MBK ENGINEERS

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TECHNICALMEMORANDUM

DATE: July 25, 2014

TO: North Delta Water Agency

FROM: Walter Bourez, Patrick Ho, and Gary Kienlen

SUBJECT: Technical Comments on Bay-Delta Conservation Plan Modeling

This technical memorandum is a summary of MBK Engineers' findings and opinions on the hydrodynamic modeling performed in support of the draft environmental document for the Bay-Delta Conservation Plan (BDCP) for North Delta Water Agency (NDWA). The results of that modeling are summarized in Appendix 5A to the draft BDCP EIR/EIS.

This review of the BDCP modeling focuses on water quality, stage, flow, and velocity at numerous locations within the NDWA. Although, this memorandum focuses on the following locations, data for other locations reviewed are contained in the Appendix:

- Sacramento River at Emmaton
- Sacramento River at Three Mile Slough
- Sacramento River at Rio Vista
- Steamboat Slough at Sutter Slough
- North Fork Mokelumne River
- Cache Slough at Ryer Island
- Barker Slough at North Bay Aqueduct (NBA)
- Shag Slough at Reclamation District (RD) 2068 intake

No Action Alternative

Assumptions used in CalSim II water operations modeling and DSM2 Delta hydrodynamic modeling for the BDCP No Action Alternatives (NAA) are defined in the December 2013 Draft BDCP[1] and associated draft EIR/S. Those assumptions include changes to hydrology cause by climate change.

Climate Change

Analysis presented in the BDCP draft plan and draft EIR/EIS attempts to incorporate the effects of climate change at two future climate periods: Early Long Term (ELT) at approximately year 2025; and Late Long Term (LLT) at approximately year 2060. Although BDCP modeling includes both the ELT and

[1] The detailed assumptions are stated in BDCP draft EIR/EIS Appendix 5A.

LLT, the EIR/EIS relies on the LLT and only includes the ELT in Appendix 5. As described in the BDCP draft plan and draft EIR/EIS[2], other analytical tools were used to determine anticipated changes to precipitation and air temperature that is expected to occur under ELT and LLT conditions. Projected precipitation and temperature were then used to determine how much water is expected to flow into the upstream reservoirs. These time-series were then input to the CalSim II model to perform water operations modeling and determine Delta inflow, outflow, and exports.

A second aspect of climate change, the anticipated amount of sea level rise, is incorporated into the CalSim II model by modifying a subroutine that determines salinity within the Delta based on flows within Delta channels. Sea level rise is evaluated in greater detail through use of DSM2 using output from CalSim II. Effects of sea level rise will manifest as a need for additional outflow when Delta water quality is controlling operations to prevent seawater intrusion. In this technical memorandum, we do not critique the climate change assumptions themselves[3], we instead focus on effects of BDCP by comparing with project modeling to without project modeling.

There are three without Project ("baseline" or "no action") modeling scenarios used for the BDCP modeling analysis: No Action Alternative (NAA)[4], No Action Alternative at the Early Long Term (NAA – ELT), and No Action Alternative at the Late Long Term (NAA –LLT). Assumptions for NAA, NAA-ELT, and NAA-LLT are provided in the Draft EIR/EIS's modeling appendix[5]. The only difference between these scenarios is the climate-related changes made for the ELT and LLT conditions (Table 1).

Table 1. Scenarios Used to Evaluate Climate Change

	Climate Change Assumptions	
Scenario	**Hydrology**	**Sea Level Rise**
No Action Alternative (NAA)	None	None
No Action Alternative at Early Long Term (NAA-ELT)	Modified reservoir inflows and runoff for expected conditions at 2025	15 cm
No Action Alternative at Early Long Term (NAA-LLT)	Modified reservoir inflows and runoff for expected conditions at 2060	45 cm

Description of the BDCP Project

The BDCP contemplates a dual conveyance system that would move water through the Delta's interior or around the Delta through an isolated conveyance facility. The BDCP CalSim II files contain a set of studies evaluating the projected operation of a specific version of such a facility. Each Alternative was imposed on two baselines: the NAA-ELT scenario and the NAA-LLT scenario. The BDCP Preferred

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2 BDCP EIR/EIS Appendix 5A, Section A and BDCP HCP/NCCP plan Appendix 5.A.2
3 This should not be read to imply that climate change assumptions are reasonable or considered correct or incorrect; the limited review reflects the scope of this memorandum.
4 NAA is also called the Existing Biological Conditions number 2 (EBC-2) in the Draft Plan.
5 BDCP EIR/EIS Appendix 5A, Section B, Table B-8.

Alternative, Alternative 4, has four possible sets of operational criteria, termed the Decision Tree. Key components of Alternative 4 ELT and Alternative 4 LLT are as follows:

The same system demands and facilities as described in the NAA with the following primary changes:

- three proposed North Delta Diversion (NDD) intakes of 3,000 cfs each;
- NDD bypass flow requirements;
- additional positive OMR flow requirements and elimination of the San Joaquin River I/E ratio and the export restrictions during Vernalis Adaptive Management Program;
- modification to the Fremont Weir to allow additional seasonal inundation and fish passage;
- modified Delta outflow requirements in the spring and/or fall (defined in the Decision Tree discussed below);
- relocation of the Emmaton salinity standard; redefinition of the E/I ratio;
- acquisition of 25,000 acres and 65,000 acres of in-Delta lands for ELT and LLT environments respectively for habitat restoration; and
- removal of current permit limitations for the south Delta export facilities.

The changes (benefits or impacts) of the operation due to Alternative 4 are highly dependent upon the assumed operation of not only the NDD and the changed regulatory requirements associated with those facilities, but also by the assumed integrated operation of existing CVP and SWP facilities. The modeling of the NAA Scenarios introduces significant changes in operating protocols suggested primarily to react to climate change. The extent of the reaction does not necessarily represent a likely outcome, and thus the Reviewers have little confidence that the NAA baselines are a valid representation of a baseline from which to compare an action Alternative. However, a comparison review of the Alt 4 to the NAA illuminates operational issues in the BDCP modeling and provides insight as to where benefits or impacts may occur.

BDCP Alternative 4 has four possible sets of operational criteria, termed the Decision Tree, that differ based on the "X2" standards that they contemplate:

- Low Outflow Scenario (LOS), otherwise known as operational scenario H1, assumes existing spring X2 standard and the removal of the existing fall X2 standard;
- High Outflow Scenario (HOS), otherwise known as H4, contemplates the existing fall X2 standard and providing additional outflow during the spring;
- Evaluated Starting Operations (ESO), otherwise known as H3, assumes continuation of the existing X2 spring and fall standards;
- Enhanced spring outflow only (not evaluated in the December 2013 Draft BDCP), scenario H2, assumes additional spring outflow and no fall X2 standards.

While it is not entirely clear how the Decision Tree would work in practice, the general concept is that, prior to operation of the NDD, implementing authorities would select the appropriate decision tree scenario (from amongst the four choices) based on their evaluation of targeted research and studies to be conducted during planning and construction of the facility.

Our review examined the ESO (or H3) scenario (labeled Alt 4-ELT or Alt 4-LLT) because it employs the same X2 standards as are implemented in NAA-ELT and NAA-LLT. This allowed the Reviewers to focus the analysis on the effects of the BDCP operations independent of the possible change in the X2 standard.

Method of Review

The first part of the review focused on effects of Delta hydrodynamics determined by DSM2 models used in support of the EIRS. During a separate review of the CalSim II modeling used in support of the EIRS (Model), MBK Engineers and Dan Steiner found that the Model provided very limited useful information to understand the effects of BDCP. The Model contains erroneous assumptions, errors, and outdated tools, which result in impractical or unrealistic Central Valley Project (CVP) and State Water Project (SWP) operations. The unrealistic operations, in turn, do not accurately depict the effects of the BDCP. An independent CalSim II water operation modeling analysis was thus performed by MBK Engineers and a subsequent DSM2 Delta hydrodynamics modeling analysis was performed and provided by Contra Costa Water District. Assumptions used in the Independent CalSim II water operations modeling is described in "Report on Review of Bay Delta Conservation Program Modeling" (MBK, 2014). The independent DSM2 model excludes climate change and sea level rise in the NAA and Alt 4 scenarios. Since the Model used in support of the EIRS analyzes NDD and habitat restoration as inseparable project components, it is not possible to distinguish whether the effects of the project are due to NDD operations or the proposed habitat restoration. Moreover, it is possible, if not probable, that NDD could be constructed and operating for an extended period of time without the proposed habitat in place. Habitat restoration requires time to establish its intended functionality and effects to Delta hydrodynamics and salinity from operating the NDD itself cannot be evaluated under the Model. To separate and understand the effects, the independent DSM2 modeling included an NAA with habitat and an Alt 4 NDD without habitat as two additional scenarios.

The DSM2 Independent Modeling provides two Alternative 4 scenarios: 1) Alternative 4 NDD without climate change, sea level rise, and habitat restoration, 2) Alternative 4 NDD without Climate Change and sea level rise, but includes 25,000 acres of habitat. For basis of comparison, a No Action Alternative without climate change, sea level rise, and habitat was provided.

Outputs were extracted from the DSM2 modeling and flows, stage, velocities, and salinity under the alternative were compared against the baseline, i.e. Alt 4 ELT is compared to NAA ELT and Alt 4 LLT is compared to NAA LLT. DSM2 simulates from October 1974 to September 1991 and produces output at 15-minute intervals. Daily maximums, minimums, and averages are then calculated from the 15-minute data. To provide meaning to the data, daily exceedance charts were produced. Percent exceedance describes the portion of the dataset, expressed in percentages, that exceeds a specific level. For example, a 90% flow exceedance of 200,000 cfs means that 90% of the daily flow during the simulated period, i.e. October 1974 to September 1991, is greater than 200,000 cfs. Exceedances provide an overall view of the entire dataset in an ordered manner. When alternatives are plotted together, differences between the alternatives are easily distinguishable and potential project effects can be identified.

Hydrodynamics and salinity were reviewed at various locations within NDWA. For the purposes of this review particular locations reviewed include the NDWA Contract compliance points on the Sacramento River at Three Mile Slough, Rio Vista and Walnut Grove, Steamboat Slough at Sutter Slough, and the Mokelumne River at Walnut Grove. Another area of interest is the Cache Slough complex, which includes lower Cache Slough, Shag Slough, and Barker Slough due to the reviewers understanding that a majority of the habitat areas will be acquired from lands adjacent to the Cache Slough complex. The project's effects on river stage, flows, and velocities in this area is of interest to NDWA, particularly at the North Bay Aqueduct (NBA) pumping plant in Barker Slough and at the RD 2068 intake pumps in Shag Slough. For certain intakes, reduced river stage to levels below historical design elevations require additional energy usage at pumping plants, which increases pumping costs, while other intakes operating through a siphon will not operate. Furthermore, increased river stage may increase seepage, requiring additional maintenance for drainage. In the inner Delta, changes in cross channel gate operations at Walnut Grove will control the hydrodynamics of the Mokelumne River and therefore effects of flow, stage, and velocities along the Mokelumne River were reviewed.

Conclusions

BDCP Modeling

Figure 1 through Figure 16 illustrates hydrodynamics, and water quality under the NAA ELT and the Existing Conditions from the EIRS. Positive maximum values quantify daily outgoing or ebb tides while negative minimum values quantify daily incoming (reverse) or flood tides. Under the NAA ELT, daily positive flows and daily reverse flows increase, while daily maximum, average, and minimum stage are increased throughout the system when compared to existing conditions. As shown in Figure 1, for the Sacramento River at Emmaton, daily outgoing flows increase by an average of 4,335 cfs, while daily average reverse flow increase by 3,614 cfs. As illustrated in Figure 2, daily maximum, average, and minimum stage on the Sacramento River at Emmaton increases by approximately 0.5 feet when compared to existing. Sea level rise is a large component to the increase in stage. Similar effects are observed in velocities at Emmaton. Figure 3 illustrates increases in daily average outgoing and incoming velocity. Positive changes in daily maximum represent an increase in velocity on the outgoing tide while negative changes in daily minimum velocity respresent an increase in velocity on the incoming tide. Increased velocities have the potential to induce scouring along channels and undermine levee stability. Figure 6 illustrates the 14-day running average salinity, expressed as electrical conductivity in millimhos per centimeter, for the Sacramento River at Emmaton over the simulation period. The NDWA contract provision at Three Mile Slough is plotted to emphasize periods of contract compliance or non-compliance. Water quality is in compliance when the 14-day running average is less than the allowed salinity concentration. Likewise, water quality is non-compliant when the 14-day running average exceeds allowed salinity concentration. To summarize Figure 6, non-compliant days were counted for the simulation period and expressed as a percentage of non-compliant days in the simulation period or 6,209 days. Figure 5 illustrates the percentage of 6,209 days that were non-compliant and also quantifies the concentration in excess of contract compliance under the NAA-ELT and existing conditions. Overall, water quality in the Sacramento River at Three Mile Slough is worse under NAA-ELT when compared to existing conditions. Under the existing conditions, 472 days were non-compliant under NDWA contract provisions, while 736 days were non-compliant under the NAA-ELT. Similar effects to flows, stage, velocities, and water quality are observed in the Sacramento River at Three Mile Slough, the Sacramento River at Rio Vista, Steamboat Slough at Sutter Slough, Barker Slough at the NBA pumping plant, and Shag slough at RD 2068's pumping plant, illustrated from Figure 6 through Figure 16.

Figure 17 through Figure 31 illustrates percent exceedances of hydrodynamics and water quality under the NAA-ELT and Alt 4-ELT. In the Sacramento River at Emmaton and Rio Vista, under Alt 4-ELT, daily positive flows and daily reverse flows increase, while daily average flow decreases when compared to

NAA-ELT. Moreover, daily maximum stage decreases, while daily minimum stage increases when compared to NAA-ELT. At Emmaton, daily average flow decreases by approximately 1,370 cfs, daily average positive flows increase by approximately 10,680 cfs, while daily average reverse flow increases by approximately 8,450 cfs as illustrated in Figure 17. Daily maximum stage decreases on an average of 0.32 feet, while daily minimum stage increases on average by approximately 0.37 feet as illustrated in Figure 18. Decreases in daily maximum stage and increases in daily minimum stage could be explained by the transport of flood and ebb tides into proposed habitat areas, which provides a dampening effect to hydrodynamics in the Delta system.

Although habitat areas are not clearly defined, the effects are observed at lower parts of the Delta system, such as the observations at Emmaton. Figure 26 illustrates an improvement in water quality in the Sacramento River at Rio Vista and at Three Mile Slough under Alt 4-ELT when compared to NAA-ELT. In Steamboat Slough at Sutter Slough, daily maximum, average, and minimum flows decrease under ALT 4-ELT as illustrated in Figure 27. As would be expected with decreased flows, decreases in stage also were also observed in Steamboat Slough, where daily average stage decreased by approximately 0.25 feet and the maximum stage is reduced on average by approximately 0.53 feet under Alt 4-ELT when compared to NAA-ELT. At the NBA pumping plant on Barker Slough daily maximum stage is decreased on average by approximately 0.6 feet, while daily minimum stage is increased on average by approximately 0.77 feet as illustrated in Figure 30. At RD 2068's pumping plant, daily maximum stage is reduced on average by 0.55 feet, while daily minimum stage is increased on average by approximately 0.57 feet as illustrated in Figure 31.

In summary, water quality is worsened under NAA ELT when compared with existing conditions. At Three Mile Slough, the number of days not compliant with NDWA water quality contract provisions has increased by 264 days under NAA ELT, compared to existing conditions. However, water quality improves under Alt 4 ELT when compared to NAA ELT. An assumption under the ELT climate change environment is a 15 cm sea level rise. Sea level rise increases stage throughout the Delta system, which may result in increased seepage and flood risk to Delta Islands. However, under the project alternative (Alt 4), daily maximum stages are reduced, while daily minimum stage increases when compared to NAA ELT.

Independent Modeling

Figure 32 through Figure 51 illustrates hydrodynamics and water quality under the NAA without habitat and NAA with habitat. Under NAA with habitat, daily positive flows and daily reverse flows increase in the Sacramento River at Emmaton and at Rio Vista, while daily average flow decreases when compared to NAA without habitat. Moreover, daily maximum stage decreases, while daily minimum stage increases when compared to NAA with habitat. At Emmaton, daily average flow increases by approximately 170 cfs, daily average positive flows increase by approximately 9,590 cfs, while daily average reverse flow increase by approximately 5,125 cfs as illustrated in Figure 32. Daily maximum stage decreases on an average of 0.31 feet, while daily minimum stage increases on average by approximately 0.36 feet as illustrated in Figure 33. Figure 36 and Figure 38 illustrates improvement in water quality in the Sacramento River at Emmaton and at Three Mile Slough under the NAA with habitat when compared to NAA without habitat. For Steamboat Slough at Sutter Slough, daily maximum, average, and minimum flows decrease under NAA without habitat as illustrated in Figure 43. Corresponding changes in stage are also observed; the daily average stage is reduced by approximately

0.1 feet, daily maximum stage is reduced on average by approximately 0.42 feet, while daily minimum stage is increased on average by 0.2 feet under NAA with habitat compared to NAA without habitat.

In the interior Delta, daily positive flow in the North Fork Mokelumne River increase on average by 1,137 cfs, while daily reverse flow increase on by 2,755 cfs as illustrated in Figure 46. Daily maximum stage decreases on average by approximately 0.72 feet while daily minimum stage increases on average by approximately 0.8 feet as illustrated on Figure 47. In Cache Slough at Ryer Island, daily maximum stage decrease on average by approximately 0.5 feet, while daily minimum stage increases by an average of approximately 0.5 feet. In Barker Slough at the NBA pumping plant daily maximum stage is reduced approximately 0.6 feet on average, while daily minimum stage is increased on average by approximately 0.76 feet as illustrated in Figure 50. At RD 2068's pumping plant, daily maximum stage is reduced on average by 0.52 feet, while daily minimum stage is increased an average of 0.56 feet as illustrated in Figure 51.

Figure 52 through Figure 71 compare the hydrodynamics and water quality under Alternative 4 with habitat and NAA without habitat. The effects are similar in pattern when compared to the models in support of the EIRS. In the Sacramento River at Emmaton and at Rio Vista, under Alt 4 with habitat, daily positive flows and daily reverse flows increase, while the daily average flows decrease when compared to NAA without habitat. Moreover, daily maximum stage decreases, while daily minimum stage increases when compared to NAA without habitat. At Emmaton, daily average flow decreases by approximately 1,800 cfs, daily average positive flows increase by 8,600 cfs, while daily average reverse flow increase by 7,460 cfs as illustrated in Figure 52. Daily maximum stage decreases by an average of 0.32 feet, while daily minimum stage increases by approximately 0.36 feet as illustrated in Figure 53. Figure 56 and Figure 58 illustrate worsening water quality in the Sacramento River at Rio Vista and at Three Mile Slough under Alt 4 with habitat when compared to NAA without habitat. In Steamboat Slough at Sutter Slough, daily maximum, average, and minimum flows decrease under ALT 4 with habitat as illustrated in Figure 63. Daily average stage is reduced by 0.29 feet, while daily maximum stage is reduced on average by 0.56 feet under Alt 4 with habitat when compared to NAA without habitat. In the interior Delta, daily positive flow in the North Fork Mokelumne River increase on average by 1,140 cfs, while daily reverse flow increases by 2,750 cfs as illustrated in Figure 66. Daily maximum stage decreases on average by approximately 0.72 feet while daily minimum stage increases on average by 0.8 feet as illustrated by Figure 67. In Cache Slough at Ryer Island, daily maximum stage decrease on average by ~0.53 feet, while daily minimum stage increase on average by ~0.5 feet. At the NBA pumping plant on Barker Slough daily maximum stage is reduced on average by ~0.62 feet, while daily minimum stage is increased on average by ~0.75 feet as illustrated in Figure 70. At RD 2068's pumping plant, daily maximum stage is reduced on average by ~0.54 feet, while daily minimum stage is increased on average by ~0.55 feet as illustrated in Figure 71.

Figure 72 through Figure 91 compare hydrodynamics and water quality under Alternative 4 without habitat and NAA without habitat. On the Sacramento River at Emmaton and Rio Vista, under Alt 4 without habitat, daily positive flows, daily reverse flows, and daily average flows decrease when compared to NAA without habitat. Changes in daily maximum, minimum, and average stage is immeasurable when compared to NAA without habitat. At Emmaton, daily average flow decreases by ~2,256 cfs, daily average positive flows decrease by ~1,058 cfs, while daily average reverse flow increase by ~2,652 cfs as illustrated in Figure 72. Figure 76 and Figure 78 illustrate worsening in water quality in the Sacramento River at Emmaton and at Three Mile Slough under Alt 4 without habitat when compared to NAA without habitat. In Steamboat Slough at Sutter Slough, daily maximum, average, and minimum flows decrease under ALT 4 with habitat as illustrated in Figure 83. Daily average stage is reduced by ~0.21 feet and daily maximum stage is reduced on average by ~0.13 feet. Daily average stage is reduced by 0.21 feet under Alt 4 without habitat when compared to NAA without habitat. In the interior Delta, daily positive flow in the North Fork Mokelumne River decrease on average by 232 cfs, while daily reverse flow increase on by 297 cfs as illustrated in Figure 86. Changes in stage are immeasurable under Alt 4 without habitat as illustrated in Figure 87. Daily maximum, minimum and average stage in Cache Slough at Ryer Island, at the NBA pumping plant on Barker Slough, and at RD 2068's pumping plant decrease by 0.02 feet as illustrated in Figure 89, Figure 90, and Figure 91.

The EIRS did not analyze the NDD without habitat restoration. Therefore, the impacts of the project cannot be adequately assessed if the NDD were to begin operating before habitat areas are acquired and established. Contrary to the Model in support of the EIRS, the independent analysis, without habitat, Alt 4 results worsening of water quality at Emmaton and Three Mile Slough when compared to NAA without habitat. Also, daily maximum, minimum, and average flow decrease at Emmaton and Rio Vista.

Recommendations

The EIR/S analysis assumes habitat restoration will be implemented and operating as fully intended under both the ELT and LLT scenarios. Even if the land is acquired for the proposed projects, habitat restoration is a time required process. Further, it is possible, if not probable, that NDD could be constructed and operating for an extended period of time without the habitat in place. The effects of NDD operations without habitat could have detrimental impacts, and should be quantified. For these reasons, the BDCP should analyze effects of operating the NDD without the habitat restoration and without the effects of climate change to assess both short term and long term impacts of the proposed project using the updated CalSim II operations and DSM2 hydrodynamics models.

No Action Alternative ELT and Existing Conditions (BDCP EIRS Modeling)

