average annual benefits of -$1.37 million. The water quality and wildfire benefits of the Preferred Alternative are not monetized due to uncertainty in the magnitude of the benefit. However, for context, there are approximately 95,000 households in Jackson County. If each household were to have a willingness to pay for the water quality and wildfire benefits of at least $15 per year, this would equate to more than $1.37 million in additional benefits and translates to a benefit-cost ratio of over 1.0. Numerous studies have shown the importance to Americans of water quality and a willingness to pay for water quality improvement, but as the magnitude of effect of the Preferred Alternative on water quality is unknown, the likelihood that the value of the water quality improvement is at least $1.37 million annually is also unknown.

The monetized costs and benefits are summarized in Table 8-8 in the Plan-EIS (which corresponds to NWPM 506.20, Economic Table 6).

4.1 Incremental Analysis

The Preferred Alternative is evaluated using an incremental analysis, which identifies how total costs and benefits change as project groups are added (or removed). The design of each project group is independent of the number of project groups included and the order in which they are installed. The table below presents the incremental costs and benefits of the Preferred Alternative.

Table D-19. Incremental Analysis of Annual Costs and Benefits Under the Preferred Alternative, Rogue River Watershed, Oregon, 2026 dollars[1]

Project Groups	Total Costs	Incremental Costs	Total Benefits	Incremental Benefits	Net Benefits
5	$172,000	N/A	$1,134,000	N/A	$962,000
5,1	$537,000	$365,000	$1,231,000	$97,000	$694,000
5,1,2	$1,299,000	$762,000	$1,402,000	$171,000	$103,000
5,1,2,3	$2,048,000	$749,000	$1,539,000	$137,000	-$509,000
5,1,2,3,4	$3,051,000	$1,003,000	$1,681,000	$142,000	-$1,370,000

1/ Price Base: 2026 dollars amortized over 100 years at a discount rate of 3.25 percent. Prepared August 2026

4.2 Preferred Alternative

Because the Preferred Alternative would provide significant agricultural damage reduction benefits and instream flow benefits, and would meet the purpose and need, the Preferred Alternative is the preferred alternative. In addition to the quantified benefits described in the preceding sections, the Preferred Alternative would also provide water quality improvements to nearby waterbodies and enhance wildfire protection capabilities. If these benefits exceed $1.37 million annually, which is within reason but not known with any certainty, then the Preferred Alternative provides the highest net benefits to the Nation.

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6 Economic Analysis Appendix

This presents the crop enterprise method used to estimate the agricultural damage to the study area under the FWOFI Alternative and the benefits of avoiding such damage under the Preferred Alternative.

6.1 Crop Enterprise Budgets

The analysis uses a total of four crop budgets: two for pasture and two for hay, with one budget for each crop used to represent current conditions and another to represent yield improvements under the Preferred Alternative. These budgets are summarized in the table below.

Table D-20. Summary of Crop Budgets

Crop	Scenario	Budget Table
Pasture	Preferred Alternative	Table D-21
Pasture	FWOFI Alternative	Table D-22
Hay	Preferred Alternative	Table D-23
Hay	FWOFI Alternative	Table D-24

We estimate the costs and benefits of agricultural production using enterprise budgets that represent typical costs and returns of producing crops in the Rogue River Valley. Enterprise budgets aim to reflect common practices and relevant costs for production in the region, but do not necessarily represent the conditions of any particular farm. As a starting point for the crop budgets in this analysis, we used a crop budget for alfalfa hay developed by the University of Idaho (UI) and a crop budget for pasture developed by the University of California Cooperative Extension (UCCE). We adjusted values in the budgets to account for changes in prices through time and local conditions in MID. The following sections outline the data and assumptions used in adjusting the budget.

6.1.1 Pasture Enterprise Budgets

The pasture enterprise budgets were based on a 2015 budget developed by UCCE for establishing and producing irrigated pasture in the Sacramento Valley, California (Forero, et al., 2015). We selected this budget as the basis for MID crop production costs because it is the most recent crop budget developed for producing irrigated pasture in the Western U.S. and because it matches the pasture production practices in the MID service area, where hay is harvested and then the land is after-grazed by livestock.

6.1.1.1 Modeled Farm

The modeled farm is 45 acres, of which 40 acres are dedicated to pasture production and five acres are non-arable land. The pasture is tilled, and flood irrigation is used. The stand life is 20 years.

6.1.1.2 Input Costs

For fertilizers, we adjust the amount used proportionally according to differences in yield from the original budget. For example, the original budget calls for 200 pounds (lbs) of fertilizer to produce 3.5 tons of hay per acre; we model a yield of 3.3 tons per acre under the FWOFI Alternative (95 percent of the original yield), so we decrease the amount of fertilizer to 190 lbs (95 percent of 200 lbs).

All prices are adjusted from the original values in the UCCE budget. We used area-specific values for fuel prices, land rental rates, and irrigation water assessments. For all other costs, we adjusted the value in the original budget using the national Producer Price Indices (PPI) produced by the National Agricultural Statistics Service (NASS), which are published for a variety of farm expenses (USDA National Agricultural Statistics Service, 2026). For example, there are price indices for fertilizer, herbicides, custom work, and the farm sector in general. The PPI cost adjustments range from a 9-percent increase in Seeds & Plants Totals to a 68-percent increase in Fertilizer Totals (including lime & soil conditioners) costs.

For land costs, we use NASS data on rental rates for pasture in Jackson County for a normalized average value of $31.87 per acre (USDA National Agricultural Statistics Service, 2026).[23] MID charges a standard assessment of $150 per account, plus a special assessment of $24 per account, and $83 per acre (Friend, 2025). For the average account in MID (8.9 acres),[24] the assessment charge per acre would be $19.54 ($174 divided by 8.9 acres). We adjust these costs to 2026 dollars using the IPDGDP to estimate a per-acre irrigation assessment cost of around $109 per acre.

Establishment costs are the expenses incurred to establish a stand of perennial crops and typically include the costs of land preparation and planting. For these costs, we model the total from the original budget (adjusted for inflation, as described above) and amortize the establishment cost over the life of the stand (in this case 20 years) at the discount rate (3.25 percent).

6.1.1.3 Labor Costs

All production activities are done through custom hire. We adjusted the cost of custom work using the "Ag Services, Custom Rates" PPI (an upward adjustment of 39 percent).

6.1.1.4 Revenues

Pasture growers in MID typically harvest one cutting of hay and then graze their cattle on the pasture for the remainder of the season (Xu, 2025; Barber, 2025). Growers generally use the harvested hay for feed for their own livestock during the winter months; without this hay growers would need to purchase feed. The value of pasture is based on feed value to the livestock. Similarly, without the pasture, MID growers would need to purchase feed from other sources. As such, we estimate the value of both the hay and the pasture as the avoided cost of purchasing replacement feed.

We estimate the total pasture yield under the FWOFI Alternative based on reported yields in MID of between 2.7 and 4.0 tons per acre (Barber, 2025). For this analysis, we use the midpoint of this range: 3.3 tons per acre. This yield is slightly higher than the normalized average reported yield for non-alfalfa hay in Jackson County from 2010 to 2018 (the most recent data available), which was 2.4 tons per acre (USDA National Agricultural Statistics Service, 2026).[25] The relatively low yield reported by NASS likely reflects the practices described above where many growers only harvest the first cutting of hay (which is reported to NASS) and graze the remainder of the growing season (which is not reported to NASS).

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[23] We use prices from 2017 to 2025 where data was available. We adjusted all prices for inflation using the IPDGDP prior to averaging. Calculating the normalized average involves dropping the minimum and maximum values and taking the mean of the remaining values.

[24] MID irrigates about 12,000 acres and serves 1,347 parcels, for an average size of 8.9 acres per parcel (Friend, 2025).

[25] Calculating the normalized average involves dropping the minimum and maximum values and taking the mean of the remaining values.

To estimate the yield of the first cutting under the FWOFI Alternative, we use reports from Oregon State University and Michigan State University that indicate the first cutting comprises roughly 40 percent of total hay yield (Bohle & Simmons, 2007; Kaatz, 2018). Following this, the first cutting for pasture growers in MID would be roughly 1.3 tons per acre (40 percent of 3.3 tons). The remaining yield (about 2 tons per acre) would be grazed. Due to trampling, stand preservation, and wildlife consumption, typically only 25 percent of pasture yield is consumed by livestock (Stam, Scasta, & Thacker, 2018). Given this, the remaining pasture yield in MID (2 tons per acre) would provide about 0.5 tons of feed. The total consumable yield (harvested plus grazed) under the FWOFI Alternative is around 1.8 tons per acre. To value this yield, we use the normalized average price for hay in 2025 in Oregon published by USDA: $240.95 per ton (USDA Economic Research Service, 2026). At this price, the harvested and grazed hay combined (1.8 tons per acre) would produce a value of about $440.31 per acre.

From 2015 to 2024, the average application rate in MID was around 2.1 AF per acre.[26] We model this as the application rate under the FWOFI Alternative. Under the Preferred Alternative, an additional 3,793 AFY would be available to MID growers (as explained in Section 3.2.1.1.1). As shown in Table D-5, an estimated 76 percent of this water (2,882 AFY) would go to pasture. This additional water would be spread across MID's estimated 8,431 pasture acres,[27] equating to an average increase of 0.34 AF per acre.

To estimate the pasture yield under the Preferred Alternative, we use a yield-to-water response ratio of 1.1: increasing water by 1 AF would increase yield by 1.1 tons. Since the Preferred Alternative is expected to increase the pasture application rate by 0.34 AF per acre, the corresponding expected increase in yield would be 0.38 tons per acre, bringing the total expected yield under the Preferred Alternative to 3.7 tons per acre. At this total yield, the first cutting would be around 1.47 tons per acre (40 percent of the total yield) and grazing would consume an additional 0.56 tons per acre (25 percent of the remaining 2.2 tons per acre). With combined consumable yield of about 2.03 tons per acre, and at the price of $240.95 per ton, pasture is estimated to produce $489.98 per acre under the Preferred Alternative.

6.1.1.5 Pasture Enterprise Budget Tables

The tables below present enterprise budgets used to estimate the costs and returns of pasture per acre in MID.

[26] Derived by taking the total MID diversion amount (30,488 AFY, shown in Table D-3) and applying the conveyance efficiency rate of 80 percent (Newton Consultants Inc, 2017). This results in a total delivered volume of about 25,000 AFY. Dividing this volume by the total acreage (11,900 as cited in Footnote 1616) results in an average application rate of 2.1 AF per acre.

[27] As shown in Table D-5, pasture acres comprise an estimated 71 percent of MID's roughly 11,900 irrigated acres (Footnote 16), equating to about 8,431 acres.

Table D-21. Pasture Crop Budget Per Acre Under the Preferred Alternative, Rogue River Valley, Oregon, 2026 dollars

Description	Quantity	Unit	$/Unit	Total
REVENUES	-	-	-	-
Harvested hay	1.47	tons	$240.95	$355.38
Grazing value (purchased hay equivalent)	0.56	tons	$240.95	$134.60
Total revenues	*2.03*	*tons*	-	*$489.98*
OPERATING COSTS	-	-	-	-
Fertilizer: 46-0-0	212.0	lbs	$0.48	$101.38
Custom - ground application	0.2	ac	$14.18	$2.84
Custom – broadcast fertilizer	1	ac	$14.18	$14.18
Custom – swath/rake/bale/roadside	1.47	tons	$64.82	$95.61
Herbicide - roundup	0	pint	$4.79	$0.00
Herbicide: 2,4-D	0	pint	$3.95	$0.00
Irrigation water	1	ac	$109.38	$109.38
Interest on operating capital	1	ac	$7.14	$7.14
Total operating costs	-	-	-	*$330.52*
CASH OVERHEAD	-	-	-	-
Office expense	1	ac	$31.26	$31.26
Liability insurance	1	ac	$25.01	$25.01
Land lease	1	ac	$31.87	$31.87
Property taxes	1	ac	$2.75	$2.75
Total cash overhead costs	-	-	-	*$90.89*
NON-CASH OVERHEAD	-	-	-	-
Establishment costs	1	ac	$30.83	$30.83
Total costs	-	-	-	*$452.24*
Net income	-	-	-	**$37.74**

Table D-22. Pasture Crop Budget Per Acre Under the FWOFI Alternative, Rogue River Valley, Oregon, 2026 dollars

Description	Quantity	Unit	$/Unit	Total
REVENUES	-	-	-	-
Harvested hay	1.33	tons	$240.95	$319.36
Grazing value (purchased hay equivalent)	0.50	tons	$240.95	$120.95
Total revenues	*1.83*	*tons*	-	*$440.31*
OPERATING COSTS	-	-	-	-
Fertilizer: 46-0-0	190.5	lbs	$0.48	$91.10
Custom - ground application	0.2	ac	$14.18	$2.84
Custom – broadcast fertilizer	1	ac	$14.18	$14.18
Custom – swath/rake/bale/roadside	1.3	tons	$64.82	$85.92
Herbicide - roundup	0	pint	$4.79	$0.00
Herbicide: 2,4-D	0	pint	$3.95	$0.00
Irrigation water	1	ac	$109.38	$109.38
Interest on operating capital	1	ac	$7.14	$7.14
Total operating costs	-	-	-	*$310.55*
CASH OVERHEAD	-	-	-	-
Office expense	1	ac	$31.26	$31.26
Liability insurance	1	ac	$25.01	$25.01
Land lease	1	ac	$31.87	$31.87
Property taxes	1	ac	$2.75	$2.75
Total cash overhead costs	-	-	-	*$90.89*
NON-CASH OVERHEAD	-	-	-	-
Establishment costs	1	ac	$30.02	$30.02
Total costs	-	-	-	*$431.46*
Net income	-	-	-	**$8.85**

6.1.2 Hay Enterprise Budgets

The hay enterprise budgets were based on a 2015 budget developed by UI for establishing and producing grass hay in Idaho (Painter, 2015). We selected this budget as the basis for MID crop production costs because it is the most recent crop budget developed for producing grass hay in an area that is regionally proximate to the Rogue River Basin.

6.1.2.1 Modeled Farm

The original crop budget estimates all costs on a per-acre basis without modeling farm operations beyond producing grass hay. The stand life is six years.

6.1.2.2 Input Costs

As in the pasture budget, we adjust the amount of fertilizer used proportionally according to differences in yield from the original budget. We used area-specific values for land rent and irrigation charges. For all other input costs, we adjusted the value in the original budget using the national PPI produced, as described above in Section 6.1.1.2.

For land costs, we use NASS data on rental rates for irrigated cropland in Jackson County for a normalized average value of $151 per acre (USDA National Agricultural Statistics Service, 2026).[28] We used the same irrigation assessment charges and fuel prices as described for pasture (Section 6.1.1.2).

6.1.2.3 Labor Costs

All production activities are done through on-farm hired labor except hauling and stacking, which is custom hire. On-farm hired labor is all machinery labor. For the cost of this labor, we use the median hourly wage rate for the agricultural equipment operators in the Medford area in 2025 and adjust to 2026 dollars using IPDGDP.[29] We further increase this wage rate by 20 percent to account for non-wage employment costs, such as health care and insurance.[30] This results in total costs of $26.82 per hour for equipment operator labor. We adjusted the cost of custom work using the "Ag Services, Custom Rates" PPI.

6.1.2.4 Revenues

To estimate the gross revenues of grass hay, we use the same total yields as pasture for the FWOFI Alternative (3.3 tons per acre) and the Preferred Alternative (3.7 tons per acre). We also use the same price for hay ($240.95 per ton). The primary difference from pasture is that all grass hay yield is harvested, avoiding the utilization loss associated with grazing. This results in gross revenues of around $882 per acre under the Preferred Alternative and $803 per acre under the FWOFI Alternative.

6.1.2.5 Hay Enterprise Budget Tables

The tables below present enterprise budgets used to estimate the costs and returns of grass hay per acre in MID.

[28] We use prices from 2016 to 2025 where data was available. We adjusted all prices for inflation using the IPDGDP prior to averaging. Calculating the normalized average involves dropping the minimum and maximum values and taking the mean of the remaining values.

[29] Based on the average wage for Agricultural Equipment Operators (occupation code 45-2091) in the Medford metropolitan area of Oregon according to the Bureau of Labor Statistics' Occupational Employment and Wage Estimates data in May 2025 (U.S. Bureau of Labor Statistics, 2025).

