

Appendix 12H

Early Life-Stage Salmon Mortality Modeling

Line items and numbers identified or noted as “No Action Alternative” represent the “Existing Conditions/No Project/No Action Condition” (described in Chapter 2 Alternatives Analysis).
Table numbering may not be consecutive for all appendixes.

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APPENDIX 12H

Early Life-Stage Salmon Mortality Modeling

12H.1 Overview

This appendix provides a summary of modeling performed to simulate early life-stage salmon mortality for the Trinity River, Sacramento River, Feather River, and American River for the Sites Reservoir Project (Project) Draft Environmental Impact Report/Environmental Impact Statement (DEIR/EIS). It includes a description of the Reclamation Salmon Mortality Model and results used in the detailed evaluation of Project action alternatives (alternatives). Results are used or referenced in Chapter 12 Aquatic Biological Resources. The fisheries impact assessment and methodology is described in Chapter 12 Aquatic Biological Resources and in Appendix 12B Fisheries Impact Assessment Methodology and Appendix 12C Fisheries Impact Summary.

12H.1.1 Introduction

The analytical framework used to evaluate the alternatives is summarized in Chapter 5 Guide to the Resource Analyses and Appendix 6B Water Resources System Modeling. Assumptions used in modeling the alternatives are summarized in Appendix 6A Modeling of Alternatives. The Reclamation Salmon Mortality Model was applied to compute salmon spawning losses in the Trinity River, Sacramento River, Feather River, and American River.

The Reclamation Salmon Mortality Model uses temperature results based on the Reclamation Temperature Model and Upper Sacramento River Water Quality Model (USRWQM) (Appendix 7E River Temperature Modeling). These temperature results are based on the results for the 82-year simulation period used for the CALSIM II Model (Appendix 6B Water Resources System Modeling) and the daily flow results from the Upper Sacramento River Daily Operations Model (USRDOM) (Appendix 6C Upper Sacramento River Daily River Flow and Operations Modeling).

The Reclamation Salmon Mortality Model results provide a way to ascertain the potential impacts on the temperature-related mortality of the early life-stages of salmon due to the expected changes in operations resulting from implementation of each alternative.

12H.1.2 Reclamation Salmon Mortality Model

The Reclamation Salmon Mortality Model computes percentages of salmon spawning losses for each of the four rivers based on the simulated water temperature data, temperature-exposure mortality criteria for three salmon life stages (pre-spawned eggs, fertilized eggs, and pre-emergent fry) and spawning distribution data. Simulated water temperature data is obtained from the Upper Sacramento River Water Quality Model for the Sacramento River, and from the Reclamation Temperature Model for the Trinity River, Feather River, and American River.

The 2008 OCAP BA Technical Appendix L (Reclamation, 2008) describes the Reclamation Salmon Mortality Model in detail, including the development history, model formulation, input assumptions, use of outputs, and limitations of the model. Appendix 12B Fisheries Impact Assessment Methodology also briefly describes the model, its inputs, and summarizes the use of the model results in the detailed evaluation of the DEIR/EIS alternatives, along with the model limitations.

12H.2 Results

This section includes the results of the Reclamation Mortality Models for the alternatives evaluated in the DEIR/EIS. The fisheries impact assessment and methodology is described in Chapter 12 Aquatic Biological Resources and in Appendix 12B Fisheries Impact Assessment Methodology and Appendix 12C Fisheries Impact Summary.

12H.2.1 Introduction

Reclamation Salmon Mortality Model annual mortality and survival results for various salmon runs are included in this appendix. This document includes summary tables and exceedance plots comparing the annual mortality and survival results of various salmon runs, in different reaches of each river. The summary tables and exceedance plots are organized by river basin, in the following order:

- Trinity River
- Sacramento River
- Feather River
- American River

Summary tables for annual mortality and survival include long-term average and averages by water year type (SWRCB D-1641 40-30-30 Index). The tables also include the absolute and relative differences between alternatives.