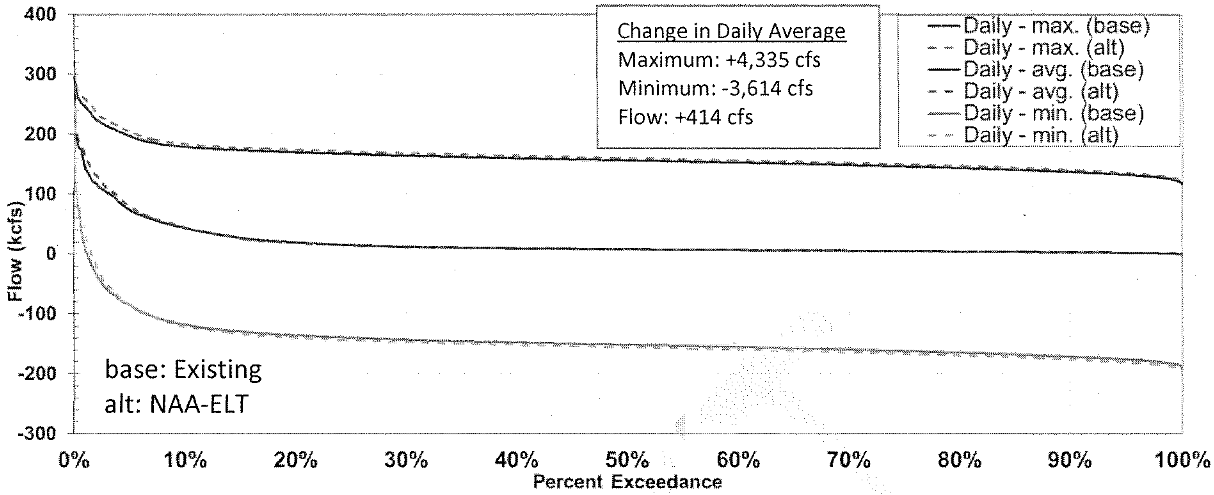

Figure 1. Daily Flow on the Sacramento River at Emmaton

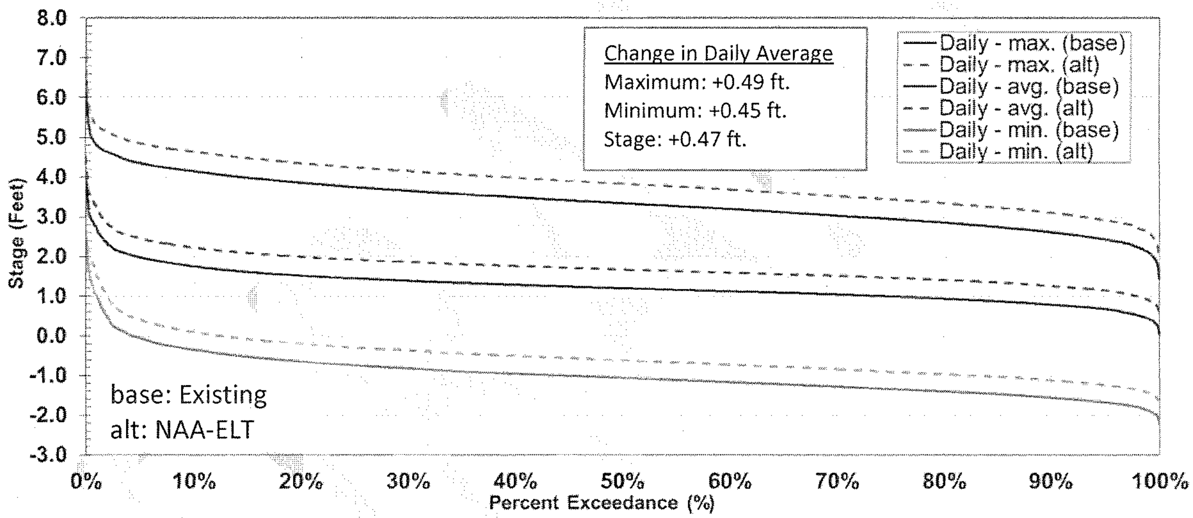

Figure 2. Daily Stage on the Sacramento River at Emmaton

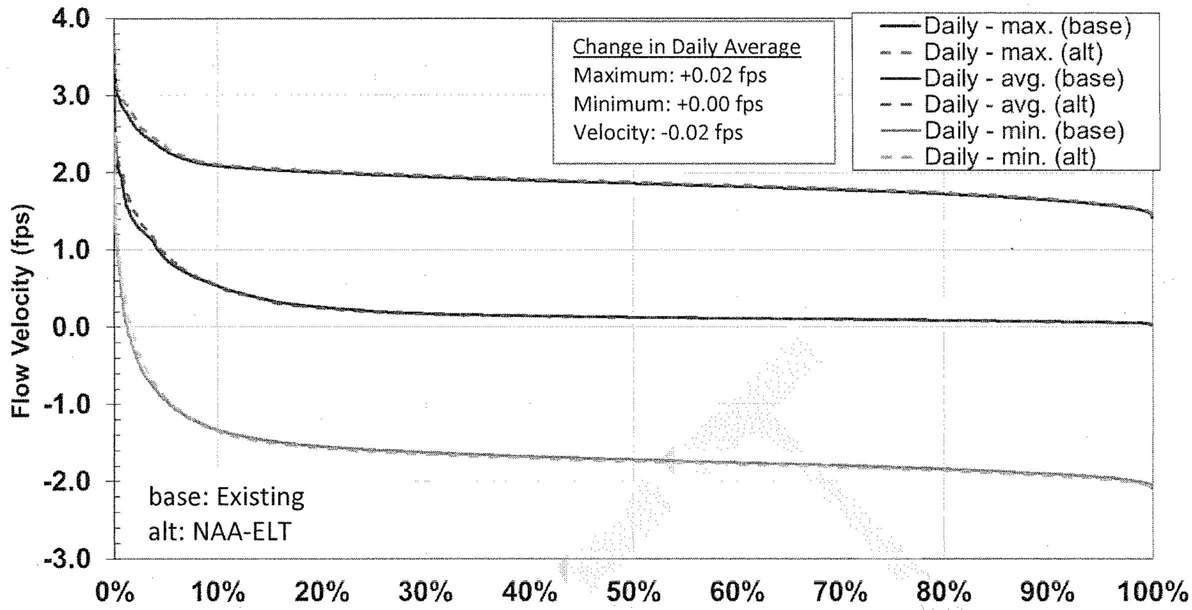

Figure 3. Daily Velocities on the Sacramento River at Emmaton

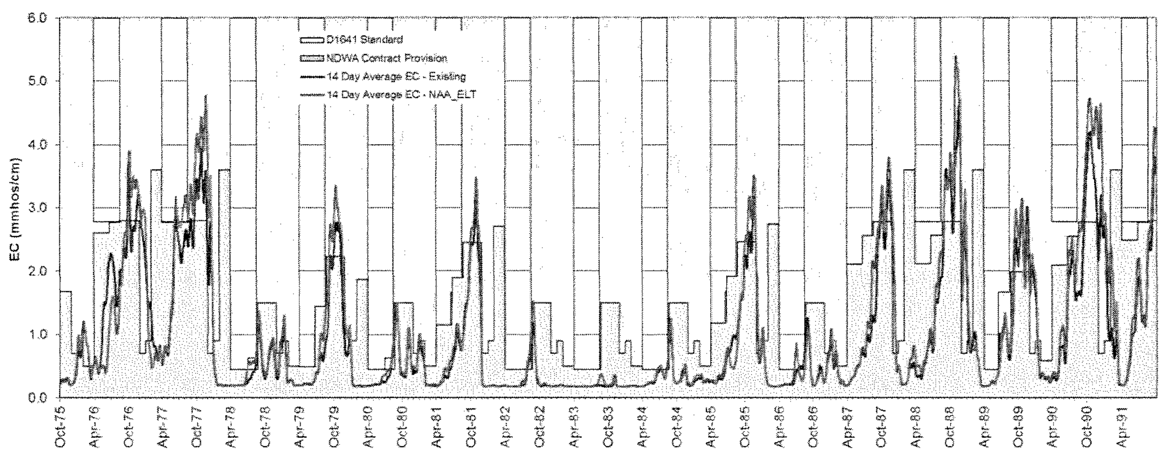

Figure 4. EC in the Sacramento River at Emmaton

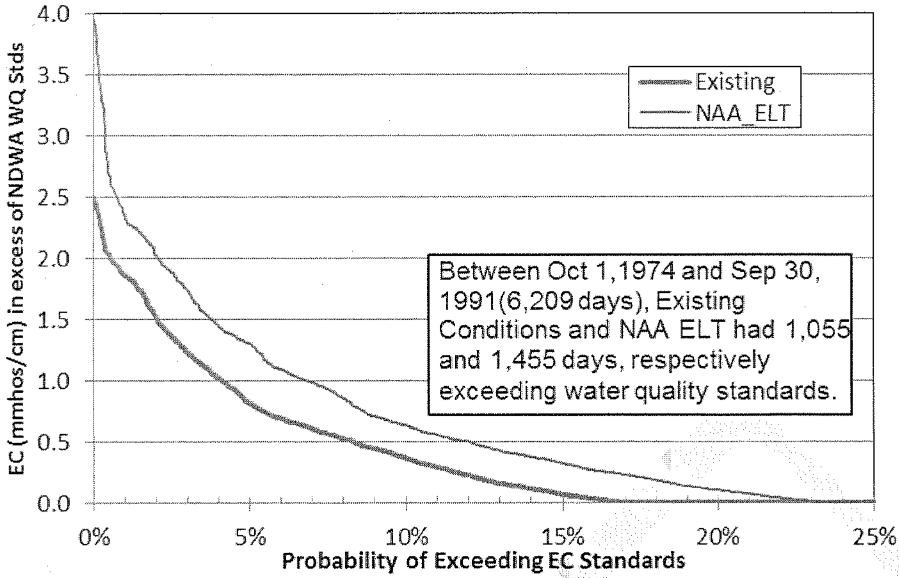

Figure 5. Probability of Exceeding EC Standards in the Sacramento River at Emmaton

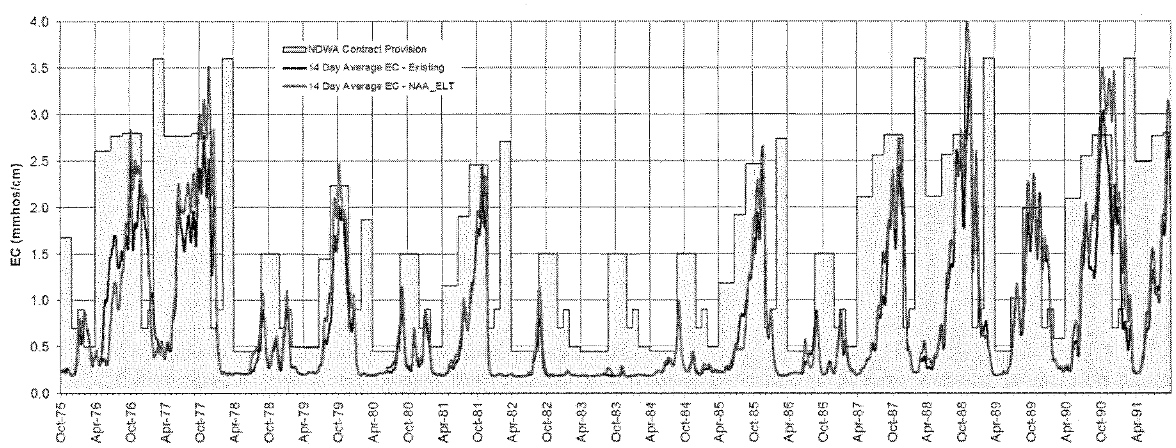

Figure 6. EC in the Sacramento River at Three Mile Slough

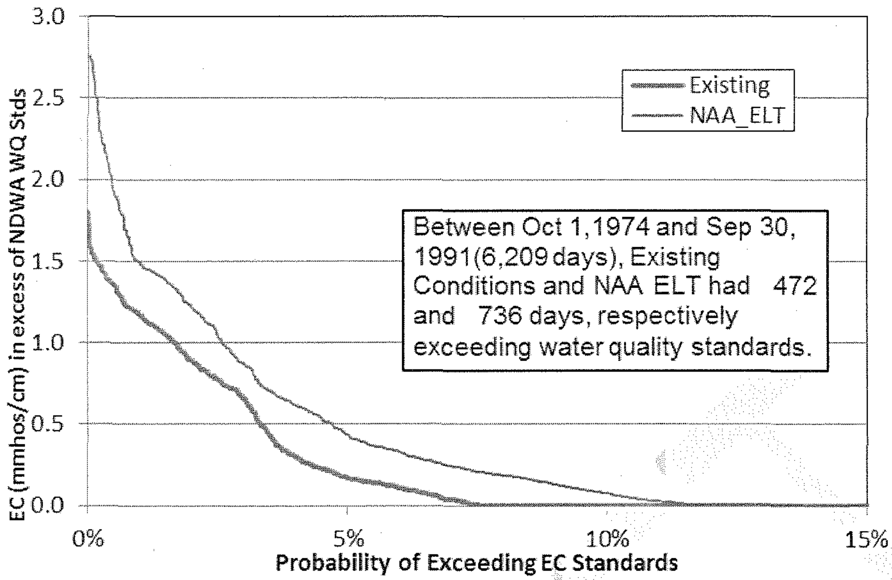

Figure 7. Probability of Exceeding EC Standards in the Sacramento River at Three Mile Slough

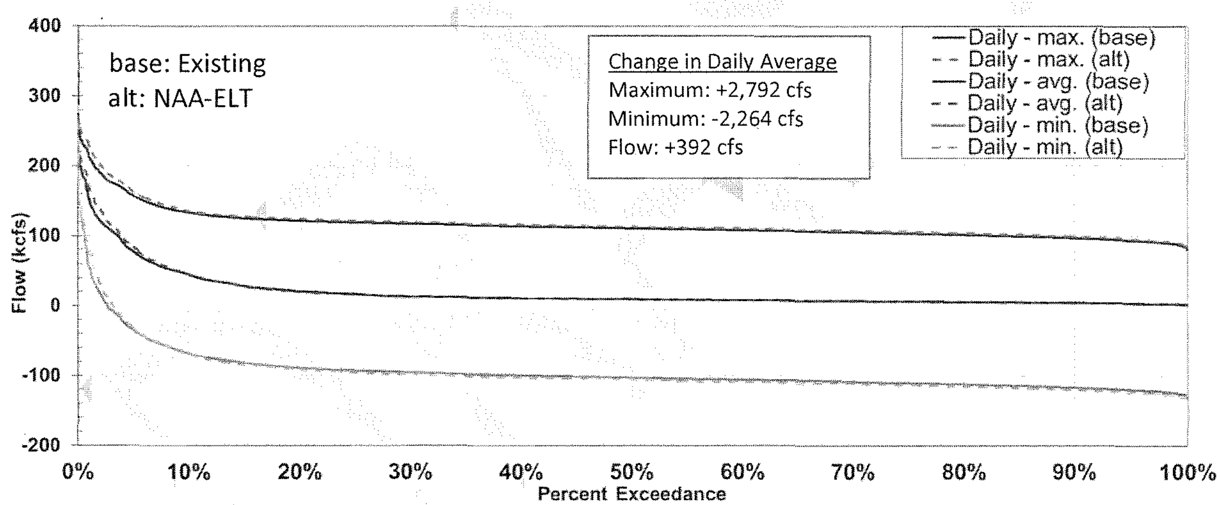

Figure 8. Daily Flow on the Sacramento River at Rio Vista

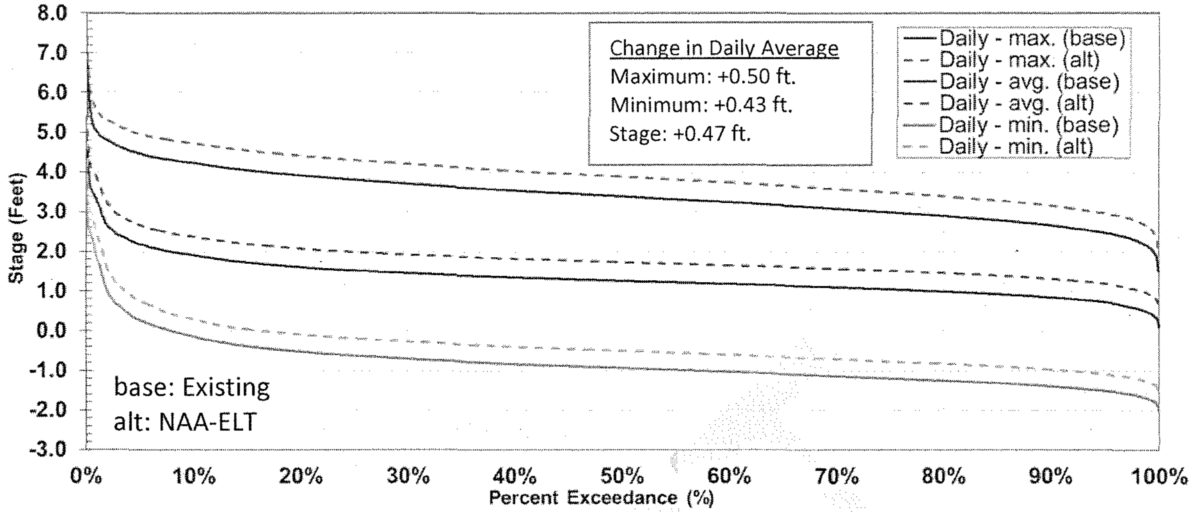

Figure 9. Daily Stage on the Sacramento River at Rio Vista

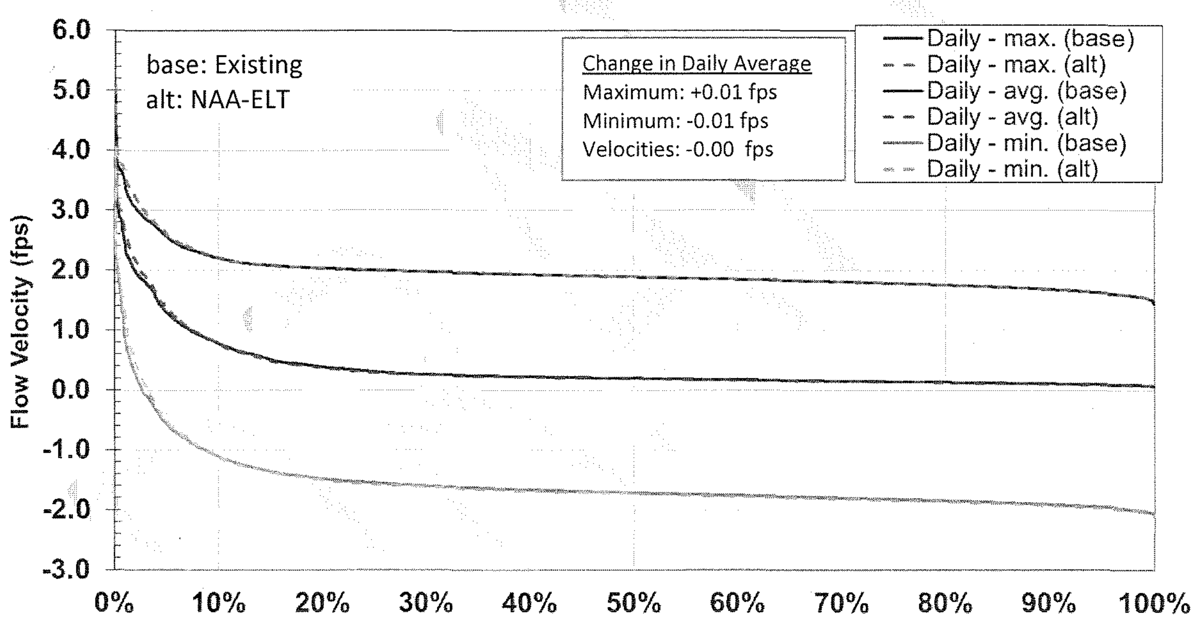

Figure 10. Daily Velocities on the Sacramento River at Rio Vista

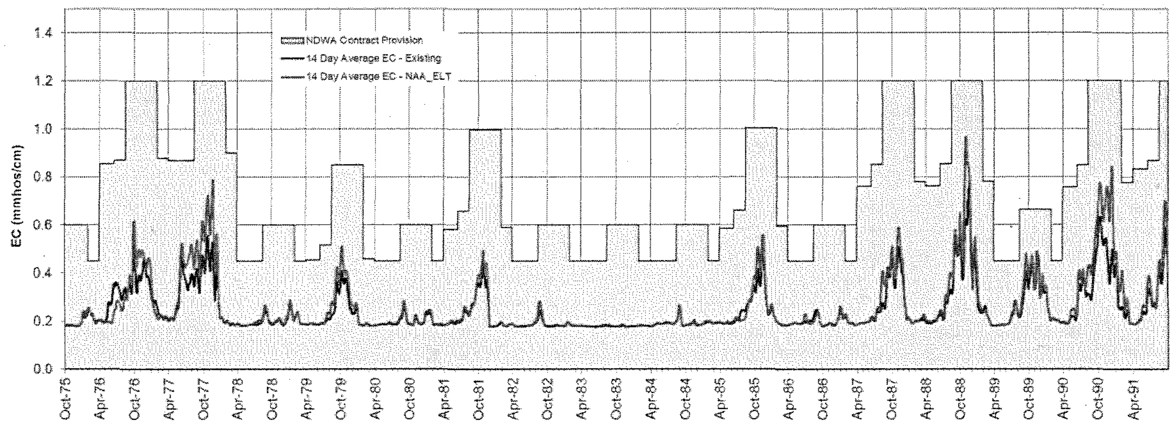

Figure 11. EC in the Sacramento River at Rio Vista

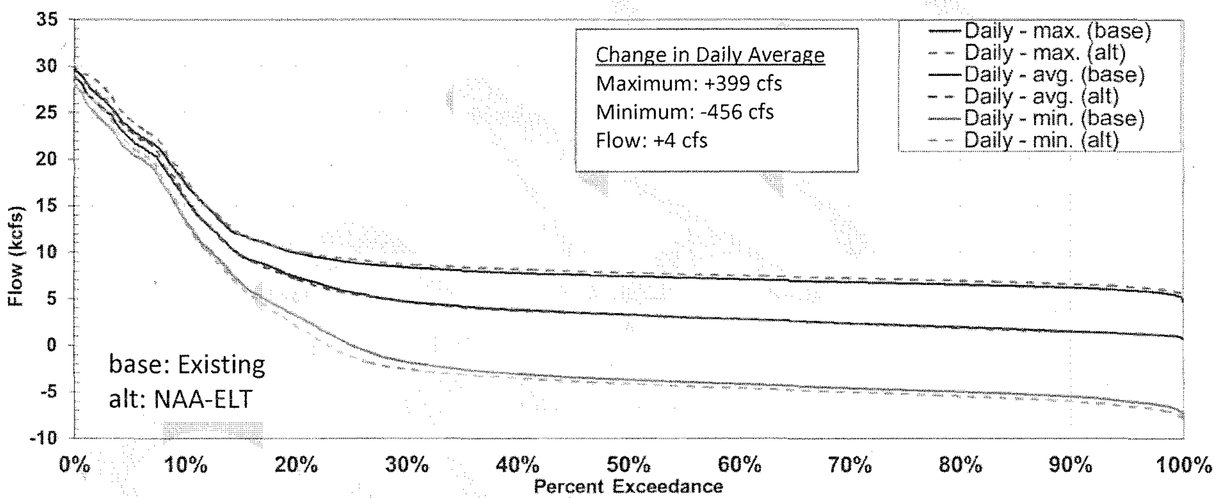

Figure 12. Daily Flow on Steamboat Slough at Sutter Slough

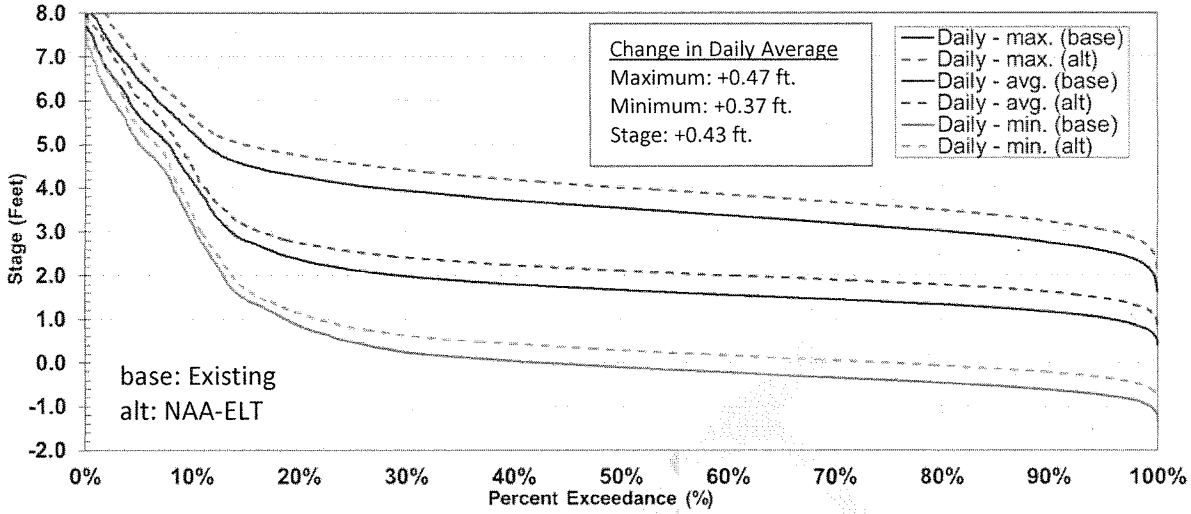

Figure 13. Daily Stage on Steamboat Slough at Sutter Slough

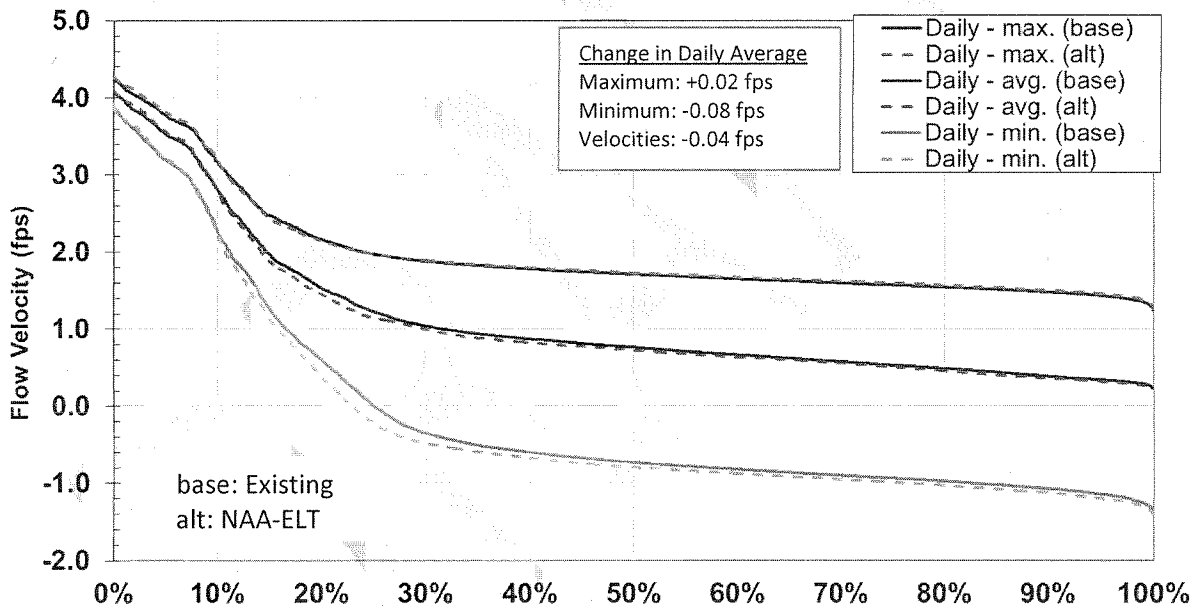

Figure 14. Daily Velocities on Steamboat Slough at Sutter Slough

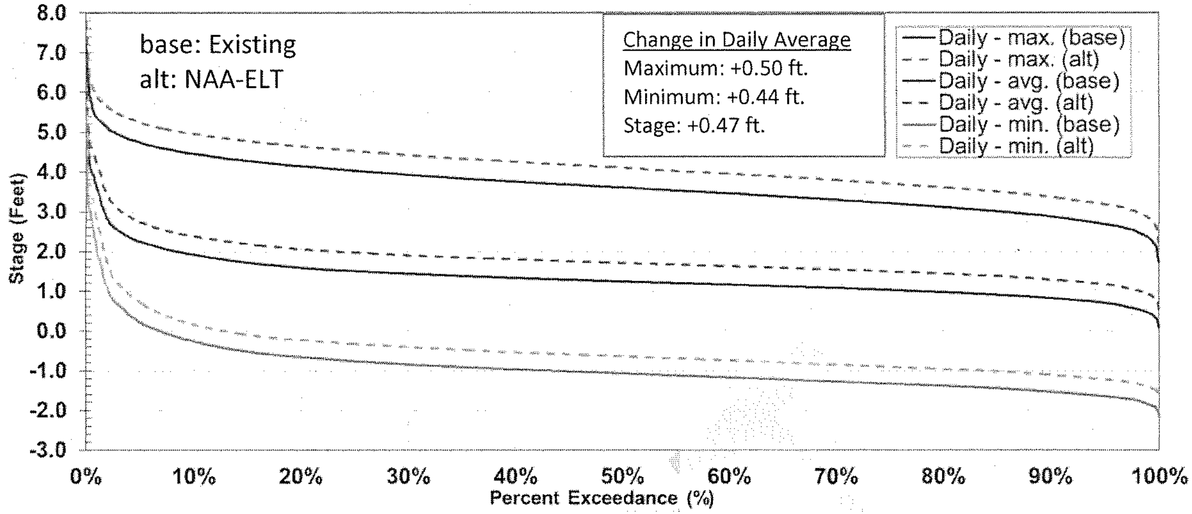

Figure 15. Daily Stage in Barker Slough at NBA Intakes

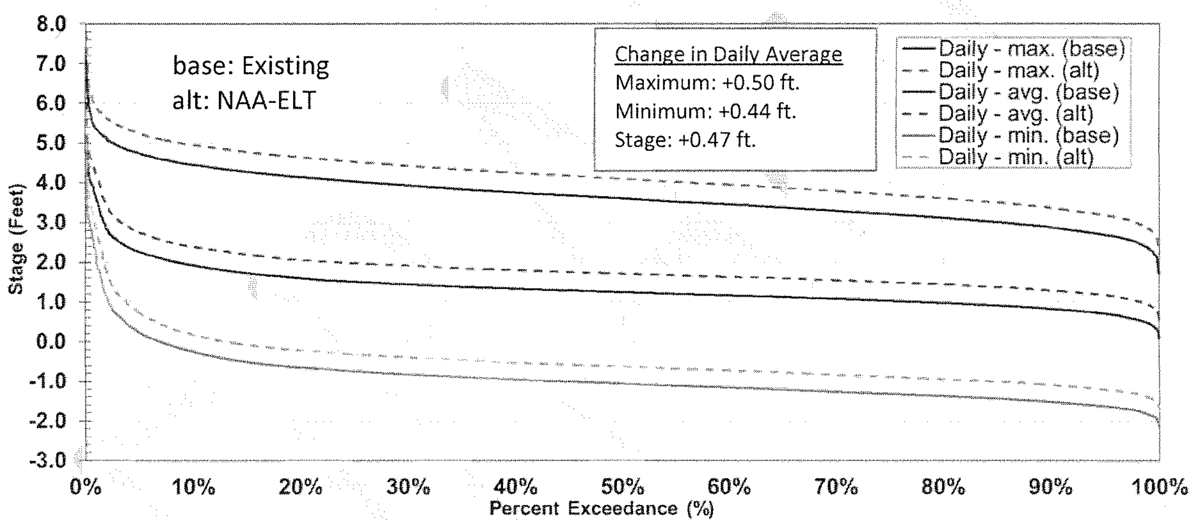

Figure 16. Daily Stage in Shag Slough (RD 2068 Pumping Plant)

No Action Alternative ELT and Alternative 4 ELT (BDCP EIRS Modeling)

