US Army Corps of Engineers®
Portland District

WILLAMETTE VALLEY SYSTEM OPERATIONS AND MAINTENANCE

FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX M: COSTS

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THE COSTS APPENDIX HAS BEEN REVISED FROM THE DEIS

Summary of changes from the DEIS:

- **Costs have been updated in all tables.**
- **Text has been revised to reflect updated costs.**

1. INTRODUCTION

The cost analysis is an estimate of the total cost for implementing, operating, and maintaining the Willamette Valley System (WVS) under each of the Environmental Impact Statement (EIS) alternatives. The effective price level for this analysis is FY25.

The cost analysis aims to describe the cost differences among alternatives, particularly between the proposed WVS EIS action alternatives and the No-action Alternative (NAA). Implementation costs include the costs of design and construction of proposed structural measures under the action alternatives.

All alternatives, including the NAA, have costs associated with operating and maintaining the WVS as well as costs that may change relative to the structural and/or operational measures included under an action alternative. These ongoing future costs include capital investments and routine and non-routine operations costs. Costs are focused on 13 Federal multiple purpose dams and reservoirs in the Willamette Valley System in Oregon but also include costs for gravel augmentation and modifications to revetments.

2. OVERVIEW

USACE operations, cost engineering, budget, asset management, project-specific specialists, fish, and hydropower provided input to the cost estimates. The objective was to identify the cost to operate the WVS under the NAA and estimate how these costs would change under the WVS EIS action alternatives. Costs are broken into capital (including construction); design and engineering; and annual Operations, Maintenance, Repair, Replacement, and Rehabilitation (OMRRR) costs.

The costs to operate the system are funded through annual Congressionally appropriated Federal tax dollars as well as revenue generated through the marketing and sale of hydropower. The Bonneville Power Administration (BPA) provides annual funding for fish and wildlife mitigation in the Willamette Basin.

2.1 No-action Alternative

The NAA is a baseline for the costs associated with operating and maintaining the WVS. The NAA provides a starting point for determining how costs vary as structural or operational changes, or both, are made under the action alternatives. The NAA assumed the WVS would continue to operate in a similar manner to current operations, balancing operations for Congressionally authorized purposes across the WVS.

Under the NAA, agencies would continue to maintain system infrastructure while routine operations and maintenance costs for hydropower, cultural resources, recreation, fish and wildlife, and other routine costs would occur. The NAA was developed to provide an accounting of costs to operate and maintain the WVS.

2.2 Capital/Construction Costs

Portland District cost engineers developed estimates for each structural measure included in the action alternatives. Projects that are currently in design use a project-specific estimate in the tables below. For projects that have not started, the design, supervision, administration, and engineering during construction cost estimate is 44 percent of construction and contingency cost. This is based on Walla Walla District Mandatory Center of Expertise for Cost Engineering recommendations based on historical USACE cost engineering estimates.

The structural measures only include measures that are unique additions under an action alternative. For example, under the NAA, the co-lead agencies would continue to invest in power-related capital improvements, additions, replacements, and fund operations and maintenance as needed.

2.3 Operations, Maintenance, Repair, Replacement, and Rehabilitation Costs

The OMRRR costs include costs to operate and maintain the dams and reservoirs and adult fish facilities. Operations and maintenance costs have been estimated for each action alternative based on the specific structural and operational measures included. Operations and programs staff and PDT members, based on their knowledge of system operations, developed an estimate of measure-specific OMRRR costs. Completed projects use actual operations and maintenance cost data, projects currently in design use a project-specific estimate, and projects that have not started use a Class 5 estimate.[1]

2.4 Risk and Uncertainty

There are multiple areas of risk and uncertainty in the cost analysis. Risk and uncertainty are inherent with estimates developed and used for water resource planning. Much of the risk and uncertainty associated with cost modeling stems from the assumptions that future costs reflect

[1] Per ER-1110-2-1302 Engineering and Design CIVIL WORKS COST ENGINEERING, a Class 5 estimate is a rough order of magnitude estimate relying on input such as broad-based assumptions, costs from comparable projects, and cost engineering judgement.

historical activities and costs. There are uncertainties in the needs and timing of operations and maintenance, construction costs, and capital requirements. Technological advancements and cost efficiencies can also affect future costs, although any future changes in technologies are speculative.