Exceedance Probability Charts are included for the following parameters for various Salmon Runs on each river:

- Annual mortality within different reaches of each river and for the river
- Annual survival within different reaches of each river and for the river
- Annual mortality by the life stage

Guidance on the appropriate use of these results is presented in Appendix 6B Water Resources System Modeling.

12H.2.2 Comparisons

For each river basin, a report is provided for each of the following comparisons:

- Alternative A compared to No Action Alternative
- Alternative B compared to No Action Alternative
- Alternative C compared to No Action Alternative
- Alternative D compared to No Action Alternative

12H.3 References

Bureau of Reclamation. 2008. 2008 OCAP BA Technical Appendix L Reclamation Salmon Mortality Model.

Appendix 12H

Early Life-stage Salmon Mortality Modeling Results

Line items and numbers identified or noted as “No Action Alternative” represent the “Existing Conditions/No Project/No Action Condition” (described in Chapter 2 Alternatives Analysis).
Table numbering may not be consecutive for all appendixes.

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Alternative A Compared to No Action Alternative

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Table AQ-03-3a
Trinity River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)
Fall-Run Total	
Long-term	
Full Simulation Period¹	
No Action Alternative	2.3
Alternative A	1.8
Difference	-0.5
Water Year Types²	
Wet (32%)	
No Action Alternative	0.8
Alternative A	0.9
Difference	0.1
Above Normal (15%)	
No Action Alternative	1.0
Alternative A	0.8
Difference	-0.2
Below Normal (17%)	
No Action Alternative	2.0
Alternative A	2.0
Difference	0.0
Dry (22%)	
No Action Alternative	1.7
Alternative A	1.4
Difference	-0.3
Critical (15%)	
No Action Alternative	8.2
Alternative A	5.2
Difference	-3.0
¹ Based on the 81-year simulation period	
² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)	

**Table AQ-03-3b
Sacramento River Salmonid Annual Mortality by Reach**

Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)															
	Fall-Run Lower Reach	Fall-Run Middle Reach	Fall-Run Upper Reach	Fall-Run Total	LateFall Lower Reach	LateFall Middle Reach	LateFall Upper Reach	LateFall Total	Spring-Run Lower Reach	Spring-Run Middle Reach	Spring-Run Upper Reach	Spring-Run Total	Winter-Run Lower Reach	Winter-Run Middle Reach	Winter-Run Upper Reach	Winter-Run Total
Long-term																
Full Simulation Period¹																
No Action Alternative	0.6	6.6	7.6	14.7	0.7	1.2	0.9	2.8	0.0	0.3	23.3	23.7	0.0	0.1	5.5	5.6
Alternative A	0.6	6.2	6.3	13.1	0.8	1.1	0.6	2.5	0.0	0.3	19.9	20.2	0.0	0.1	3.9	4.0
Difference	0.0	-0.4	-1.2	-1.6	0.1	0.0	-0.4	-0.3	0.0	0.0	-3.4	-3.5	0.0	0.0	-1.6	-1.6
Water Year Types²																
Wet (32.1%)																
No Action Alternative	0.5	5.0	4.7	10.2	0.6	1.4	1.3	3.3	0.0	0.2	9.0	9.2	0.0	0.1	0.6	0.8
Alternative A	0.5	4.8	4.2	9.6	0.6	0.9	0.5	2.0	0.0	0.2	8.5	8.7	0.0	0.1	0.4	0.5
Difference	0.0	-0.2	-0.5	-0.7	0.0	-0.5	-0.8	-1.3	0.0	0.0	-0.5	-0.5	0.0	0.0	-0.2	-0.2
Above Normal (13.6%)																
No Action Alternative	0.5	5.6	4.9	11.1	0.8	1.2	0.6	2.7	0.0	0.3	11.2	11.5	0.0	0.1	0.6	0.7
Alternative A	0.5	5.5	4.2	10.2	0.9	1.2	0.5	2.7	0.0	0.3	10.6	10.9	0.0	0.1	0.6	0.7
Difference	0.0	-0.1	-0.7	-0.8	0.1	0.0	-0.1	0.0	0.0	0.0	-0.6	-0.6	0.0	0.0	0.1	0.1
Below Normal (17%)																
No Action Alternative	0.5	5.9	4.4	10.9	0.7	0.8	0.3	1.9	0.0	0.3	11.7	12.0	0.0	0.1	1.0	1.1
Alternative A	0.5	5.4	3.5	9.4	1.0	1.0	0.2	2.2	0.0	0.3	9.9	10.2	0.0	0.1	1.4	1.5
Difference	0.0	-0.5	-0.9	-1.4	0.2	0.2	-0.1	0.3	0.0	0.0	-1.8	-1.9	0.0	0.0	0.4	0.4
Dry (22%)																
No Action Alternative	0.6	7.4	8.5	16.5	0.9	1.4	0.9	3.2	0.0	0.4	24.7	25.0	0.0	0.1	1.8	1.9
Alternative A	0.6	6.9	6.7	14.2	1.0	1.6	0.7	3.3	0.0	0.4	20.5	20.8	0.0	0.1	1.3	1.4
Difference	0.0	-0.5	-1.8	-2.3	0.2	0.1	-0.2	0.1	0.0	0.0	-4.2	-4.2	0.0	0.0	-0.6	-0.6
Critical (15%)																
No Action Alternative	0.7	10.6	18.5	29.8	0.5	0.5	1.1	2.1	0.0	0.5	77.2	77.7	0.0	0.2	31.2	31.4
Alternative A	0.7	9.8	15.7	26.3	0.7	1.0	0.9	2.6	0.0	0.4	64.0	64.5	0.0	0.2	21.5	21.6
Difference	0.0	-0.8	-2.8	-3.5	0.2	0.5	-0.2	0.5	0.0	0.0	-13.1	-13.2	0.0	0.0	-9.7	-9.7