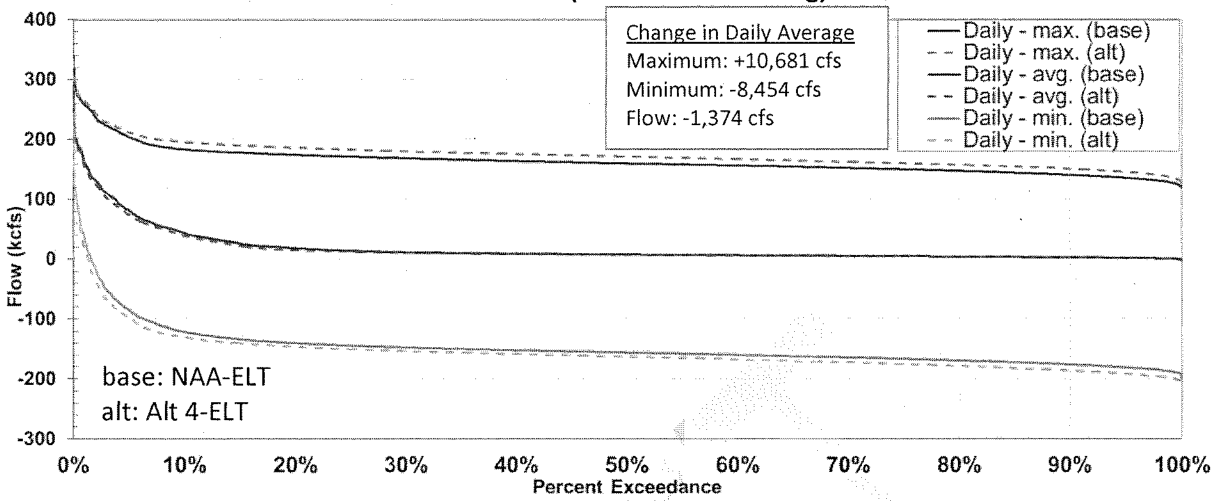

Figure 17. Daily Flow in the Sacramento River at Emmaton

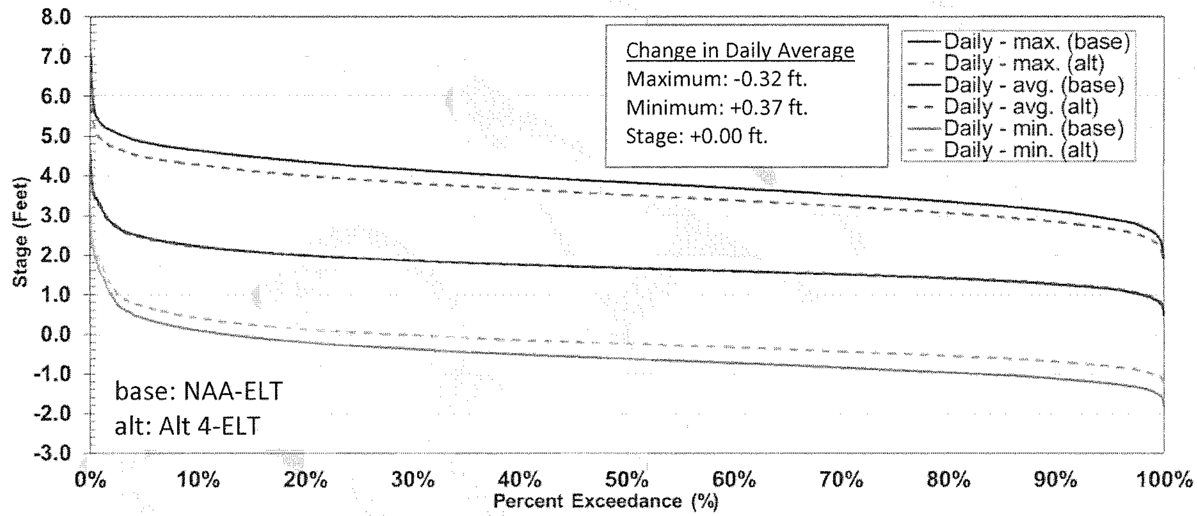

Figure 18. Daily Stage in the Sacramento River at Emmaton

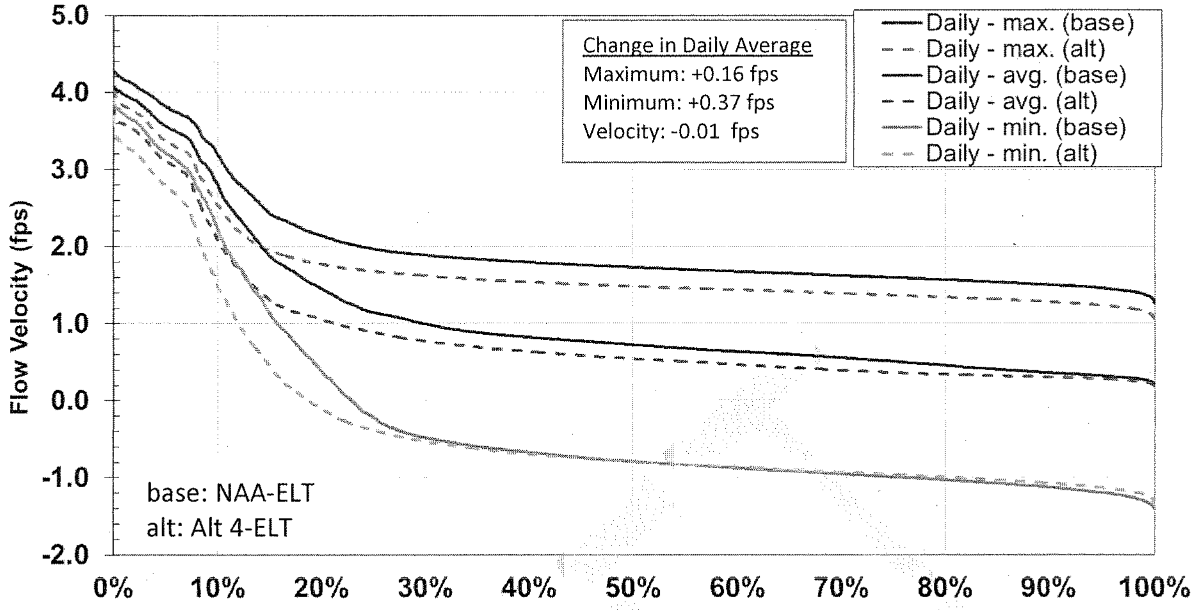

Figure 19. Daily Velocities in the Sacramento River at Emmaton

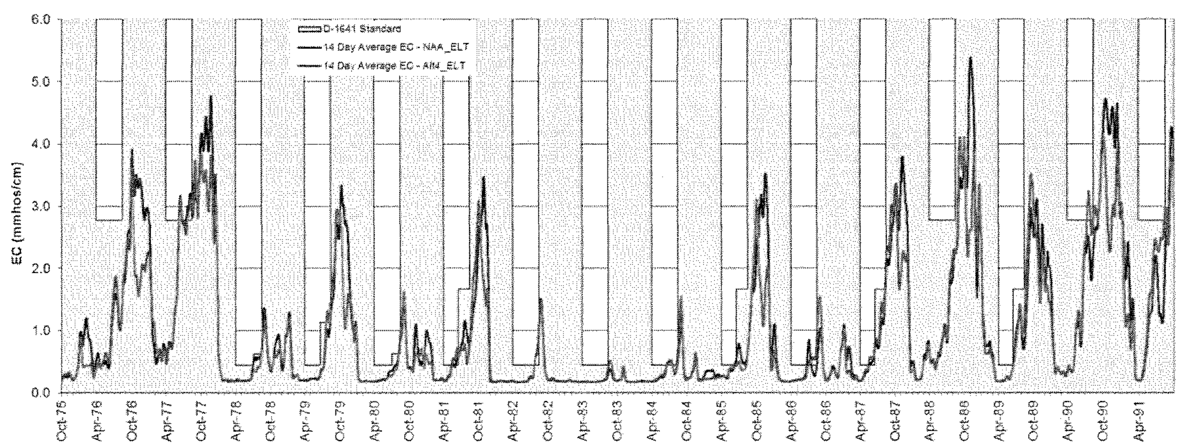

Figure 20. EC in the Sacramento River at Emmaton

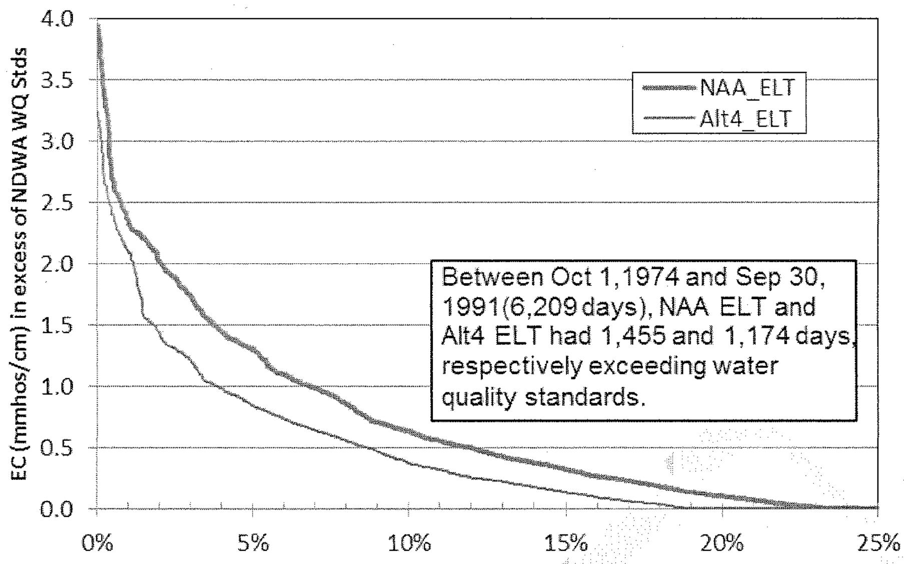

Figure 21. Probability of Exceeding EC Standards in the Sacramento River at Emmaton

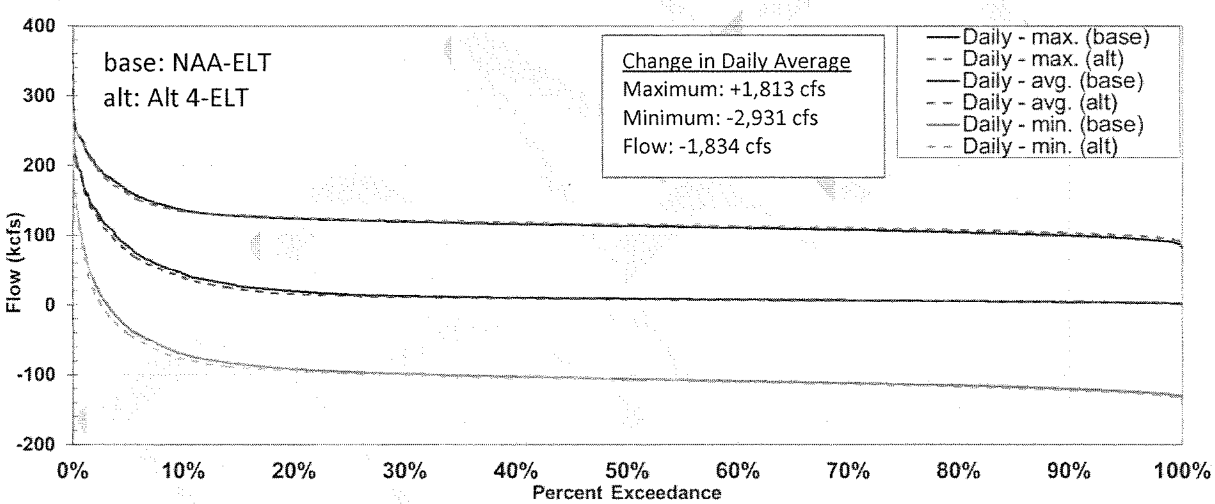

Figure 22. Daily Flow in the Sacramento River at Rio Vista

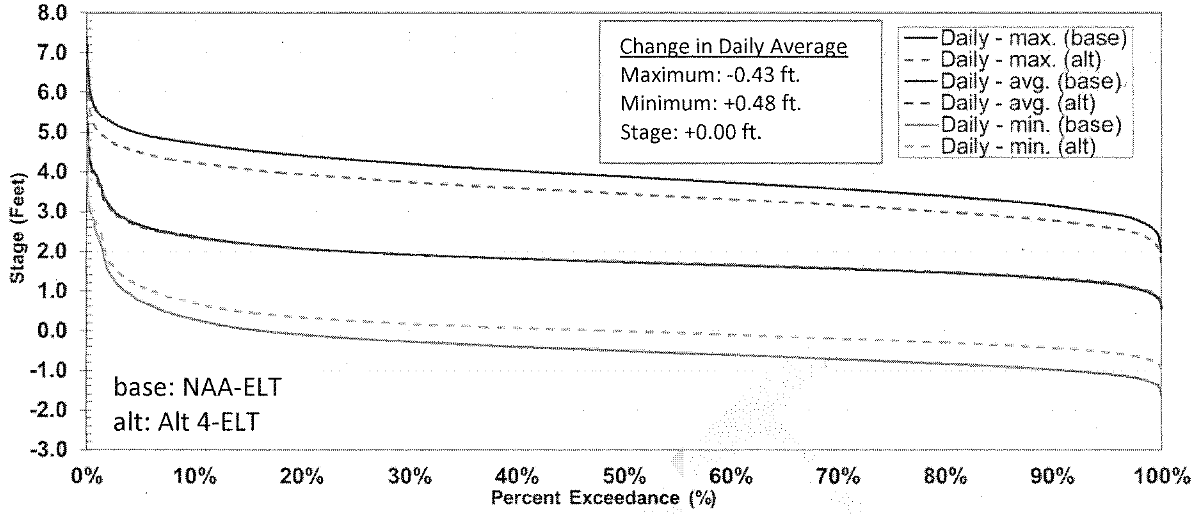

Figure 23. Daily Stage in the Sacramento River at Rio Vista

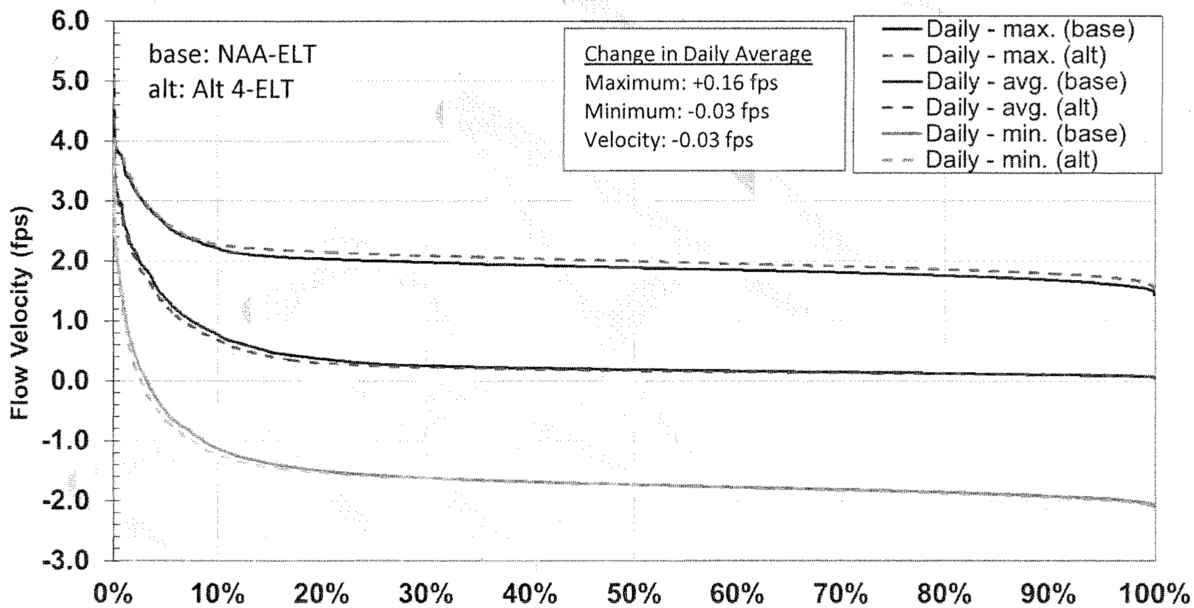

Figure 24. Daily Velocities in the Sacramento River at Rio Vista

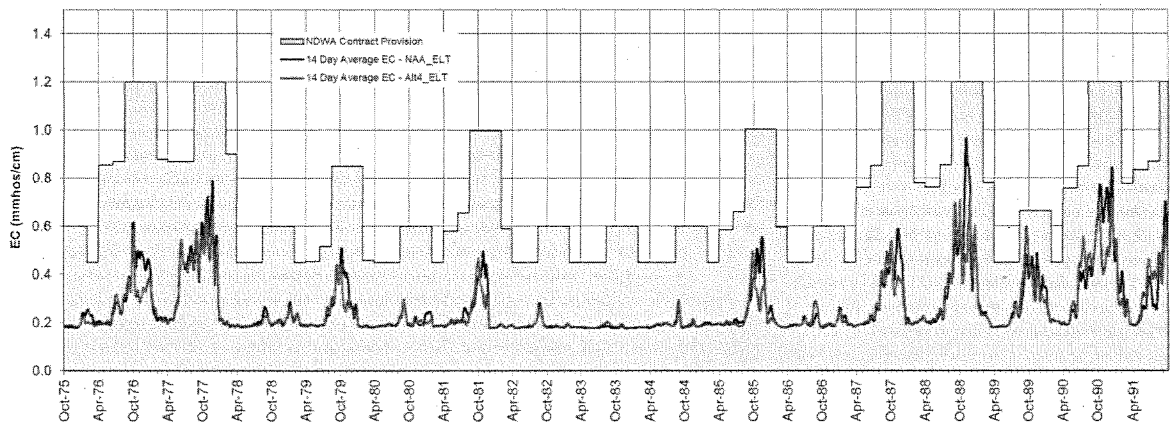

Figure 25. EC in the Sacramento River at Rio Vista

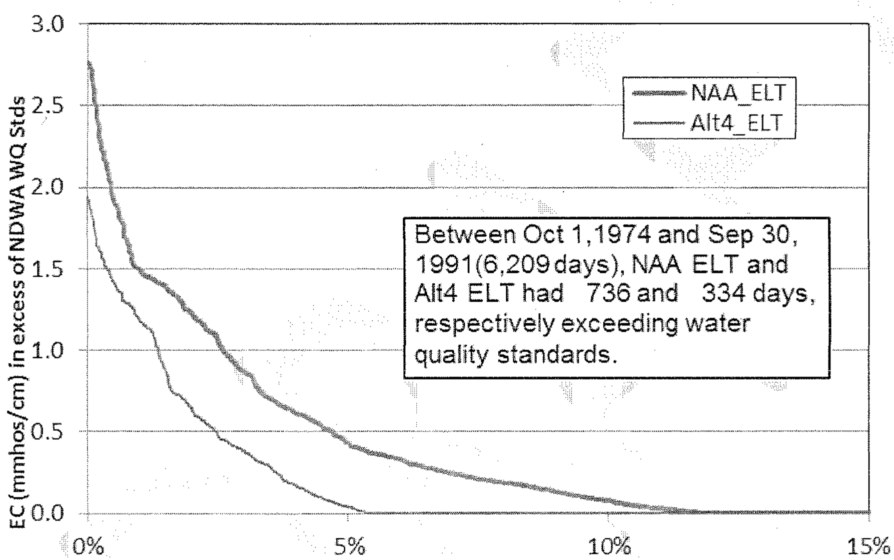

Figure 26. Probability of Exceeding EC Standards in the Sacramento River at Three Mile Slough

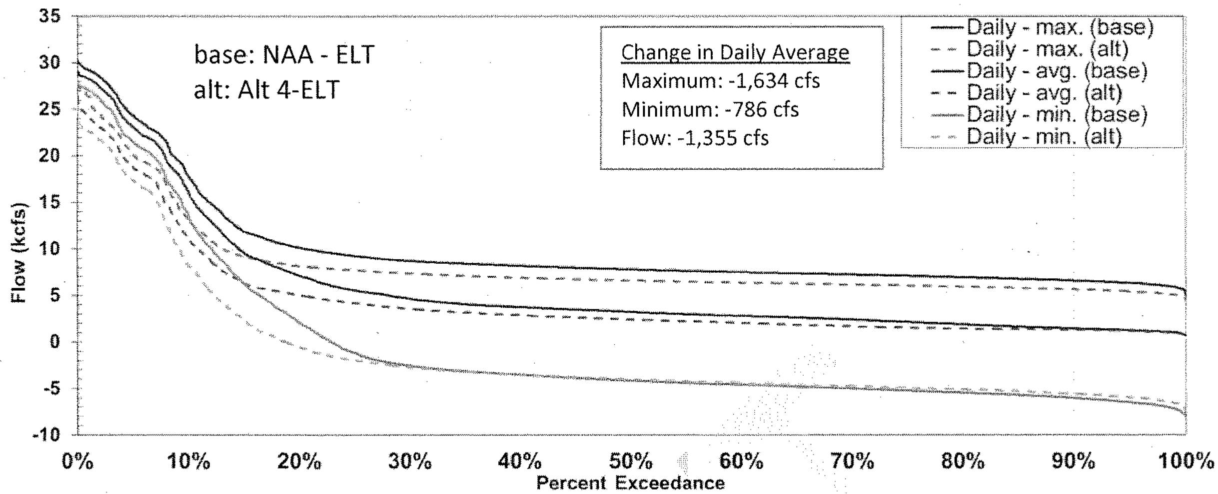

Figure 27. Daily Flow in Steamboat Slough at Sutter Slough

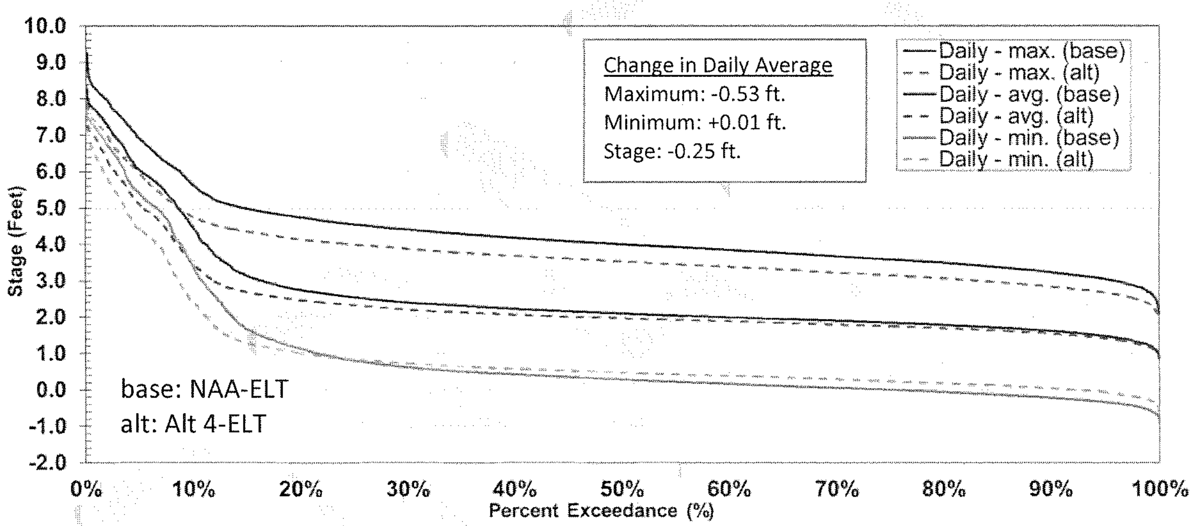

Figure 28. Daily Stage in Steamboat Slough at Sutter Slough

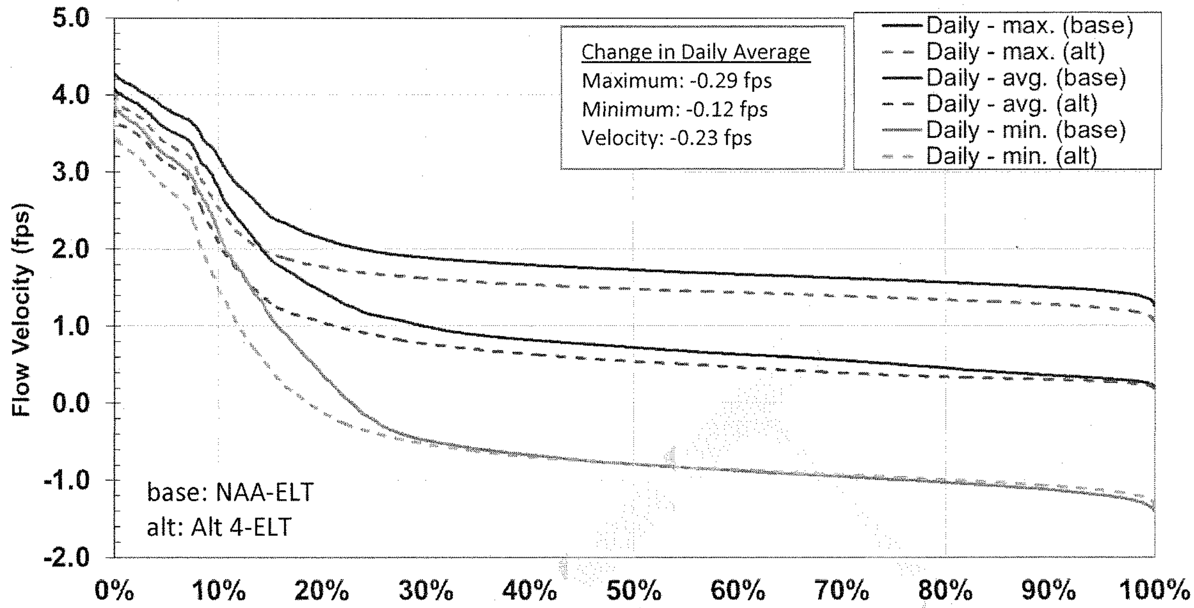

Figure 29. Daily Velocities in Steamboat Slough at Sutter Slough

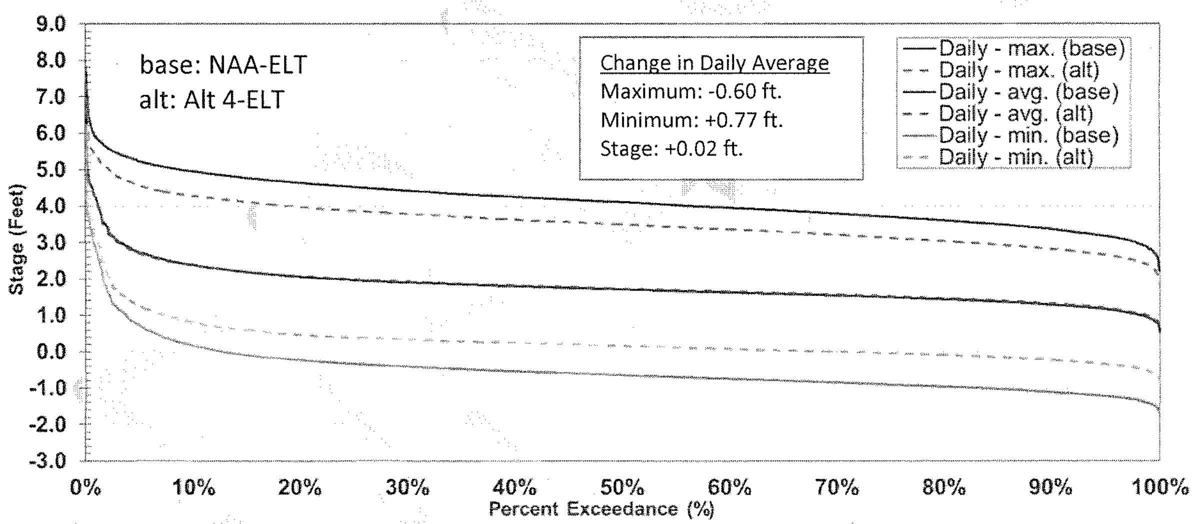

Figure 30. Daily Stage in Barker Slough at NBA Intakes

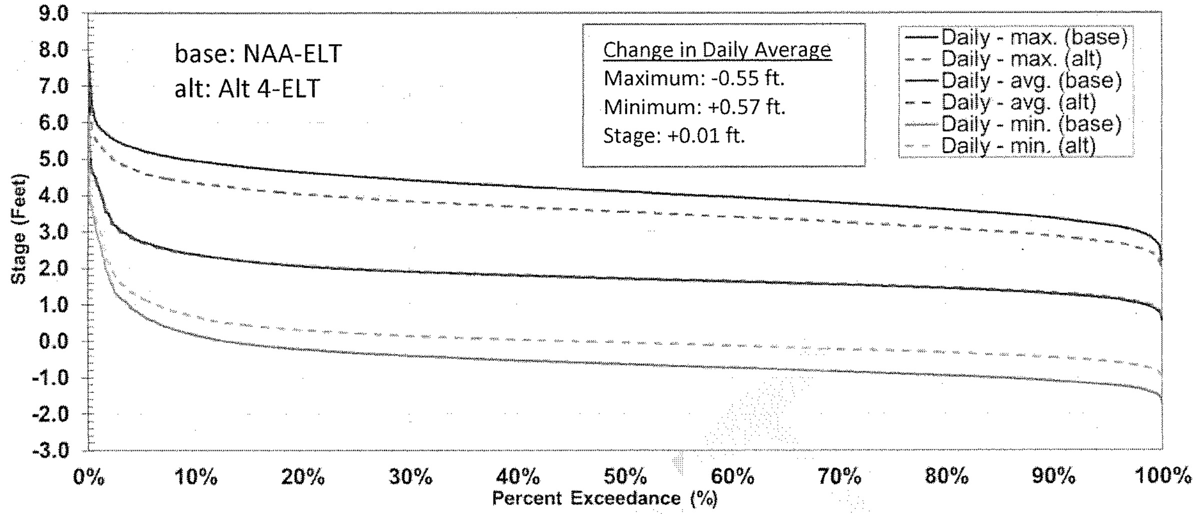

Figure 31. Daily Stage in Shag Slough (RD 2068 Pumping Plant)