[30] This is roughly the average proportion of non-wage labor costs for all private, part-time workers in the U.S. in December 2018 (Bureau of Labor Statistics, 2018).

Table D-23. Hay Crop Budget Per Acre Under the Preferred Alternative, Rogue River Valley, Oregon, 2026 dollars

Description	Quantity	Unit	$/Unit	Total
REVENUES	-	-	-	-
Grass Hay	3.7	ton	$240.95	$882.09
VARIABLE COSTS	-	-	-	-
Nitrogen	36.6	lb	$0.96	$35.06
Phosphorus	102.5	lb	$0.92	$94.72
Sulfur	14.6	lb	$0.47	$6.89
Fuel	3.1	gal	$3.91	$12.25
Lubricants	1	acre	$1.48	$1.48
Machinery Repairs	1	ac	$11.82	$11.82
Machinery Labor	0.8	hours	$26.82	$20.29
Custom haul & stack	3.7	ton	$12.47	$45.65
Fertilizer rental	1	ac	$1.42	$1.42
Bailing twine	3.7	ton	$5.61	$20.55
Operating interest	1	ac	$5.61	$5.61
Total variable costs	-	-	-	*$255.74*
FIXED COSTS	-	-	-	-
Machinery depreciation	1	ac	$22.28	$22.28
Machinery interest	1	ac	$14.64	$14.64
Machinery insurance, taxes, housing, licenses	1	ac	$4.04	$4.04
Land cost	1	ac	$150.95	$150.95
Water assessment fee	1	ac	$109.38	$109.38
Amortized establishment cost	1	ac	$96.68	$96.68
Overhead	1	ac	$6.77	$6.77
Management fee	1	ac	$15.59	$15.59
Total fixed costs	-	-	-	*$420.32*
Total costs	-	-	-	*$676.06*
Net Returns	-	-	-	**$206.03**

Table D-24. Hay Crop Budget Per Acre Under the FWOFI Alternative, Rogue River Valley, Oregon, 2026 dollars

Description	Quantity	Unit	$/Unit	Total
REVENUES	-	-	-	-
Grass Hay	3.3	ton	$240.95	$803.17
VARIABLE COSTS	-	-	-	-
Nitrogen	36.6	lb	$0.96	$35.06
Phosphorus	102.5	lb	$0.92	$94.72
Sulfur	14.6	lb	$0.47	$6.89
Fuel	3.1	gal	$3.91	$12.25
Lubricants	1.0	acre	$1.48	$1.48
Machinery Repairs	1.0	ac	$11.82	$11.82
Machinery Labor	0.8	hours	$26.82	$20.29
Custom haul & stack	3.3	ton	$12.47	$41.57
Fertilizer rental	1.0	ac	$1.42	$1.42
Bailing twine	3.3	ton	$5.61	$18.71
Operating interest	1.0	ac	$5.61	$5.61
Total variable costs	-	-	-	*$249.81*
FIXED COSTS	-	-	-	-
Machinery depreciation	1	ac	$22.28	$22.28
Machinery interest	1	ac	$14.64	$14.64
Machinery insurance, taxes, housing, licenses	1	ac	$4.04	$4.04
Land cost	1	ac	$150.95	$150.95
Water assessment fee	1	ac	$109.38	$109.38
Amortized establishment cost	1	ac	$96.68	$96.68
Overhead	1	ac	$6.77	$6.77
Management fee	1	ac	$15.59	$15.59
Total fixed costs	-	-	-	*$420.32*
Total costs	-	-	-	*$670.14*
Net Returns	-	-	-	**$133.03**

6.2 Probability of Siphon Failure

The siphons that would be replaced under the Preferred Alternative are Prestressed Concrete Cylinder Pipes (PCCPs). The failure of PCCPs typically begins when cracks develop in their protective mortar coating, which allows water to enter and cause the underlying prestressing wires to corrode. As these wires corrode, their ability to offset the internal operating pressure of the pipe is compromised, eventually leading to catastrophic failure. According to a report from the Bureau of Reclamation (Jermyn 2021), the probability of a PCCP failure is influenced by a combination of material, manufacturing, environmental, and operational factors (Jermyn M. , Bureau of Reclamation Materials Engineer, 2025). Because the siphons were constructed nearly 70 years ago, the details of their construction (including the exact materials and manufacturing process) are unknown. However, as the Bureau of Reclamation report shows, age and size are useful factors in assessing expected failure of PCCPs, so we use these known details to model the probability of siphon failure. The actual remaining service life of the siphons depends on their condition, which can only be accurately determined with an electromagnetic inspection, which is expensive and has not been performed on the MID siphons (Jermyn M. , 2025; Friend, 2025).

To model the annual probability of failure for the Lake Creek, Wyant, and Osborne siphons, we use a Weibull distribution, a probability distribution that is commonly used to model reliability and failure rates (ScienceDirect, 2025). The Weibull cumulative distribution function is provided by the following formula:

(1) $$F(t) = 1 - e^{-(t/\eta)^{\beta}}$$

Where:

F(t) = the probability that a failure would occur before time t

t = the time period (in years)

η = the period at which 63.2% of subjects would fail ("characteristic life")

β = a scaling parameter that determines how the rate of failure changes over time

We set $\beta = 3$, which models a probability of failure that increases over time, reflecting the likely pattern for infrastructure and equipment that wear out as they age. We calculate η using the mean time to failure (MTTF) for siphons of this construction, age, and size that is documented in the Bureau of Reclamation report: 36.8 years (Jermyn M. , 2021). Using the formula below, the value of η is 41.2 years.

(2) $$\eta = \frac{MTTF}{\Gamma\left(1+\frac{1}{\beta}\right)} = \frac{36.8}{\Gamma\left(1+\frac{1}{3}\right)} = 41.2$$

The siphons were constructed in 1956, making them 69 years old. Using the formula above, the probability of a single siphon failure happening before this year would be over 99 percent.[31] The probability of any one of three siphons failing before this year would be nearly 100 percent.[32] Given that none of the three siphons have failed, it is likely that the calculation overestimates the probability of siphon failure. Based on professional judgment, we adjust the probability of siphon

[31] $F(69) = 1 - e^{-\left(\frac{69}{41.2}\right)^3} = 0.991$

[32] $1 - (1 - 0.991)^3 = 0.9999992$

failure downward to the value at its approximate MTTF: 41 years. According to the Weibull distribution, this brings down the cumulative probability of failure in this year from over 99 percent to about 63 percent. If the actual probability of failure is higher than this, the expected damages would be higher than the figures modeled, as would the benefits.

The table below summarizes the siphons' ages and associated probability of failure according to the Weibull function. The most relevant years of the analysis are shown annually, while other calculations are summarized in 10-year increments. The first column in the table shows the age of the siphons and the second column shows the corresponding year in the analysis. Using Formula 1 and the parameters above, we estimate the cumulative probability of a single, specific siphon failing for each year of the siphons' lives.[33] In other words, this is the probability that a specific siphon would fail prior to the given year. This estimate is shown in the third column of the table.

The fourth column in the table calculates the annual conditional probability of a specific siphon failing. To calculate the annual conditional probability of failure during any given year, we use the following formula:

(3) $$P(t) = \frac{F(t+1) - F(t)}{1 - F(t)}$$

Where:

P(t) = the probability that a failure would occur during a given year

t = the given year

t +1 = the year following the given year

F(t) = the cumulative probability of failure in the given year

F(t+1) = the cumulative probability of failure in the year following the given year

Using the annual conditional probability that a specific siphon would fail (Formula 3 above), we calculate the annual probability that any one of the siphons would fail using Formula 4 below. This calculation is shown in the fifth column of the table.

(4) $$A(t) = 1 - \left(1 - P(t)\right)^3$$

To calculate the expected annual damages of failure, it is necessary to have the cumulative probability of any one siphon failing. We calculate this value each year using Formula 5 below. The results are shown in the sixth column of the table below.

(5) $$C(t) = 1 - \prod_{i=41}^{t}(1 - A(i))$$

Lastly, estimating the expected damages in the failure year requires the annual unconditional probability (i.e., the probability of failure ignoring past survival). This is calculated by subtracting the cumulative probability of failure in a given year (t) from the cumulative probability of failure in the following year (t+1). This calculation is shown in the last column of the table below.

[33] This is different the probability of having any one of the three siphons fail, whose calculation follows.

Table D-25. Probability of Siphon Failure

Year of Siphon Life	Year in Analysis	Cumulative Probability of a Specific Siphon Failure Before Year[1]	Annual Conditional Probability of a Specific Siphon Failing	Annual Conditional Probability of Any Siphon Failing	Cumulative Probability of Any Siphon Failing Prior to Given Year[1,2]	Annual Unconditional Probability of Any Siphon Failing
1	-40	0%	0%	0%	N/A	N/A
10	-31	1%	0%	1%	N/A	N/A
20	-21	11%	2%	5%	N/A	N/A
30	-11	32%	4%	11%	N/A	N/A
40	-1	60%	7%	19%	N/A	N/A
41	0	63%	7%	20%	20%	19.9%
42	1	65%	7%	21%	36%	16.6%
43	2	68%	8%	22%	50%	13.7%
44	3	70%	8%	22%	61%	11.2%
45	4	73%	8%	23%	70%	9.0%
46	5	75%	9%	24%	78%	7.2%
47	6	77%	9%	25%	83%	5.6%
48	7	79%	10%	26%	88%	4.4%
49	8	81%	10%	27%	91%	3.3%
50	9	83%	10%	28%	93%	2.5%
51	10	85%	11%	29%	95%	1.9%
52	11	87%	11%	30%	97%	1.4%
53	12	88%	12%	31%	98%	1.0%
54	13	89%	12%	32%	98%	0.7%
55	14	91%	12%	33%	99%	0.5%
56	15	92%	13%	34%	99%	0.3%
57	16	93%	13%	35%	100%	0.2%
58	17	94%	14%	36%	100%	0.2%
60	19	95%	15%	38%	100%	0.1%
70	29	99%	19%	47%	100%	0.0%
80	39	100%	24%	57%	100%	0.0%
90	49	100%	30%	65%	100%	0.0%
100	59	100%	35%	73%	100%	0.0%
110	69	100%	41%	79%	100%	0.0%
120	79	100%	46%	85%	100%	0.0%
130	89	100%	52%	89%	100%	0.0%
140	99	100%	58%	92%	100%	0.0%

1/ Results are rounded to the nearest percentage. Values that are rounded to 100% still have a very small probability of survival.
2/ Represents the cumulative probability that any one siphon would have failed prior to the given year.

We use the probabilities in the table above to calculate the expected losses in the event of a siphon failure. As the sixth column in the table shows, there is a near certainty that at least one siphon will fail prior to Year 17. Accordingly, from Year 17 onward, this analysis models a 100-percent probability of incurring the annual damages following failure (about $1.26 million, as described in Section 2.2.3) and a 0-percent probability of incurring the roughly $1.59 million in one-time damages that are expected in the year of failure. Prior to Year 17, the annual probability of failure follows the last column of the table above, and the cumulative probability of failure follows the sixth column of the table above. The probabilities used to estimate the annual expected losses are shown in the second and third columns in the table below. As the third column shows, the cumulative probability is delayed by one year because the expected annual damages begin to accrue in the year after failure.

The expected loss in the year of failure is calculated by multiplying the annual unconditional probability of failure each year (the second column in the table) by the estimated damages that would occur in the year of failure ($1,594,838). Column four in Table D-26 shows this calculation. The expected annual loss after the year of failure is calculated by multiplying the conditional probability of siphon failure (delayed by one year) by the expected annual loss after the failure year ($1,262,558). This calculation is shown in the fifth column of Table D-26. The total expected damages of siphon failure equal the sum of the expected losses in the year of failure and the expected annual losses after the failure year. This calculation is displayed in the last column of the table below. The annual expected damages rise from around $317,000 in Year 0 to $1.257 million in Year 17 and stay at that level through the end of the period of analysis.

Table D-26. Expected Damages of Siphon Failure Under the FWOFI Alternative, Rogue River Watershed, Oregon, 2026 dollars

Year of Analysis	Probability of a Siphon Failure in a Given Year	Estimated Cumulative Probability of a Siphon Failure[1]	Expected One-time Loss in Failure Year[2]	Expected Annual Loss Following Failure Year[3]	Total Expected Loss from Siphon Failure[4]
Column / Calculation	A	B = sum of A from previous years	C = A x $1.59 Million	D = B x $1.26 million	E = C + D
0	19.9%	0%	$316,847	$0	$316,847
1	16.6%	19.9%	$264,902	$250,833	$515,735
2	13.7%	36.5%	$218,826	$460,543	$679,369
3	11.2%	50.2%	$178,567	$633,777	$812,344
4	9.0%	61.4%	$143,913	$775,140	$919,053
5	7.2%	70.4%	$114,527	$889,069	$1,003,596
6	5.6%	77.6%	$89,975	$979,735	$1,069,710
7	4.4%	83.2%	$69,768	$1,050,964	$1,120,732
8	3.3%	87.6%	$53,385	$1,106,196	$1,159,581
9	2.5%	91.0%	$40,299	$1,148,459	$1,188,758
10	1.9%	93.5%	$30,006	$1,180,362	$1,210,368
11	1.4%	95.4%	$22,032	$1,204,116	$1,226,148
12	1.0%	96.8%	$15,948	$1,221,558	$1,237,506
13	0.7%	97.8%	$11,379	$1,234,183	$1,245,563
14	0.5%	98.5%	$8,001	$1,243,192	$1,251,193
15	0.3%	99.0%	$5,543	$1,249,526	$1,255,069
16	0.2%	99.3%	$3,782	$1,253,914	$1,257,696
17-100	0.0%	100.0%	$0	$1,256,908	$1,256,908

Source: Highland Economics' analysis Prepared August 2026

Note: Values in the table may not be exact products or sums due to rounding.

1/ These probabilities are delayed one year from the probabilities in Table D-25 to appropriately calculate the annual damages that occur after the year of failure.

2/ Equal to the one-time loss multiplied by the annual unconditional probability of failure

3/ Equal to the annual loss multiplied by the cumulative probability of failure

4/ Equal to the sum of the expected losses in the year of failure and the expected annual losses after the failure year

D.2 Alternatives Considered During Formulation

This appendix section presents the alternatives considered in the formulation phase. During this phase, alternatives were evaluated based on meeting both National Environmental Policy Act (NEPA) and environmental review requirements specific to NRCS federal investments in water resources projects (PR&G). According to NEPA, Federal agencies shall include "a detailed statement by the responsible official on […] a reasonable range of alternatives to the proposed agency action, including an analysis of any negative environmental impacts of not implementing the proposed agency action in the case of a no action alternative, that are technically and economically feasible, and meet the purpose and need of the proposal." (42 U.S.C. 4331). According to the PR&G DM9500-013, alternatives should reflect a range of scales and management measures and be evaluated against the Federal Objective and Guiding Principles; against the extent to which they address the problems and opportunities identified in the purpose and need; and against the criteria of completeness, effectiveness, efficiency, and acceptability:

1. Completeness is the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others. It does not necessarily mean that alternative actions need to be large in scope or scale.
2. Effectiveness is the extent to which an alternative alleviates the specified problems and achieves the specified opportunities.
3. Efficiency is the extent to which an alternative alleviates the specified problems and realizes the specified opportunities at the least cost.
4. Acceptability is the viability and appropriateness of an alternative from the perspective of the Nation's general public and consistency with existing Federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency.

Alternatives eliminated during formulation are shown and discussed below. Alternatives selected for further evaluation are discussed in the Plan-EIS.

Table D-27. Alternatives Considered During the Formulation Phase and Criteria in PR&G Achieved.

Alternative	PR&G Criterion: Completeness	PR&G Criterion: Effectiveness	PR&G Criterion: Efficiency	PR&G Criterion: Acceptability	Selected for Further Evaluation
New Alignment	✓	✓	-	-	-
Reduced Pipe Size and Add Pumping	✓	✓	-	-	-
SCADA Only	-	-	-	✓	-
Limited Piping	-	-	✓	✓	-
Canal Lining	✓	-	-	✓	✓

Alternative	PR&G Criterion: Completeness	PR&G Criterion: Effectiveness	PR&G Criterion: Efficiency	PR&G Criterion: Acceptability	Selected for Further Evaluation
Piping the Entire Alignment	✓	✓	✓	✓	✓
Piping and Adding New Siphons	✓	✓	✓	✓	✓

D.2.1 New Alignment

This alternative evaluates a new alignment of the JSC from the start of the canal at the junction to the Bradshaw Drop, where the canal splits for RRVID and MID. A new alignment would require MID to obtain approximately 13 miles of new easements, which would be expensive. A new alignment would require a substantial increase in design engineering funding to determine the correct route that would be an improvement on the existing alignment and would still allow water to flow from the points of diversion to District patrons. A new alignment would also require extensive land use review due to the majority of the land surrounding the existing alignment being zoned Exclusive Farm Use. For these reasons, a new alignment alternative was not carried forward for analysis in the Plan-EIS.