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Table AQ-03-3c
Feather River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)		
	Fall-Run Lower Reach	Fall-Run Upper Reach	Fall-Run Total
Long-term			
Full Simulation Period¹			
No Action Alternative	1.4	0.8	2.2
Alternative A	1.3	0.7	2.0
Difference	0.0	-0.1	-0.1
Water Year Types²			
Wet (32%)			
No Action Alternative	1.1	0.3	1.4
Alternative A	1.2	0.3	1.5
Difference	0.0	0.0	0.1
Above Normal (15%)			
No Action Alternative	0.9	0.2	1.1
Alternative A	0.9	0.2	1.1
Difference	0.0	0.0	0.0
Below Normal (17%)			
No Action Alternative	1.4	0.5	1.9
Alternative A	1.4	0.5	1.9
Difference	0.0	0.0	0.1
Dry (22%)			
No Action Alternative	1.5	0.9	2.4
Alternative A	1.6	1.0	2.6
Difference	0.1	0.1	0.1
Critical (15%)			
No Action Alternative	2.0	2.8	4.8
Alternative A	1.6	1.8	3.4
Difference	-0.4	-1.0	-1.4
1 Based on the 81-year simulation period			
2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)			

Table AQ-03-3d
American River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)
	Fall-Run Total
Long-term	
Full Simulation Period¹	
No Action Alternative	17.6
Alternative A	17.5
Difference	-0.1
Water Year Types²	
Wet (32%)	
No Action Alternative	19.6
Alternative A	19.6
Difference	0.0
Above Normal (15%)	
No Action Alternative	13.7
Alternative A	13.1
Difference	-0.6
Below Normal (17%)	
No Action Alternative	14.0
Alternative A	14.1
Difference	0.1
Dry (22%)	
No Action Alternative	17.7
Alternative A	17.5
Difference	-0.2
Critical (15%)	
No Action Alternative	21.1
Alternative A	21.2
Difference	0.2

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Alternative B Compared to No Action Alternative