No Action Alternative with Habitat and No Action Alternative without Habitat (Independent Modeling)

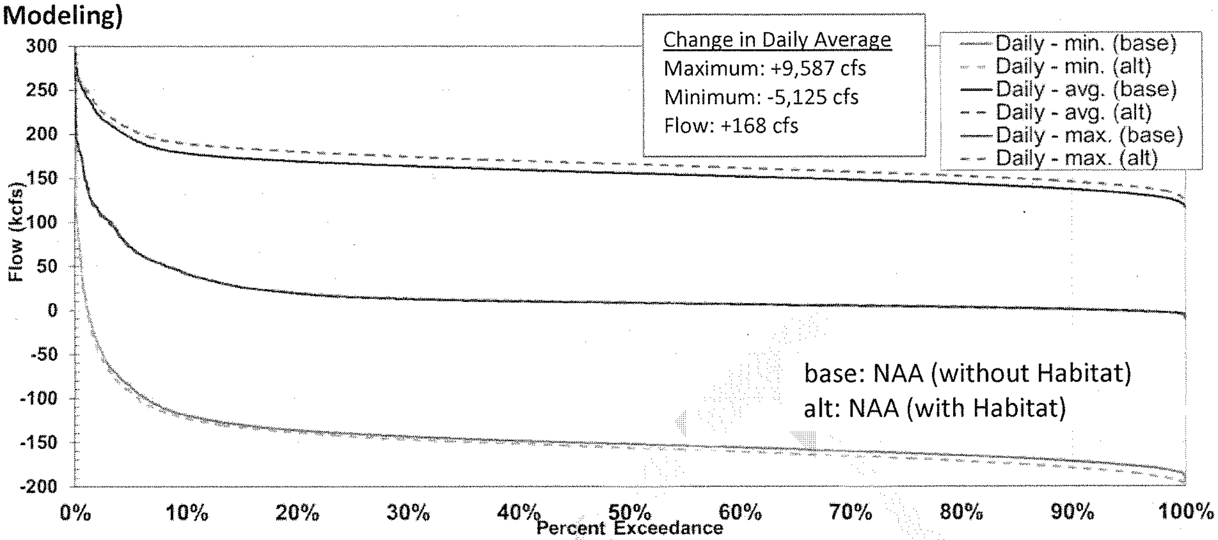

Figure 32. Daily Flow in Sacramento River at Emmaton

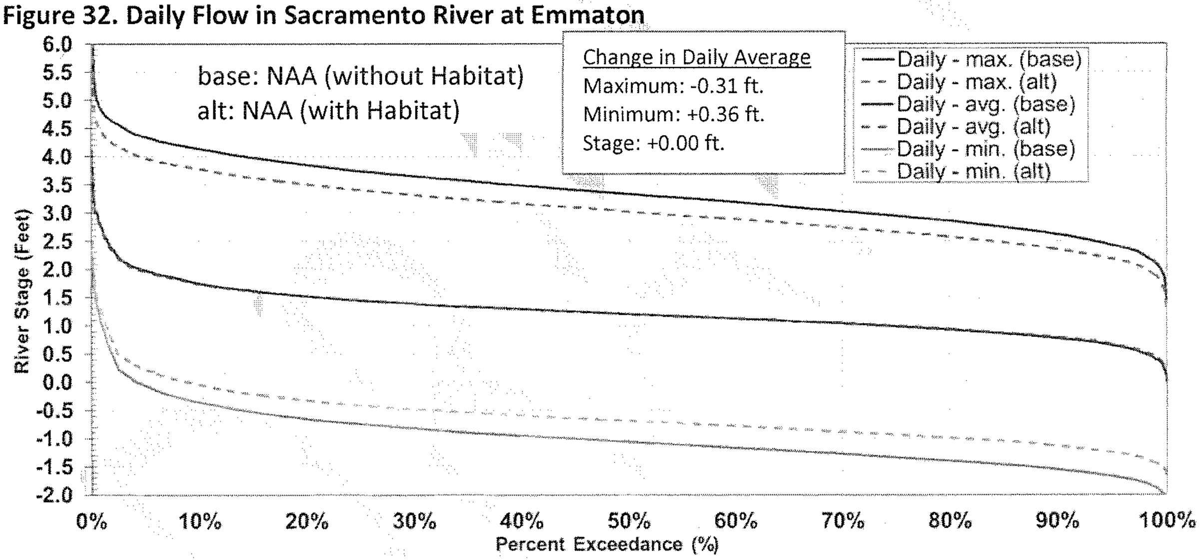

Figure 33. Daily Stage in Sacramento River at Emmaton

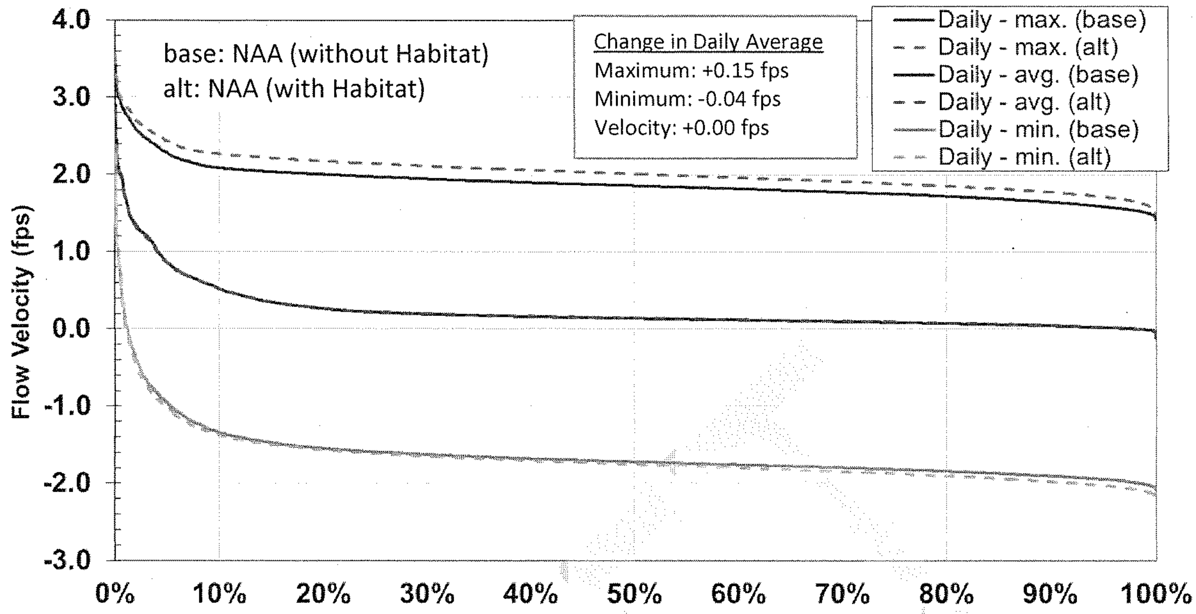

Figure 34. Daily Velocities in Sacramento River at Emmaton

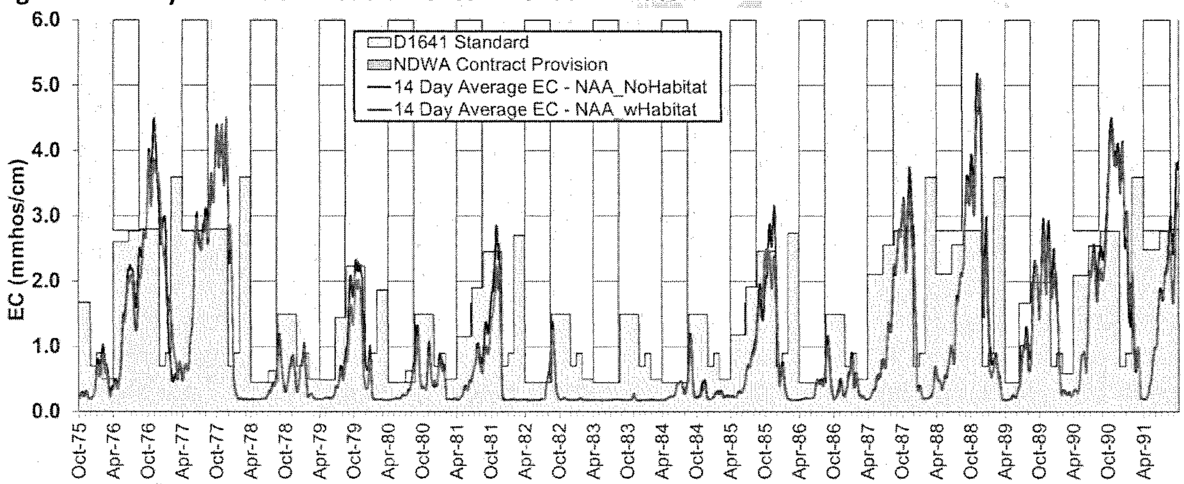

Figure 35. EC in the Sacramento River at Emmaton

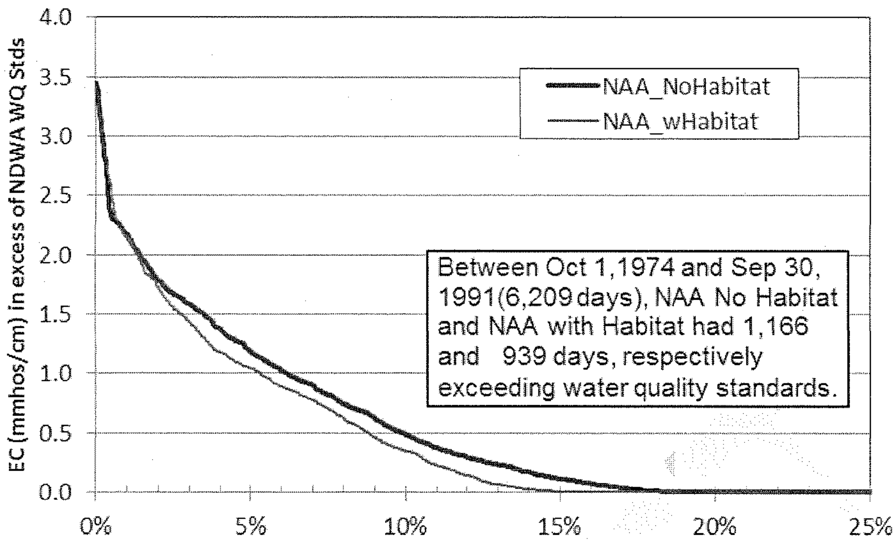

Figure 36. Probability of Exceeding EC Standards in the Sacramento River at Emmaton

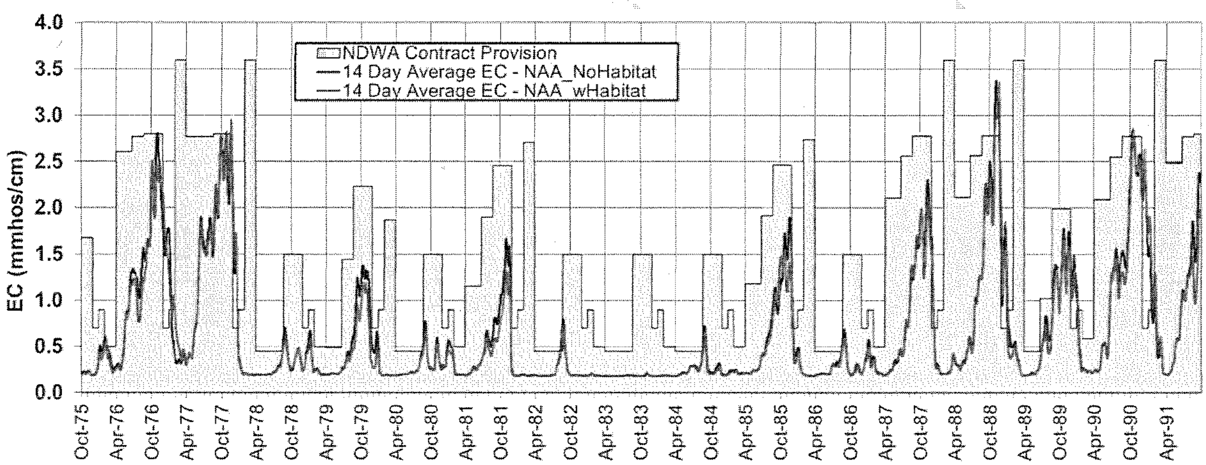

Figure 37. EC in the Sacramento River at Three Mile Slough

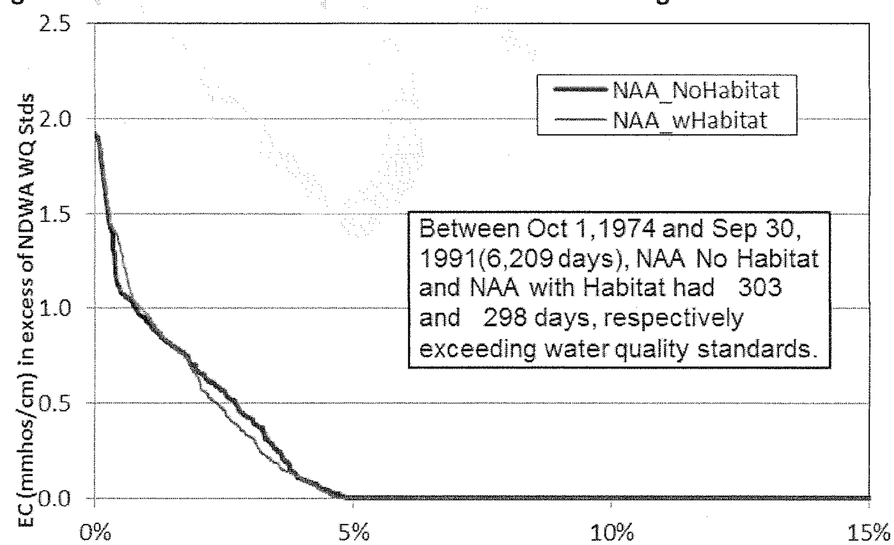

Figure 38. Probability of Exceeding EC Standards in the Sacramento River at Three Mile Slough