D.2.2 Reduced Pipe Size and Add Pumping

This alternative evaluates a smaller pipe size augmented with pumping to deliver the required water to MID and RRVID patrons. The pipe would be installed within the existing canal easement and a new pumping station would be constructed at the junction. This alternative would decrease initial capital costs for pipe installation but these savings would be partially offset by the cost to construct the pumping station. In addition, MID would need to allot annual O&M funding for pumping station operation, including electrical utility costs. A new pumping station would also require extensive land use review due to the land surrounding the junction being zoned Exclusive Farm Use. For these reasons, this alternative was not carried forward for analysis in the Plan-EIS.

D.2.3 SCADA Only

This alternative evaluates the implementation of Supervisory Control and Data Acquisition (SCADA) instead of piping. Under this alternative, SCADA sites would be installed throughout the District. Sites would be located on existing turnouts and canals within the District. Installing SCADA would enhance water management within the District by providing the District the capability to collect data from various sensors and devices in the field, primarily from flow meters. This alternative would not meet the purpose and need for the project to address existing system water losses, inefficient water delivery, and the risk of infrastructure failure. For these reasons, this alternative was not carried forward for analysis in the Plan-EIS.

D.2.4 Limited Piping

This alternative evaluates only piping those segments of the JSC that have been at risk of failure or have required frequent maintenance. This alternative would decrease initial capital costs for pipe installation but these savings would be partially offset by the cost to construct multiple pressure reducing stations which would be required when transitioning from piped to open canal structures.

This alternative would not meet the purpose and need for the project to address existing system water losses, inefficient water delivery, and the risk of infrastructure failure for sections that were not piped. For these reasons, this alternative was not carried forward for analysis in the Plan-EIS.

D.2.5 Piping the Entire Alignment

This alternative evaluated the modernization of the existing open JSC within the project area with a closed pipeline system along the current JSC alignment. This alternative would meet the purpose and need for the project by addressing existing system water losses, alleviating inefficient water delivery, and reducing the risk of infrastructure failure. This alternative was carried forward for analysis in the Plan-EIS.

D.2.6 Piping and Adding New Siphons

This alternative evaluated the modernization of the existing open JSC within the project area with a closed pipeline system. Some of the segments of the project area could have new alignment options, primarily by adding more siphons to the system to reduce pipeline length and potentially reduce project capital construction costs. This alternative would require new easements for the new siphons, with their own costs, but these costs would be offset by shortening the overall pipe length. This alternative would meet the purpose and need for the project by addressing existing system water losses, alleviating inefficient water delivery, and reducing the risk of infrastructure failure. This alternative was carried forward for analysis in the Plan-EIS.

D.3 Capital Costs

D.3.1 Preferred Alternative Costs

This section presents capital costs for the Preferred Alternative. Costs shown differ from elsewhere in the Plan-EIS because they do not include project administration, technical assistance, and permitting costs.

A wide variety of materials are available for piping; availability of piping materials, prices, and new products change over time. Piping materials that could be used for the Preferred Alternative include, but are not limited to, polyvinyl chloride, steel, high-density polyethylene (HDPE), bar-wrapped concrete cylinder, fiberglass, and ductile iron. The Preferred Alternative was priced using HDPE pipe, which at the time of this analysis was considered to be the most effective material.

At the time of project implementation, the specific piping material would be selected based on a number of considerations: the cost of the project would meet NED requirements; meet construction requirements; be appropriate based on local conditions and risk factors; and result in minor or no changes to project effects described in Section 6 of the Plan-EIS, as determined through the tiered decision framework approach outlined in Section 1.4 of the Plan-EIS. The NRCS State Conservationist and the Sponsoring Local Organization would possess the final discretion to select the appropriate piping material.

Table D-28. Preferred Alternative Capital Costs.

Phase	Proposed Improvement	Quantity	Quantity units	Construction Cost	Engineering, Survey, and Construction Management	General Contractor Construction Management	Contingency	Total Cost
1	72 inch 10 psi Krah HDPE Installed in Existing Canal	9,280	ft	$4,523,200	$452,300	$633,200	$1,682,600	$7,291,400
1	Drainage Restoration	5,000	sq ft	$63,000	$6,300	$8,800	$23,400	$101,500
1	Inlet Structure	1	each	$90,000	$9,000	$12,600	$33,500	$145,100
1	Monitoring and Control	1	each	$44,700	$4,500	$6,300	$16,600	$72,000
1	Proposed Turnout with Stand Pipe	3	each	$90,000	$9,000	$12,600	$33,500	$145,100
1	Temporary Energy Dissipator	1	each	$100,000	$10,000	$14,000	$37,200	$161,200
1	East Bench Flume Reinforcement	1	each	$122,900	$12,300	$17,200	$45,700	$198,000
1	Grasshopper Siphon Land Acquisition	1	each	$28,100	$2,800	$3,900	$10,500	$45,300
1	Grasshopper 72 inch 20 psi Krah HDPE Installed with Excavation and Backfilling & Bore and Jacking in New Alignment	438	ft	$686,500	$68,600	$96,100	$255,400	$1,106,600
1	Grasshopper Siphon Maintenance Road	1	each	$32,500	$3,300	$4,600	$12,100	$52,400

Phase	Proposed Improvement	Quantity	Quantity units	Construction Cost	Engineering, Survey, and Construction Management	General Contractor Construction Management	Contingency	Total Cost
Phase 1 Total				**$5,780,900**	**$578,100**	**$809,300**	**$2,150,500**	**$9,318,600**
2	72 inch 10 psi Krah HDPE Installed in Existing Canal	1,670	ft	$814,000	$81,400	$114,000	$302,800	$1,312,200
2	72 inch 20 psi Krah HDPE Installed in Existing Canal	10,983	ft	$6,828,200	$682,800	$955,900	$2,540,100	$11,007,100
2	72 inch 30 psi Krah HDPE Installed in Existing Canal	4,547	ft	$3,571,600	$357,200	$500,000	$1,328,600	$5,757,400
2	Drainage Restoration	7,500	sq ft	$94,500	$9,400	$13,200	$35,100	$152,200
2	Proposed Turnout with Stand Pipe	5	each	$150,000	$15,000	$21,000	$55,800	$241,800
2	Stand Pipe	1	each	$15,000	$1,500	$2,100	$5,600	$24,200
2	Temporary Energy Dissipator	1	each	$100,000	$10,000	$14,000	$37,200	$161,200
2	Central Bench Flume Reinforcement	1	each	$126,000	$12,600	$17,600	$46,900	$203,200
2	Owens Siphon Land Acquisition	1	each	$36,700	$3,700	$5,100	$13,700	$59,200
2	Owens Gulch 72 inch 50 psi Krah HDPE Installed with Excavation and	574	ft	$798,000	$79,800	$111,700	$296,900	$1,286,400

Phase	Proposed Improvement	Quantity	Quantity units	Construction Cost	Engineering, Survey, and Construction Management	General Contractor Construction Management	Contingency	Total Cost
	Backfilling & Bore and Jacking in New Alignment							
2	Owens Siphon Maintenance Road	1	each	$32,500	$3,300	$4,600	$12,100	$52,400
Phase 2 Total				**$12,566,500**	**$1,256,700**	**$1,759,200**	**$4,674,800**	**$20,257,300**
3	72 inch 30 psi Krah HDPE Installed in Existing Canal	12,566	ft	$9,870,500	$987,100	$1,381,900	$3,671,800	$15,911,300
3	Drainage Restoration	69,772	sq ft	$878,600	$87,800	$123,000	$326,800	$1,416,300
3	Proposed Turnout with Stand Pipe	6	each	$180,000	$18,000	$25,200	$67,000	$290,200
3	Temporary Energy Dissipator	1	each	$100,000	$10,000	$14,000	$37,200	$161,200
3	Eagle Gulch Siphon Land Acquisition	1	each	$28,200	$2,800	$3,900	$10,500	$45,500
3	Eagle Gulch 72 inch 70 psi Krah HDPE Installed with Excavation and Backfilling & Bore and Jacking in New Alignment	1,004	ft	$1,573,400	$157,300	$220,300	$585,300	$2,536,300
3	Eagle Gulch Siphon Maintenance Road	1	each	$43,300	$4,300	$6,100	$16,100	$69,900

Phase	Proposed Improvement	Quantity	Quantity units	Construction Cost	Engineering, Survey, and Construction Management	General Contractor Construction Management	Contingency	Total Cost
Phase 3 Total				**$12,674,000**	**$1,267,300**	**$1,774,400**	**$4,714,700**	**$20,430,700**
4	72 inch 30 psi Krah HDPE Installed in Existing Canal	1,156	ft	$908,400	$90,800	$127,200	$337,900	$1,464,300
4	72 inch 40 psi Krah HDPE Installed in Existing Canal	16,845	ft	$16,123,500	$1,612,400	$2,257,300	$5,997,900	$25,991,100
4	72 inch PRV Station	1	each	$350,000	$35,000	$49,000	$130,200	$564,200
4	Monitoring and Control	1	each	$44,700	$4,500	$6,300	$16,600	$72,000
4	Proposed Turnout with Stand Pipe	9	each	$270,000	$27,000	$37,800	$100,400	$435,200
4	Outlet Structure	1	each	$90,000	$9,000	$12,600	$33,500	$145,100
Phase 4 Total				**$17,786,600**	**$1,778,700**	**$2,490,200**	**$6,616,500**	**$28,671,900**
5	South Fork Little Butte Creek Road Crossing	1	each	$50,000	$5,000	$7,000	$18,600	$80,600
5	Lake Creek 72 inch 30 psi Krah HDPE Installed with Excavation and Backfilling & Bore and Jacking in New Alignment & Existing Siphon Demolition	563	ft	$714,500	$71,500	$100,000	$265,800	$1,151,800

Phase	Proposed Improvement	Quantity	Quantity units	Construction Cost	Engineering, Survey, and Construction Management	General Contractor Construction Management	Contingency	Total Cost
5	Osborne Creek 72 inch 50 psi Krah HDPE Installed with Excavation and Backfilling & Bore and Jacking in New Alignment & Existing Siphon Demolition	1,094	ft	$1,561,700	$156,200	$218,600	$581,000	$2,517,500
5	Wyant 72 inch 30 psi Krah HDPE Installed with Excavation and Backfilling & Bore and Jacking in New Alignment & Existing Siphon Demolition	145	ft	$203,100	$20,300	$28,400	$75,500	$327,400
Phase 5 Total				**$2,529,300**	**$253,000**	**$354,000**	**$940,900**	**$4,077,300**
Grand Total				**$51,337,300**	**$5,133,800**	**$7,187,100**	**$19,097,400**	**$82,755,800**

D.4 Simplified Ecosystem Service Multi-Criteria Decision Analysis

Using a Simplified Ecosystem Service Multi-Criteria Decision Analysis to Better Capture the Value of Irrigation Infrastructure Modernization

D.4.1 Summary

Benefit-cost analysis, which incorporates the monetary value of ecosystem services, is a widely used approach by decisionmakers to evaluate the merits of federal investment in land and water resource projects. This framework offers a valuable decision tool, one that is effective in communicating the benefits that ecological goods and services provide to human well-being (Ferraro et al 2025; Olander et al 2015). More recently, however, a growing number of researchers are challenging the ecosystem service framework, suggesting that commodification of nature only reflects nature's value when it is viewed as providing a service or benefit to humans, and that the framework omits other values such as the meaningful relationships between people and nature and the value of nature independent of human benefit (Pascual et al., 2023; Ferraro et al 2025; IPBES 2022). To better capture and evaluate the previously omitted values that a federal investment may have, NRCS-Oregon is developing a Simplified Ecosystem Service Multi-Criteria Decision Analysis framework (PR&G Appendix B(3)). This analysis will act as a companion to the benefit-cost analysis already within the PL 83-566 Watershed Planning process and will more fully incorporate partner preferences and critical nonmonetary benefits into decision making.

D.4.2 Ecosystem Services in Policy

Ecosystem services are defined as the benefits people obtain from natural systems—grouped into provisioning services (e.g., food, water, fiber), regulating services (e.g., water purification, flood control, erosion prevention), cultural services (e.g., recreation, spiritual and aesthetic values), and supporting services (e.g., nutrient cycling, soil formation). Since the concept gained prominence in the late 1990s, the use of ecosystem services has offered a powerful political rationale for conservation investment by translating ecological value into economic terms that decisionmakers recognize. Olander et al. (2015) documented the federal embrace of ecosystem services to make causal connections between proposed actions and "outcomes valued by people," as an important step in embedding ecological considerations in agency planning processes where they have previously been absent.

NRCS formalized this approach in the National Watershed Program Manual (390-NWPM-501, Subpart D, 2024), which guides Watershed Project Plans to use ecosystem services to compare alternatives, conduct tradeoff analyses, and account for both monetized and nonmonetized benefits. This framework has meaningfully advanced NRCS's ability to demonstrate conservation value for more informed decision making, in particular for investments where ecosystem service benefits can be monetized.

D.4.3 Limitations of the Ecosystem Service Framework

D.4.3.1 Monetization Excludes Nonmonetizable Values

A limitation of the ecosystem services framework is its reliance on monetization as the primary measure of value. Placing a dollar figure on nature was championed as a way to make conservation easily accessible to decisionmakers, but many now argue that this strategy has not delivered the conservation outcomes its proponents hoped for (Lewton 2026). Researchers argue that putting ecosystem services into an anthropocentric, economic framework oversimplifies the complexity of ecological systems. They suggest that the approach favors services which are readily monetized but

excludes ecosystem processes and species for which direct economic value is difficult to assign (Ferraro et al., 2025). The result is that decisionmaker priorities may be skewed toward projects with market-valued services and away from projects that may be critical, but which lack demonstrable monetary value (Ferraro et al., 2025).

While current ecosystem service frameworks can capture the monetizable aspects of nature which contribute to human well-being (instrumental values), they struggle to capture relational values, those meaningful relationships between people and nature (Pascual et al., 2023; Ferraro et al., 2025; Kenter et al., 2025; IPBES 2022 and 2024). For rural communities whose identities, livelihoods, and social bonds are tied to working landscapes and shared water systems, relational values are often what motivate conservation action. However, due to the inherent limits in monetizing these values, projects that strongly support relational values risk not moving forward.

Capturing intrinsic value in ecosystem service frameworks, that of nature's value independent of human benefit, presents a similar challenge. Ecosystem services, by definition, position humans to receive benefits from nature. This perspective of servitude limits the ability of the ecosystem service framework to recognize ecosystems as complex and interdependent with value beyond what is derived by humans. If a project will restore aquatic habitat, for example, but there are few or no known federally listed species or species of concern, and no known species or ecosystem functions that provide a service to humans, the ecosystem service framework will likely assign little to no value to the habitat restoration aspect of the project. Yet the absence of a measurable human benefit does not diminish the ecological importance, or intrinsic value, of the habitat being restored and the species that interact with the habitat. Ferraro et al. (2025) caution that framing conservation exclusively in terms of human utility risks "exacerbating biodiversity loss by placing emphasis on short-term human benefits rather than long-term ecological resilience."

D.4.3.2 Rapid Changes in Project Costs and Monetized Ecosystem Service Benefits May Affect the Perceived Value of Projects

Project costs and ecosystem service benefits are both vulnerable to market volatility and political priorities, but not always in the same way. Construction costs generally respond sharply and immediately to market changes. For example, construction costs for irrigation infrastructure modernization projects have risen dramatically and rapidly in recent years due to supply chain disruptions, labor costs, and materials inflation. For these same projects, the change in monetary values for the ecosystem service benefits has generally been more temperate. This is expected because the methods used to calculate ecosystem service monetary values are typically derived from rigorous, peer-reviewed studies which, by their nature, reflect historical conditions. Geopolitical priorities, however, can rapidly influence the monetary value of an ecosystem service, as has occurred with the social cost of carbon and the associated monetary ecosystem benefit of carbon sequestration (e.g., Kerns et al., 2025). The result of this incongruity is that the monetized benefits of projects with well-documented community and ecological value may not exceed the project's cost. In the report Monetary Valuation of Ecosystem Services and Assets for Ecosystem Accounting (NCAVES and MAIA 2022), the authors identify that "…monetary values will not fully reflect the importance of ecosystems for people and the economy. Assessing the importance of ecosystems will therefore require consideration of a wide range of information beyond data on the monetary value of ecosystems and their services. This will include data on the biophysical characteristics of ecosystems, data on the characteristics of the people, businesses and communities that are dependent on them."