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Table AQ-03-5a
Trinity River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)	
	Fall-Run Total	
Long-term		
Full Simulation Period¹		
No Action Alternative	2.3	
Alternative B	2.0	
Difference	-0.3	
Water Year Types²		
Wet (32%)		
No Action Alternative	0.8	
Alternative B	0.9	
Difference	0.0	
Above Normal (15%)		
No Action Alternative	1.0	
Alternative B	0.8	
Difference	-0.2	
Below Normal (17%)		
No Action Alternative	2.0	
Alternative B	2.1	
Difference	0.1	
Dry (22%)		
No Action Alternative	1.7	
Alternative B	1.6	
Difference	-0.1	
Critical (15%)		
No Action Alternative	8.2	
Alternative B	6.0	
Difference	-2.1	

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

**Table AQ-03-5b
Sacramento River Salmonid Annual Mortality by Reach**

Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)															
	Fall-Run Lower Reach	Fall-Run Middle Reach	Fall-Run Upper Reach	Fall-Run Total	LateFall Lower Reach	LateFall Middle Reach	LateFall Upper Reach	LateFall Total	Spring- Run Lower Reach	Spring- Run Middle Reach	Spring- Run Upper Reach	Spring- Run Total	Winter- Run Lower Reach	Winter- Run Middle Reach	Winter- Run Upper Reach	Winter- Run Total
Long-term																
Full Simulation Period¹																
No Action Alternative	0.6	6.6	7.6	14.7	0.7	1.2	0.9	2.8	0.0	0.3	23.3	23.7	0.0	0.1	5.5	5.6
Alternative B	0.6	6.2	6.4	13.2	0.8	1.2	0.6	2.6	0.0	0.3	20.1	20.4	0.0	0.1	4.1	4.2
Difference	0.0	-0.4	-1.1	-1.5	0.1	0.0	-0.3	-0.2	0.0	0.0	-3.2	-3.2	0.0	0.0	-1.4	-1.4
Water Year Types²																
Wet (32.1%)																
No Action Alternative	0.5	5.0	4.7	10.2	0.6	1.4	1.3	3.3	0.0	0.2	9.0	9.2	0.0	0.1	0.6	0.8
Alternative B	0.5	4.9	4.5	9.9	0.6	0.9	0.5	2.0	0.0	0.2	8.6	8.8	0.0	0.1	0.4	0.5
Difference	0.0	-0.1	-0.3	-0.3	0.0	-0.5	-0.7	-1.3	0.0	0.0	-0.4	-0.4	0.0	0.0	-0.2	-0.2
Above Normal (13.6%)																
No Action Alternative	0.5	5.6	4.9	11.1	0.8	1.2	0.6	2.7	0.0	0.3	11.2	11.5	0.0	0.1	0.6	0.7
Alternative B	0.5	5.5	4.4	10.5	0.9	1.3	0.6	2.8	0.0	0.3	10.4	10.6	0.0	0.1	0.7	0.9
Difference	0.0	-0.1	-0.5	-0.6	0.1	0.1	-0.1	0.2	0.0	0.0	-0.8	-0.8	0.0	0.0	0.2	0.2
Below Normal (17%)																
No Action Alternative	0.5	5.9	4.4	10.9	0.7	0.8	0.3	1.9	0.0	0.3	11.7	12.0	0.0	0.1	1.0	1.1
Alternative B	0.5	5.4	3.5	9.5	1.0	1.1	0.2	2.3	0.0	0.3	9.5	9.8	0.0	0.1	1.4	1.6
Difference	0.0	-0.5	-0.9	-1.4	0.2	0.2	-0.1	0.4	0.0	0.0	-2.2	-2.2	0.0	0.0	0.5	0.5
Dry (22%)																
No Action Alternative	0.6	7.4	8.5	16.5	0.9	1.4	0.9	3.2	0.0	0.4	24.7	25.0	0.0	0.1	1.8	1.9
Alternative B	0.6	6.9	6.7	14.1	1.0	1.6	0.7	3.3	0.0	0.4	19.4	19.8	0.0	0.1	1.7	1.8
Difference	0.0	-0.6	-1.8	-2.4	0.1	0.1	-0.2	0.1	0.0	0.0	-5.3	-5.3	0.0	0.0	-0.1	-0.1
Critical (15%)																
No Action Alternative	0.7	10.6	18.5	29.8	0.5	0.5	1.1	2.1	0.0	0.5	77.2	77.7	0.0	0.2	31.2	31.4
Alternative B	0.7	9.7	15.7	26.1	0.7	1.0	0.9	2.7	0.0	0.4	67.6	68.0	0.0	0.2	22.0	22.2
Difference	0.0	-0.9	-2.8	-3.7	0.2	0.5	-0.2	0.6	0.0	0.0	-9.6	-9.6	0.0	0.0	-9.2	-9.2