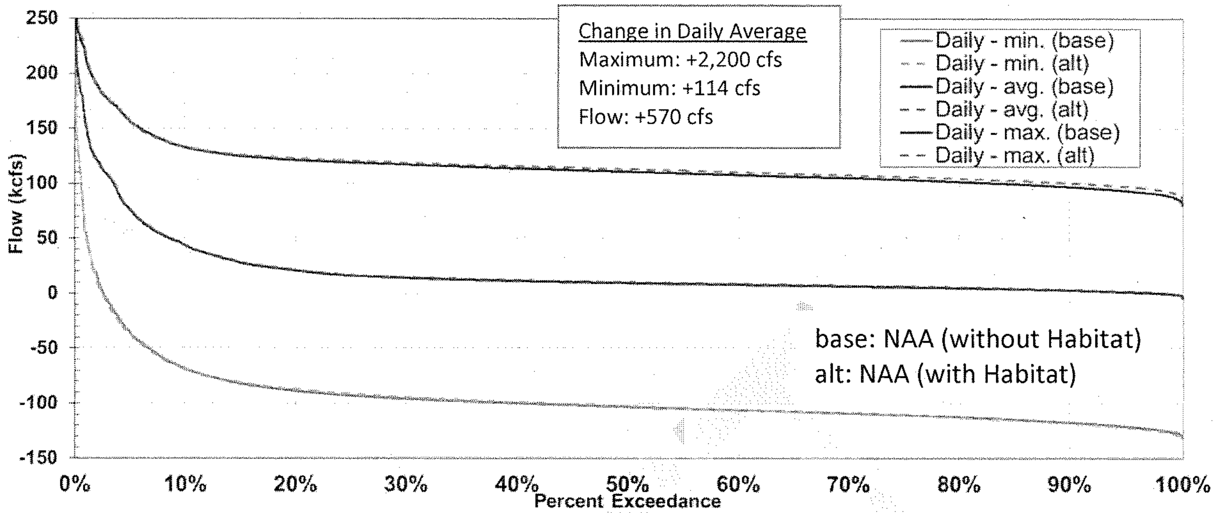

Figure 39. Daily Flow in Sacramento River at Rio Vista

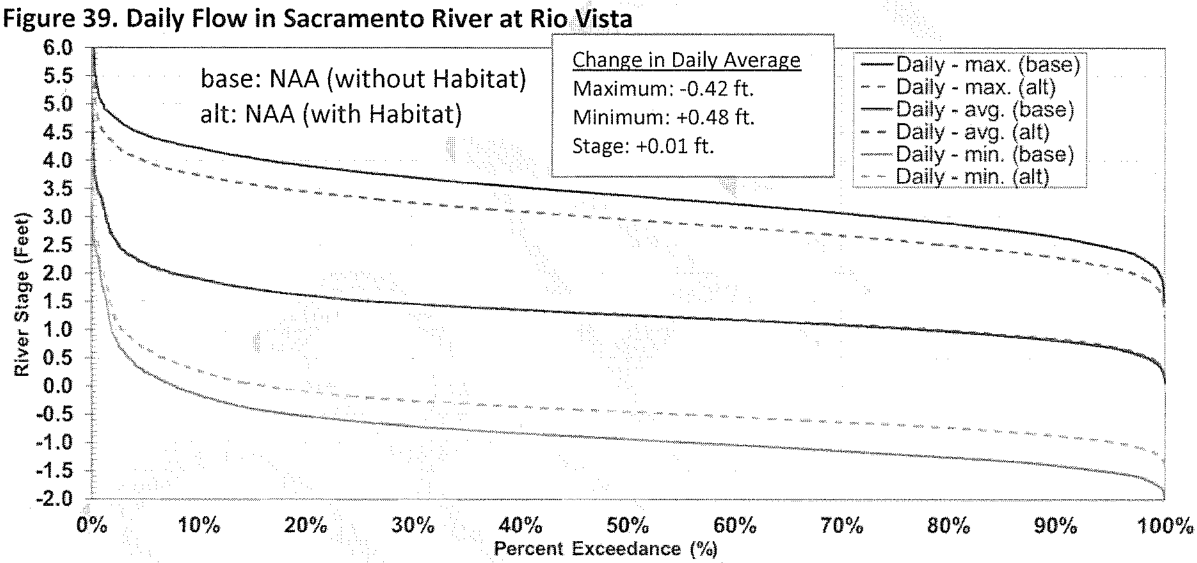

Figure 40. Daily Stage in Sacramento River at Rio Vista

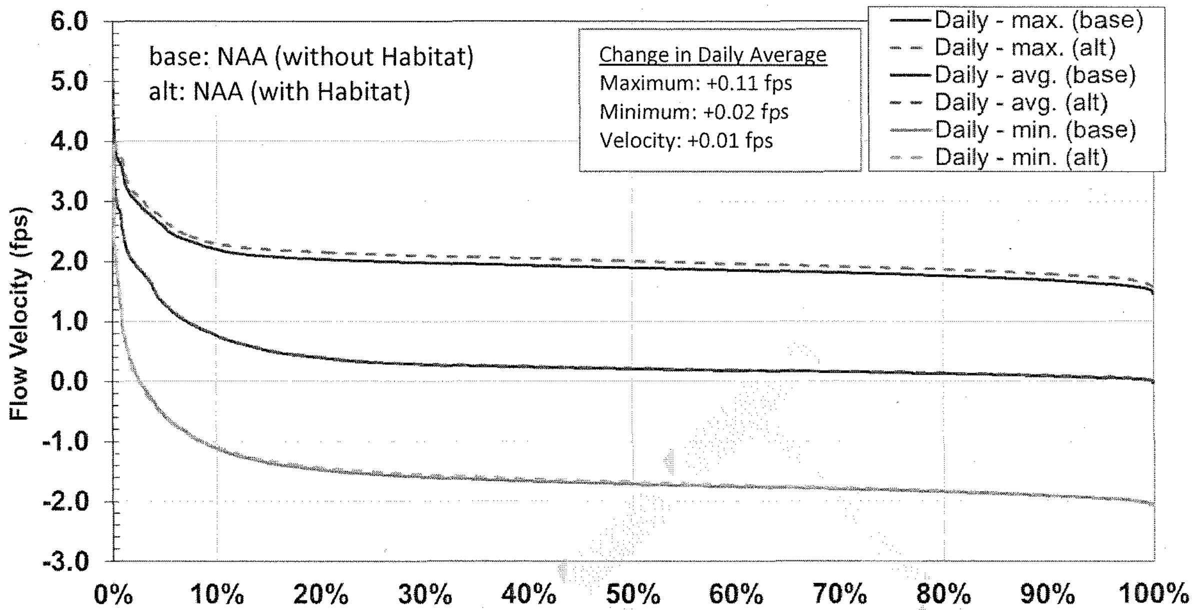

Figure 41. Daily Velocities in Sacramento River at Rio Vista

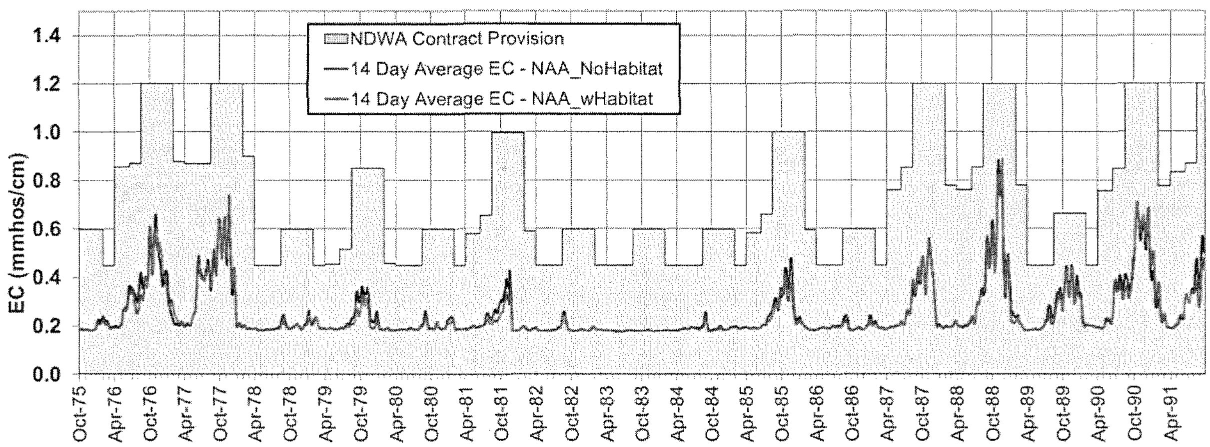

Figure 42. EC in the Sacramento River at Rio Vista

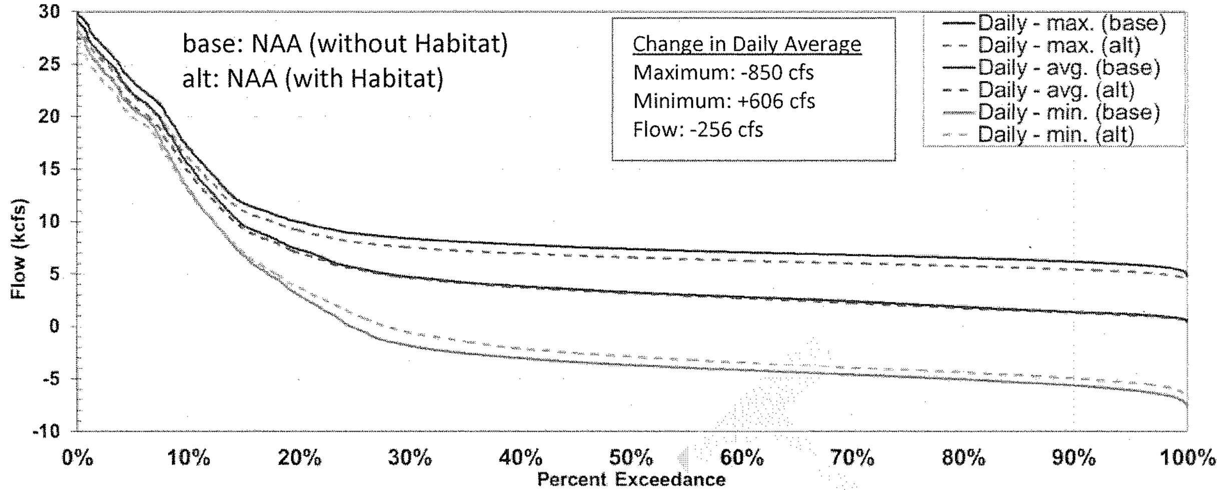

Figure 43. Daily Flow in Steamboat Slough at Sutter Slough

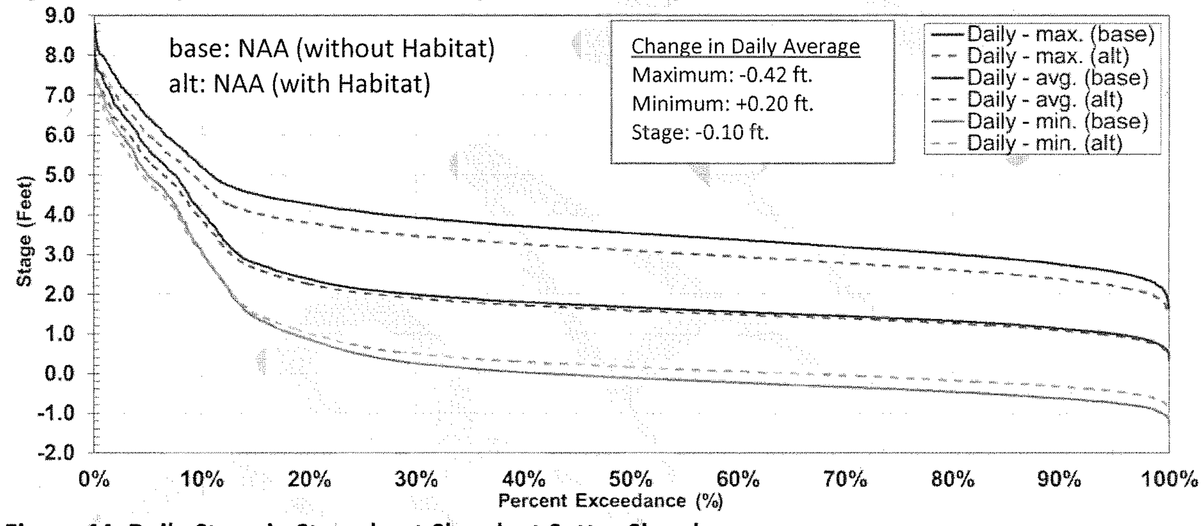

Figure 44. Daily Stage in Steamboat Slough at Sutter Slough

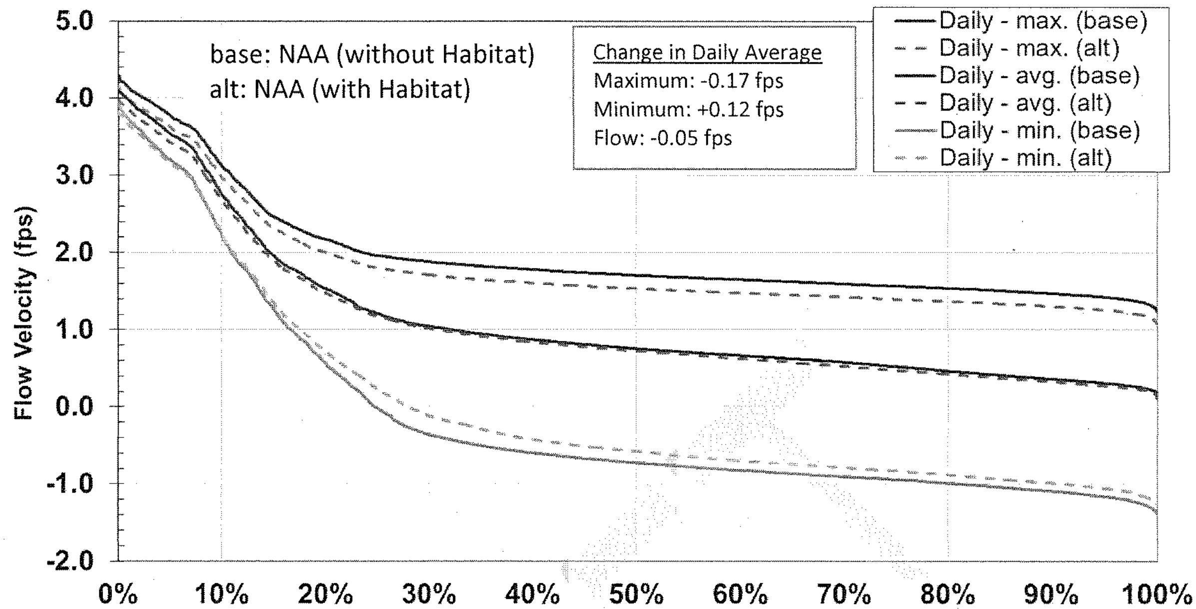

Figure 45. Daily Velocities in Steamboat Slough at Sutter Slough

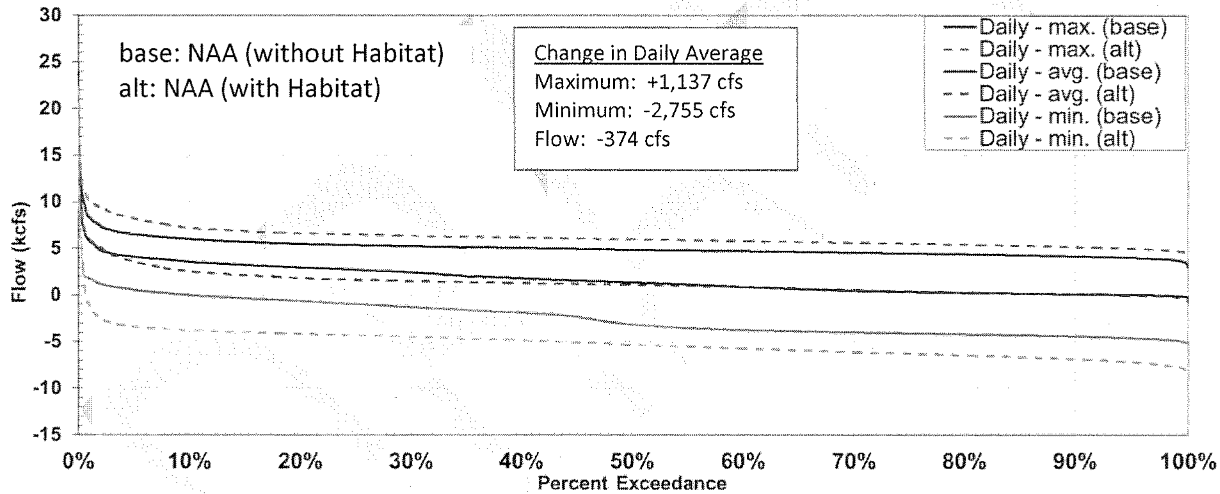

Figure 46. Daily Flow in North Fork Mokelumne River

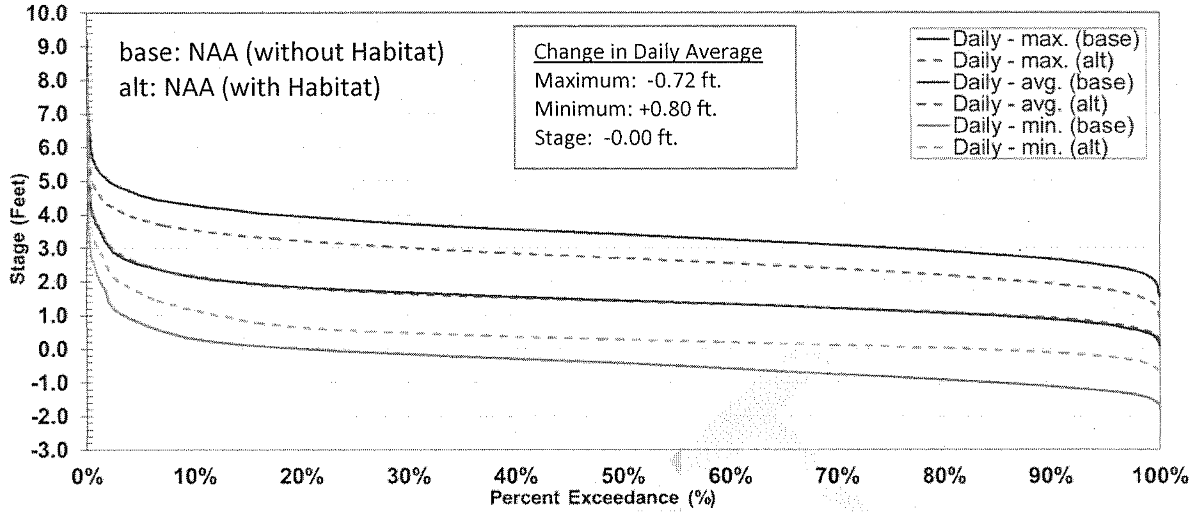

Figure 47. Daily Stage in North Fork Mokelumne River

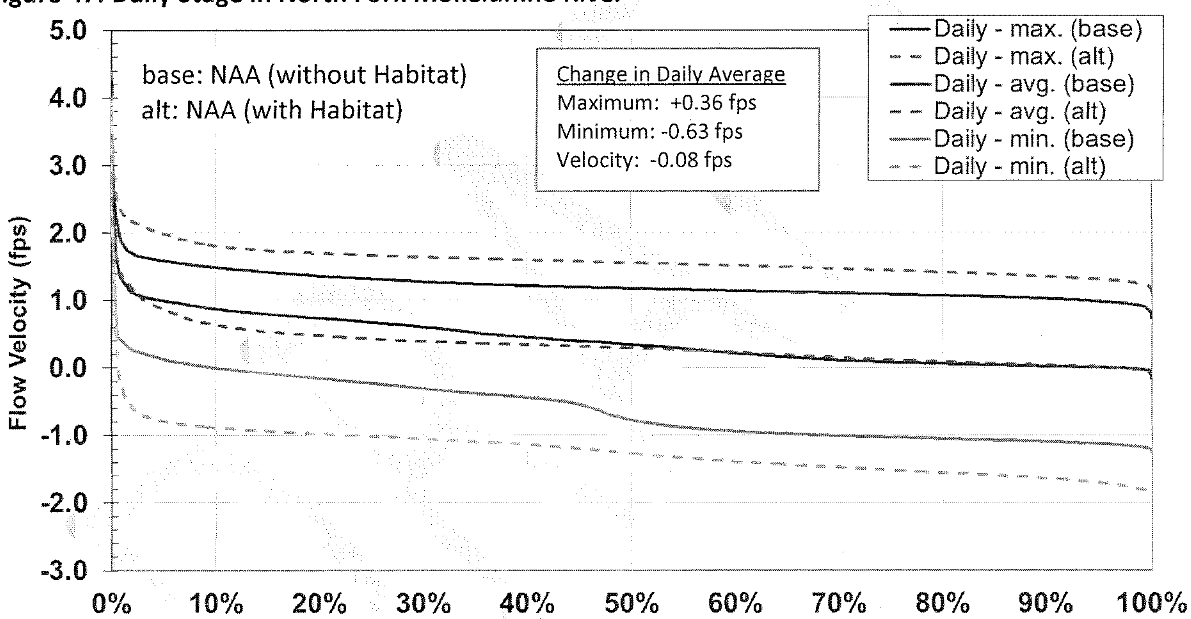

Figure 48. Daily Velocities in North Fork Mokelumne River

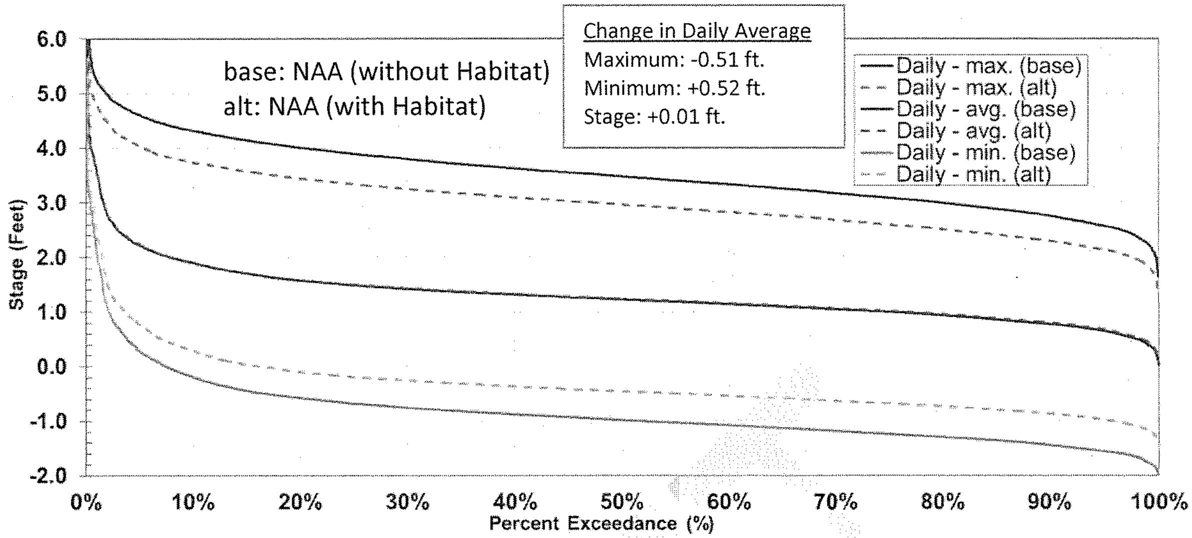

Figure 49. Daily Stage in Cache Slough at Ryer Island

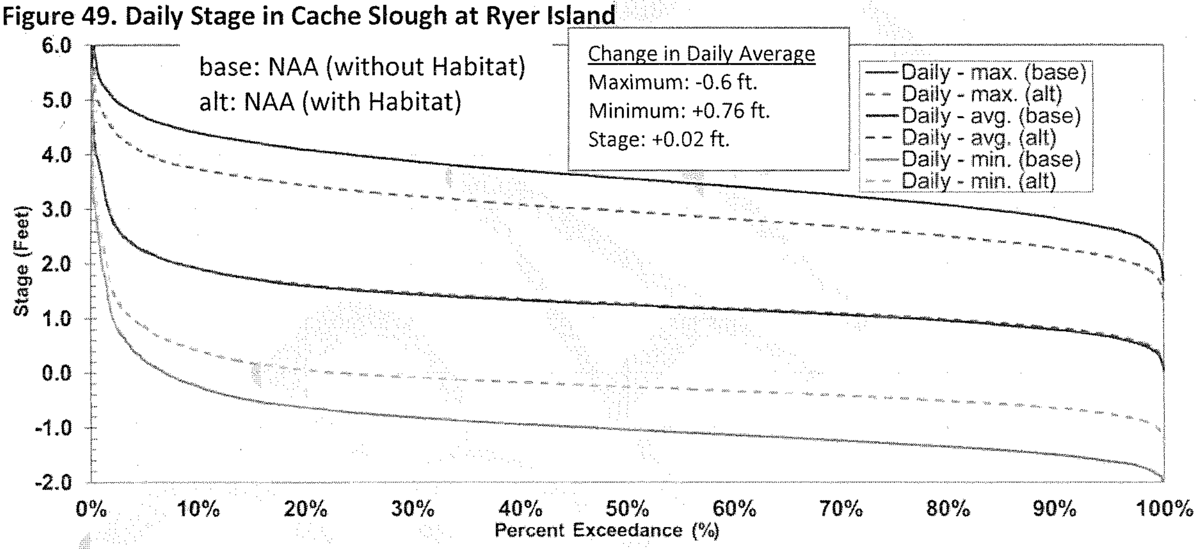

Figure 50. Daily Stage in Barker Slough at NBA Intakes

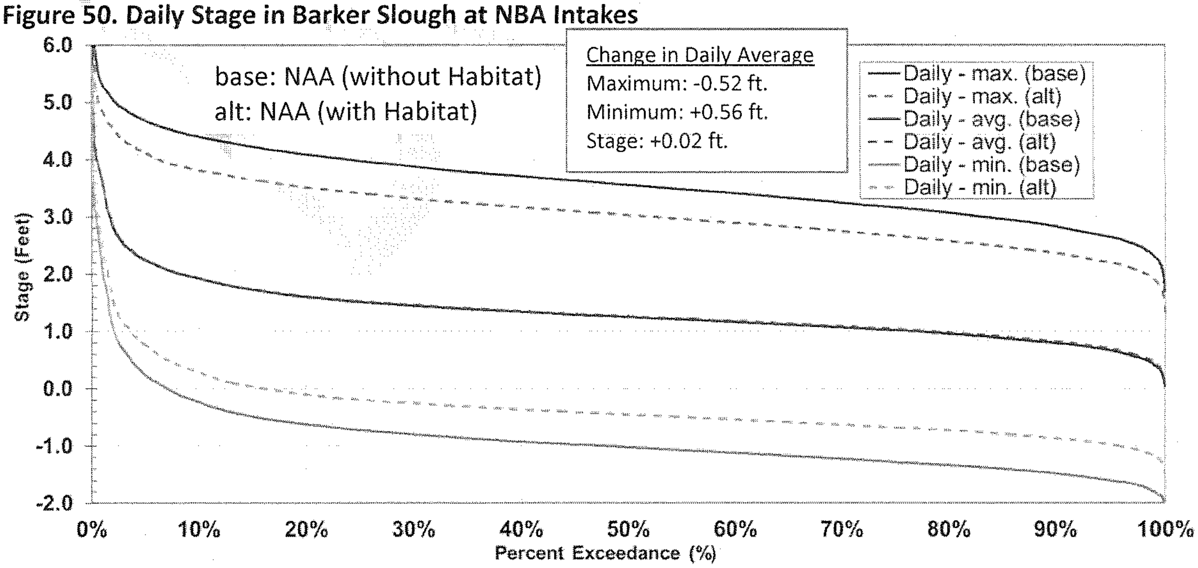

Figure 51. Daily Stage in Shag Slough at RD 2068 Intakes

Alternative 4 with Habitat and No Action Alternative without Habitat (Independent Modeling)

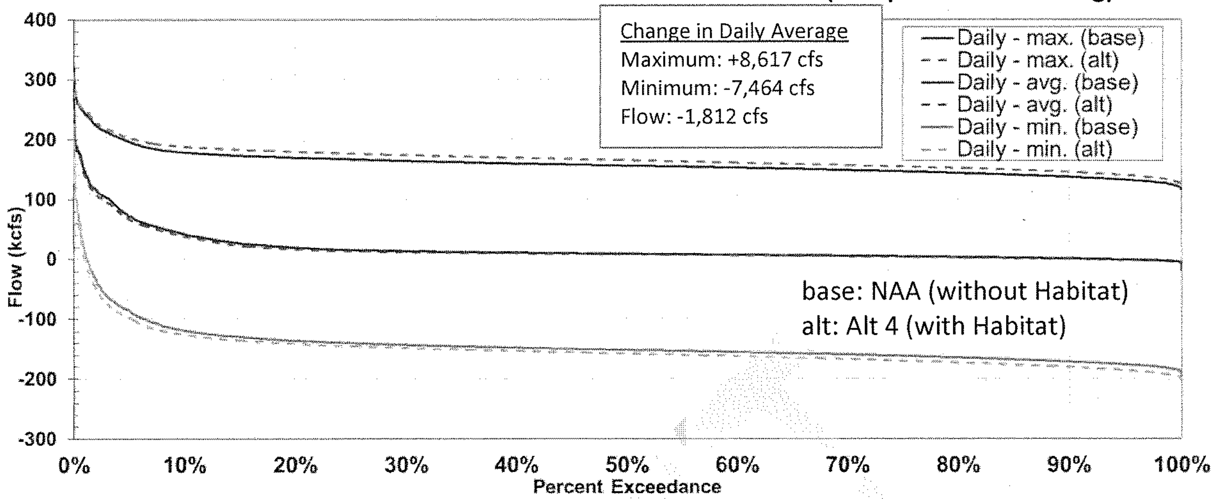

Figure 52. Daily Flow in Sacramento River at Emmaton

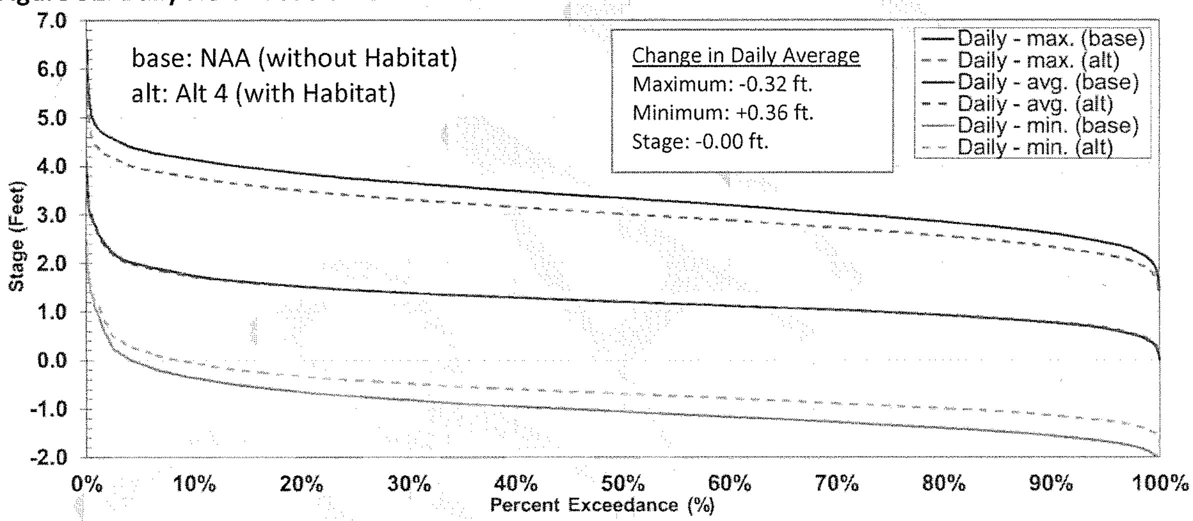

Figure 53. Daily Stage in Sacramento River at Emmaton

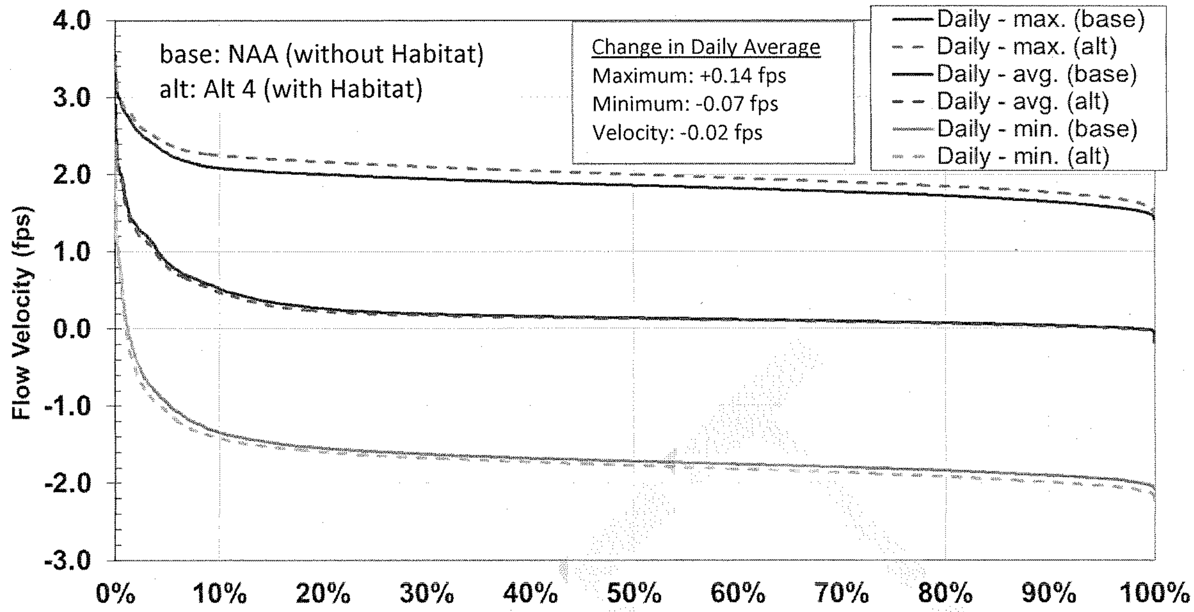

Figure 54. Daily Velocities in Sacramento River at Emmaton

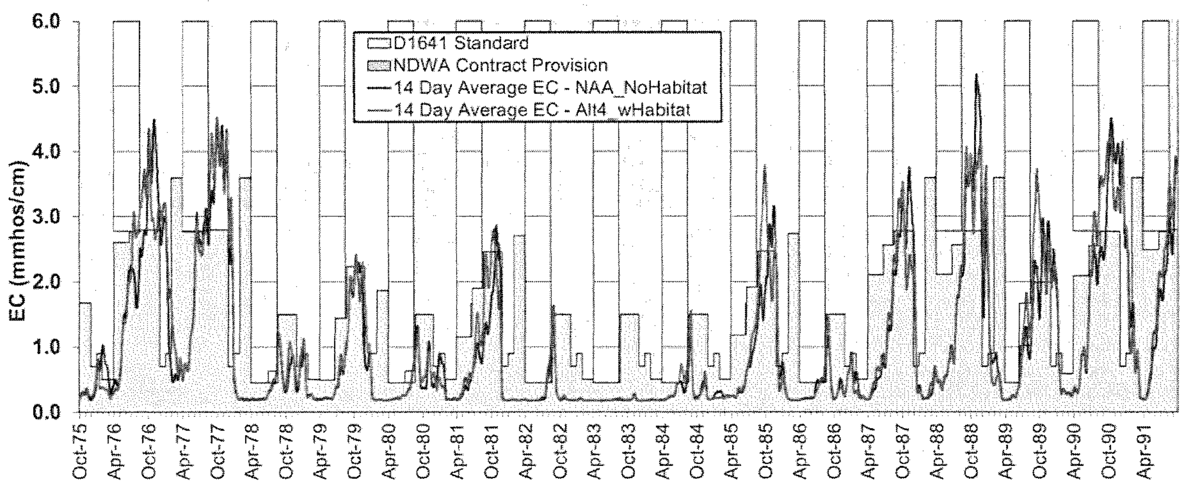

Figure 55. EC in the Sacramento River at Emmaton

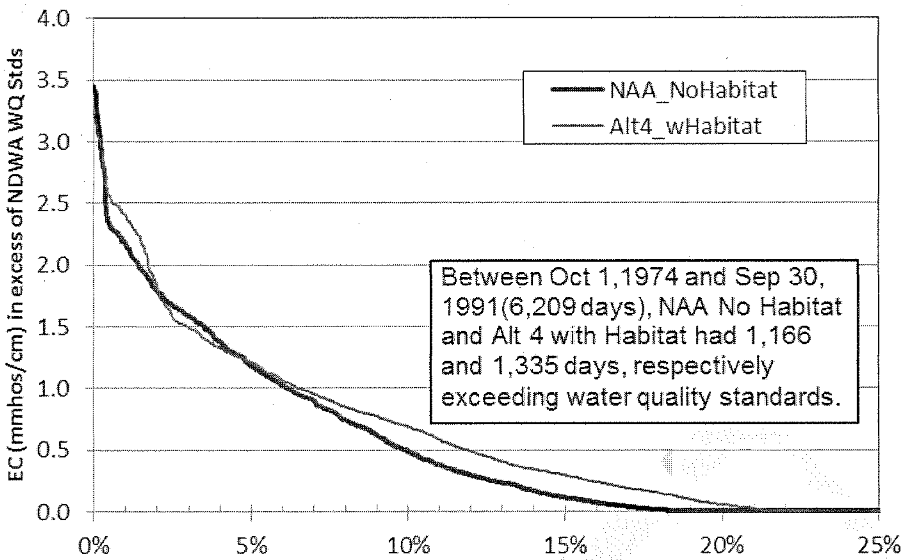

Figure 56. Probability of Exceeding EC Standards in the Sacramento River at Emmaton

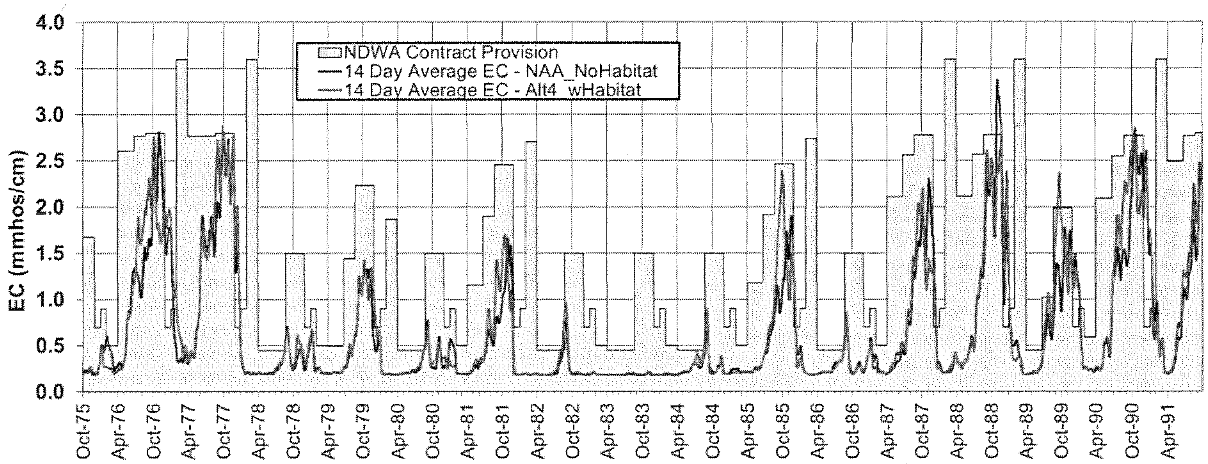

Figure 57. EC in the Sacramento River at Three Mile Slough

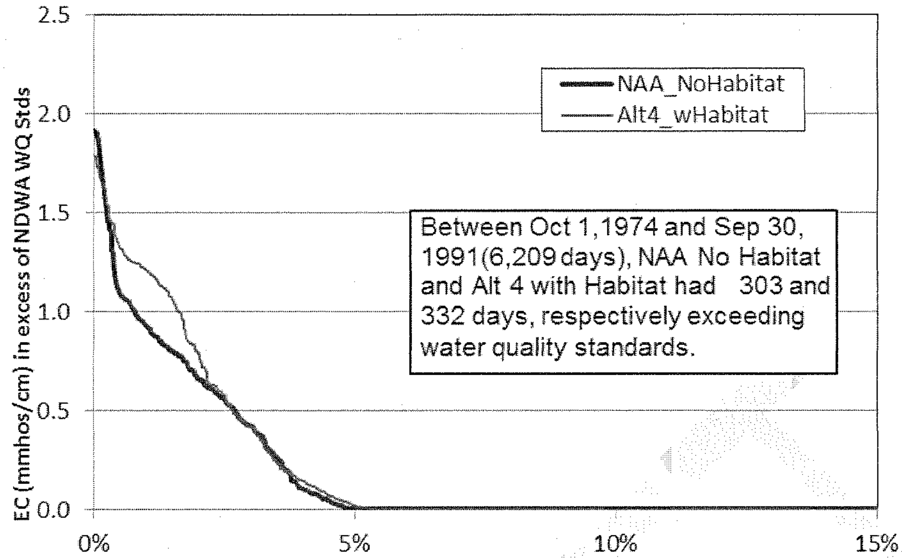

Figure 58. Probability of Exceeding EC Standards in the Sacramento River at Three Mile Slough

