Appendix 12K
Delta Passage Modeling

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APPENDIX 12K
Delta Passage Modeling

12K.1 Overview

This appendix provides a summary of modeling performed to simulate migration and survival of fall-run and spring-run juvenile Chinook salmon while in the Sacramento-San Joaquin Delta (Delta). The Delta Passage Model (DPM), developed by Cramer Fish Sciences, was used for the Sacramento River for the Draft Environmental Impact Report/Environmental Impact Statement (DEIR/EIS). A description of the DPM and the results used in the detailed evaluation of the Sites Reservoir Project (Project) action alternatives (alternatives) are included. Results were 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. As an integrated component of the Interactive Object-oriented Simulation (IOS) model, the DPM was also applied to simulate migration and survival of winter-run juvenile Chinook salmon. A description of the IOS model and the results of the winter-run DPM for winter-run Chinook salmon are presented in Appendix 12J Winter-Run Chinook Salmon Life Cycle Modeling.

12K.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.

DPM simulates migration, survival, and abundance of fall-run and spring-run juvenile Chinook salmon while in the Delta, entering from the Sacramento River and leaving at Chipps Island as they migrate to the ocean. To estimate survival, DPM considers migration pathways through the Delta, the speed of migration, reach conditions, and loss due to Delta exports at Banks and Jones pumping plants. DPM provides results of annual survival rates for juvenile Chinook salmon passage through the Delta. The report is included as part of this appendix.

DPM uses outputs from the SWP and CVP Hydrology and System Operations Model (CALSIM II), and daily and sub-daily flow results from the Delta Hydrodynamics Model (DSM2 HYDRO). The CALSIM II model is described in Appendix 6B Water Resources System Modeling and the DSM2 model is described in the Appendix 7D Sacramento-San Joaquin Delta Modeling.

12K.2 Results

This section includes the results of the DPM 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.

12K.2.1 Introduction

DPM annual survival results for fall-run and spring-run juvenile Chinook salmon are included in this appendix. IOS/DPM annual survival results for winter-run juvenile Chinook salmon are included in

Appendix 12L Weighted Useable Area Analysis. This document includes exceedance probability charts and tables comparing the results.

The exceedance probability charts and tables are organized by the Chinook salmon run, in the following order:

- Sacramento Fall-Run
- Sacramento Spring-Run

Exceedance probability charts and tables are included for the following parameter:

- Annual Overall Delta Survival Rates

DPM results are not intended to predict specific migration pathways and survival rates for juvenile Chinook salmon migrating through the Delta, but rather to indicate a trend in survival in response to the alternative evaluated. Further guidance on the appropriate use of model results is presented in Appendix 6B Water Resources System Modeling.

12K.2.2 Comparisons

For each run of Chinook salmon, a report is provided for 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

Appendix 12K
Delta Passage Model Results

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Alternative A Compared to No Action Alternative

Table AQ-08-3
Fall-Run Chinook Salmon Delta Survival

Long-term Average and Average by Water Year Type Annual Survival	
Analysis Period	**Annual Delta Survival Rate**
Long-term	
Full Simulation Period[1]	
No Action Alternative	0.30
Alternative A	0.29
Difference	0.00
Water Year Types[2]	
Wet (32.5%)	
No Action Alternative	0.30
Alternative A	0.29
Difference	0.00
Above Normal (12.5%)	
No Action Alternative	0.30
Alternative A	0.30
Difference	0.00
Below Normal (17.5%)	
No Action Alternative	0.30
Alternative A	0.30
Difference	0.00
Dry (22.5%)	
No Action Alternative	0.29
Alternative A	0.29
Difference	0.00
Critical (15%)	
No Action Alternative	0.28
Alternative A	0.28
Difference	0.00

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). Water years may not correspond to the biological years in IOS.

Table AQ-09-3
Spring-Run Chinook Salmon Delta Survival

Long-term Average and Average by Water Year Type Annual Survival	
Analysis Period	**Annual Delta Survival Rate**
Long-term	
Full Simulation Period[1]	
No Action Alternative	0.28
Alternative A	0.28
Difference	0.00
Water Year Types[2]	
Wet (32.5%)	
No Action Alternative	0.28
Alternative A	0.28
Difference	0.00
Above Normal (12.5%)	
No Action Alternative	0.29
Alternative A	0.29
Difference	0.00
Below Normal (17.5%)	
No Action Alternative	0.29
Alternative A	0.29
Difference	0.00
Dry (22.5%)	
No Action Alternative	0.28
Alternative A	0.28
Difference	0.00
Critical (15%)	
No Action Alternative	0.28
Alternative A	0.28
Difference	0.00

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). Water years may not correspond to the biological years in IOS.