Given the uncertainty associated with the planning-level design for structural measures, the Walla Walla District Mandatory Center of Expertise for Cost Engineering developed an abbreviated risk analysis. During the analysis, the Project Delivery Team discussed project definition, status of the design, and various elements of project risk to establish high and low variance from the estimated project cost (Table 2-1).

Table 2-1. Estimated Variance in Capital Cost by Alternative.

Alternative	Low-Cost Range (millions)	Current Total Cost (millions)	High-Cost Range (millions)
1	2,020	3,288	5,274
2A	1,292	1,967	2,760
2B/5	1,242	1,913	2,869
3A	386	637	933
3B	473	755	1,266
4	2,183	3,492	5,541

Due to a complex Federal study approval and project appropriation process, the actual implementation timeframe for each alternative is uncertain. The cost analysis presents total "project first costs" in FY25 dollars. Project first costs include construction costs as well as contingency; supervision and administration; planning, engineering, and design; and engineering during construction.

3. COST ESTIMATES

3.1 Capital and Operations, Maintenance, Repair, Replacement, and Rehabilitation Cost Estimates by Alternative

This section provides cost estimates of the engineering and design during construction, capital construction, and annual operations and maintenance for each Alternatives, including the No Action Alternative. Costs in the tables below are in millions of dollars. Cost estimate for nature-based improvements to revetments is listed separately since the revetments are not associated with specific dams.

Table 3-1. No-action Alternative Costs by Sub-Basin

Location	Capital ($M)	OMRRR ($M)
North Santiam		
Detroit/Big Cliff	0.0	8.1
South Santiam		
Foster	0.0	2.7
Green Peter	0.0	6.3
Long Tom		
Fern Ridge	0.0	2.5
McKenzie		
Cougar	0.0	6.5
Blue River	0.0	2.1
Middle Fork		
Hills Creek	0.0	4.4
Lookout/Dexter	0.0	10.7
Fall Creek	0.0	2.1
Revetments		
Total	0	45

Table 3-2. Alternative 1 Costs by Sub-Basin

Location	Design/ EDC ($M)	Low Design/EDC ($M)	High Design/EDC ($M)	Capital ($M)	Low Capital ($M)	High Capital ($M)	OMRRR ($M)	Low OMRRR ($M)	High OMRRR ($M)
North Santiam									
Detroit/Big Cliff	251.7	143.8	367.6	986.6	592.8	1418.0	13.2	10.5	17.1
South Santiam									
Foster	27.5	13.6	47.4	58.7	28.0	102.9	2.9	2.3	3.9
Green Peter	303.7	193.2	512.9	690.3	439.2	1165.8	11.5	9.2	15.0
Long Tom									
Fern Ridge	3.1	1.6	6.2	7.1	3.5	14.2	2.5	2.0	3.2
McKenzie									
Cougar	2.9	2.3	5.7	6.8	5.4	13.2	6.7	2.2	3.6
Blue River	0.1	0.1	0.1	0.4	0.4	0.6	2.2	1.8	2.9
Middle Fork									
Hills Creek	0.0	0.0	0.0	0.0	0.0	0.0	4.4	3.5	5.7
Lookout/Dexter	285.7	178.8	489.5	649.3	406.4	1112.5	15.7	12.5	20.4
Fall Creek	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.6	2.7
Revetments	4.1	3.3	5.3	9.6	7.6	12.4	0.0	0.0	0.0
Total	879	537	1,435	2,409	1,483	3,840	61	46	75