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Table AQ-03-5c
Feather River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)		
	Fall-Run Lower Reach	Fall-Run Upper Reach	Fall-Run Total
Long-term			
Full Simulation Period¹			
No Action Alternative	1.4	0.8	2.2
Alternative B	1.3	0.7	2.1
Difference	0.0	-0.1	-0.1
Water Year Types²			
Wet (32%)			
No Action Alternative	1.1	0.3	1.4
Alternative B	1.2	0.3	1.5
Difference	0.0	0.0	0.0
Above Normal (15%)			
No Action Alternative	0.9	0.2	1.1
Alternative B	0.9	0.2	1.1
Difference	0.0	0.0	0.0
Below Normal (17%)			
No Action Alternative	1.4	0.5	1.9
Alternative B	1.4	0.5	1.9
Difference	0.0	0.0	0.1
Dry (22%)			
No Action Alternative	1.5	0.9	2.4
Alternative B	1.5	0.9	2.4
Difference	0.0	0.0	0.0
Critical (15%)			
No Action Alternative	2.0	2.8	4.8
Alternative B	1.8	2.2	4.0
Difference	-0.2	-0.6	-0.8

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Table AQ-03-5d
American River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)	
	Fall-Run Total	
Long-term		
Full Simulation Period¹		
No Action Alternative		17.6
Alternative B		17.7
Difference		0.1
Water Year Types²		
Wet (32%)		
No Action Alternative		19.6
Alternative B		19.9
Difference		0.4
Above Normal (15%)		
No Action Alternative		13.7
Alternative B		13.3
Difference		-0.5
Below Normal (17%)		
No Action Alternative		14.0
Alternative B		14.1
Difference		0.1
Dry (22%)		
No Action Alternative		17.7
Alternative B		17.5
Difference		-0.2
Critical (15%)		
No Action Alternative		21.1
Alternative B		21.5
Difference		0.5

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Alternative C Compared to No Action Alternative

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Table AQ-03-7a
Trinity River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)	
	Fall-Run Total	
Long-term		
Full Simulation Period¹		
No Action Alternative		2.3
Alternative C		1.7
Difference		-0.7
Water Year Types²		
Wet (32%)		
No Action Alternative		0.8
Alternative C		0.9
Difference		0.1
Above Normal (15%)		
No Action Alternative		1.0
Alternative C		0.7
Difference		-0.3
Below Normal (17%)		
No Action Alternative		2.0
Alternative C		1.9
Difference		-0.1
Dry (22%)		
No Action Alternative		1.7
Alternative C		1.3
Difference		-0.4
Critical (15%)		
No Action Alternative		8.2
Alternative C		4.6
Difference		-3.6