D.4.4 NRCS-Oregon's Simplified Ecosystem Service Multi-Criteria Decision Analysis (MCDA) Approach

The scientific community has moved toward incorporating frameworks that more fully recognize the extent of nature's value. Instrumental, relational, and intrinsic values are all legitimate and consequential dimensions of how communities relate to nature, but evaluating projects based on instrumental values alone may produce incomplete outcomes (Pascual et al., 2023; Lewton 2026).

In Oregon, irrigated agriculture touches all three of these values through simultaneously shaping water availability, agricultural viability, ecological connectivity, and community resilience. The state's annual $6.8 billion agricultural industry contributing to the generation of $42 billion annual economic impact is built on family-owned and operated farms. Of the more than 35,000 farms in the state, 96% are family-owned and operated and about 90% are under 500 acres. These small and mid-size farms contribute to one-third of the state's agricultural output, sustaining local economies and rural communities. The remaining 10% of farms are large. By producing two-thirds of the state's agricultural output, these large farms, and the large-scale production processes they support, Oregon-grown products help meet domestic and global food demands (Oregon State Board of Agriculture 2025).

While incorporating economic numbers into a benefit-cost analysis is relatively straightforward, incorporating the beliefs and value that Oregonians hold about agriculture and natural resources is more challenging. A 2023 state-wide survey by the Oregon Values and Beliefs Center found that 94% of Oregonians surveyed felt that small scale farms and locally grown food close to markets and customers were very or somewhat important. 95% of responders felt that protecting soil, water, and air quality was very important (Oregon Values and Beliefs Center 2023). Despite the high value Oregonians place on the agricultural industry and associated natural resources, irrigation infrastructure projects identified by communities and supported by experts often result in benefit-cost ratios below the threshold to merit federal investment. To address this gap, NRCS-Oregon is developing a simplified Multi-Criteria Decision Analysis (MCDA) for ecosystem services to better account for relational and intrinsic values. NRCS-OR anticipates that using this new framework will complement the benefit-cost analysis required under the PL 83-566 Watershed Planning process to form a more complete assessment of a project's value.

D.4.4.1 Scoring

The simplified Ecosystem Service MCDA evaluates project value across three categories: economic, environmental, and sociocultural through questions that create an opportunity for a Sponsoring Local Organization (SLO) to build a coherent, community-grounded account of why a project matters. Within each category, an SLO responds to structured questions aimed at identifying project values that may otherwise be difficult to incorporate, for example, the role of modernized irrigation system infrastructure in sustaining multigenerational family farms or the ecosystems that working landscapes support.

NRCS-OR will then review the responses, consider the watershed problems, opportunities, resource concerns, and project objectives and constraints, and assign a score to each question. Possible scores range from -7 to +7 points, reflecting the project's negative impact or positive benefit on the resource or value being addressed. A question with a score of -7 points reflects a project that is expected to have an extremely negative impact, 0 points reflects a project that has no benefit, and positive 7 points reflects a project expected to have an exceptional benefit. After each question has

been scored, NRCS will total the points in each category. NRCS will weight each category's total score to create a percentage and then combine those for a total project percentage.

Under the current framework, each category is given equal weight. When combined, if a project's total exceeds 51% of the points available, NRCS would determine that the project has demonstrated substantive benefits. Taken alongside the benefit-cost ratio quantitative analysis, the simplified Ecosystem Service MCDA would provide NRCS with a more comprehensive understanding of the project's value and an additional evaluation tool for NRCS when considering the merit of federal investment.

D.4.5 References

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D.4.6 Scoring Scale Used in Evaluation of Public Benefits

Each of the questions will be scored according to the scale described below.

Exceptional public benefit: +7 points

- The project is likely to achieve benefits of an exceptionally high standard or quality.
- The outcomes are very substantial and/or represent a key or critical advancement.
- The response includes supporting information and evidence describing the anticipated change in conditions as a result of the project.
- The response includes all necessary information to document a high likelihood of success in achieving the public benefit.

High public benefit: +5 points

- The project is likely to achieve public benefits meeting a high standard or quality.
- The outcomes represent an important advancement.
- The response includes supporting information and evidence describing the anticipated change in conditions as a result of the project.
- The response includes sufficient information to support the achievement of the anticipated public benefit.

Medium public benefit: +3 points

- The project is likely to achieve moderate public benefit.
- The outcomes are likely to achieve an improvement in conditions.
- The response includes supporting information and evidence describing the anticipated change in conditions as a result of the project.

Minor public benefit: +1 point

- The project may achieve minor public benefits.
- Supporting information or evidence may be limited or incomplete.

No benefit: 0 points

- The project is not likely to achieve a public benefit.
- The claims of public benefit are unsupported.
- No positive or negative impact related to the public benefit. No change.

Minor negative impact or detriment: -1 point

- The project may have a minor negative effect or impact in this category.
- Any negative outcomes are limited in scope or scale.

Medium negative impact or detriment: -3 points

- The project is likely to cause moderate harm and have a negative impact in this category.
- Negative outcomes are demonstrable and affect a defined group, area, or resource.

High negative impact or detriment: -5 points

- The project is likely to cause significant harm and have a substantial negative impact in this category.
- Negative outcomes are well-supported by evidence and affect a broader community, region, or resource.

Extreme negative impact or detriment: -7 points

- The project is likely to cause severe or irreversible harm in this category.

- Negative outcomes are very substantial and/or represent a critical deterioration in conditions.
- The response includes information and evidence documenting the anticipated negative change in conditions as a result of the project.

D.4.7 Public Benefit Questions and Guidance

This section provides an overview of the question format, how the NRCS review team will score the public benefits, and provides recommendations for how or what information should be included in the question response and Watershed Plan to facilitate public benefit scoring.

General guidance:

- The SLO is encouraged to use the responses to questions in each of the benefit categories to help build a community-grounded narrative for why a project matters. The questions are developed to provide an opportunity for the SLO to identify project values that may otherwise be difficult to monetize and incorporate in the National Economic Development (NED) benefit-cost analysis, for example, the role of modernized irrigation system infrastructure in sustaining multigenerational family farms or the ecosystems that working landscapes support.

- For questions that draw on specific metrics that may appear in the NED, for example, consider the metric, but develop the response to describe what the metrics may mean for the community or region. The purpose of this Simplified Ecosystem Service MCDA is to provide an opportunity for the responder to identify additional community, regional, or watershed context for the project.

- Where applicable, the responder should identify relevant sections in the Watershed Plan and Appendices where the topics discussed in the responses below can be found.

- Responders may reference responses to other questions if specific metrics or aspects from other responses apply.

- A word limit has not been defined; however, responders should strive to keep responses concise and refer to the Watershed Plan and Appendices, as applicable, to help maintain brevity.

- For some questions, the short-term effects of project implementation may be different than the long-term effects. For the purposes of this analysis, focus on the long-term effects, as short-term effects can often be mitigated unless there are special circumstances.

- For each question, the responder is encouraged to briefly summarize the applicable current conditions. Identifying the current conditions may allow the responder to better contextualize the project benefits and may allow NRCS to better assess the project's public benefit.

D.4.8 Questions and Answers

Economic Public Benefits

1. Does the project have an economic effect that is important to the community through job creation, job retention, or increased economic activity?

- Regional economic development benefits associated with increased agricultural production would support an estimated 150 agricultural jobs (direct, indirect, induced) through improved water reliability.
- Construction is expected to support approximately 320 jobs over the 4-year construction period.
- Generates ~$3.3 million/year in regional economic benefits through increased agricultural production and related activity.
- Supports increased agricultural production value, contributing to higher farm revenue and regional economic output.
- Maintains economic activity that would decline under No Action (e.g., crop loss, reduced yields, and lost production).
- Provides long-term support for the agricultural economy, sustaining production, sales, and farm revenue dependent on reliable irrigation.
- See Plan-EIS Sections 2.1, 6.5.2.1, Appendix D

2. Does the project result in increases in efficiency and/or innovation in the area?

- Converts open canal to a piped system (~11.5 miles), eliminating seepage losses and improving conveyance efficiency.
- Reduces water loss and improves delivery reliability and timing, increasing overall system performance.
- Decreases operations and maintenance needs and costs (e.g., reduced canal maintenance and seepage management).
- Improves drought resilience and water use efficiency, enabling more effective use of limited water supply.
- See Plan Sections 2.1, 5.3.2, 6.5, Appendix D

3. Compared to the baseline conditions, would the project result in Operations and Maintenance (O&M) effort savings?

- Reduces annual O&M costs by converting open canal to piped system, eliminating routine canal maintenance (e.g., vegetation control, sediment removal, seepage management).
- Avoids higher and uncertain future repair costs under No Action due to likely infrastructure failure
- O&M costs for the JSC will fall by 75 percent after the project, which is an annual savings of roughly $83,600.
- See Appendix D.3.2.1.1.2

4. Does the project result in enhancement of infrastructure, farmland, public resource lands, industrial lands, commercial lands, or lands having other key uses?

- Replaces aging, failure-prone canal and siphon infrastructure with ~11.5 miles of piped system, substantially improving reliability and functionality of irrigation infrastructure.
- Prevents potential infrastructure failure that would cut off water to ~4,800 acres and reduce supply to ~13,700 acres, protecting the viability of irrigated farmland.
- Enhances the reliability and value of agricultural lands by ensuring consistent irrigation water delivery.
- Supports the continued productive use and preservation of agricultural land by reducing water-supply and infrastructure-related risks.
- Improves overall condition and performance of the irrigation system, benefiting agricultural, rural residential, and associated land uses.
- See Plan-EIS Sections 5.3.2, 6.5, Appendix D

5. Does the project enhance economic value associated with tourism, recreation, fishing (recreational or commercial) or other?

- Project improves instream flows, water quality, and aquatic habitat, which supports fish populations and enhances recreational fishing opportunities
- Healthier stream conditions provide indirect benefits to nature-based recreation (e.g., fishing, wildlife viewing)
- Quantified instream flow value (~$97,000 annually) indicates measurable but modest economic contribution tied to ecosystem improvements
- References: Plan-EIS Sections 4.12, 4.13, 6.12, 6.13

6. Does the project result in increases in agricultural-related economic value or productivity of farmland?

- Project increases water supply reliability and reduces shortages, enabling more consistent irrigation across farmland
- Reduction in average annual delivery shortages (~10,200 acre-feet) supports increased crop production and reduced fallowing
- Improved water availability directly increases crop yields and quality, particularly for pasture and alfalfa production
- Project prevents crop losses and enables full or extended irrigation seasons compared to curtailed baseline conditions
- Benefits are direct, measurable, and substantial across a large acreage (~21,000 irrigated acres served by the system)
- References: Plan-EIS Sections 2.1, 4.12; Appendix D Sections D.2, D.6

Environmental Public Benefits (Biophysical)

7. Does the project improve degraded land, reduce processes that drive land degradation or desertification, and/or support soil health?

- Existing conditions include inefficient open canal conveyance with seepage, operational spills, and periodic failures, contributing to excess water application in some areas and water shortages in others, which can stress soils and reduce productivity
- Persistent drought and unreliable irrigation supplies have led to fallowing, reduced crop vigor, and risk of long-term soil degradation due to inconsistent moisture availability
- Project improves water delivery efficiency and reliability, enabling more consistent and controlled irrigation, which supports soil moisture balance and reduces stress on agricultural soils
- Without the project, continued infrastructure deterioration and water shortages would likely exacerbate soil degradation risks, including reduced productivity and increased erosion in drought conditions
- References: Plan-EIS Sections 2.1, 4.8, 4.12, 6.8, 6.12

8. Does the project result in an improvement to surface water quantity?

- The open Joint System Canal loses 5,057 acre-feet of water per year due to seepage, evaporation, operational spills, and aging infrastructure inefficiencies
- To compensate for these losses, additional water must be diverted from Little Butte Creek, contributing to reduced instream flows, elevated stream temperatures, and degraded aquatic habitat conditions
- Project modernization would restore 1,264 acre-feet per year in South Fork Little Butte Creek during August September. This represent an estimated 106% increase in streamflow during these months.
- The project would also improve hydrologic conditions within approximately 20 affected waterbodies and restore more natural flow conditions in previously disrupted drainages and tributaries
- Benefits occur at the watershed scale and provide substantial long-term improvements to surface water quantity and ecological function, particularly during drought and low-flow periods
- References: Plan-EIS Sections 2.1, 2.2.2, 4.12, 4.13, 6.12.2, 6.13.2; Water Resources Technical Report Sections 6.1, 7.1.2, 7.5; Fish and Aquatic Resources Technical Report Section 7.1.2

9. Does the project result in an improvement to surface water quality?

- Existing conditions in the Little Butte Creek watershed include impaired surface water quality associated with elevated temperatures, sedimentation, turbidity, phosphorus, low dissolved oxygen, E. coli, and flow modification
- Open canal operations contribute to water quality degradation through seepage, incidental headgate releases, operational spills, and delivery inefficiencies that alter natural hydrology and increase thermal loading in connected streams

- Eliminating canal seepage and incidental releases would reduce sources of turbidity and thermal pollution that can cause physiological stress and habitat degradation for fish and aquatic species
- Increased instream flows in South Fork Little Butte Creek, including an estimated 106% increase in August and September, would improve temperature regulation, dissolved oxygen concentrations, and overall aquatic habitat quality during critical seasonal conditions
- Benefits occur across approximately 20 affected waterbodies and represent long-term improvements to watershed water quality conditions and aquatic ecosystem function, including benefits to temperature, flow modification, dissolved oxygen, sedimentation, and phosphorus within affected waterbodies
- References: Plan-EIS Sections 4.12, 4.13, 6.12.2, 6.13.2; Water Resources Technical Report Sections 5.3.3, 6.1, 7.1.2, 7.5; Fish and Aquatic Resources Technical Report Section 7.1.2

10. Does the project result in an improvement to groundwater quantity?

- Major contributors to alluvial aquifer recharge in the area include surface water from rivers, reservoirs, lakes, irrigation, and canal seepage
- Piping the JSC would result in the alluvial aquifer within the groundwater study area losing approximately 3,793 AF/year of water input. Given other sources of alluvial aquifer recharge, the 3,793 AF/year of water input from the JSC into the alluvial aquifer is a relatively minor contribution to the groundwater system and is not anticipated to have a significant effect on groundwater levels.
- Approximately 1,264 AF/year of water would remain in North Fork Little Butte Creek and South Fork Little Butte Creek where it could enter the alluvial aquifer via infiltration.
- The project would improve long-term drought resilience and water management reliability within the watershed, helping reduce pressure on both surface water and groundwater resources during dry conditions
- References: Plan-EIS Sections 4.12, 6.12.2, 6.17.2; Water Resources Technical Report Sections 5.3, 6.1, 7.1.2, 7.5

11. Does the project result in an improvement to groundwater quality?

- Existing groundwater quality conditions in the project area are not identified as substantially impaired
- Project modernization would pipe approximately 11.5 miles of canal, substantially reducing uncontrolled seepage, operational spills, and incidental discharges that contribute to pollutant transport and degraded water quality conditions
- Reduced seepage and improved water management would likely reduce localized infiltration of sediment, nutrients, and contaminants into shallow groundwater adjacent to the canal corridor.
- No measurable groundwater-quality improvement is identified.
- References: Plan-EIS Sections 4.12, 6.12.2, 6.17.2; Water Resources Technical Report Sections 5.3.3, 6.1, 7.1.2, 7.5; Fish and Aquatic Resources Technical Report Section 7.1.2