Table 3-3 Alternative 2A Costs by Sub-Basin

Location	Design/ EDC ($M)	Low Design/EDC ($M)	High Design/EDC ($M)	Capital ($M)	Low Capital ($M)	High Capital ($M)	OMRRR ($M)	Low OMRRR ($M)	High OMRRR ($M)
North Santiam									
Detroit/Big Cliff	248.9	141.5	362.0	980.3	587.7	1405.4	13.2	10.5	17.1
South Santiam									
Foster	24.7	11.4	41.9	52.4	22.9	90.2	2.9	2.3	3.8
Green Peter	18.3	14.6	24.0	41.6	33.1	54.6	6.6	5.3	8.6
Long Tom									
Fern Ridge	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.0	3.2
McKenzie									
Cougar	40.1	32.1	52.2	163.9	131.1	213.0	11.6	6.1	10.0
Blue River	0.1	0.1	0.1	0.4	0.4	0.6	2.2	1.8	2.9
Middle Fork									
Hills Creek	0.0	0.0	0.0	0.0	0.0	0.0	4.4	3.5	5.7
Lookout/Dexter	117.0	93.6	152.2	266.0	212.8	345.8	15.6	12.5	20.3
Fall Creek	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.6	2.7
Revetments	4.1	3.3	5.3	9.6	7.6	12.4	0.0	0.0	0.0
Total	453	297	638	1,514	996	2,122	61	46	74

Table 3-4 Alternative 2B and Alternative 5 Costs by Sub-Basin

Location	Design/ EDC ($M)	Low Design/EDC ($M)	High Design/EDC ($M)	Capital ($M)	Low Capital ($M)	High Capital ($M)	OMRRR ($M)	Low OMRRR ($M)	High OMRRR ($M)
North Santiam									
Detroit/Big Cliff	248.9	141.5	362.0	980.3	587.7	1405.4	13.2	10.5	17.1
South Santiam									
Foster	24.7	11.4	41.9	52.4	22.9	90.2	2.9	2.3	3.8
Green Peter	18.3	14.6	24.0	41.6	33.1	54.6	6.6	5.3	8.6
Long Tom									
Fern Ridge	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
McKenzie									
Cougar	45.7	34.3	114.3	104.2	78.2	260.0	6.9	2.4	4.3
Blue River	0.1	0.1	0.1	0.4	0.4	0.6	2.2	1.8	2.9
Middle Fork									
Hills Creek	0.0	0.0	0.0	0.0	0.0	0.0	4.4	3.5	5.7
Lookout/Dexter	117.0	93.6	152.2	266.0	212.8	345.8	15.6	12.5	20.3
Fall Creek	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.6	2.7
Revetments	4.1	3.3	5.3	9.6	7.6	12.4	0.0	0.0	0.0
Total	459	299	700	1,454	943	2,169	54	40	65

Table 3-5 Alternative 3A Costs by Sub-Basin

Location	Design/ EDC ($M)	Low Design/EDC ($M)	High Design/EDC ($M)	Capital ($M)	Low Capital ($M)	High Capital ($M)	OMRRR ($M)	Low OMRRR ($M)	High OMRRR ($M)
North Santiam									
Detroit/Big Cliff	0.6	0.5	0.8	1.7	1.4	2.2	8.3	6.6	10.7
South Santiam									
Foster	0.1	0.1	0.1	0.4	0.4	0.6	2.8	2.2	3.6
Green Peter	18.3	14.6	24.0	41.6	33.1	54.6	6.6	5.3	8.6
Long Tom									
Fern Ridge	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.0	3.2
McKenzie									
Cougar	9.6	7.7	12.5	22.1	17.7	28.8	6.7	2.3	3.7
Blue River	73.8	42.3	107.1	168.0	96.4	243.7	2.6	2.0	3.3
Middle Fork									
Hills Creek	87.6	49.2	134.8	199.2	111.9	306.4	4.7	3.8	6.1
Lookout/Dexter	0.0	0.0	0.0	0.0	0.0	0.0	10.7	8.6	14.0
Fall Creek	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.6	2.7
Revetments	4.1	3.3	5.3	9.6	7.6	12.4	0.0	0.0	0.0
Total	194	118	285	443	269	649	47	34	56