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

**Table AQ-03-7b
Sacramento River Salmonid Annual Mortality by Reach**

Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)															
	Fall-Run Lower Reach	Fall-Run Middle Reach	Fall-Run Upper Reach	Fall-Run Total	LateFall Lower Reach	LateFall Middle Reach	LateFall Upper Reach	LateFall Total	Spring-Run Lower Reach	Spring-Run Middle Reach	Spring-Run Upper Reach	Spring-Run Total	Winter-Run Lower Reach	Winter-Run Middle Reach	Winter-Run Upper Reach	Winter-Run Total
Long-term																
Full Simulation Period¹																
No Action Alternative	0.6	6.6	7.6	14.7	0.7	1.2	0.9	2.8	0.0	0.3	23.3	23.7	0.0	0.1	5.5	5.6
Alternative C	0.6	6.2	6.3	13.1	0.8	1.1	0.6	2.5	0.0	0.3	19.5	19.8	0.0	0.1	3.4	3.6
Difference	0.0	-0.4	-1.2	-1.6	0.1	0.0	-0.4	-0.3	0.0	0.0	-3.9	-3.9	0.0	0.0	-2.0	-2.0
Water Year Types²																
Wet (32.1%)																
No Action Alternative	0.5	5.0	4.7	10.2	0.6	1.4	1.3	3.3	0.0	0.2	9.0	9.2	0.0	0.1	0.6	0.8
Alternative C	0.5	4.8	4.2	9.5	0.6	0.9	0.5	2.0	0.0	0.2	8.5	8.7	0.0	0.1	0.4	0.5
Difference	0.0	-0.2	-0.5	-0.7	0.0	-0.5	-0.8	-1.3	0.0	0.0	-0.5	-0.5	0.0	0.0	-0.2	-0.2
Above Normal (13.6%)																
No Action Alternative	0.5	5.6	4.9	11.1	0.8	1.2	0.6	2.7	0.0	0.3	11.2	11.5	0.0	0.1	0.6	0.7
Alternative C	0.5	5.5	4.2	10.3	0.9	1.3	0.5	2.7	0.0	0.3	10.2	10.5	0.0	0.1	0.6	0.7
Difference	0.0	-0.1	-0.7	-0.8	0.1	0.0	-0.1	0.0	0.0	0.0	-1.0	-0.9	0.0	0.0	0.0	0.0
Below Normal (17%)																
No Action Alternative	0.5	5.9	4.4	10.9	0.7	0.8	0.3	1.9	0.0	0.3	11.7	12.0	0.0	0.1	1.0	1.1
Alternative C	0.5	5.5	3.6	9.7	1.0	1.0	0.2	2.3	0.0	0.3	10.0	10.3	0.0	0.1	1.4	1.5
Difference	0.0	-0.4	-0.7	-1.2	0.2	0.2	-0.1	0.3	0.0	0.0	-1.7	-1.7	0.0	0.0	0.4	0.4
Dry (22%)																
No Action Alternative	0.6	7.4	8.5	16.5	0.9	1.4	0.9	3.2	0.0	0.4	24.7	25.0	0.0	0.1	1.8	1.9
Alternative C	0.6	6.9	6.6	14.1	1.0	1.6	0.6	3.2	0.0	0.4	19.7	20.1	0.0	0.1	1.4	1.5
Difference	0.0	-0.6	-1.8	-2.4	0.2	0.1	-0.3	0.0	0.0	0.0	-4.9	-5.0	0.0	0.0	-0.5	-0.5
Critical (15%)																
No Action Alternative	0.7	10.6	18.5	29.8	0.5	0.5	1.1	2.1	0.0	0.5	77.2	77.7	0.0	0.2	31.2	31.4
Alternative C	0.7	9.9	15.6	26.3	0.7	1.1	0.9	2.7	0.0	0.4	62.6	63.0	0.0	0.2	18.3	18.5
Difference	0.0	-0.6	-2.8	-3.5	0.2	0.5	-0.2	0.6	0.0	0.0	-14.6	-14.6	0.0	0.0	-12.9	-12.9

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Table AQ-03-7c
Feather River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)		
	Fall-Run Lower Reach	Fall-Run Upper Reach	Fall-Run Total
Long-term			
Full Simulation Period¹			
No Action Alternative	1.4	0.8	2.2
Alternative C	1.4	0.8	2.2
Difference	0.0	0.0	0.0
Water Year Types²			
Wet (32%)			
No Action Alternative	1.1	0.3	1.4
Alternative C	1.2	0.3	1.5
Difference	0.0	0.0	0.1
Above Normal (15%)			
No Action Alternative	0.9	0.2	1.1
Alternative C	0.9	0.2	1.1
Difference	0.0	0.0	0.0
Below Normal (17%)			
No Action Alternative	1.4	0.5	1.9
Alternative C	1.4	0.5	1.9
Difference	0.0	0.0	0.1
Dry (22%)			
No Action Alternative	1.5	0.9	2.4
Alternative C	1.6	1.1	2.6
Difference	0.0	0.2	0.2
Critical (15%)			
No Action Alternative	2.0	2.8	4.8
Alternative C	1.8	2.3	4.1
Difference	-0.2	-0.5	-0.7