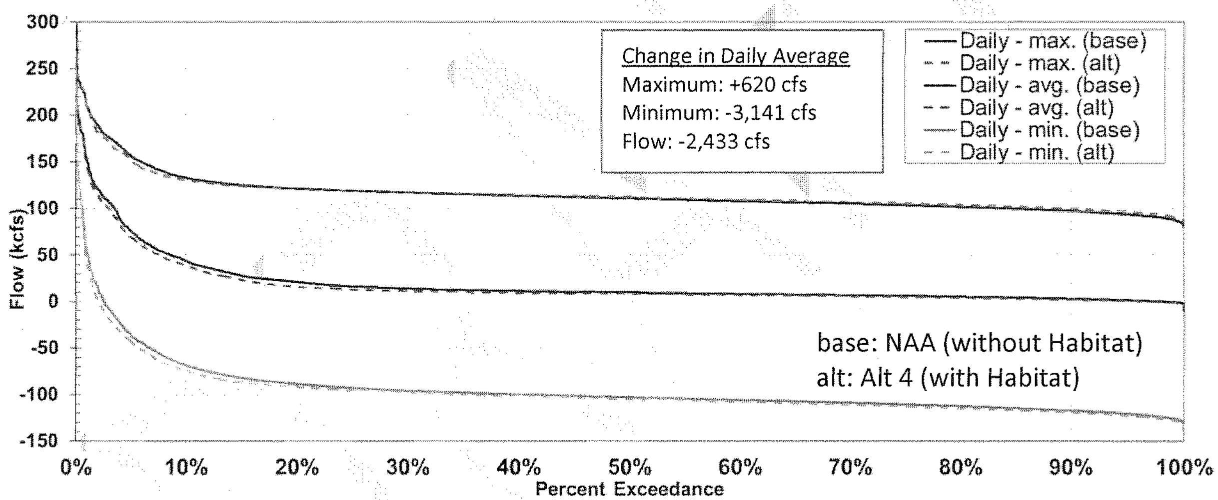

Figure 59. Daily Flow in Sacramento River at Rio Vista

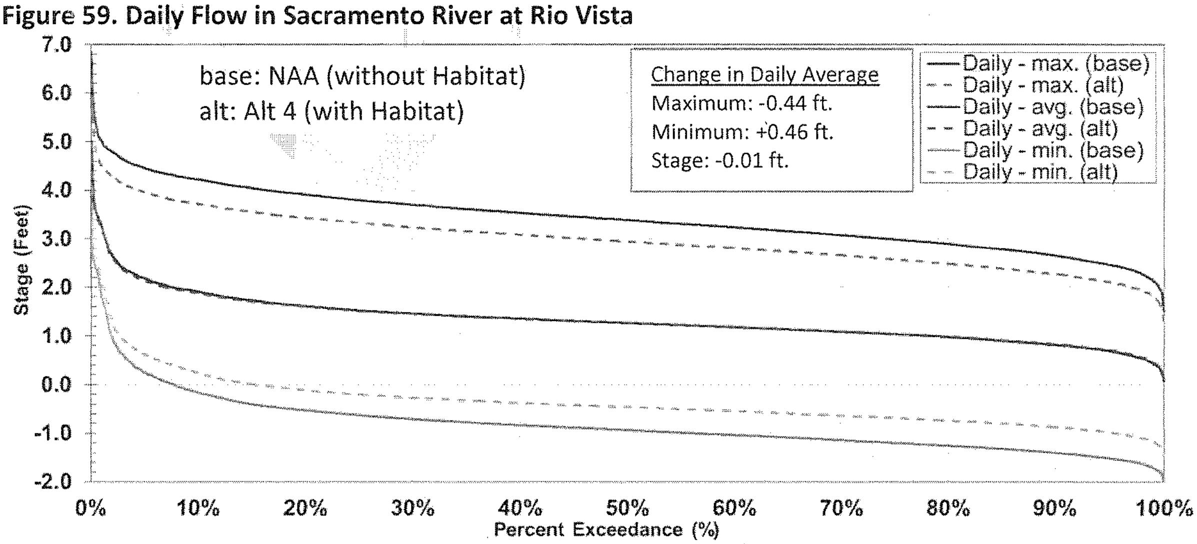

Figure 60. Daily Stage in Sacramento River at Rio Vista

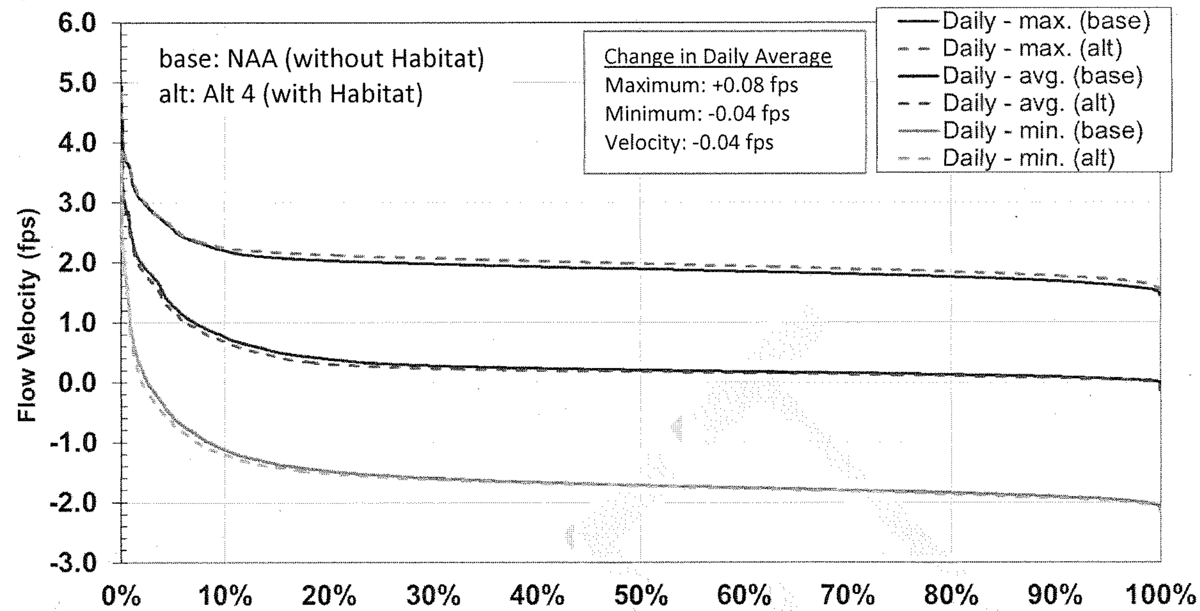

Figure 61. Daily Velocities in Sacramento River at Rio Vista

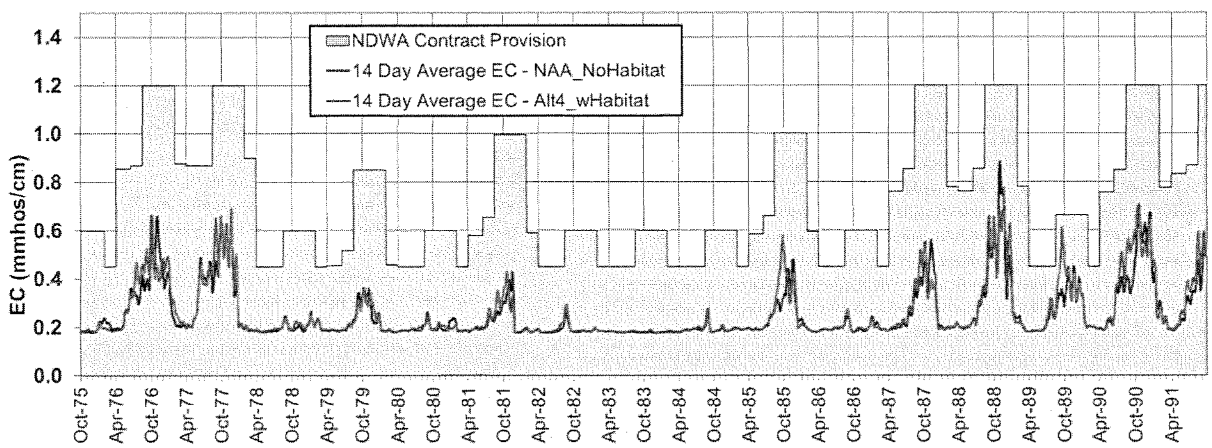

Figure 62. EC in the Sacramento River at Rio Vista

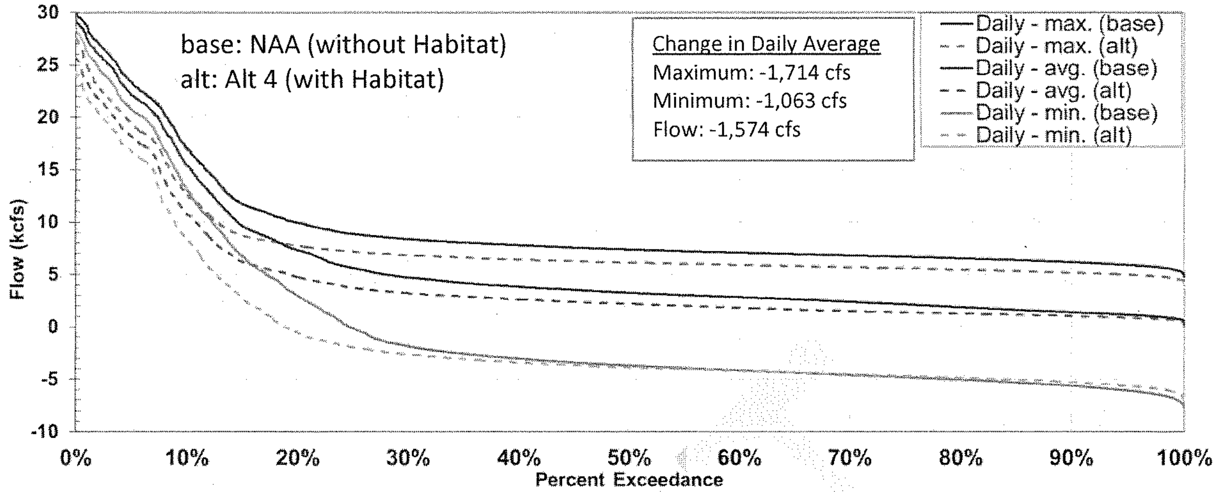

Figure 63. Daily Flow in Steamboat Slough at Sutter Slough

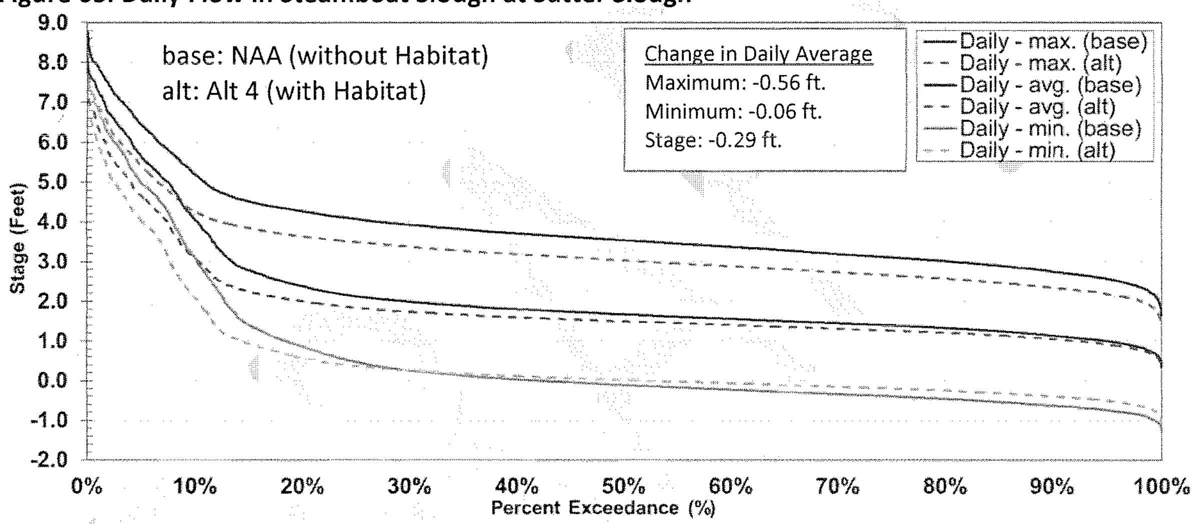

Figure 64. Daily Stage in Steamboat Slough at Sutter Slough

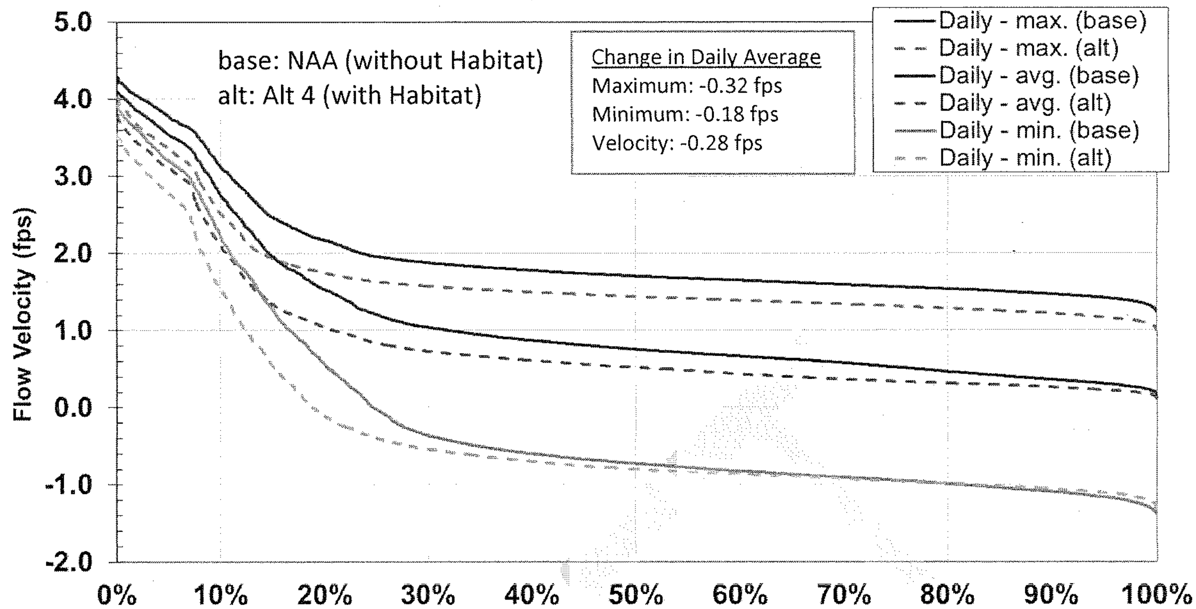

Figure 65. Daily Velocities in Steamboat Slough at Sutter Slough

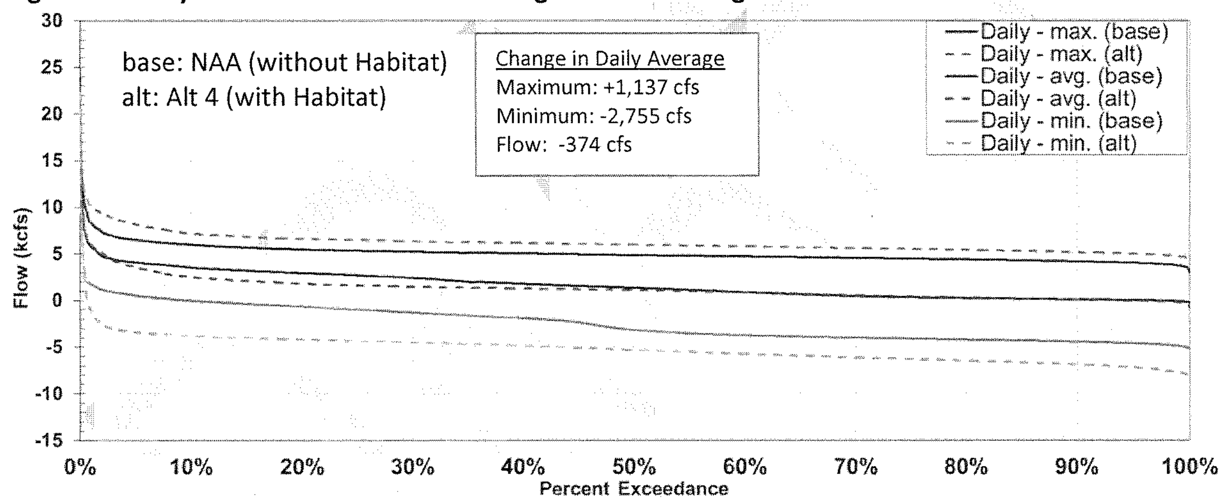

Figure 66. Daily Flow in North Fork Mokelumne River

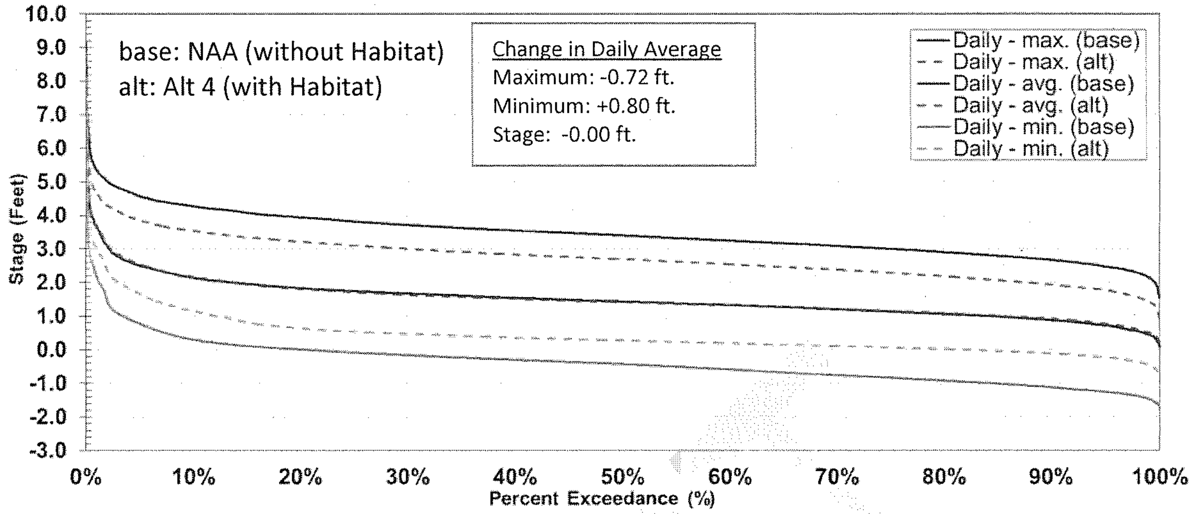

Figure 67. Daily Stage in North Fork Mokelumne River

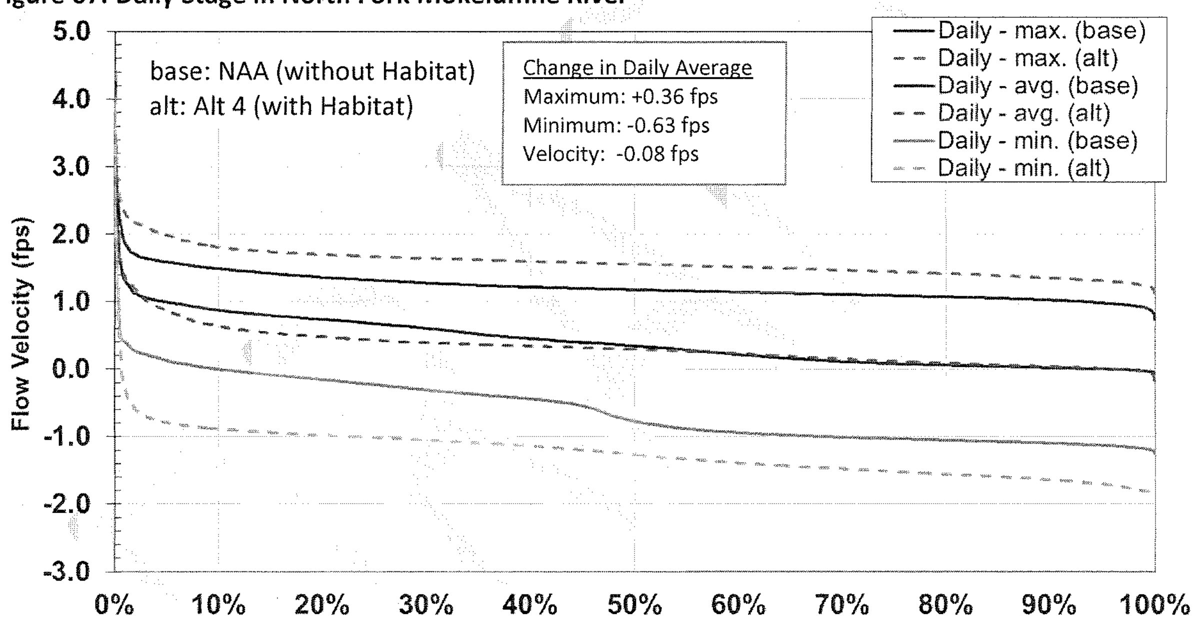

Figure 68. Daily Velocities in North Fork Mokelumne River

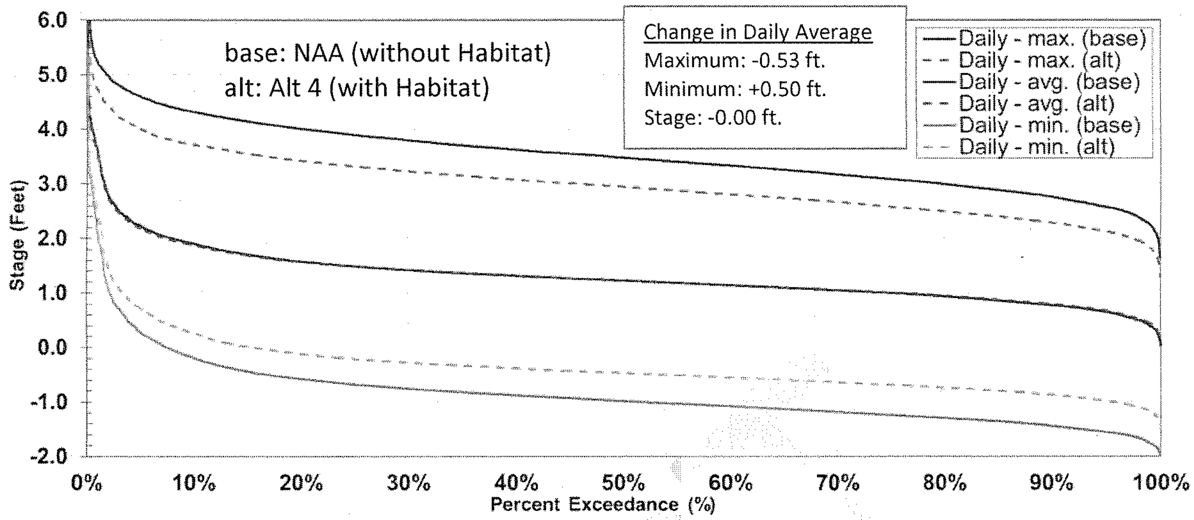

Figure 69. Daily Stage in Cache Slough at Ryer Island

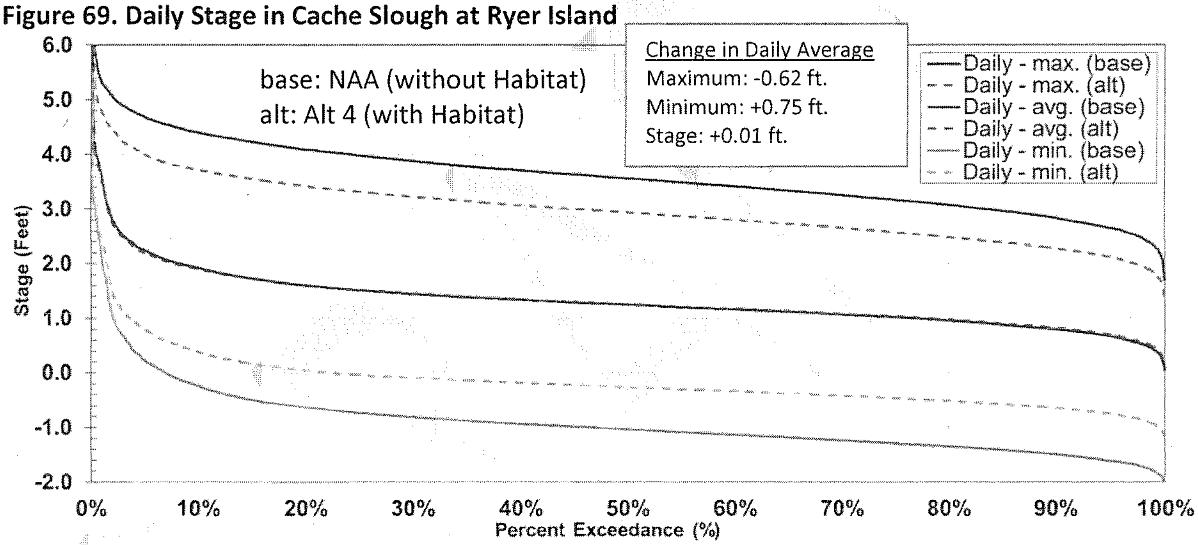

Figure 70. Daily Stage in Barker Slough at NBA Intakes

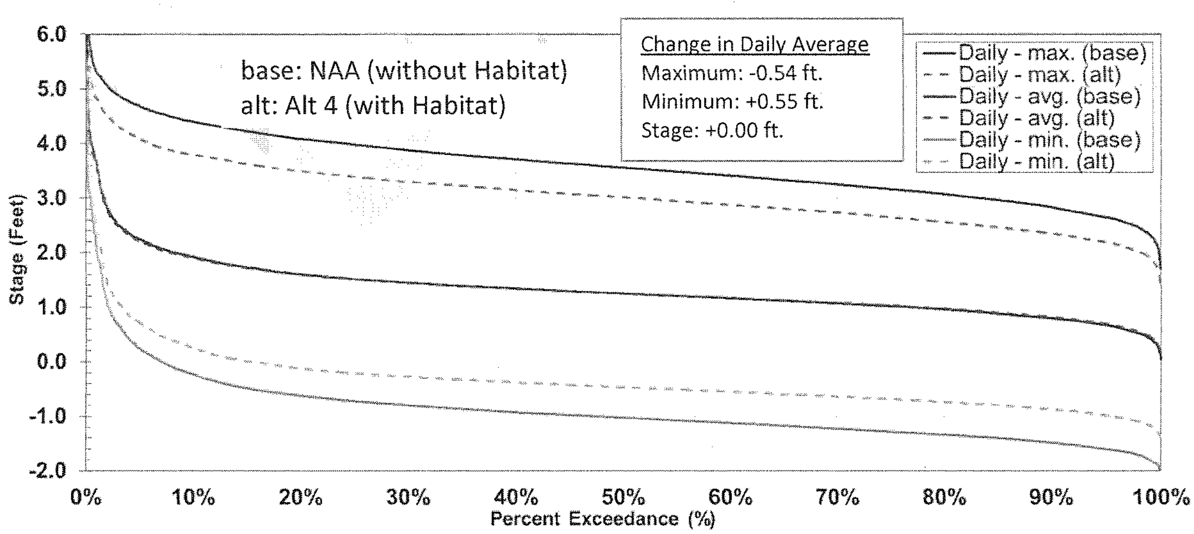

Figure 71. Daily Stage in Shag Slough at RD 2068 Intakes

Alternative 4 without Habitat and No Action Alternative without Habitat (Independent Modeling)