12. Does the project improve habitat for species?

- Existing habitat conditions within the Little Butte Creek watershed are constrained by low late-season streamflows, elevated water temperatures, degraded water quality, disrupted hydrologic connectivity, and altered flow regimes associated with irrigation diversions and canal infrastructure
- Low flows in South Fork Little Butte Creek during critical summer months currently limit habitat availability, migration access, and water quality conditions for ESA-listed Southern Oregon/Northern California Coast coho salmon and other cold-water fish species
- Conserved water would increase streamflows in South Fork Little Butte Creek by an average 106% in August and September, substantially improving habitat availability during the most ecologically limiting period of the year
- Increased streamflows and reduced thermal pollution would improve water temperature regulation, dissolved oxygen concentrations, migration conditions, and habitat suitability for salmonids and other aquatic species
- The project would reconnect 13 streams and drainages previously intercepted by the canal system, restoring more natural flooding frequency, hydrologic connectivity, riparian processes, and aquatic habitat function
- Habitat benefits occur across multiple waterbodies and aquatic systems within the watershed and provide substantial long-term improvements for aquatic species and riparian ecological function
- References: Plan-EIS Sections 4.13, 6.13.2, 6.14.2, 6.15.2; Fish and Aquatic Resources Technical Report Sections 5, 7.1.2, 7.5; Water Resources Technical Report Sections 6.1, 7.1.2, 7.5

13. Does the project provide energy benefits?

- Project modernization would pipe approximately 11.5 miles of canal, substantially improving conveyance efficiency and reducing operational water losses
- Improved delivery efficiency reduces the amount of water that must be diverted, transported, and managed throughout the system, indirectly reducing operational energy demand associated with water management activities
- Reduced water losses and improved water management efficiency also provide secondary ecological co-benefits through improved instream flows, reduced diversion pressure, and increased drought resilience
- References: Plan-EIS Sections 2.1, 4.12, 6.12.2, 6.17.2, 8.1

14. Does the project result in an improvement to air quality?

- Existing air quality conditions in the project area are generally in attainment for criteria pollutants; however, agricultural operations, exposed canal corridors, vehicle traffic, and drought-related soil conditions can contribute to localized dust and particulate emissions
- Short-term construction activities would temporarily increase dust, equipment exhaust, and construction-related emissions; however, these impacts would be minimized through implementation of erosion control and construction BMPs
- No long-term air quality impacts are anticipated.
- References: Plan-EIS Sections 4.4, 6.4

15. Does the project improve the ability of ecosystems to maintain their function during climatic variability?

- Existing ecosystem conditions within the Little Butte Creek watershed are increasingly vulnerable to drought, reduced snowpack, elevated stream temperatures, reduced late-season flows, and increasing competition between agricultural and ecological water demands
- Conserved water and reduced diversion demand would improve instream flow conditions during critical drought periods, including an estimated 106% increase in South Fork Little Butte Creek streamflow during August and September
- Increased streamflows and improved hydrologic conditions would improve temperature regulation, dissolved oxygen levels, aquatic habitat availability, and ecological resilience for ESA-listed salmonids and other aquatic species during climate-related stress periods
- Without the project, continued infrastructure deterioration, inefficient conveyance losses, and increasing drought stress would likely worsen ecological vulnerability and habitat degradation throughout the watershed
- References: Plan-EIS Sections 4.12, 4.13, 4.16, 6.12.2, 6.13.2, 6.16.2; Water Resources Technical Report Sections 5.3, 6.1, 7.1.2, 7.5; Fish and Aquatic Resources Technical Report Section 7.1.2

16. Does the project result in improvements that address one or more limiting ecological factors in the project watershed?

- Existing ecological conditions within the Little Butte Creek watershed are constrained by several interacting limiting factors, including low late-season streamflows, elevated stream temperatures, degraded water quality, altered hydrology, and reduced habitat connectivity associated with irrigation diversions and aging canal infrastructure
- Low summer flows and elevated temperatures in South Fork Little Butte Creek are identified as major limiting factors for ESA-listed Southern Oregon/Northern California Coast coho salmon and other cold-water aquatic species
- Conserved water would improve instream flows during critical low-flow periods, including an estimated 106% increase in South Fork Little Butte Creek streamflow during August and September, directly addressing one of the primary ecological limiting factors in the watershed
- Increased flows and improved hydrologic conditions would improve water temperature regulation, dissolved oxygen levels, aquatic habitat availability, fish passage conditions, and overall habitat quality for salmonids and other aquatic species
- References: Plan-EIS Sections 4.12, 4.13, 6.12.2, 6.13.2, 6.14.2; Water Resources Technical Report Sections 6.1, 7.1.2, 7.5; Fish and Aquatic Resources Technical Report Sections 5, 7.1.2

17. Does the project support crop diversity?

- Existing agricultural production within the MID service area is constrained by water delivery inefficiencies, seasonal shortages, and unreliable irrigation associated with aging open canal infrastructure

- Improved water delivery consistency and reduced shortages could provide growers with greater flexibility to maintain or expand cultivation of higher-value and potentially more diverse crop types beyond drought-tolerant or lower-risk forage crops
- More reliable irrigation supplies could also support sustained vegetative cover and improved soil conditions that can benefit broader agroecosystem functions, including pollinator habitat and soil productivity
- References: Plan-EIS Sections 2.1, 4.12, 6.12.2, 6.17.2; Appendix D (agricultural production and water shortage analysis); Land Use Technical Report Section 5; Water Resources Technical Report Sections 6.1, 7.1.2

Socio-Cultural Public Benefits

18. Does the project support public health and/or public safety?

- Existing conditions include aging open canal infrastructure with seepage, operational inefficiencies, and risk of canal failures that can threaten nearby properties, water delivery reliability, and public safety
- Project modernization would pipe approximately 11.5 miles of canal, substantially reducing the risk of canal failures, operational spills, erosion, and uncontrolled water releases affecting nearby communities and agricultural operations
- Installation of fire standpipes along the piped canal system would improve emergency water access and wildfire response capability for local fire protection districts and surrounding rural communities
- Improved water management and increased instream flows would also improve watershed resilience and water quality conditions during drought and climate-related stress periods
- References: Plan-EIS Sections 4.3, 4.12, 4.13, 4.17, 6.3.2, 6.12.2, 6.13.2, 6.17.2, 8.1; Water Resources Technical Report Sections 5.3.3, 6.1, 7.1.2, 7.5; Fish and Aquatic Resources Technical Report Section 7.1.2

19. Does the project support local food systems and the vitality of the local communities?

- The MID service area supports a long-established agricultural community that depends on reliable irrigation water for crop production, local agricultural economies, and associated community livelihoods
- Existing water delivery inefficiencies, drought conditions, and infrastructure reliability concerns create risks to long-term agricultural productivity and the economic stability of local farming operations
- Project modernization would improve irrigation reliability and reduce conveyance losses, helping sustain agricultural production across approximately 21,000 irrigated acres and supporting the long-term viability of local producers
- Improved water reliability and drought resilience would help maintain local agricultural output, reduce crop losses, support farm-related employment, and strengthen the resilience of the regional agricultural economy and food system

- References: Plan-EIS Sections 2.1, 6.12.2, 6.17.2, 8.1; Appendix D (agricultural production and regional economic impacts); Land Use Technical Report Section 5; Water Resources Technical Report Sections 6.1, 7.1.2

20. Does the project support the intrinsic value or inherent worth of something independent of human benefit?

- The project includes ecological restoration and habitat improvement objectives that recognize the importance of aquatic ecosystems, riparian systems, and native species beyond solely agricultural or economic benefits
- Project design would improve habitat conditions for ESA-listed Southern Oregon/Northern California Coast coho salmon and other native aquatic species through increased instream flows, improved water quality, restored hydrologic connectivity, and enhanced ecological function
- The project includes avoidance, minimization, restoration, and mitigation measures intended to reduce harm to wetlands, riparian systems, aquatic habitats, and sensitive species during and after construction
- Long-term project outcomes are expected to reduce ecological stressors such as low streamflows, elevated temperatures, disrupted connectivity, and degraded habitat conditions that currently impair watershed ecological integrity
- References: Plan-EIS Sections 4.13, 4.14, 4.15, 6.13.2, 6.14.2, 6.15.2, 8.1, Fish and Aquatic Resources Technical Report Sections 5, 7.1.2, 7.5; Water Resources Technical Report Sections 6.1, 7.1.2, 7.5

21. Does the project result in improvements in conditions for underrepresented or underserved communities?

- The project area includes rural agricultural communities that depend on reliable irrigation infrastructure and are vulnerable to drought, water shortages, infrastructure failures, and economic stress associated with declining agricultural productivity
- Project modernization would improve irrigation reliability, drought resilience, and long-term agricultural viability for local landowners, producers, and agricultural workers within the MID service area
- Public outreach and engagement were conducted throughout project development, including public meetings, agency coordination, solicitation of scoping comments, and ongoing community engagement regarding ecological, agricultural, and infrastructure concerns
- References: Plan-EIS Sections 3, 7, 8.1; Table 3-1; Appendix D (regional economic impacts); Land Use Technical Report; Water Resources Technical Report

22. Does the project support identity, livelihood, or sense of place values of people or communities in the area?

- The Little Butte Creek watershed and surrounding JSC corridor support long-established rural agricultural communities whose livelihoods, local identity, and sense of place are closely tied to irrigated farming, ranching, and working landscapes

- Reliable irrigation water supplied through the MID system is foundational to continued agricultural production, local economic stability, and the long-term viability of family farms and agricultural operations within the region
- Project modernization would improve irrigation reliability, drought resilience, and long-term water security, helping sustain agricultural livelihoods and reduce risks to farming operations associated with aging infrastructure and water shortages
- Improved water management and ecological conditions would also support restoration of aquatic habitats and streamflows within Little Butte Creek, helping sustain community values associated with healthy waterways, fisheries, and watershed stewardship
- References: Plan-EIS Sections 3, 4.16, 6.16.2, 8.1; Cultural Resources Technical Report; Land Use Technical Report;

23. Does the project support state or local priorities?

- The project would support the goals and objectives of several existing plans, including the SONCC Coho Salmon Recovery Plan, Little Butte Creek Watershed Analysis, Rogue River Basin Total Maximum Daily Load and Water Quality Management Plan, Jackson County Comprehensive Plan, Jackson County Community Wildfire Protection Plan, and Oregon Integrated Water Resources Strategy.
- The project would support these plans by improving irrigation water efficiency and reliability, increasing instream flows, improving water quality and aquatic habitat, restoring natural stream and riparian connectivity, and increasing access to water for wildfire response.
- The project directly supports recovery priorities for ESA-listed Southern Oregon/Northern California Coast coho salmon through improved late-season streamflows, improved water quality, restored hydrologic connectivity, and enhanced aquatic habitat conditions within South Fork Little Butte Creek and connected tributaries
- The project also supports collaborative basin planning and regional watershed restoration priorities focused on balancing agricultural water use with ecological restoration and improved watershed resilience
- References: Plan-EIS Sections 1.3, 1.4, 2.1, 3, 4.12, 4.13, 6.12.2, 6.13.2, 8.1; Water Resources Technical Report Sections 6.1, 7.1.2, 7.5; Fish and Aquatic Resources Technical Report Sections 5, 7.1.2, 7.5

24. Does the project support recreation and/or scenic values?

- Current low streamflows, degraded aquatic habitat, elevated water temperatures, and impaired water quality limit recreational fishing opportunities and reduce ecological and scenic quality within portions of the watershed
- Project modernization would improve instream flows, water quality, aquatic habitat conditions, and watershed ecological function, supporting improved recreational fishing opportunities and healthier stream environments within South Fork Little Butte Creek and connected waterways

- Increased streamflows during critical low-flow periods, including an estimated 106% increase in South Fork Little Butte Creek streamflow during August and September, would improve aquatic habitat conditions important for fish populations and nature-based recreation
- No substantive recreation or scenic benefit was identified
- References: Plan-EIS Sections 4.12, 4.13, 4.16, 6.12.2, 6.13.2, 6.16.2; Fish and Aquatic Resources Technical Report Sections 5, 7.1.2; Water Resources Technical Report Sections 6.1, 7.1.2

25. Does the project support traditional cultural places, sacred areas, or archaeologically sensitive sites?

- The Joint System Canal is a contributing feature to the NRHP-eligible Rogue River Basin Project Linear District, recognizing its historical significance within the regional irrigation system and cultural landscape
- Project modernization would pipe and alter portions of the historic open canal system, resulting in adverse effects to historic character-defining features and integrity of the historic irrigation landscape
- Adverse effects to historic properties would be addressed through mitigation measures developed through the NHPA Section 106 consultation process.
- References: Plan-EIS Sections 4.1, 6.1; Cultural Resources Technical Report; Appendix C (consultation and coordination); Appendix E

D.4.9 Scoring Table

Benefit Category	Question Number	Scoring Questions and Summary	Preliminary Score	NRCS Final Score
Economic	1	Does the project have an economic effect that is important to the community through job creation, job retention, or increased economic activity?	5	5
Economic	2	Does the project result in increases in efficiency and/or innovation in the area?	7	7
Economic	3	Compared to the baseline conditions, would the project result in Operations and Maintenance (O&M) effort savings?	7	7
Economic	4	Does the project result in enhancement of infrastructure, farmland, public resource lands, industrial lands, commercial lands, or lands having other key uses?	7	5
Economic	5	Does the project result in enhancement of the economic value associated with tourism, recreation, fishing (recreational or commercial), or other?	3	3
Economic	6	Does the project result in increases in agricultural-related economic value or productivity of farmland?	10	7
		Total Economic Score		**34**
Environmental	7	Does the project improve degraded land, reduce processes that drive land degradation or desertification, and/or support soil health?	3	3
Environmental	8	Does the project result in an improvement to surface water quantity?	7	7
Environmental	9	Does the project result in an improvement to surface water quality?	7	7
Environmental	10	Does the project result in an improvement to groundwater quantity?	-1	0
Environmental	11	Does the project result in an improvement to groundwater quality?	0	0
Environmental	12	Does the project improve habitat for species?	7	5

Benefit Category	Question Number	Scoring Questions and Summary	Preliminary Score	NRCS Final Score
Environmental	13	Does the project provide energy benefits?	1	3
Environmental	14	Does the project result in an improvement to air quality?	0	0
Environmental	15	Does the project improve the ability of ecosystems to maintain their function during climatic variability?	7	7
Environmental	16	Does the project result in improvements that address one or more limiting ecological factors in the project watershed?	7	7
Environmental	17	Does the project support crop diversity?	3	3
		Total Environmental Score		**42**
Socio-cultural	18	Does the project support public health and/or public safety?	5	3
Socio-cultural	19	Does the project support local food systems and the vitality of the local communities?	5	5
Socio-cultural	20	Does the project support the intrinsic value or inherent worth of something independent of human benefit?	5	5
Socio-cultural	21	Does the project result in improvements in conditions for underrepresented or underserved communities?	3	3
Socio-cultural	22	Does the project support identity, livelihood, or sense of place values of people or communities in the area?	5	5
Socio-cultural	23	Does the project support state or local priorities?	7	7
Socio-cultural	24	Does the project support recreation and/or scenic values?	3	0
Socio-cultural	25	Does the project support traditional cultural places, sacred areas, or archaeologically sensitive sites?	-1	0

Benefit Category	Question Number	Scoring Questions and Summary	Preliminary Score	NRCS Final Score
		Total Socio-cultural Score		**28**
		Total MCDA Score		**104**
		Total MCDA Points Available		**175**
		Overall Percentage Score		**59%**

D.4.10 Detailed Guidance and Scoring Criteria Simplified Ecosystem Service MCDA Questions

D.4.10.1 Category: Economic Public Benefits

Question 1: Does the project have an economic effect that is important to the community through job creation, job retention, or increased economic activity?

Economic effects include job impacts and broader economic activity associated with goods and services. When evaluating economic effects, consider values the project generates, including those that cannot be easily monetized or captured through conventional market-based indicators. Job creation means the project would result in new jobs, while retention means the project would prevent the loss of existing jobs. Include direct (project) and indirect (supply chain/support) effects. Note any ripple effects in the local, regional, or national economy. Specify if jobs are temporary or permanent (permanent are weighted more).

Increased economic activity includes growth in production, sales, or revenue post-project. Also consider new firms, contracts, or orders that may be possible because of the project. Include broader benefits e.g., food/water security, avoided costs, and support for agricultural systems and community livelihoods. Consider both direct and indirect economic impacts.