Table 3-6 Alternative 3B Costs by Sub-Basin

Location	Design/ EDC ($M)	Low Design/EDC ($M)	High Design/EDC ($M)	Capital ($M)	Low Capital ($M)	High Capital ($M)	OMRRR ($M)	Low OMRRR ($M)	High OMRRR ($M)
North Santiam									
Detroit/Big Cliff	0.65	0.52	0.84	1.71	1.37	2.22	8.3	6.6	10.7
South Santiam									
Foster	0.1	0.1	0.1	0.4	0.4	0.6	2.8	2.2	3.6
Green Peter	18.3	14.6	24.0	41.6	33.1	54.6	6.6	5.3	8.6
Long Tom									
Fern Ridge	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.0	3.2
McKenzie									
Cougar	45.7	34.3	114.3	104.2	78.2	260.0	6.9	2.4	4.3
Blue River	73.8	42.3	107.1	168.0	96.4	243.7	2.6	2.0	3.3
Middle Fork									
Hills Creek	87.6	49.2	134.8	199.2	111.9	306.4	4.7	3.8	6.1
Lookout/Dexter	0.0	0.0	0.0	0.0	0.0	0.0	10.7	8.6	14.0
Fall Creek	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.6	2.7
Revetments	4.1	3.3	5.3	9.6	7.6	12.4	0.0	0.0	0.0
Total	230	144	386	525	329	880	47	35	56

Table 3-7 Alternative 4 Costs by Sub-Basin

Location	Design/ EDC ($M)	Low Design/EDC ($M)	High Design/EDC ($M)	Capital ($M)	Low Capital ($M)	High Capital ($M)	OMRRR ($M)	Low OMRRR ($M)	High OMRRR ($M)
North Santiam									
Detroit/Big Cliff	251.7	143.8	367.6	986.6	592.8	1418.0	13.2	10.5	17.1
South Santiam									
Foster	27.5	13.6	47.4	58.7	28.0	102.9	2.9	2.3	3.8
Green Peter	3.1	2.4	6.1	7.0	5.4	13.9	6.3	5.0	8.2
Long Tom									
Fern Ridge	3.1	1.6	6.2	7.1	3.5	14.2	2.5	2.0	3.2
McKenzie									
Cougar	42.9	34.3	57.7	170.2	136.2	225.7	11.6	6.1	10.0
Blue River	0.1	0.1	0.1	0.4	0.4	0.6	2.2	1.8	2.9
Middle Fork									
Hills Creek	301.0	191.0	507.4	684.0	434.1	1153.1	9.7	7.7	12.6
Lookout/Dexter	285.7	178.8	489.5	649.3	406.4	1112.5	15.7	12.5	20.4
Fall Creek	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.6	2.7
Revetments	4.1	3.3	5.3	9.6	7.6	12.4	0.0	0.0	0.0
Total	919	569	1,487	2,573	1,614	4,053	66	50	81

3.2 Annual Costs

An implementation schedule was not developed for each alternative; therefore year-by-year costs are not available for each alternative. The annual costs in Table 3-8 are the costs in the above tables distributed evenly over the 30-year period of analysis.

Table 3-8 Design and Engineering During Construction (EDC), Capital, and Annual Operations and Maintenance Costs and Total Annual Costs for Each Alternative

Alternative	Design and EDC ($M)	Design and EDC Annual ($M)	Capital ($M)	Capital Annual ($M)	O&M Annual ($M)	Total Annual ($M)*
NAA	0	0	0	0	45	45
1	879	29	2,409	80	61	171
2A	453	15	1,514	50	61	127
2B	459	15	1,454	48	54	118
3A	194	6	443	15	47	68
3B	230	8	525	17	47	72
4	919	31	2,573	86	66	182
5	459	15	1,454	48	54	118

* The total in this column may not be the sum of the three annual columns due to rounding.

REFERENCES

United States Army Corps of Engineers (USACE). 2019. Economic Guidance Memorandum 22-01, Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2022. October 31, 2021. Available at https://planning.erdc.dren.mil/toolbox/library/EGMs/EGM22-01.pdf