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Table AQ-03-7d
American River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)
	Fall-Run Total
Long-term	
Full Simulation Period¹	
No Action Alternative	17.6
Alternative C	17.8
Difference	0.2
Water Year Types²	
Wet (32%)	
No Action Alternative	19.6
Alternative C	20.1
Difference	0.5
Above Normal (15%)	
No Action Alternative	13.7
Alternative C	13.4
Difference	-0.4
Below Normal (17%)	
No Action Alternative	14.0
Alternative C	13.9
Difference	-0.1
Dry (22%)	
No Action Alternative	17.7
Alternative C	17.7
Difference	0.0
Critical (15%)	
No Action Alternative	21.1
Alternative C	21.8
Difference	0.8

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Alternative D Compared to No Action Alternative

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Table AQ-03-9a
Trinity River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)	
	Fall-Run Total	
Long-term		
Full Simulation Period¹		
No Action Alternative		2.3
Alternative D		2.0
Difference		-0.4
Water Year Types²		
Wet (32%)		
No Action Alternative		0.8
Alternative D		0.8
Difference		0.0
Above Normal (15%)		
No Action Alternative		1.0
Alternative D		1.0
Difference		0.0
Below Normal (17%)		
No Action Alternative		2.0
Alternative D		2.2
Difference		0.1
Dry (22%)		
No Action Alternative		1.7
Alternative D		1.5
Difference		-0.2
Critical (15%)		
No Action Alternative		8.2
Alternative D		5.7
Difference		-2.5

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

**Table AQ-03-9b
Sacramento River Salmonid Annual Mortality by Reach**

Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)															
	Fall-Run Lower Reach	Fall-Run Middle Reach	Fall-Run Upper Reach	Fall-Run Total	LateFall Lower Reach	LateFall Middle Reach	LateFall Upper Reach	LateFall Total	Spring- Run Lower Reach	Spring- Run Middle Reach	Spring- Run Upper Reach	Spring- Run Total	Winter- Run Lower Reach	Winter- Run Middle Reach	Winter- Run Upper Reach	Winter- Run Total
Long-term																
Full Simulation Period¹																
No Action Alternative	0.6	6.6	7.6	14.7	0.7	1.2	0.9	2.8	0.0	0.3	23.3	23.7	0.0	0.1	5.5	5.6
Alternative D	0.6	6.2	6.3	13.1	0.8	1.1	0.6	2.4	0.0	0.3	20.0	20.3	0.0	0.1	2.6	2.8
Difference	0.0	-0.4	-1.2	-1.6	0.1	-0.1	-0.4	-0.4	0.0	0.0	-3.3	-3.3	0.0	0.0	-2.8	-2.8
Water Year Types²																
Wet (32.1%)																
No Action Alternative	0.5	5.0	4.7	10.2	0.6	1.4	1.3	3.3	0.0	0.2	9.0	9.2	0.0	0.1	0.6	0.8
Alternative D	0.5	4.9	4.3	9.7	0.6	0.9	0.5	2.0	0.0	0.2	8.7	8.9	0.0	0.1	0.4	0.5
Difference	0.0	-0.1	-0.4	-0.6	0.0	-0.6	-0.8	-1.4	0.0	0.0	-0.3	-0.3	0.0	0.0	-0.2	-0.2
Above Normal (13.6%)																
No Action Alternative	0.5	5.6	4.9	11.1	0.8	1.2	0.6	2.7	0.0	0.3	11.2	11.5	0.0	0.1	0.6	0.7
Alternative D	0.5	5.4	4.0	9.9	0.9	1.2	0.5	2.7	0.0	0.3	10.2	10.4	0.0	0.1	0.5	0.7
Difference	0.0	-0.3	-0.8	-1.1	0.1	0.0	-0.1	0.0	0.0	0.0	-1.0	-1.0	0.0	0.0	0.0	0.0
Below Normal (17%)																
No Action Alternative	0.5	5.9	4.4	10.9	0.7	0.8	0.3	1.9	0.0	0.3	11.7	12.0	0.0	0.1	1.0	1.1
Alternative D	0.5	5.5	3.7	9.7	0.9	0.9	0.2	2.0	0.0	0.3	10.0	10.3	0.0	0.1	0.8	1.0
Difference	0.0	-0.4	-0.7	-1.2	0.1	0.1	-0.1	0.1	0.0	0.0	-1.7	-1.7	0.0	0.0	-0.1	-0.1
Dry (22%)																
No Action Alternative	0.6	7.4	8.5	16.5	0.9	1.4	0.9	3.2	0.0	0.4	24.7	25.0	0.0	0.1	1.8	1.9
Alternative D	0.6	6.9	6.5	14.0	1.0	1.5	0.7	3.1	0.0	0.4	19.4	19.7	0.0	0.1	1.2	1.4
Difference	0.0	-0.5	-2.0	-2.5	0.1	0.1	-0.3	-0.1	0.0	0.0	-5.3	-5.3	0.0	0.0	-0.6	-0.6
Critical (15%)																
No Action Alternative	0.7	10.6	18.5	29.8	0.5	0.5	1.1	2.1	0.0	0.5	77.2	77.7	0.0	0.2	31.2	31.4
Alternative D	0.7	9.9	15.7	26.3	0.7	0.9	0.9	2.5	0.0	0.4	66.4	66.8	0.0	0.2	13.6	13.8
Difference	0.0	-0.7	-2.7	-3.5	0.2	0.4	-0.2	0.4	0.0	0.0	-10.8	-10.9	0.0	0.0	-17.6	-17.6