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Alternative B Compared to No Action Alternative

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Table AQ-08-5
Fall-Run Chinook Salmon Delta Survival

Long-term Average and Average by Water Year Type Annual Survival	
Analysis Period	**Annual Delta Survival Rate**
Long-term	
Full Simulation Period[1]	
No Action Alternative	0.30
Alternative B	0.29
Difference	0.00
Water Year Types[2]	
Wet (32.5%)	
No Action Alternative	0.30
Alternative B	0.29
Difference	0.00
Above Normal (12.5%)	
No Action Alternative	0.30
Alternative B	0.30
Difference	0.00
Below Normal (17.5%)	
No Action Alternative	0.30
Alternative B	0.30
Difference	0.00
Dry (22.5%)	
No Action Alternative	0.29
Alternative B	0.29
Difference	0.00
Critical (15%)	
No Action Alternative	0.28
Alternative B	0.28
Difference	0.00

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). Water years may not correspond to the biological years in IOS.

Table AQ-09-5
Spring-Run Chinook Salmon Delta Survival

Long-term Average and Average by Water Year Type Annual Survival	
Analysis Period	**Annual Delta Survival Rate**
Long-term	
Full Simulation Period[1]	
No Action Alternative	0.28
Alternative B	0.28
Difference	0.00
Water Year Types[2]	
Wet (32.5%)	
No Action Alternative	0.28
Alternative B	0.28
Difference	0.00
Above Normal (12.5%)	
No Action Alternative	0.29
Alternative B	0.29
Difference	0.00
Below Normal (17.5%)	
No Action Alternative	0.29
Alternative B	0.29
Difference	0.00
Dry (22.5%)	
No Action Alternative	0.28
Alternative B	0.28
Difference	0.00
Critical (15%)	
No Action Alternative	0.28
Alternative B	0.28
Difference	0.00

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). Water years may not correspond to the biological years in IOS.

Alternative C Compared to No Action Alternative

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Table AQ-08-7
Fall-Run Chinook Salmon Delta Survival

Long-term Average and Average by Water Year Type Annual Survival	
Analysis Period	**Annual Delta Survival Rate**
Long-term	
Full Simulation Period[1]	
No Action Alternative	0.30
Alternative C	0.29
Difference	0.00
Water Year Types[2]	
Wet (32.5%)	
No Action Alternative	0.30
Alternative C	0.29
Difference	0.00
Above Normal (12.5%)	
No Action Alternative	0.30
Alternative C	0.30
Difference	0.00
Below Normal (17.5%)	
No Action Alternative	0.30
Alternative C	0.30
Difference	0.00
Dry (22.5%)	
No Action Alternative	0.29
Alternative C	0.29
Difference	0.00
Critical (15%)	
No Action Alternative	0.28
Alternative C	0.28
Difference	0.00

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). Water years may not correspond to the biological years in IOS.

Table AQ-09-7
Spring-Run Chinook Salmon Delta Survival

Long-term Average and Average by Water Year Type Annual Survival	
Analysis Period	**Annual Delta Survival Rate**
Long-term	
Full Simulation Period[1]	
No Action Alternative	0.28
Alternative C	0.28
Difference	0.00
Water Year Types[2]	
Wet (32.5%)	
No Action Alternative	0.28
Alternative C	0.28
Difference	0.00
Above Normal (12.5%)	
No Action Alternative	0.29
Alternative C	0.29
Difference	0.00
Below Normal (17.5%)	
No Action Alternative	0.29
Alternative C	0.29
Difference	0.00
Dry (22.5%)	
No Action Alternative	0.28
Alternative C	0.28
Difference	0.00
Critical (15%)	
No Action Alternative	0.28
Alternative C	0.28
Difference	0.00

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). Water years may not correspond to the biological years in IOS.

Alternative D Compared to No Action Alternative

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Table AQ-08-9
Fall-Run Chinook Salmon Delta Survival

Long-term Average and Average by Water Year Type Annual Survival	
Analysis Period	**Annual Delta Survival Rate**
Long-term	
Full Simulation Period[1]	
No Action Alternative	0.30
Alternative D	0.29
Difference	0.00
Water Year Types[2]	
Wet (32.5%)	
No Action Alternative	0.30
Alternative D	0.29
Difference	0.00
Above Normal (12.5%)	
No Action Alternative	0.30
Alternative D	0.30
Difference	0.00
Below Normal (17.5%)	
No Action Alternative	0.30
Alternative D	0.30
Difference	0.00
Dry (22.5%)	
No Action Alternative	0.29
Alternative D	0.29
Difference	0.00
Critical (15%)	
No Action Alternative	0.28
Alternative D	0.28
Difference	-0.01

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). Water years may not correspond to the biological years in IOS.

Table AQ-09-9
Spring-Run Chinook Salmon Delta Survival

Long-term Average and Average by Water Year Type Annual Survival	
Analysis Period	**Annual Delta Survival Rate**
Long-term	
Full Simulation Period[1]	
No Action Alternative	0.28
Alternative D	0.28
Difference	0.00
Water Year Types[2]	
Wet (32.5%)	
No Action Alternative	0.28
Alternative D	0.28
Difference	0.00
Above Normal (12.5%)	
No Action Alternative	0.29
Alternative D	0.29
Difference	0.00
Below Normal (17.5%)	
No Action Alternative	0.29
Alternative D	0.29
Difference	0.00
Dry (22.5%)	
No Action Alternative	0.28
Alternative D	0.28
Difference	0.00
Critical (15%)	
No Action Alternative	0.28
Alternative D	0.28
Difference	0.00

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). Water years may not correspond to the biological years in IOS.