Tip*: Briefly summarize the applicable current conditions to contextualize the benefit(s). This will help NRCS appropriately evaluate the project's benefit(s). In the Watershed Plan, if applicable, quantify and describe jobs created/retained, and reference supporting economic plans or activities. In this response, indicate the location in the Watershed Plan location where these details are identified, but focus on what the jobs or increase in economic activity mean to the community and local, regional, and/or national economy. Note potential decline without the project (if applicable).*

Exceptional: 7 pts	Exceptional or critical economic benefit to the community or region. Jobs are permanent and substantial, and/or economic activity increases significantly across multiple sectors with broad direct and indirect effects. Strong supporting evidence demonstrates a high likelihood of success.
High: 5 pts	High economic benefit to the community or region. Jobs are largely permanent, and/or economic activity increases across one or more businesses or sectors with meaningful direct and indirect effects. Supporting evidence is provided.
Medium: 3 pts	Moderate economic benefit. Jobs or economic activity is limited in scale or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor economic benefits. Jobs created may be few or temporary, and economic activity increases are limited. Supporting evidence is limited.
No benefit: 0 pts	The project is not likely to create jobs or increase economic activity, or claims are unsupported.
Minor detriment: -1 pt	Minor detrimental economic effects may occur (e.g., minor job losses or reduced economic activity with limited scope or duration).
Medium detriment: -3 pts	Moderately detrimental economic effect (e.g., moderate job losses, reduced economic activity, or supply chain disruption).
High detriment: -5 pts	Substantial and wide-reaching economic harm is expected (e.g., high job losses, major economic activity reduction, or disruption to agricultural systems or community livelihoods), with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible economic harm is expected (e.g., critical job losses, sector collapse, or long-term livelihood damage).

Question 2: Does the project result in increases in efficiency and/or innovation in the area?

Increase in efficiency means the project would make improvements in performance or functionality resulting in less effort or waste. Increase in innovation means that new, creative solutions and ideas would be implemented. Examples of increases in efficiency and innovation include water system efficiencies such as system redundancy (back-up, inter-ties), eliminating leakage, water flow monitoring systems (e.g., SCADA), recycled water, hydro production, innovative production techniques, energy savings (e.g., the energy required to move, treat, or heat water), and/or time savings.

Tip*: Briefly summarize the applicable current conditions to contextualize project benefit(s). Consider the project not only in terms of on-site operational improvements, but also in the broader area context, such as how the efficiency or innovation gains may benefit neighboring water users, regional infrastructure networks, or the wider agricultural community. Indicate the location(s) in the Watershed Plan where supporting details about efficiency gains or innovative practices implemented are located. In this response, focus on what the improvements mean for the district, watershed, or region. Note potential decline in system performance without the project, if applicable.*

Exceptional: 7 pts	Exceptional or transformative increases in efficiency and/or innovation at a district, watershed, or regional scale. Improvements are extensive, long-term, and well-documented. Strong supporting evidence demonstrates a high likelihood of success and wide-reaching benefit.
High: 5 pts	Increases in efficiency or innovation are highly likely and well-supported. The magnitude, scale, or certainty of improvement are considerable. Meaningful benefits may extend beyond the immediate project area.
Medium: 3 pts	Moderate increases in efficiency or innovation. Benefits may be localized, incremental, or focused on specific components of the system. Improvements are real but limited in scope, scale, or certainty.
Minor: 1 pt	Minor increases in efficiency or innovation. Benefits are real but minimal in scale or impact. Supporting evidence is limited.
No benefit: 0 pts	No expected increase in efficiency or innovation. Evidence is insufficient or claims unsupported. System performance, resource use, or operational practices remain unchanged.
Minor detriment: -1 pt	A minor reduction in efficiency or innovation may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	A moderate reduction in efficiency or innovation is expected. Effects are meaningful, may affect multiple system components or users, and may warrant concern.
High detriment: -5 pts	Significant reductions in efficiency or innovation may occur with wide-reaching effects on system performance or operational capacity.
Extreme detriment: -7 pts	The project is likely to cause severe or irreversible reductions in efficiency or innovation, including potential collapse of system functionality or long-term degradation of infrastructure performance.

Question 3: Compared to the baseline conditions, would the project result in Operations and Maintenance (O&M) effort savings?

Avoided O&M efforts are defined here as O&M expenses or time saved by implementing a project compared to the baseline conditions. Examples of O&M savings may include avoiding the time and cost of replacing or repairing infrastructure by a project sponsor or their patrons, reduced regulatory compliance costs, reduced labor hours, or reduced cost of herbicide or insecticide application.

Tip: *Briefly summarize the applicable current conditions to contextualize project benefit(s). When describing saved O&M effort, consider discussing if the savings is a large or small portion of the sponsor's overall budget and contextualize how these savings would affect the irrigation community. For example, if installing SLO infrastructure would save producers 20 hours of work a month, how would those producers use their extra time and what would that mean for the community? If saved effort is monetized and captured in the National Economic Development analysis, please briefly summarize the savings so that NRCS can complete a review based on the response information.*

Exceptional: 7 pts	Exceptional or critical reduction in annual O&M costs or effort. Savings are well-documented, may affect a considerable portion of the sponsor's overall O&M budget, and/or have meaningful positive effects on the irrigation community. Strong supporting evidence demonstrates a high likelihood of sustained savings.
High: 5 pts	Major reduction in annual O&M costs or effort. Savings are notable and well-supported, with meaningful benefits to the sponsor and/or patrons. Supporting evidence is provided.
Medium: 3 pts	Moderate reduction in annual O&M costs or effort. Savings may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor reduction in annual O&M costs or effort. Benefits are real but minimal. Supporting evidence may be limited.
No benefit: 0 pts	The project is not likely to result in avoidance of O&M costs or effort for the project sponsor(s) or patrons, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor increase in annual O&M costs or effort may occur, likely in the short term. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate increase in annual O&M costs or effort over the long term. Effects are meaningful and may affect the sponsor's operational capacity or patron burden.
High detriment: -5 pts	Substantial and sustained increase in O&M costs or effort is expected, placing considerable strain on the sponsor's budget or operations, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible increase in O&M costs or effort is likely, potentially threatening the financial viability of the sponsor or long-term operability of the system.

Question 4: Does the project result in enhancement of infrastructure, farmland, public resource lands, industrial lands, commercial lands, or lands having other key uses?

Enhancement of infrastructure, including municipal infrastructure, farmland, public resource lands, industrial lands, commercial lands, and other lands means that the value, effectiveness, or reliability of such infrastructure or lands would increase as a result of project implementation. This may include an increase in the re-sale or rental value of the land or improvements. Example projects may result in maintained, repaired, or upgraded infrastructure; maintained or buffered riparian areas; and maintained or improved soils.

Tip: *The Farmland Protection Policy Act (FPPA) aims to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses. Identify if the project supports FPPA's aims by enhancing farmland, which includes prime farmland, unique farmland, and land of statewide or local importance, or by reducing the potential conversion of farmland to nonagricultural use. Farmland does not have to be currently used for cropland; farmland can be forest land, pastureland, cropland, or other land, but not water or urban built-up land. Summarize the applicable current conditions to contextualize project benefit(s).*

Exceptional: 10 pts	Exceptional or critical enhancement of infrastructure or land. Improvements are extensive, well-documented, and have meaningful positive effects on the community or region. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial enhancement of infrastructure or land. Improvements are notable and well-supported, with meaningful benefits to the sponsor, patrons, or broader community. Supporting evidence is provided.
Medium: 3 pts	Moderate enhancement of infrastructure or land. Improvements may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor enhancement of infrastructure or land. Benefits are real but minimal. Supporting evidence is limited.
No benefit: 0 pts	Enhancements are not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor degradation of infrastructure or land, or minor removal from productive use may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate degradation of infrastructure or land, or removal from productive use is likely. Effects are meaningful and may warrant concern.
High detriment: -5 pts	Substantial degradation of infrastructure or land is expected, with significant removal from productive use and wide-reaching effects, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible degradation of infrastructure or land is likely, including potential permanent loss of farmland, critical infrastructure, or productive lands.

Question 5: Does the project result in enhancement of the economic value associated with tourism, recreation, fishing (recreational or commercial), or other?

Enhancement of the economic value associated with tourism, recreation, and fishing (recreational or commercial) means that the attractiveness, accessibility, or productivity of these activities would increase because of project implementation. Examples include increases in daily park fees, tour guide revenues, boat or gear rentals, fishing licenses, or hospitality and lodging revenue. Also consider broader indirect effects, such as increased visitor spending in local businesses, growth in outfitter or guide services, and improvements to fisheries that support recreational or commercial harvests. Projects that restore or improve water quantity, quality, or timing may enhance downstream recreational and commercial opportunities even if those effects occur beyond the immediate project boundary.

Tip: *Briefly summarize the applicable current conditions to contextualize the benefit(s). Consider both direct economic effects (e.g., fishing license revenue, lodging stays) and indirect effects (e.g., local spending by visitors, supply chain support for outfitters). Identify the locations where these effects are described in detail in the Watershed Plan and summarize in this response. Focus on considering the project in the broader regional context, for example, how improvements to irrigation infrastructure may affect streamflow timing or water temperatures in ways that benefit or detract from recreational and commercial fishing opportunities. Note potential decline in tourism, recreation, or fishing activity without the project, if applicable.*

Exceptional: 10 pts	Exceptional enhancement of the economic value of tourism, recreation, or fishing. Benefits are well-documented, extend across multiple sectors or user groups, and have meaningful positive effects on the local or regional economy. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial enhancement. Benefits are notable and well-supported by evidence, with meaningful effects on the community or region.
Medium: 3 pts	Moderate enhancement. Benefits may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor enhancement. Benefits are real but minimal. Supporting evidence is limited.
No benefit: 0 pts	Enhanced values are not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in the economic value of tourism, recreation, or fishing may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in economic value is likely. Effects are meaningful and may warrant concern.
High detriment: -5 pts	Substantial decrease in economic value is expected, with wide-reaching effects on the local or regional economy, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in the economic value is expected. This may include the potential collapse of fisheries or long-term loss of recreation-dependent livelihoods.

Question 6: Does the project result in increases in agricultural-related economic value or productivity of farmland?

Farmland relates to areas of prime farmland, unique farmland, and land of statewide or local importance, which may include irrigated agricultural lands, non-irrigated agricultural lands, or other productive lands. For example, farmland can be forest land, pastureland, cropland, or other land, but not water or urban built-up land.

Increases in agricultural economic value or farmland productivity can be direct (e.g., increased crop yields, improved crop quality, or lands returning to production due to improved water supply) or indirect (e.g., improved water delivery reliability, reduced erosion, or producer cost savings that enable conversion to higher-value crops). Indirect benefits may also extend to adjacent industries and employment.

Tip: *Briefly summarize the applicable current conditions to contextualize the benefit(s). Where applicable, identify the sections in the Watershed Plan that highlight changes to farmland or financial performance. Describe whether the anticipated increase in value or productivity is direct, indirect, or both, and explain what that means for the area's agricultural community. Where applicable, cite articles, reports, studies, or grower interviews. Note if a decline in agricultural viability is anticipated without the project.*

Exceptional: 10 pts	Exceptional increase in agricultural economic value or farmland productivity. Benefits are well-documented and have meaningful positive effects on sponsor operations and the broader agricultural community. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial increase in agricultural economic value or farmland productivity. Benefits are notable and well-supported with meaningful effects on, for example, farm revenues, operational viability, or risk reduction. Supporting evidence is provided.
Medium: 3 pts	Moderate increase in agricultural economic value or farmland productivity. Benefits may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor increase in agricultural economic value or farmland productivity. Benefits are real but minimal. Supporting evidence is limited.
No benefit: 0 pts	Increased value or productivity is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in agricultural economic value or farmland productivity may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in agricultural economic value or farmland productivity is likely. Effects are meaningful and may affect farm revenues, operational viability, or land in production.
High detriment: -5 pts	Substantial decrease in agricultural economic value or farmland productivity is expected, with wide-reaching effects on sponsor operations or the broader agricultural community, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in agricultural economic value or farmland productivity is likely, including potential permanent loss of productive farmland or long-term collapse of agricultural viability in the project area.

D.4.10.2 Category: Environmental Public Benefits

Question 7: Does the project improve degraded land, reduce processes that drive land degradation or desertification, and/or support soil health?

Land degradation refers to the "many processes that drive the decline or loss in biodiversity, ecosystem functions or services, and includes the degradation of freshwater and coastal ecosystems that are closely interconnected with terrestrial ecosystems."[34]

Degraded land means "a state of land which results from the persistent decline or loss in biodiversity ecosystem functions or services that cannot fully recover unaided within decadal time scales."[34]

Desertification means "the degradation of land and vegetation, soil erosion and the loss of topsoil and fertile land in arid, semi-arid, and dry sub-humid areas, caused primarily by human activities and climate variations."[35]

Soil health is the ability of soil to function as a living system that supports plants, animals, people, and ecosystem services now and into the future. A healthy soil cycles nutrients; holds and filters water; supports diverse biological communities; and contributes to crop productivity, environmental quality, and resilience.[36]

Tip: *Briefly summarize the applicable current conditions in the area to contextualize the benefit(s). When describing whether the project improves degraded land, reduces drivers of degradation or desertification, and/or supports soil health, explain what those improvements mean for the agricultural community (local, regional, or national), watershed, or broader landscape. If applicable, note the potential for continued or accelerated degradation without the project.*

Exceptional: 10 pts	Exceptional improvement to land health. Benefits are well-documented, durable, and have meaningful positive effects at the farm, watershed, or landscape scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvement to land health. Benefits are notable and well-supported, with meaningful effects on ecosystem function, productivity, or resilience. Supporting evidence is provided.
Medium: 3 pts	Moderate improvement to land health. Benefits may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor improvement to land health. Benefits are real but minimal. Supporting evidence is limited.
No benefit: 0 pts	Improvement to land health is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in land health may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.

[34] Fisher, J., Montanarella, L., and Scholes, R. Chapter 1: Benefits to people from avoiding land degradation and restoring degraded land. In IPBES (2018): The IPBES assessment report on land degradation and restoration. Montanarella, L., Scholes, R., and Brainich, A. (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany, pp.1-51.

[35] United Nations Convention to Combat Desertification. https://www.unccd.int/land-and-life/desertification/overview

[36] https://www.farmers.gov/conservation/concerns-tool/soil

Medium detriment: -3 pts	Moderate decrease in land health is likely. Effects are meaningful and may affect ecosystem function, productivity, or long-term land viability.
High detriment: -5 pts	Substantial decrease in land health is expected, with wide-reaching effects on the farm, watershed, or landscape, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in land health is likely, potentially resulting in permanent loss of productive capacity or ecosystem function.

Question 8: Does the project result in an improvement to surface water quantity?

Improvement in surface water quantity refers to a project's ability to increase the availability, reliability, or beneficial use of surface water resources (e.g., streams, rivers, reservoirs, wetlands). Increased water quantity supports a wide range of ecosystem processes including regulation of water flows, reduction of flood and drought risks, maintenance of aquatic habitats, etc. Improvements may result from changes in watershed hydrology, water management, infrastructure efficiency, or land stewardship practices, for example.

Tip: *Briefly describe the current surface water conditions affected by the project. Be sure to reference appropriate sections in the Watershed Plan. Describe the expected ecological benefits, such as enhanced aquatic habitat, improved stream temperature regulation, etc. Where applicable, cite reports, studies, or grower interviews that support the environmental expectations.*

Exceptional: 10 pts	Exceptional improvement in surface water quantity with substantial benefits to ecological systems and water availability. Benefits are well-documented, durable, and meaningful at the watershed or regional scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvement in surface water quantity that meaningfully benefits ecological processes and water availability. Benefits are well-supported but may be somewhat more limited in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in surface water quantity. Benefits may be limited in scope, magnitude, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in surface water quantity. Benefits are possible but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in surface water quantity is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in surface water quantity may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in surface water quantity is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial decrease in surface water quantity is expected, with wide-reaching effects on ecological systems and water availability, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in surface water quantity is likely, potentially resulting in permanent loss of aquatic habitat, water availability, or watershed function.

Question 9: Does the project result in an improvement to surface water quality?

Improvement in surface water quality refers to a project's ability to reduce pollutants, sediment, nutrients, or other impairments in streams, rivers, reservoirs, or wetlands. Improved water quality supports a wide range of ecosystem processes, including aquatic habitat function, drinking water safety, and the reduction of harmful algal blooms.