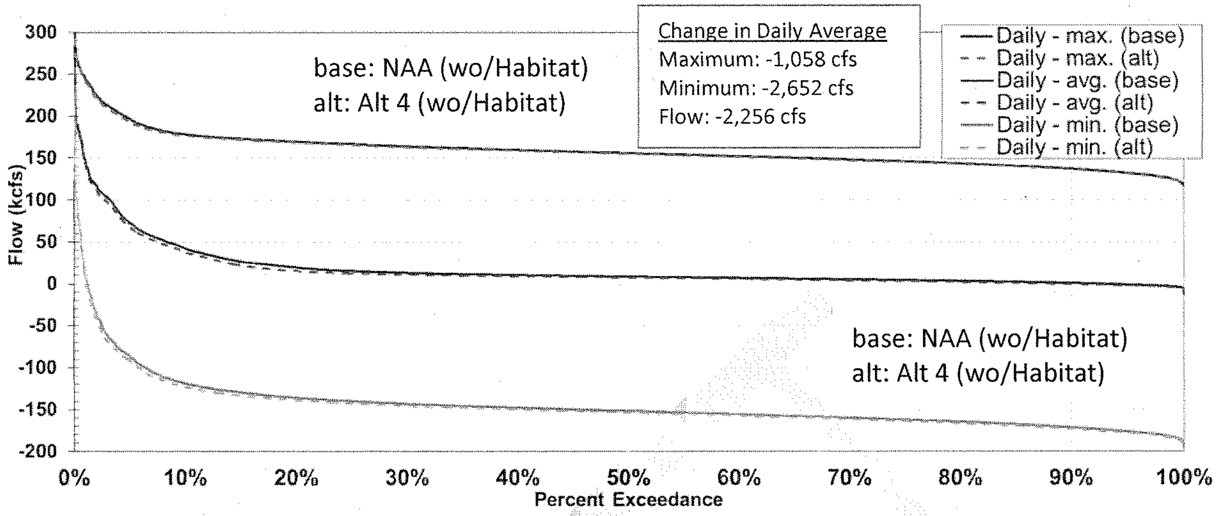

Figure 72. Daily Flow in Sacramento River at Emmaton

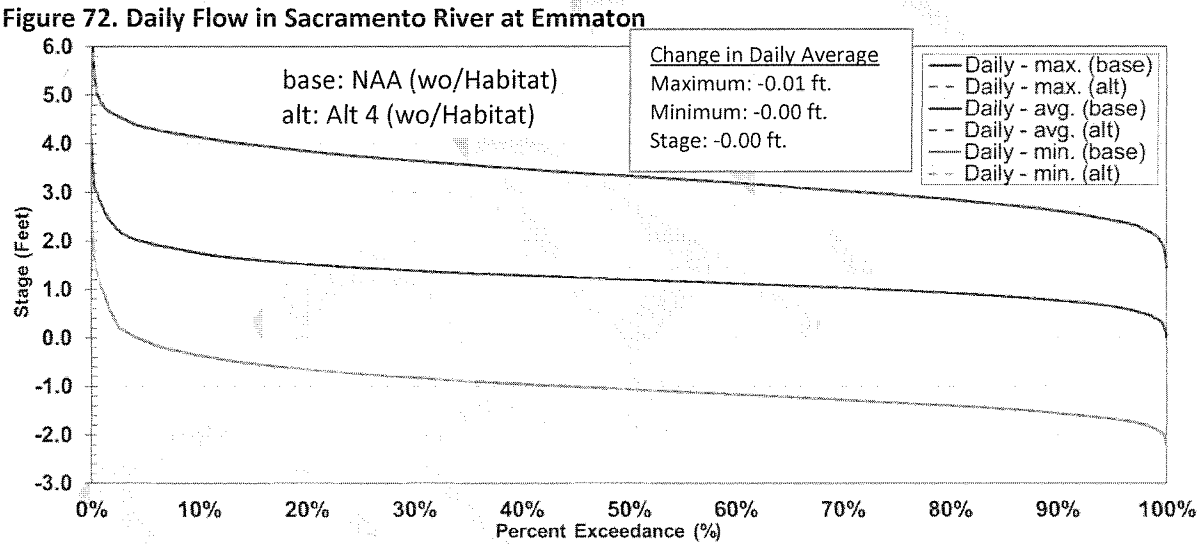

Figure 73. Daily Stage in Sacramento River at Emmaton

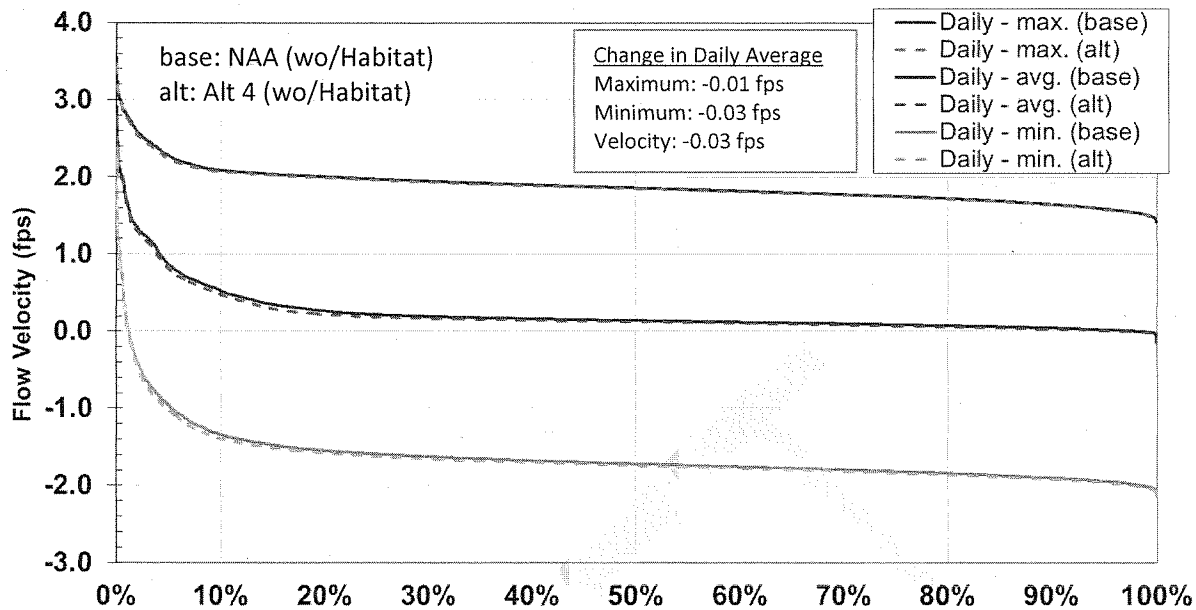

Figure 74. Daily Velocities in Sacramento River at Emmaton

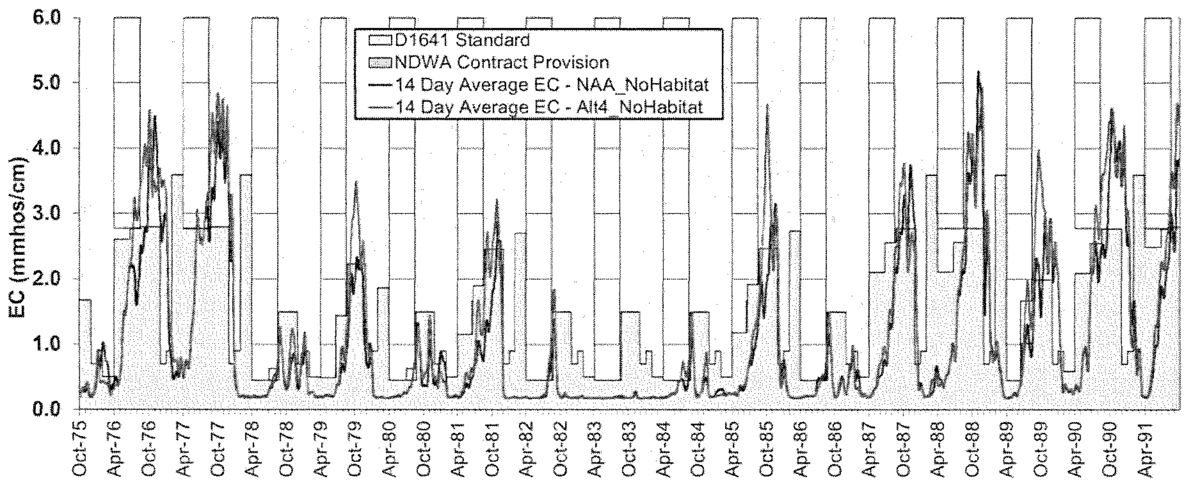

Figure 75. EC in the Sacramento River at Emmaton

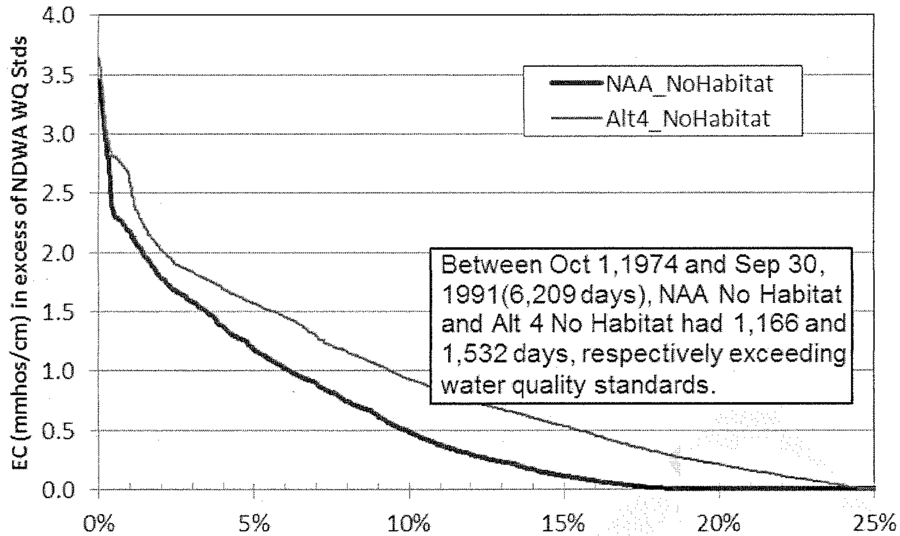

Figure 76. Probability of Exceeding EC Standards in the Sacramento River at Emmaton

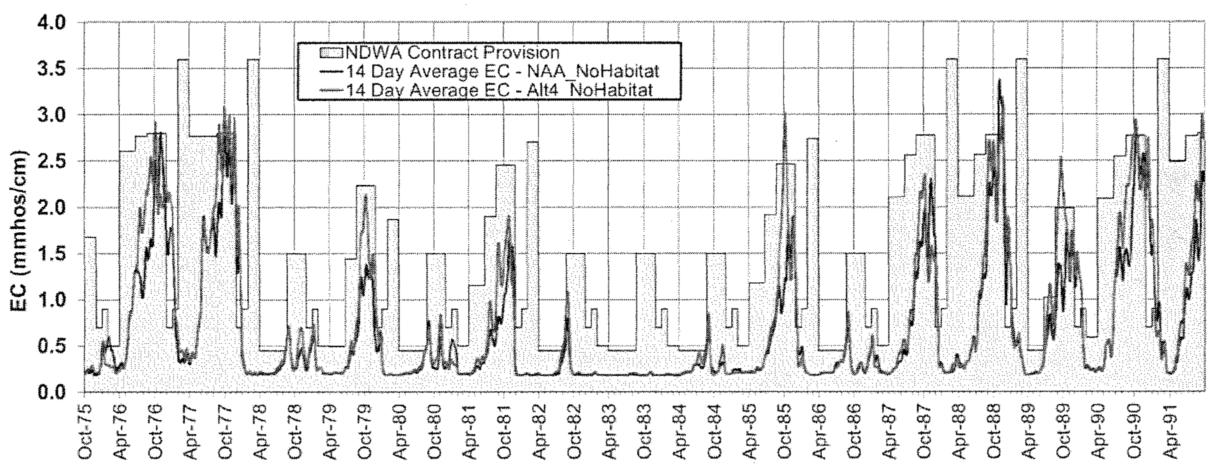

Figure 77. EC in the Sacramento River at Three Mile Slough

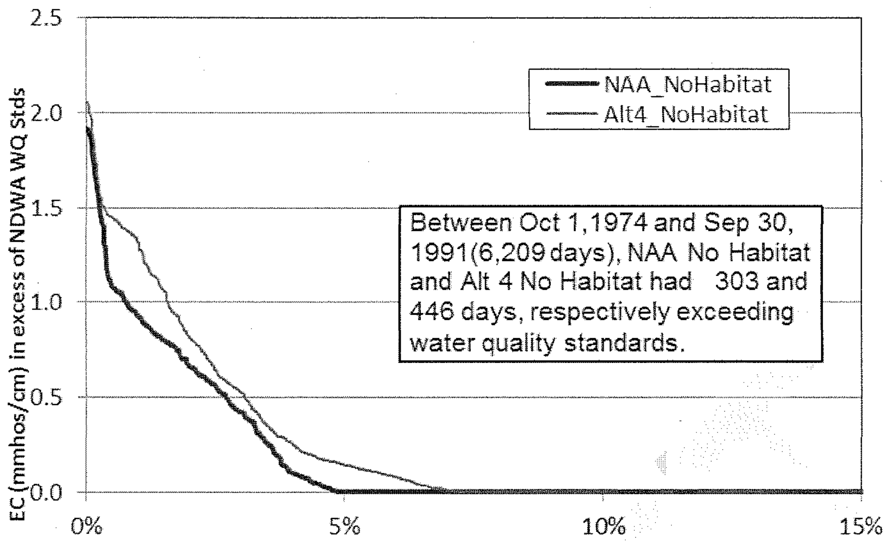

Figure 78. Probability of Exceeding EC Standards in the Sacramento River at Three Mile Slough