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Table AQ-03-9c
Feather River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)		
	Fall-Run Lower Reach	Fall-Run Upper Reach	Fall-Run Total
Long-term			
Full Simulation Period¹			
No Action Alternative	1.4	0.8	2.2
Alternative D	1.4	0.8	2.1
Difference	0.0	-0.1	-0.1
Water Year Types²			
Wet (32%)			
No Action Alternative	1.1	0.3	1.4
Alternative D	1.2	0.3	1.5
Difference	0.0	0.0	0.0
Above Normal (15%)			
No Action Alternative	0.9	0.2	1.1
Alternative D	0.9	0.2	1.1
Difference	0.0	0.0	0.0
Below Normal (17%)			
No Action Alternative	1.4	0.5	1.9
Alternative D	1.4	0.5	1.9
Difference	0.0	0.0	0.0
Dry (22%)			
No Action Alternative	1.5	0.9	2.4
Alternative D	1.6	0.8	2.4
Difference	0.1	-0.1	0.0
Critical (15%)			
No Action Alternative	2.0	2.8	4.8
Alternative D	1.9	2.5	4.4
Difference	-0.1	-0.3	-0.4

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

Table AQ-03-9d
American River Salmonid Annual Mortality
Long-term Average and Average by Water Year Type

Analysis Period	Annual Mortality (%)
	Fall-Run Total
Long-term	
Full Simulation Period¹	
No Action Alternative	17.6
Alternative D	17.6
Difference	0.0
Water Year Types²	
Wet (32%)	
No Action Alternative	19.6
Alternative D	19.4
Difference	-0.1
Above Normal (15%)	
No Action Alternative	13.7
Alternative D	13.4
Difference	-0.4
Below Normal (17%)	
No Action Alternative	14.0
Alternative D	13.9
Difference	-0.2
Dry (22%)	
No Action Alternative	17.7
Alternative D	17.7
Difference	0.0
Critical (15%)	
No Action Alternative	21.1
Alternative D	21.5
Difference	0.5

¹ Based on the 81-year simulation period

² As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)