Tip: *Briefly describe the current surface water quality parameters affected by the project. Reference appropriate sections in the Watershed Plan. Describe the expected ecological benefits, such as reduced sediment or nutrient loading, enhanced aquatic habitat, reduced algal blooms, etc. Where applicable, cite reports, studies, or grower interviews that support the environmental expectations.*

Exceptional: 10 pts	Exceptional improvement in surface water quality with substantial benefits to ecological systems and water resources. Benefits are well-documented, durable, and meaningful at the watershed or regional scale. Supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvement in surface water quality that meaningfully benefits ecological processes and water resources. Benefits are well-supported but may be somewhat more limited in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in surface water quality. Benefits may be limited in scope, magnitude, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in surface water quality. Benefits are possible but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in surface water quality is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in surface water quality may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in surface water quality is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial decrease in surface water quality is expected, with wide-reaching effects on ecological systems and water resources, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in surface water quality is likely, potentially resulting in permanent impairment of aquatic habitat, drinking water sources, or downstream water resources.

Question 10: Does the project result in an improvement to groundwater quantity?

An improvement in groundwater quantity means the project enhances groundwater storage, recharge, aquifer levels, or availability. These changes may, for example, reduce risk of land subsidence or strengthen water-related ecosystem processes, such as drought buffering and baseflow support for streams.

Examples of ways that projects may improve groundwater are increasing groundwater recharge, reducing groundwater pumping, restoring hydrologic function, and supporting sustainable groundwater management.

Tip: *Briefly describe the current groundwater quantity conditions to contextualize the project benefit(s). Reference appropriate sections in the Watershed Plan. Describe any expected ecological benefits, such as enhanced aquatic habitat or improved surface and groundwater connection. Where applicable, cite reports or studies that support the environmental expectations.*

Exceptional: 10 pts	Exceptional improvement in groundwater quantity. Benefits are well-documented, durable, and meaningful at the watershed or regional scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement in groundwater quantity that meaningfully benefits ecological systems or water users. Benefits are well-supported but may be somewhat less extensive or certain than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in groundwater quantity. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in groundwater quantity. Benefits are possible but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in groundwater quantity is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in groundwater quantity may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in groundwater quantity is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial decrease in groundwater quantity is expected, with wide-reaching effects on aquifer storage, recharge, or dependent ecological systems, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in groundwater quantity is likely, potentially resulting in permanent aquifer depletion, loss of baseflow support, or long-term impairment of groundwater-dependent ecosystems or water users.

Question 11: Does the project result in an improvement to groundwater quality?

An improvement in groundwater quality means the project reduces contamination, salinity, nutrient loading, or other pollutants that impair groundwater for drinking water, irrigation supply, ecosystem support, or community uses. Improved groundwater quality supports water purification, protection of sole source aquifers, and the health of groundwater-dependent ecosystems and communities. Improvements may result from reduced agricultural chemical inputs, changes in irrigation management, infrastructure upgrades that prevent leaching or seepage, or land stewardship practices that reduce pollutant infiltration.

Tip: *Briefly describe the current groundwater quality conditions to contextualize the project benefit(s), including any known contaminants, impairments, or regulatory concerns. Reference appropriate sections in the Watershed Plan. Describe expected water quality benefits and consider both on-site and down-gradient effects on water users and ecosystems. Where applicable, cite reports or studies that support the environmental expectations. Note the potential for continued or worsening impairment without the project, if applicable.*

Exceptional: 10 pts	Exceptional improvement in groundwater quality with substantial benefits to water users, ecosystems, and community water supplies. Benefits are well-documented, durable, and meaningful at the watershed or regional scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement in groundwater quality that meaningfully benefits water users or dependent ecosystems. Benefits are well-supported but may be somewhat less extensive or certain than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in groundwater quality. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in groundwater quality. Benefits are possible but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in groundwater quality is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in groundwater quality may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in groundwater quality is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial decrease in groundwater quality is expected, with wide-reaching effects on water users, dependent ecosystems, or community water supplies, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in groundwater quality is likely, potentially resulting in permanent impairment of drinking water sources, sole source aquifers, or groundwater-dependent ecosystems.

Question 12: Does the project improve habitat for species?

Improved habitat for species means the project enhances the quantity, quality, condition, or connectivity of natural or managed habitats that support wildlife, fish, invertebrates, plants, or other organisms. Habitat improvement may occur through changes in hydrology, vegetation, water quality, soil condition, or physical structure of ecosystems that increase suitability for species' survival, reproduction, migration, or long-term population viability.

Increasing habitat area, complexity, carrying capacity, or connectivity are some examples of ways that improving habitat for species may be realized.

Tip: *Briefly describe the current habitat conditions or limiting factors of concern for species or ecological communities and identify the ecological processes that may be affected by the project. Be sure to reference appropriate sections in the Watershed Plan. Describe any expected habitat benefits and how these benefits would support terrestrial or aquatic species. Where applicable, cite scientific articles, reports, or studies that support the environmental expectations.*

Exceptional: 10 pts	Exceptional, well-documented, and long-term improvements in habitat quantity, quality, condition, or connectivity for species. Benefits are ecologically meaningful at the watershed or landscape scale and may include habitat for species listed under the Endangered Species Act or species of concern. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement in habitat quantity, quality, condition, or connectivity. Benefits are ecologically meaningful and well-supported, though somewhat less in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in habitat conditions. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in habitat conditions for terrestrial or aquatic species. Benefits are real but minimal.
No benefit: 0 pts	Habitat improvement is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detriment to habitat conditions for terrestrial or aquatic species may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detriment to habitat conditions is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial detriment to habitat quantity, quality, condition, or connectivity is expected, with wide-reaching effects on terrestrial or aquatic species, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible detriment to habitat conditions is likely, potentially resulting in permanent loss of critical habitat, displacement of ESA-listed or species of concern, or long-term collapse of ecological communities.

Question 13: Does the project provide energy benefits?

An energy benefit means the project reduces energy demand or increases energy-use efficiency in support of agricultural, ecological, or community water management activities. Examples of projects that may result in energy benefits include transitions to lower-energy delivery systems, gravity-fed infrastructure, pump upgrades, reduced groundwater pumping, etc. These improvements can produce co-benefits for water quality, food security, and climate variability mitigation by reducing reliance on fossil fuels and lowering the carbon footprint of water management operations.

Tip: *Briefly describe the current energy use conditions to contextualize the project benefit(s). Identify the specific project components expected to reduce energy demand or increase energy-use efficiency, and reference appropriate sections in the Watershed Plan if expected savings have been quantified. Consider how energy benefits that result from a project may affect local or regional energy demands. If applicable, discuss how energy benefits may affect other ecological processes. Cite reports or studies that support the benefit expectations.*

Exceptional: 10 pts	Exceptional, well-documented, and long-term improvement in energy use. Benefits are large in magnitude and meaningful at the local, regional, or national scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant reduction in energy demand or increase in energy-use efficiency. Benefits are notable and well-supported, with meaningful effects, though somewhat less in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized reduction in energy demand or increase in energy-use efficiency. Benefits may apply to specific system components or carry greater uncertainty but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental reduction in energy demand or increase in energy-use efficiency. Expected benefits are limited in scale or evidence.
No benefit: 0 pts	Reduction in energy demand or increase in energy-use efficiency is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor increase in energy demand or decrease in energy-use efficiency may occur. Effects are limited in scale and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate increase in energy demand or decrease in energy-use efficiency is likely. Effects are meaningful and may affect operational costs or the environmental footprint of the system over the long term.
High detriment: -5 pts	Substantial increase in energy demand or decrease in energy-use efficiency is expected, with wide-reaching effects on operational costs or system sustainability, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible increase in energy demand is likely, potentially resulting in long-term financial strain on the sponsor or fundamental impairment of system viability.

Question 14: Does the project result in an improvement to air quality?

An improvement in air quality means that the project reduces emissions, pollutants, particulates, odors, or atmospheric contaminants associated with land use, water management, vegetation condition, or agricultural operations. For example, improvements may result from changes that reduce dust, volatile compounds, exhaust from machinery, greenhouse gas emissions, or ozone-forming pollutants. Air quality benefits may occur directly through reduced emissions or indirectly through improved soil, vegetation, water, and land management processes.

Some examples of projects that may improve air quality are those that reduce dust and particulates through soil health practices, erosion reduction, or improved surface moisture; those that reduce wildfire risk or severity through improved hydrologic or vegetation management; etc.

Tip: *Briefly describe the air-quality concerns or pollutant sources and how the project is expected to reduce emissions, particulates, odors, etc. Contextualize the project benefits to the community or region. If applicable, describe any links between improvement in air quality and supporting ecological process and/or species. cite reports or studies that support the environmental expectations.*

Exceptional: 10 pts	Exceptional, well-documented, and long-term improvement in air quality. Benefits are considerable in magnitude, extend across the community or region, and may produce meaningful co-benefits for ecological processes or public health. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvement in air quality that is meaningful and well-supported. Benefits are notable in extent, magnitude, or certainty, though somewhat less than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in air quality. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in air quality. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in air quality is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detriment to air quality may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detriment to air quality is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial detriment to air quality is expected, with wide-reaching effects on the community, region, or dependent ecological processes, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible detriment to air quality is likely, potentially resulting in long-term public health impacts, significant increases in atmospheric pollutants, or permanent degradation of air quality conditions in the project area.

Question 15: Does the project improve the ability of ecosystems to maintain their function during climatic variability?

Maintaining ecosystem function during climatic variability means that the project improves the ability of ecosystems—terrestrial, aquatic, riparian, etc.—to absorb, adapt to, and recover from climate-related stressors such as drought, extreme precipitation, flooding, heatwaves, shifting snowpack or runoff patterns, increased evapotranspiration, high-intensity storms, and disturbance events (erosion, wildfire, pest outbreaks). This may occur through projects that restore ecological functions such as water retention, nutrient cycling, soil formation, and biodiversity. Examples may include those projects that improve water availability, improve water management infrastructure, reduce wildfire or erosion risk, or enhance landscape connectivity.

Tip: *Briefly describe the current ecosystem conditions and the climate-related stressors or vulnerabilities of concern (e.g., drought frequency, flood risk, erosion, shifting runoff patterns, wildfire risk), to contextualize the project benefit(s). Consider how the project is expected to improve the ability of ecosystems to absorb, adapt to, or recover from these stressors both locally and in the wider region, if applicable. Consider how the project supports ecological functions. Reference appropriate sections in the Watershed Plan, and cite reports or studies that support the environmental expectations. Note the potential for continued or worsening ecological vulnerability without the project, if applicable.*

Exceptional: 10 pts	Exceptional, well-documented, and long-term improvement in the ability of ecosystems to maintain their function during climatic variability. Benefits are considerable in magnitude, extend across the watershed or landscape, and strengthen key ecological processes. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement in ecosystem functional capacity during climatic variability. Benefits are ecologically meaningful and well-supported, though somewhat less in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in ecosystem functional capacity during climatic variability is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor reduction. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate reduction is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial reduction is expected, with wide-reaching effects on ecological processes and the ability of terrestrial, aquatic, or riparian systems to recover from disturbance. Supporting evidence is provided.
Extreme detriment: -7 pts	Severe or irreversible reduction in ecosystem functional capacity during climatic variability is likely, potentially resulting in permanent degradation of ecological processes, loss of landscape-scale resilience, or transition to a fundamentally degraded ecological state.

Question 16: Does the project result in improvements that address one or more limiting ecological factors in the project watershed?

A limiting ecological factor is any resource or condition that restricts the health, productivity, distribution, or resilience of species, habitats, or ecosystems. Limiting factors may be physical, chemical, biological, or hydrological in nature, and often interact in ways that compound their effects on ecological communities. Projects that address limiting factors may include those that improve hydrologic function, water quality or quantity, habitat connectivity, riparian condition, sediment dynamics, water temperature, or reduce barriers to species movement.

Tip: *Briefly describe the current ecological conditions and identify the specific limiting factor(s) of concern in the project watershed. If a project is expected to reduce or remove those limitations, describe the ecological processes or species communities most likely to benefit. Consider whether benefits are localized or extend across the broader watershed and what the benefits may mean to the area or community. Reference appropriate sections in the Watershed Plan and cite reports or studies that support the environmental expectations, if applicable.*

Exceptional: 7 pts	Exceptional, well-documented, and long-term improvement to one or more limiting ecological factors. Benefits are considerable in magnitude, extend across the watershed or landscape, and are expected to produce meaningful recovery of ecological function, habitat, or species communities. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement to one or more limiting ecological factors. Benefits are ecologically meaningful and well-supported, though somewhat less in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement to one or more limiting ecological factors. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement to one or more limiting ecological factors. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement to limiting ecological factors is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detriment to one or more limiting ecological factors may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detriment to one or more limiting ecological factors is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial detriment to one or more limiting ecological factors is expected, with wide-reaching effects on species, habitats, or watershed-scale ecological processes, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible detriment to one or more limiting ecological factors is likely, potentially resulting in permanent degradation of ecological function or the long-term loss of species or habitat viability in the watershed.

Question 17: Does the project support crop diversity?

Crop diversity may include genetic, species, functional, or temporal diversity in agricultural production, which affect ecological function and stability through soil health and microbiome function, pollination, and pest regulation, among others. Projects that support crop diversity may include, for example, those that enable new crop choices through improved delivery systems, more flexibility in water timing, or improved soil health. Projects that support crop diversity may do so by enabling new crop choices through improved water delivery reliability, more flexible water timing, improved soil health, or reduced water stress.

Tip: *Briefly describe the current cropping systems and the conditions that may limit crop diversity in the project area, such as water delivery constraints, soil health limitations, or inflexible irrigation timing. Consider how the project is expected to enable or support greater crop diversity, and consider benefits from the perspective of local agriculture, the local community, soil health, and associated biodiversity such as pollinators and pest-regulating species. Where applicable, note any connections between increased crop diversity and food security, nutritional outcomes, or market opportunities. Cite reports, articles, or grower interviews that support the benefit expectations.*

Exceptional: 10 pts	Exceptional, well-documented, and long-term support for crop diversity. Benefits are considerable in magnitude, extend across multiple dimensions of diversity, and produce meaningful benefits for ecosystem function. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial support for crop diversity that is meaningful and well-supported. Benefits are notable in extent, magnitude, or certainty, though somewhat less than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized support for crop diversity. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental support for crop diversity. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Support for crop diversity is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor reduction in crop diversity may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate reduction in crop diversity is likely. Effects are meaningful and may affect ecosystem function over the long-term.
High detriment: -5 pts	Substantial reduction in crop diversity is expected, with wide-reaching effects on agricultural resilience and ecosystem function with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible reduction in crop diversity is likely, potentially resulting in permanent loss of agrobiodiversity, long-term degradation of soil health, or collapse of diversified farming systems in the project area.

D.4.10.3 Category: Socio-Cultural Public Benefits

Question 18: Does the project support public health and/or public safety?

Public health refers to the protection and improvement of community health and well-being through prevention, environmental quality, and reduced exposure to health risks. Public health can be strongly influenced by nature's contributions to people. Examples may include clean drinking water and reduced waterborne diseases, improved air quality and reduced respiratory illness, reduced exposure to toxic substances, climate regulation that moderates heat and other extreme events, mental and cultural well-being associated with healthy landscapes.

Public safety refers to the protection of people, communities, and property from hazards, accidents, disasters, and other threats that can cause injury, loss of life, or damage. Public safety emphasizes risk reduction, hazard mitigation, and resilience, particularly in relation to environmental, infrastructural, and climate conditions. Examples may include projects that offer protection from environmental and natural hazards (e.g., floods, wildfires, landslides, drought impacts); improve infrastructure reliability and safety (e.g. dams, canals, water systems), accident and injury prevention (e.g. infrastructure use), and emergency preparedness and response (e.g. fish consumption advisories, water contact advisories); and support resilience to climate variability.

Tip: *Briefly describe the current public health and/or public safety conditions or risks relevant to the project, such as water quality impairments, flood or wildfire hazards, infrastructure vulnerabilities, or exposure to toxic substances. Describe how the project is expected to reduce those risks or improve health and safety outcomes and identify the population or communities most likely to benefit. Where applicable, note connections between ecological improvements and public health outcomes. Reference appropriate sections in the Watershed Plan and cite reports or studies that support the expected benefits.*

Exceptional: 10 pts	Exceptional, well-documented, and durable improvements to public health and/or safety. Benefits address major risks or hazards, benefit a considerable portion of the community or watershed, and are expected to be long-lasting. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvements to public health and/or safety. Benefits are meaningful and well-supported, though somewhat less in magnitude, geographic extent, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvements to public health and/or safety. Benefits are real and meaningful but limited in scope, affected population, or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor or incidental improvements to public health and/or safety. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Benefits to public health and/or safety are not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detrimental effects to public health and/or safety may occur. Effects are limited in scale or scope, likely mitigable, and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detrimental effects to public health and/or safety are likely. Effects may be long-term, broad in geographic extent, and/or difficult to mitigate.
High detriment: -5 pts	Substantial detrimental effects to public health and/or safety are expected, with wide-reaching consequences for community health, hazard exposure, or infrastructure reliability, with supporting evidence.

Extreme detriment: -7 pts	Severe or irreversible detrimental effects to public health and/or safety are likely, potentially resulting in long-term harm to community well-being, permanent increases in hazard exposure, or critical impairment of public water or safety infrastructure.

Question 19: Does the project support local food systems and the vitality of the local communities?

Supporting local food systems and the vitality of local communities means that self-reliant and resilient food networks connect food producers and food consumers in the same geographic region. The project may strengthen the capacity of local agricultural systems, producers, processors, and communities to produce, access, distribute, and sustain food over time, particularly in the face of environmental, economic, and climate-related stressors. Strong food systems may support cultural identity, social cohesion, and relational values tied to the area. Examples of project outcomes that may support local food systems and community vitality are improving water availability, reliability, or quality for local agricultural production; enhancing soil health; supporting crop diversity and diversified production systems; enhancing pollinator habitat; and reducing energy and operational costs.

Tip: *Briefly describe the current local food systems and local communities to contextualize the project benefit(s). Describe how the project's outcomes would support local food systems and community vitality via, for example, production capacity, food access, and the long-term viability of the agricultural community. Note any connections between food systems and the cultural values they support. Cite articles, reports, grower interviews, or community input that support the expected benefits.*

Exceptional: 10 pts	Exceptional, well-supported, and long-term benefits to local food systems and community vitality are expected. Benefits are widespread, durable, and transformative.
High: 5 pts	Significant benefits to local food systems and/or community vitality. Benefits are meaningful and well-supported, though somewhat less in magnitude, extent, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized benefits to local food systems or community vitality. Benefits are real but limited in scale, scope, or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor or incidental benefits to local food systems or community vitality. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Support for local food systems or community is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor negative effects to local food systems or community vitality may occur. Effects are limited in scale or scope, likely mitigable, and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate negative impacts to local food systems or community vitality are likely. Effects are meaningful and may affect food production capacity, community food access, or the cultural and relational values tied to local food systems.
High detriment: -5 pts	Substantial negative impacts to local food systems or community vitality are expected, with wide-reaching effects on food production, community resilience, or cultural and social dimensions of local food identity, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible negative impacts to local food systems or community vitality are likely, potentially resulting in long-term loss of food production capacity, collapse of local agricultural systems, or permanent disruption of the cultural and relational values that underpin community food identity and vitality.

Question 20: Does the project support the intrinsic value or inherent worth of something independent of human benefit?

The intrinsic value or inherent worth means that the value of ecosystems, species, habitats, or ecological processes is recognized and supported for their own sake, independent of their usefulness or benefits to people. Intrinsic value reflects the ethical position that non-human life and ecological systems have worth as ends in and of themselves, not merely as means to human wellbeing.

Tip*: Describe how the project recognizes or supports the intrinsic value of non-human entities beyond their usefulness to people. Consider: (1) which species, habitats, or ecological processes are valued for their own sake; (2) how the project design, outcomes, or planning process reflects recognition of intrinsic value — for example, through avoidance of harm, restoration of ecological integrity, or explicit consideration of the rights or agency of non-human entities; and (3) how the project actions and outcomes may avoid, reduce, or reverse harm to non-human entities over the long term. Reference the Watershed Plan and other sources where applicable.*

Exceptional: 10 pts	Strong and long-term support for the intrinsic value of ecosystems, species, or ecological processes. Intrinsic value may have played a large role in project's design and outcome. Supporting evidence is well-documented.
High: 5 pts	Substantial support for intrinsic value. Though intrinsic value considerations may not be the sole or primary diver of the project's design and outcomes, intrinsic value is clearly present and meaningfully supported.
Medium: 3 pts	Moderate or localized support for intrinsic value. Support is real but limited in scope or emphasis.
Minor: 1 pt	Minor or incidental support for intrinsic value.
No benefit: 0 pts	The project is not likely to support intrinsic value, or support is not documented.
Minor detriment: -1 pt	Minor harm to species, habitats, or ecological processes is expected. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate harm to species, habitats, or ecological processes is expected. Effects are meaningful, may affect ecological integrity or species of concern, and warrant consideration.
High detriment: -5 pts	Substantial harm to species, habitats, or ecological processes, with wide-reaching or long-term consequences for ecological integrity is expected.
Extreme detriment: -7 pts	The project is likely to cause severe or irreversible harm to species, habitats, or ecological processes, potentially resulting in permanent loss of ecological entities or processes.

Question 21: Does the project result in improvements in conditions for underrepresented or underserved communities?

Improving conditions for underrepresented or underserved communities means that the project and/or public planning process reduces existing disparities, improves environmental or socio-economic conditions, or increases access to resources, decision-making, or benefits for communities that have historically experienced disproportionate environmental burdens. Underrepresented or underserved communities include people who are minority or low-income, economically distressed rural communities, tribal communities, or other communities traditionally underrepresented in public processes.

Tip: *Identify which of the communities above would benefit from the project and in what way. Demonstrate that project-siting decisions have been examined and affected landowners or communities have been engaged. Identify public engagement methods. Consider how project outcomes would benefit these communities. Reference the Watershed Plan and other sources where applicable.*

Exceptional: 10 pts	Exceptional and long-term improvements in conditions for one or more underrepresented or underserved communities. Equity considerations are meaningfully reflected in project design and outcomes. Benefits address significant disparities in environmental quality, resource access, or socioeconomic conditions, and are well-documented and likely to be durable. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvements in conditions for underrepresented or underserved communities. Benefits are meaningful and well-supported, though somewhat less in magnitude, scale, or certainty than Exceptional. Equity considerations are present and documented. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvements in conditions for underrepresented or underserved communities. Benefits are real but limited in scale, scope, or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor or incidental improvements in conditions for underrepresented or underserved communities. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Improvements in conditions for underrepresented communities are not likely, or equity considerations were not documented.
Minor detriment: -1 pt	Minor negative effects on underrepresented or underserved communities may occur. Effects are limited in scale or scope, likely mitigable, and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate negative effects on underrepresented or underserved communities are likely. Effects are meaningful, may exacerbate existing disparities in environmental quality or resource access, and are substantial enough to warrant concern.
High detriment: -5 pts	Substantial negative effects on underrepresented or underserved communities are expected, with wide-reaching consequences for environmental conditions, resource access, or socioeconomic equity, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible negative effects on underrepresented or underserved communities are likely, potentially resulting in long-term harm to community well-being, permanent worsening of existing disparities, or critical loss of access to resources, decision-making, or environmental quality for historically marginalized groups.

Question 22: Does the project support identity, livelihood, or sense of place values of people or communities in the area?

Supporting identity, livelihood, or sense of place values means the project helps sustain, strengthen, or restore the cultural identities, place-based livelihoods, practices, meanings, and relationships that people and communities associate with their landscapes and ecosystems. These values reflect how people understand who they are, how they make a living, and how they relate to specific places over time. Examples may include sustaining or enhancing place-based practices (e.g., agriculture, ranching, fishing, or land stewardship); maintaining or restoring landscape features that communities identify with (e.g., working lands, riparian corridors, or floodplains); reducing disruptions that threaten identity (e.g. water insecurity, land degradation); supporting cultural practices and traditions (e.g. Indigenous or local knowledge systems).

Tip: *Describe how identity, livelihood, or sense of place values are present in the communities affected by the project and how the project is expected to sustain, strengthen, or restore them. Consider values held by farmers, ranchers, fishers, Indigenous communities, and others whose identities and livelihoods are tied to the land, water, and working landscapes of the watershed. Be attentive to the ways that projects can both support and disrupt relational values. Reference the Watershed Plan and other sources where applicable.*

Exceptional: 10 pts	Exceptional and long-term support for identity, livelihood, or sense of place values. Support strengthens the connections between people and the landscapes, practices, and traditions that define their identity and way of life. Strong supporting evidence is provided.
High: 5 pts	Substantial support. Benefits are meaningful, with notable positive effects, though somewhat less in magnitude, scale, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized support. Benefits are real but limited in scope, depth, or certainty. Some supporting evidence or community input is provided.
Minor: 1 pt	Minor or incidental support. Benefits are real but minimal, and documentation or community engagement is limited.
No benefit: 0 pts	Support for identity, livelihood, or sense of place values is not likely, or such values are not considered or documented.
Minor detriment: -1 pt	Minor negative effects may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences for community-nature relationships.
Medium detriment: -3 pts	Moderate negative effects are likely. Effects are meaningful, may disrupt place-based practices or cultural relationships with the landscape, and are substantial enough to warrant concern.
High detriment: -5 pts	Substantial negative effects are expected. Effects may significantly disrupt community-nature relationships, undermine place-based livelihoods, or erode cultural identity tied to the landscape, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible negative effects are likely, potentially resulting in permanent disruption of place-based practices, loss of cultural identity tied to the land or water, or long-term erosion of the relational values that sustain community well-being and connection to the landscape.

Question 23: Does the project support state or local priorities?

A state or local priority is one that is identified in a plan, strategy, or study. These include documents such as state and local water quality plans, species and habitat conservation or recovery plans, local economic development plans, regional planning efforts, collaborative basin planning efforts, state or local hazard mitigation plans, etc., or strategies such as restoration and protection of native fish species of cultural significance to Indian tribes.

Tip: *Identify the specific state or local priority or priorities that the project supports and cite the plan, strategy, or study in which the priority is documented. Describe how the project's outcomes align with or advance the stated goals of that priority and explain how central or significant the project's role is in achieving those goals. Where the project supports multiple priorities, note this and describe the breadth of alignment. Where relevant, reference tribal strategies or collaborative planning processes, including those addressing native fish species of cultural significance to Indian tribes. Reference appropriate sections in the Watershed Plan where applicable.*

Exceptional: 10 pts	Exceptional role in supporting one or more state or local priorities. The project directly and substantially advances the stated goals of a formally identified priority, is well-documented, and may be central to the priority's achievement. The project may support multiple priorities simultaneously. Strong supporting evidence is provided.
High: 5 pts	Substantial role in supporting one or more state or local priorities. The project meaningfully advances a formally identified priority and is well-supported, though its role may be somewhat less central or comprehensive than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate role in supporting one or more state or local priorities. The project contributes to a formally identified priority but may be limited in its scope, certainty, or directness of contribution. Some supporting evidence is provided.
Minor: 1 pt	Minor role in supporting a state or local priority. The connection to a formally identified priority is real but limited or incidental. Supporting evidence is limited.
No benefit: 0 pts	No meaningful promotion of state or local priorities, or benefit claims are unsupported.
Minor detriment: -1 pt	The project may be mildly counter to one or more state or local priorities. Effects are limited in scope and are unlikely to significantly impede priority achievement.
Medium detriment: -3 pts	The project runs counter to one or more state or local priorities in a meaningful way. Effects are substantial enough to warrant concern and may impede progress toward formally identified goals.
High detriment: -5 pts	The project substantially conflicts with one or more state or local priorities, with wide-reaching implications for priority achievement, with supporting evidence.
Extreme detriment: -7 pts	The project severely or irreversibly conflicts with one or more state or local priorities, potentially undermining or setting back formally identified goals in a lasting or transformative way.

Question 24: Does the project support recreation and/or scenic values?

Supporting recreation means the project enhances the quality, accessibility, safety, or experience of outdoor recreation opportunities. Supporting scenic values means the project improves the visual, aesthetic, and experiential qualities of landscapes and waterscapes valued by communities and visitors. These values include both use-based recreation (e.g., fishing, hunting, hiking, boating, wildlife viewing, etc.) and non-use scenic or aesthetic values (e.g., viewsheds, landscape character, tranquility, etc.).

Tip: *Briefly describe the current recreation and/or scenic conditions in the project area and identify how the project is expected to enhance them. Consider both use-based recreation (e.g., fishing, hunting, hiking, boating, wildlife viewing) and non-use scenic or aesthetic values (e.g., viewsheds, landscape character, tranquility). Describe who benefits — local community members, visitors, or both — and whether benefits are localized or extend across the broader watershed or region. Note whether recreation or scenic values were identified through community input, partner engagement, or planning documents, and whether the project may support or conflict with existing recreation plans or access agreements. Reference the Watershed Plan and other sources where applicable.*

Exceptional: 10 pts	Widespread, exceptional, and long-term support for recreation and/or scenic values. Benefits are well-documented, extend across a considerable portion of the community or region, and may reflect meaningful integration of recreation or scenic values into project design and outcomes. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial support for recreation and/or scenic values. Benefits are meaningful and well-supported, with notable positive effects on recreation quality, accessibility, or scenic character, though somewhat less in magnitude, geographic extent, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized support for recreation and/or scenic values. Benefits are real but limited in scope, affected area, or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor or incidental support for recreation and/or scenic values. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Support for recreation or scenic values is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detriment to recreation or scenic values may occur. Effects are limited in scale or scope, likely mitigable, and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detriment to recreation or scenic values is likely. Effects are meaningful, may reduce the quality, accessibility, or character of recreation or scenic resources, and are substantial enough to warrant concern.
High detriment: -5 pts	Substantial detriment to recreation or scenic values is expected, with wide-reaching effects on recreation opportunities or landscape character, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible detriment to recreation or scenic values is likely, potentially resulting in permanent loss of recreation access, significant degradation of landscape character, or long-term impairment of the aesthetic and experiential qualities valued by communities and visitors.

Question 25: Does the project support traditional cultural places, sacred areas, or archaeologically sensitive sites?

Supporting traditional cultural places (TCP), sacred areas, or archaeologically sensitive sites means the project avoids, minimizes, or reverses harm to places that hold deep cultural, spiritual, historical, or archaeological significance for Indigenous peoples, local communities, or other groups with long-standing connections to the landscape. These places may include ceremonial sites, ancestral territories, fishing and gathering areas of cultural significance, burial grounds, irrigation or land management features of historical importance, or landscapes recognized under the National Historic Preservation Act, the National Register of Historic Places, or tribal cultural resource management plans.

Tip: *Identify whether traditional cultural places, sacred areas, or archaeologically sensitive sites are present in or near the project area. Reference the Watershed Plan, cultural resource surveys, tribal consultation records, or other sources where applicable. Briefly identify the current conditions and describe the nature and significance of those places to the communities. Describe any project design and siting decisions associated with the planning process. Where the project actively supports access to, restoration of, or protection of these places, describe how and for whom.*

Exceptional: 10 pts	Exceptional and long-term support for TCPs, sacred areas, or archaeologically sensitive sites. The project actively protects, restores, or improves access to such places, and cultural or tribal values played a meaningful role in project design. Meaningful tribal consultation or community engagement has been conducted and documented. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial support. The project takes deliberate steps to avoid harm and may benefit culturally significant places or access to them. Tribal consultation or community engagement has been conducted.
Medium: 3 pts	Moderate support. The project avoids known impacts and demonstrates reasonable consideration of cultural resource values, though the depth of engagement; or benefit may be limited.
Minor: 1 pt	Minor or incidental support. The project does not knowingly harm such places, but consideration of cultural resource values is limited or not well-documented.
No benefit: 0 pts	The project is not likely to support TCPs, sacred areas, or archaeologically sensitive sites. Such areas may not be located near the project, or such values are not considered or documented.
Minor detriment: -1 pt	Minor detrimental impacts. Effects are limited in scale or scope, or likely mitigable.
Medium detriment: -3 pts	Moderate impacts are expected. Effects are meaningfully detrimental, may affect community access or the integrity of culturally significant resources, and warrant concern.
High detriment: -5 pts	Substantial impacts are expected with wide-reaching consequences for cultural integrity, community access, or the preservation of irreplaceable resources, with supporting evidence.
Extreme detriment: -7 pts	The project is likely to cause severe or irreversible harm, potentially resulting in permanent loss of or damage to places of deep cultural, spiritual, or historical significance to Indigenous peoples or local communities.