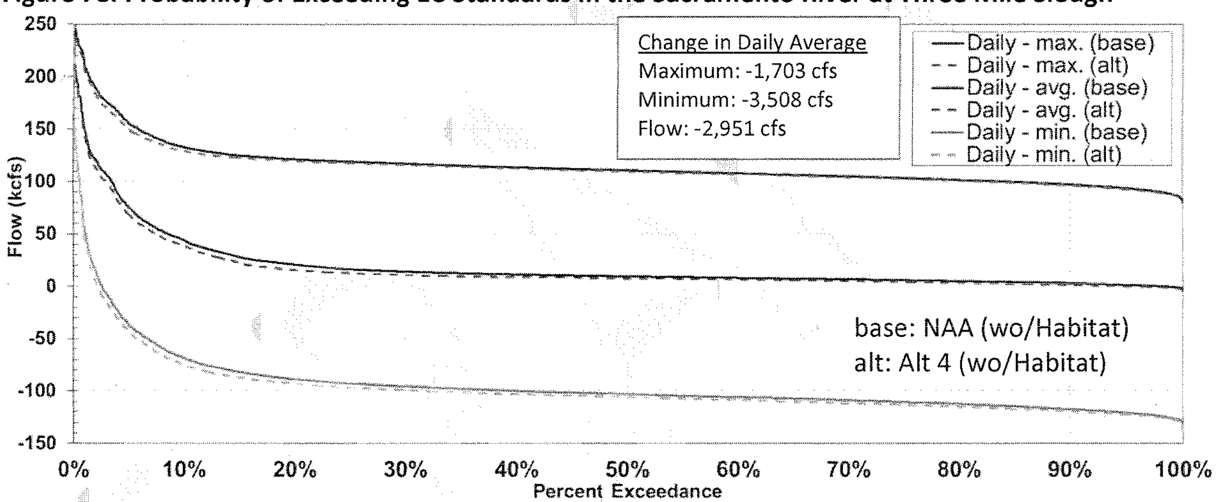

Figure 79. Daily Flow in Sacramento River at Rio Vista

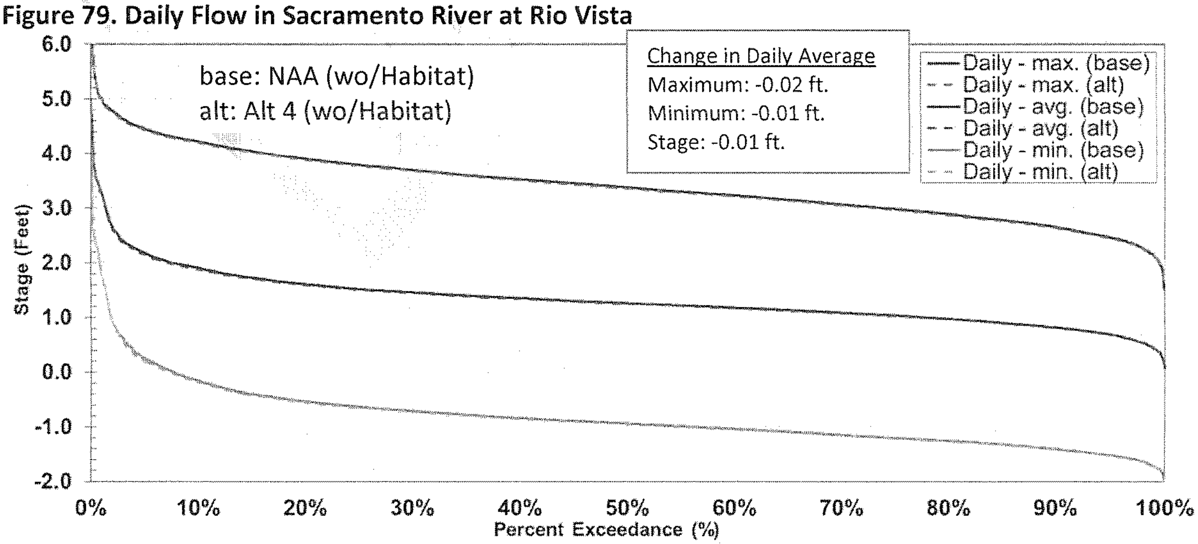

Figure 80. Daily Stage in Sacramento River at Rio Vista

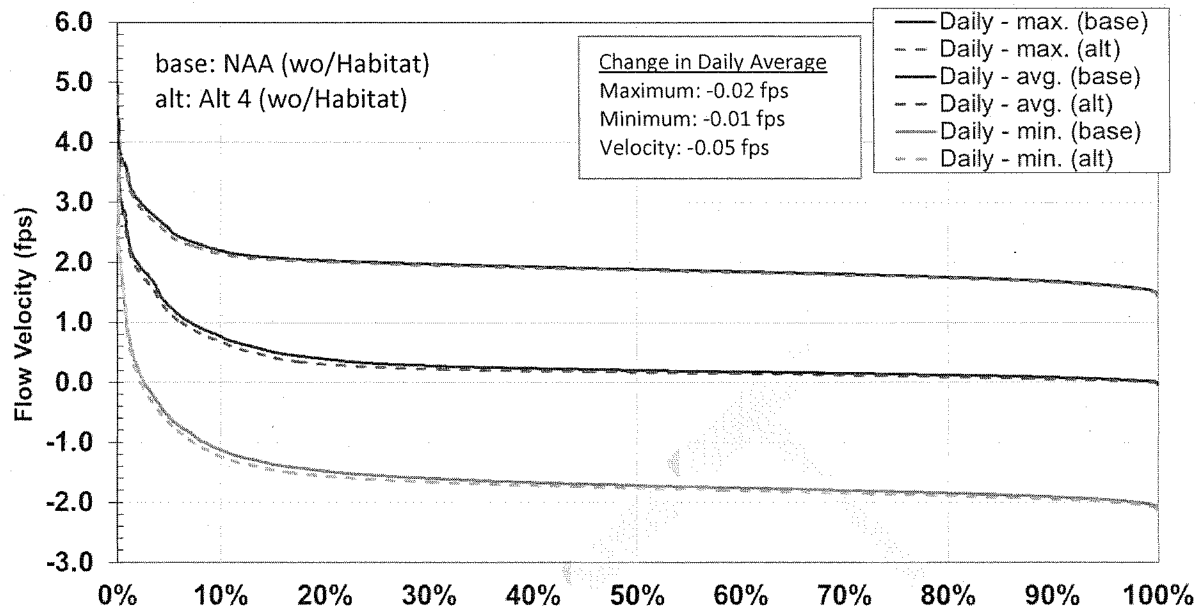

Figure 81. Daily Velocities in Sacramento River at Rio Vista

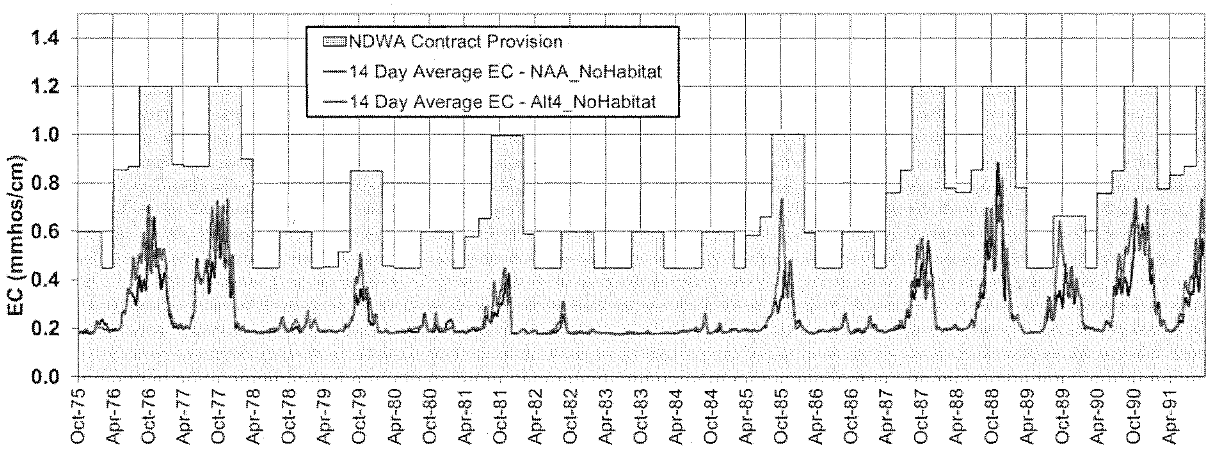

Figure 82. EC in the Sacramento River at Rio Vista

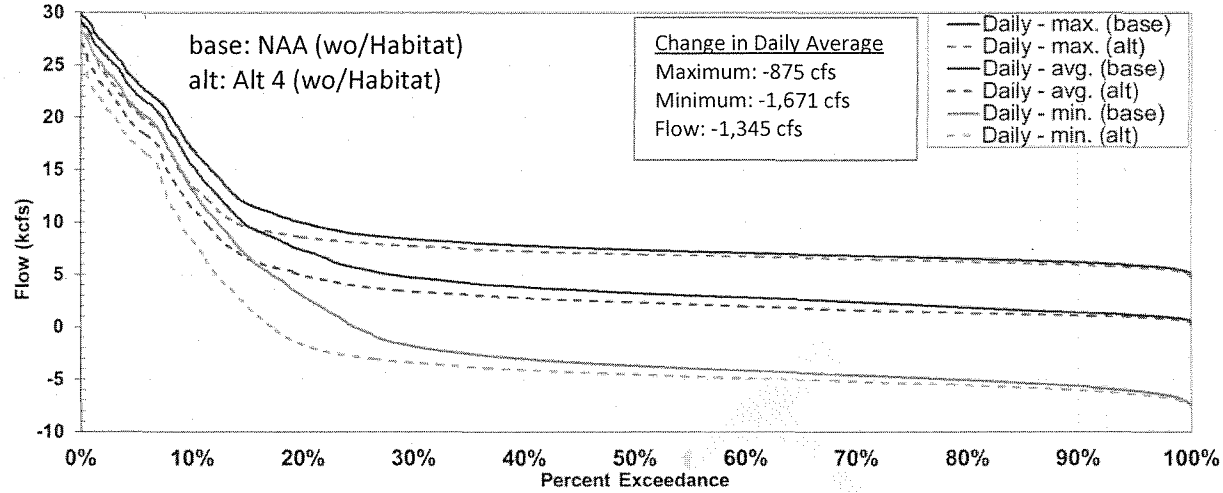

Figure 83. Daily Flow in Steamboat Slough at Sutter Slough

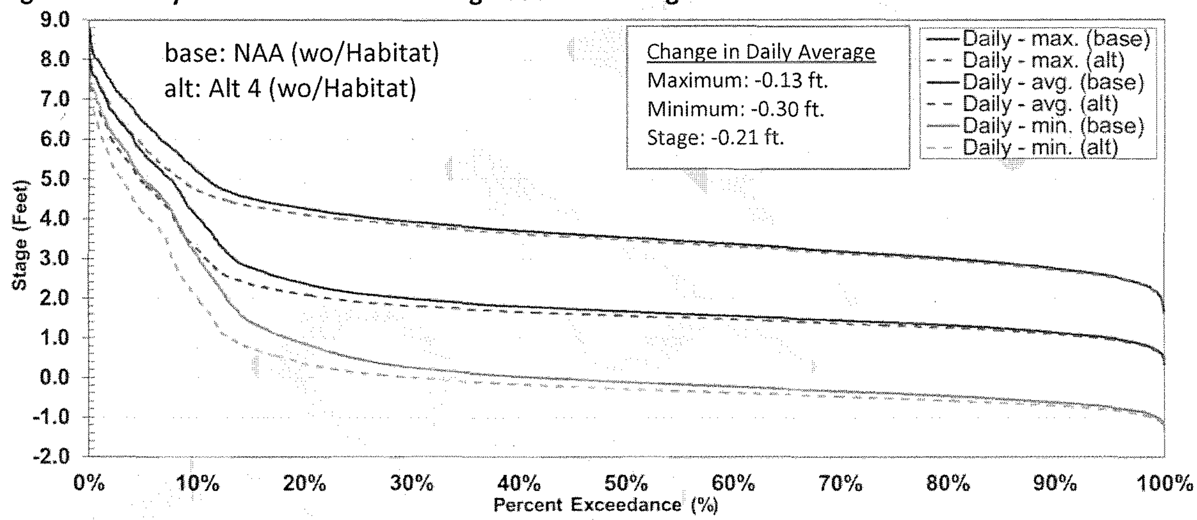

Figure 84. Daily Stage in Steamboat Slough at Sutter Slough

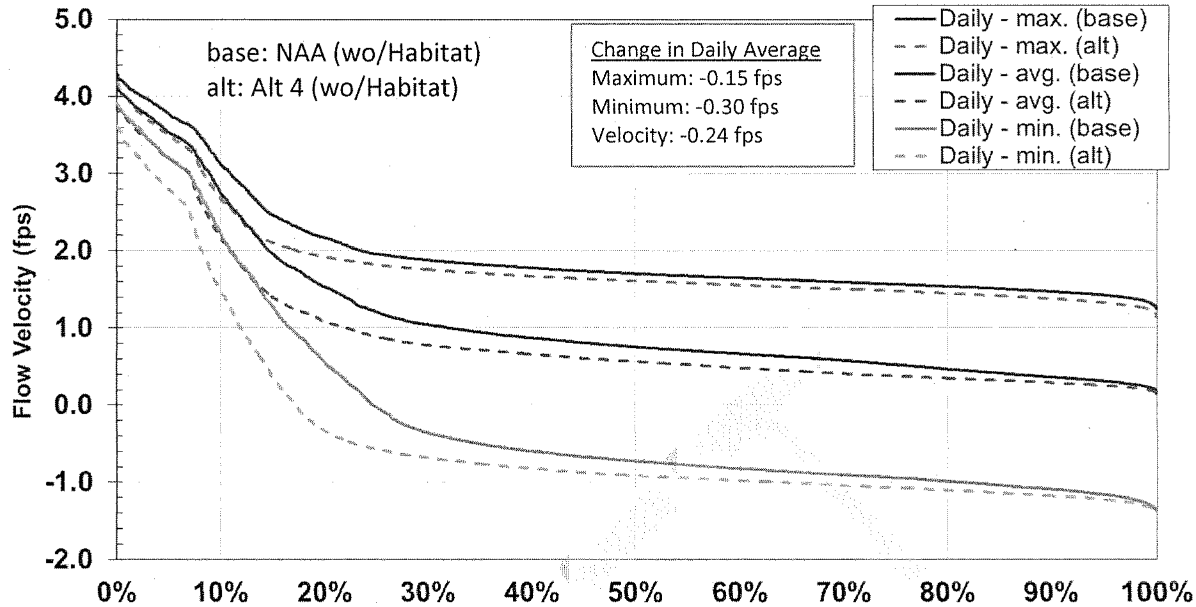

Figure 85. Daily Velocities in Steamboat Slough at Sutter Slough

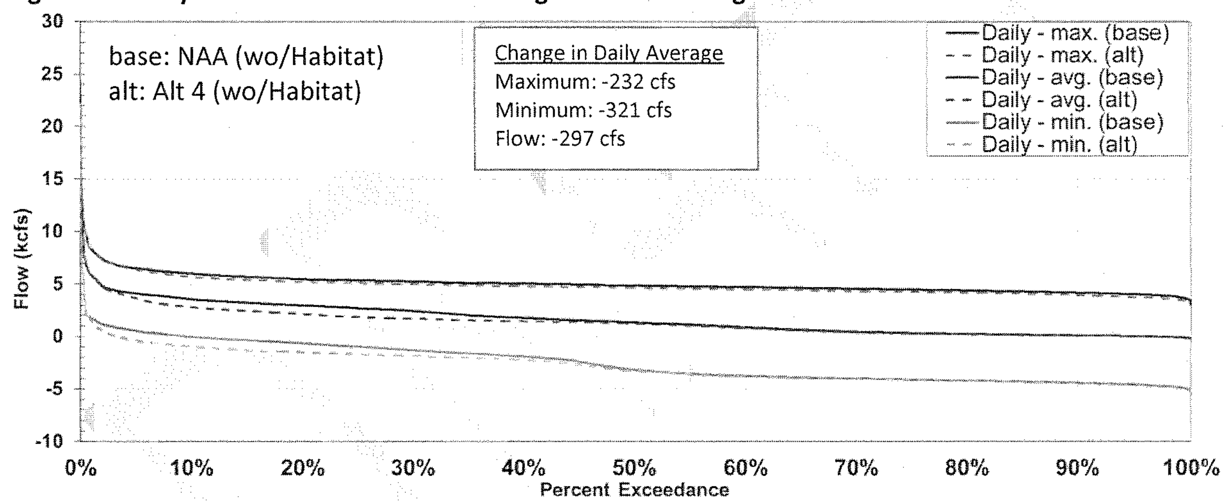

Figure 86. Daily Flow in North Fork Mokelumne River

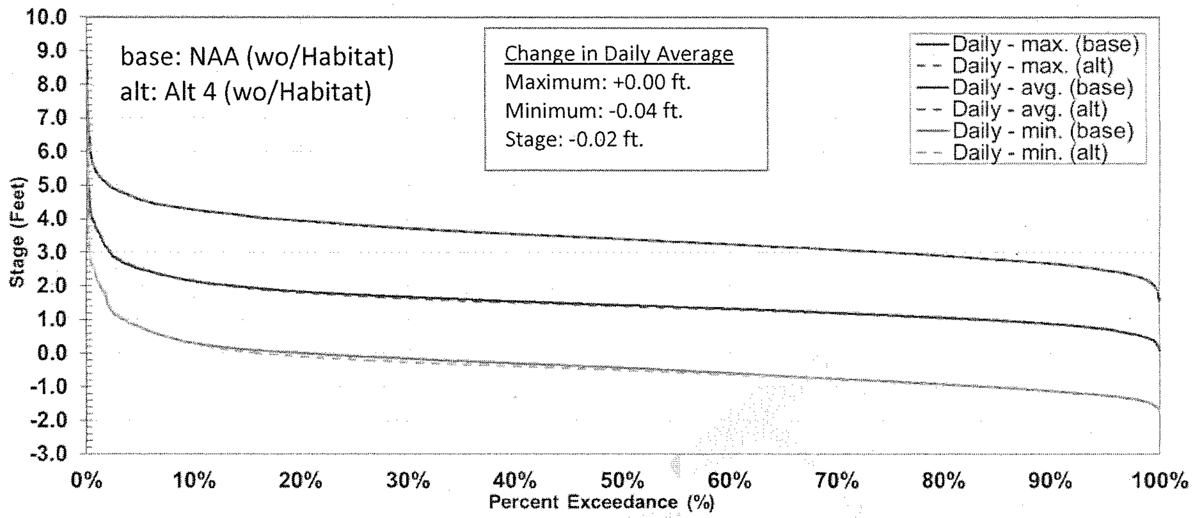

Figure 87. Daily Stage in North Fork Mokelumne River

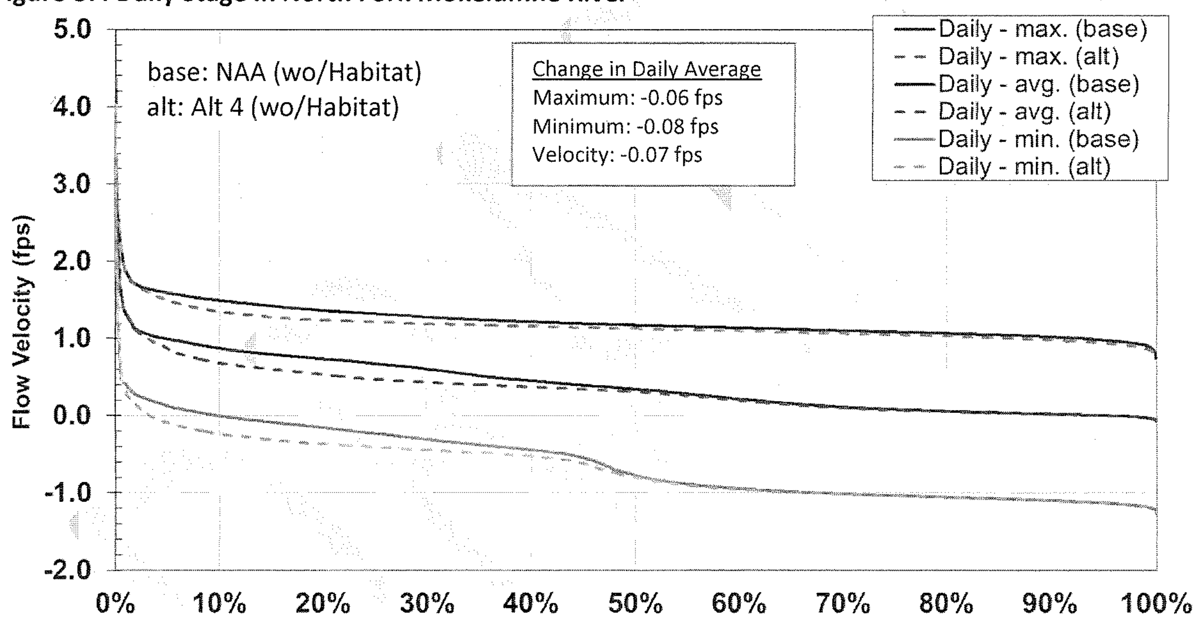

Figure 88. Daily Velocities in North Fork Mokelumne River

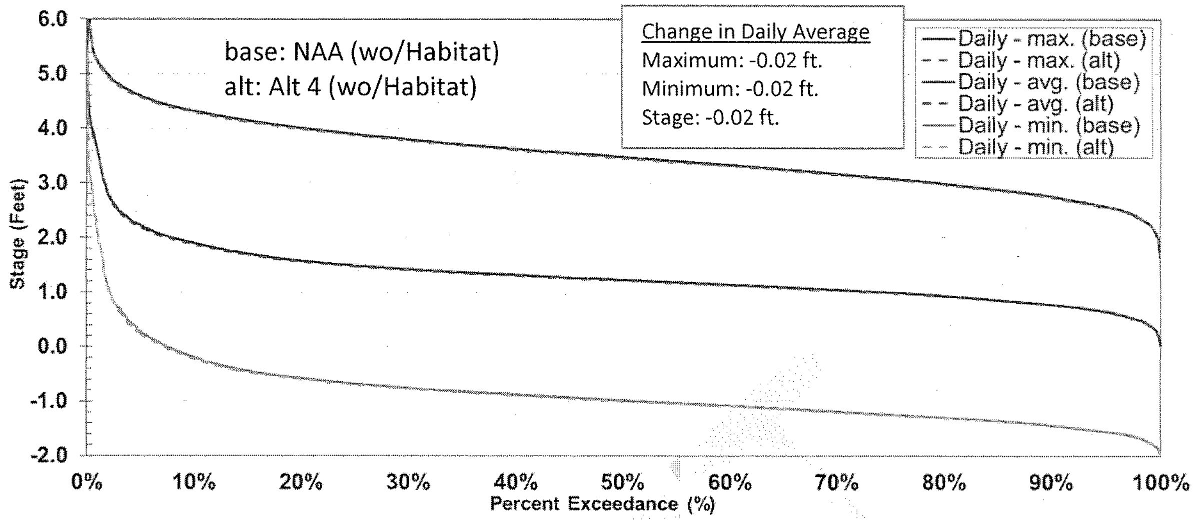

Figure 89. Daily Stage in Cache Slough at Ryer Island

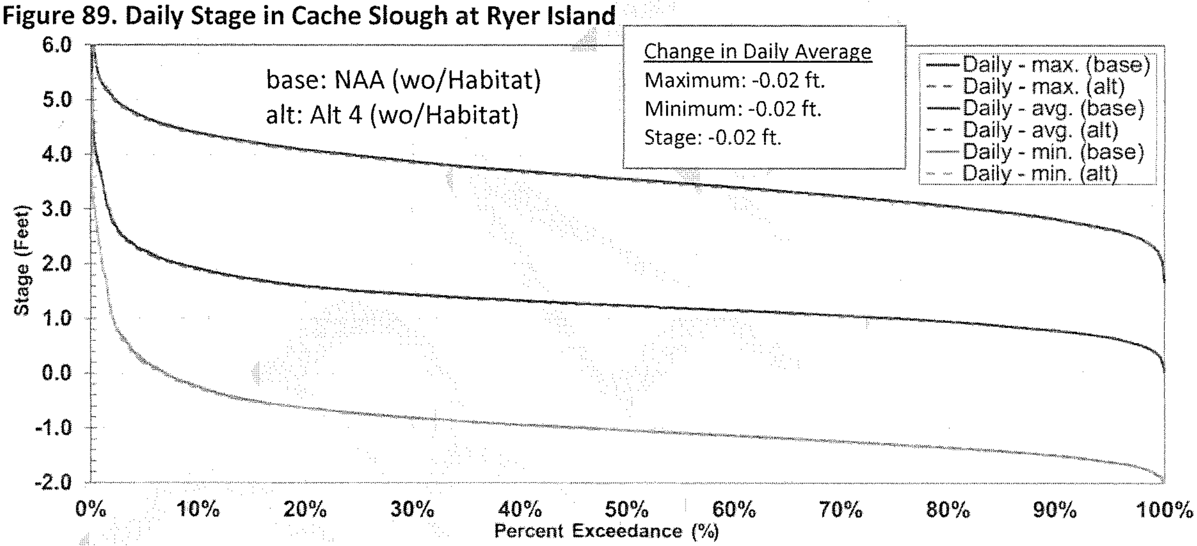

Figure 90. Daily Stage in Barker Slough at NBA Intakes

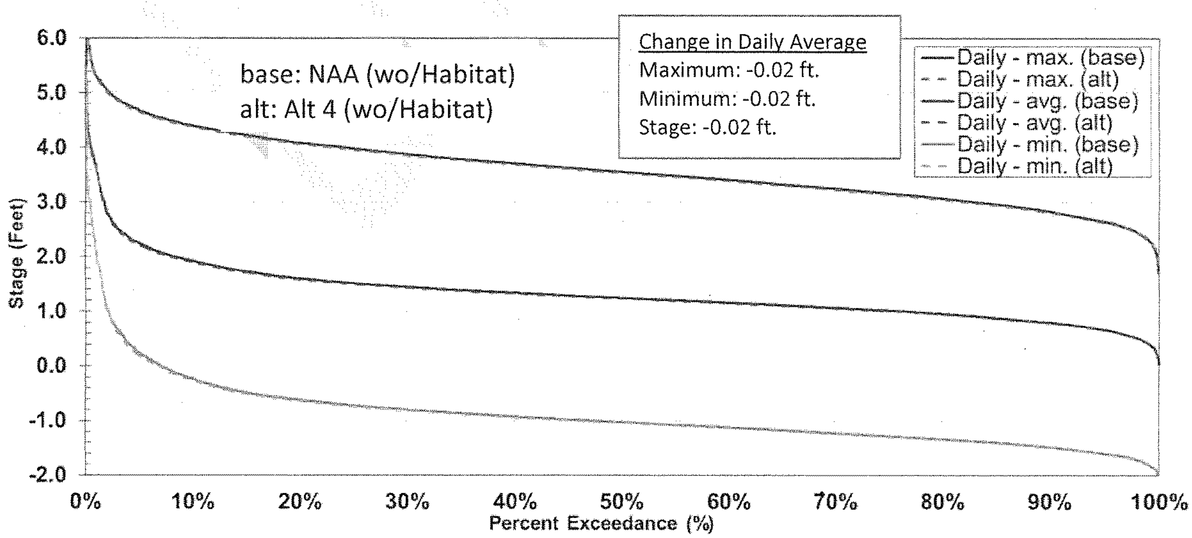

Figure 91. Daily Stage in Shag Slough at RD 2068 Intakes

MBK ENGINEERS

Water Resources • Flood Control • Water Rights

TECHNICAL MEMORANDUM

DATE: October 28, 2015

TO: David Aladjem

FROM: Walter Bourez, Lee Bergfeld, and Dan Easton

SUBJECT: Technical Comments on the Bay Delta Conservation Plan/California Water Fix Partially Recirculated Draft EIR/Supplemental Draft EIS

1. Overview

This technical memorandum is a summary of MBK Engineers' (MBK) findings and opinions concerning the Bay Delta Conservation Plan (BDCP)/California Water Fix Partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS). These findings and opinions include comments specific to the RDEIR/SDEIS document and analysis, and also concern numerous comments previously submitted regarding the BDCP Draft Environmental Impact Report/Draft Environmental Impact Statement (BDCP Draft EIR/EIS). The key findings of MBK's review of the RDEIR/SDEIS are: (a) the description of the proposed project is insufficient for analysis; (b) the project description is inconsistent with the RDEIR/SDEIS's analysis; and (c) issues regarding the analysis that MBK previously identified remain unaddressed. Assumptions, errors, and outdated tools used in the analysis for the BDCP Draft EIR/EIS remain in the RDEIR/SDEIS and result in impractical or unrealistic CVP and SWP operations. The use of the analyses from the BDCP Draft EIR/EIS therefore provides limited useful information about the effects of the proposed California Water Fix project.

2. Project Description Is Insufficient for Analysis

The California Water Fix RDEIR/SDEIS project description in Section 4.1 is insufficient to perform the necessary technical analyses to identify the proposed project's potential environmental effects. There are several specific aspects of the proposed project that require additional description before modeling and technical analyses can be performed to identify potential environmental effects. The following sections describe the key aspects of the project description that require more definition.

2.1 North Delta Diversion Operations Plan/Point of Diversion Prioritization

The RDEIR/SDEIS does not include an operations plan for use of the North Delta Diversion (NDD). An operations plan is necessary to understand and describe the conditions under which the NDD would be used in the context of State Water Project (SWP) and Central Valley Project (CVP) operations, and how SWP and CVP diversions would be prioritized between the existing points of diversion in the South Delta and the NDD. Without describing how the CVP and SWP would be operated with a NDD, it is not possible to analyze the changes in CVP and SWP operations that may occur with the NDD; therefore it is not possible to determine the environmental effects that would be caused by changes in CVP and SWP operations.

The RDEIR/SDEIS describes the operation of the NDD as follows: "The proposed project operations include a preference for south Delta pumping in July through September to provide limited flushing for improving general water quality conditions and reduced residence times" (p. 4.1-6). These appear to be the only guidelines provided in the RDEIR/SDEIS that describe how the CVP and SWP operators would decide to either export water through-Delta at the existing South Delta diversions or at the NDD facility. This statement is insufficient to analyze NDD facility operations in conjunction with existing South Delta facilities. The following example illustrates this point.

Inflows from upstream reservoir releases and Delta exports are frequently governed by water quality standards in State Water Resources Control Board (SWRCB) Decision 1641 (D-1641) from July through September. Compliance with water quality standards is achieved through the combination of Delta inflows and exports. When water quality standards govern Delta operations, increases in Delta inflows generally allow for increases in Delta exports from the South Delta facilities at less than a one-for-one ratio because Delta outflows must increase to maintain water quality as South Delta exports increase. This additional outflow is commonly referred to as the "carriage water cost" for any additional exports from the South Delta. However, if water quality standards are being met with specific Delta inflow and South Delta export amounts, and if either the CVP or SWP wants to increase Delta exports, there would be no carriage water cost if the water were exported at the NDD. Therefore, 100 percent of any additional Delta inflow could be exported from the NDD, creating a water supply benefit to using the NDD during this period. However, operating the NDD to create this water supply benefit would not be consistent with the RDEIR/SDEIS's stated operational guideline, which is to "improve general water quality conditions and reduce residence times." The RDEIR/SDEIS does not provide an adequate description of how the NDD facilities would be operated under this, or any other, condition. Nor does the RDEIR/SDEIS offer any description of how diversions would be prioritized between the NDD and South Delta facilities outside the July through September period. An operations plan for the NDD must be defined before technical analyses of environmental effects can be performed.

2.2 Definition and Source of Additional Spring Outflow

The RDEIR/SDEIS identifies Alternative 4A (ALT 4A) as the preferred alternative (p. 2-20). A component of ALT 4A is a requirement for additional Delta outflow in the spring (P. 4.1-9). However, the project description does not adequately describe the expected quantity, timing, or source of the additional spring outflow. It is not possible to analyze the potential environmental effects associated with providing additional spring outflow without more definition as to the source, quantity, and timing of the flow.

According to the spring outflow section in RDEIR/SDEIS Table 4.1-2,

> initial operations will provide a March–May average Delta outflow bounded by the requirements of Scenario H3, which are consistent with D-1641 standards, and Scenario H4, which would be scaled to Table 3-24 in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS . . . (p. 4.1-9)

This description implies that, when meeting the existing outflow requirements in D-1641, the additional spring outflow would be bounded between zero and 9,200 to 44,500 cubic feet per second (cfs), as defined in Table 3-24 of the BDCP Draft EIR/EIS. While the existing outflow requirements in D-1641 are well-defined and understood in terms of source, quantity, and timing, the upper bound on this additional required spring outflow is not.

Regarding the source of the additional spring outflow, the RDEIR/SDEIS states:

> the proposed project includes spring outflow criteria, which are intended to be provided through acquisition of water from willing sellers. If sufficient water cannot be acquired for this purpose, the spring outflow criteria will be accomplished through operations of the SWP and CVP to the extent an obligation is imposed on either the SWP or CVP under federal or applicable state law. (p. 4.1-6)

The ALT 4A project description does not adequately describe the source of additional spring outflow, a necessary component for analyzing the environmental effects and, particularly, for determining what effects implementing California Water Fix would have on non-participating CVP and SWP contractors and other Sacramento Valley water users. Additional detail is required to identify willing sellers, to describe where sellers would be located, how sellers would provide the additional water, when sellers would be able to provide water, and to provide other similar information. This information must be provided before the potential environmental effects of providing additional spring outflow can be determined. These details must be provided because the environmental effects of making water available through land retirement, groundwater pumping, temporary crop idling, non-CVP/SWP reservoir releases, or water transfers are significantly different, may have different environmental effects and, possibly require different forms of mitigation. Where these environmental effects occur should also be described to ensure that the effects on local ecosystems and economies are disclosed.

Additionally, agricultural water users are typically not irrigating during the entire March through May period. Therefore, there may not be sufficient water available from willing sellers to directly meet increased spring Delta outflow requirements through reductions in agricultural diversions. This may require additional releases of stored water from CVP and SWP reservoirs. This potential is partially acknowledged in the statement that Delta outflow would be provided from a combination of SWP and CVP operations if or when outflow is not available from willing sellers. However, this statement lacks the detail necessary to describe potential environmental effects within the CVP/SWP system. The proposed project should describe under what conditions additional spring outflow would be provided from the CVP, the SWP, or a combination of both projects. These details must be provided before potential environmental effects can be determined, because providing additional water from Shasta Reservoir would have different environmental effects than providing it from Trinity, Oroville or Folsom Reservoir, or through reductions in exports. Providing additional Delta outflow from either the CVP or SWP through any combination of additional reservoir releases or changes in Delta exports would affect the operations of both projects through the Coordinated Operations Agreement (COA). These factors must be considered, defined, and then analyzed before the potential environmental effects can be determined.

How California Water Fix would implement the increased spring outflow component of the preferred alternative must be better described to allow for analyses of environmental effects. The RDEIR/SDEIS's reliance on the effects being bounded by analyses of the BDCP ALT 4 H3 and H4 simulations leaves too much uncertainty concerning the breadth of operational and environmental effects and, likely omits numerous potential environmental impacts.

2.3 Definition and Description of Adaptive Management Process

The RDEIR/SDEIS describes an Adaptive Management Process that may be used to adjust certain operational criteria, including spring Delta outflow requirements, NDD bypass flows, South Delta export operations including Old and Middle River (OMR) flow requirements, and Head of Old River Barrier (HORB) operations. The potential for adjustment in the operational criteria is contained in Table 4.1-2: "Adjustments to the criteria above [NDD bypass, South Delta exports, OMR, and HORB] and these outflow targets [spring Delta outflow] may be made using the Adaptive Management Process . . . " (p. 4.1-9).

These potential adjustments and the environmental effects are not analyzed in the RDEIR/SDEIS. The RDEIR/SDEIS suggests that the range of the spring Delta outflow requirements would be bounded by two different scenarios, H3 and H4, which are evaluated in Table 4.1-1 of the BDCP Draft EIR/EIS (p. 4.1-5). However, no attempt to quantify the range of effects associated with any of the other criteria is provided in the RDEIR/SDEIS.

Evaluating a range of additional spring outflows without identifying their source, quantity, and timing does not adequately disclose the potential environmental effects associated with the Adaptive Management Process. Providing no description of the likely range of changes in the other criteria that may occur under the Adaptive Management Process is another area where the project description lacks sufficient detail for analysis of potential environmental effects.

3. PROJECT DESCRIPTION IS INCONSISTENT WITH ANALYSIS

As described above, the project description does not contain the specificity necessary to identify, analyze, and disclose the environmental effects of implementing the preferred alternative. Furthermore, the RDEIR/SDEIS's analyses performed to assess the environmental effects are inconsistent with the description of the project alternatives in the RDEIR/SDEIS. This inconsistency between the project description for the proposed, and ultimately the preferred, alternative and the analysis chosen for that alternative occurs because of reliance on model results and technical analyses conducted for the BDCP Draft EIR/EIS alternatives, notably BDCP Alternative 4 (BDCP ALT 4) Scenarios H3 and H4. The RDEIR/SDEIS states that "the Lead Agencies have determined that they may reasonably rely on the modeling conducted for Alternative 4 to accurately predict the environmental effects of Alternative 4A" (p. 4.1-43, line 17-19).

BDCP Draft EIR/EIS alternatives, however, are fundamentally different in several key areas from the alternatives described in the RDEIR/SDEIS. These key areas are described in the following sections. To support their conclusion that model results for a project analyzed in the BDCP Draft EIR/EIS may be relied upon to "accurately predict" environmental effects for a different proposed project in the RDEIR/SDEIS, the Lead Agencies conducted a sensitivity analysis for the RDEIR/SDEIS. The sensitivity analysis and conclusions are described at the end of this section.

3.1 Tidal Wetland Restoration

The BDCP Draft EIR/EIS's ALT 4 assumed that 25,000 acres of tidal wetland restoration would be in place as part of the project in the Early Long Term (ELT), at approximately 2025, and that 65,000 acres of tidal wetland restoration would be in place in the Late Long Term (LLT), at approximately 2060. There was no tidal wetland restoration in the No Action Alternative (NAA). In the BDCP Draft EIR/EIS, it was assumed the restored tidal wetlands would influence Delta tidal fluctuations, salinity, and operations. Generally, when the Delta contained more fresh water and lower salinity, it was expected that less Delta outflow would be necessary to keep it fresh with the wetlands in place because the wetlands served as a bulwark against tidal intrusion. On the other hand, when the Delta contained more salt water, the opposite would be true. More Delta outflow would be necessary to flush salts out because of the retention capacity of the wetlands. In either case, the effect was expected to be significant enough that tidal wetland restoration needed to be represented in the CalSim II simulations of the BDCP project alternatives. Operationally, additional wetlands could result in a different balance of Sacramento River inflows and exports to meet D-1641 standards, which could result in changes in CVP and SWP reservoir releases, allocations, and deliveries.

Depending on the location of the restored tidal wetlands, they could also buffer and reduce the tidal energy that carries salt water into the Delta. This is important when considering that operation of the NDD may reduce the volume of fresh water in the lower Sacramento River used to repel tidal energy and salt water intrusion. In this way, restoring tidal wetlands as part of BDCP ALT 4 reduced the additional salinity intrusion that would otherwise result from an NDD.

The ALT 4A project description in the RDEIR/SDEIS includes 59 acres of tidal wetland restoration (p. 4.1-5), or 0.2 percent of the area included at the ELT in the BDCP Draft EIR/EIS. This area would likely be too small to have a significant effect on Delta water quality, tidal energy, or CVP/SWP operations. However, CalSim II modeling performed for the BDCP Draft EIR/EIS was assumed to represent the operation of the ALT 4A for the RDEIR/SDEIS and was compared to an NAA that did not include any tidal wetland restoration. It is inappropriate to assume that ALT 4A in the RDEIR/SDEIS would have the same effects on Delta water quality, tidal energy, and CVP/SWP operations as the BDCP alternative that would have included nearly 25,000 acres more tidal wetland restoration. The RDEIR/SDEIS's modeling for ALT 4A does not reflect the reality of ALT 4A's significantly reduced amount of restored wetlands.

3.2 Relaxation of the Sacramento River Agricultural Water Quality Compliance Point

BDCP ALT 4 would have relaxed the Sacramento River agricultural water quality compliance point contained in D-1641 from Emmaton to Threemile Slough, a location approximately 3 miles upstream of Emmaton. The project description of ALT 4A in the RDEIR/SDEIS removes the relaxation of this water quality compliance point and leaves compliance at Emmaton, as specified in D-1641 (p. 4.3.4-23). Changing the water quality compliance location to Threemile Slough would require less fresh water flow from the Sacramento River to comply with the water quality standard because Threemile Slough is located further from Suisun Bay and the Pacific Ocean. The change in location for the water quality standard would likely affect the balance between exports and Sacramento River inflow necessary for compliance. Additionally, because meeting a water quality standard at Threemile Slough can be done with less Sacramento River flow, it could allow higher diversions at the NDD facility, or lower releases from upstream reservoirs. Therefore, it is inconsistent and inappropriate for the RDEIR/SDEIS to state that the operational effects in the modeling results for BDCP ALT 4 which includes moving the water quality compliance point, are the same as ALT 4A in the RDEIR/SDEIS, which does not include moving the compliance point.

3.3 Fremont Weir Gates

BDCP ALT 4 included habitat restoration in the Yolo Bypass. One component of the restoration was installation of operable gates on Fremont Weir at the northern end of the Yolo Bypass to allow for more frequent flooding of the bypass. The operable gates would be opened when Sacramento River flows at Freeport exceed 25,000 cfs, and would divert as much as 6,000 cfs of Sacramento River flow into the

Yolo Bypass, depending on the stage of the river. Therefore, opening the Fremont Weir gates would result in up to 6,000 cfs less flow at Freeport.

The ALT 4A project description in the RDEIR/SDEIS removes the Fremont Weir gates from the alternative because they are now considered to be included in the NAA (p. 4.1-23). However, the CalSim II modeling performed for the BDCP Draft EIR/EIS, which included the Fremont Weir gates, is assumed to represent the operation of ALT 4A for the RDEIR/SDEIS and is compared to an NAA that did not include the Fremont Weir gates. It is inconsistent and inappropriate for the RDEIR/SDEIS to attempt to determine the operational impacts of ALT 4A by comparing BDCP ALT 4, which includes the operable gates, to an NAA that does not include the gates. However, unlike the first two inconsistencies described above, this change will likely have lesser impacts on key operational parameters such as reservoir storage, exports and Delta outflow, since the gates would be opened during high-flow events when the system would likely be in a surplus condition.

3.4 RDEIR/SDEIS Sensitivity Analysis

The RDEIR/SDEIS attempts to address the inconsistencies identified above with a sensitivity analysis as described in the RDEIR/SDEIS's Appendix B. In this sensitivity analysis, BDCP ALT 4 is modified to remove the tidal wetland restoration, water quality compliance point relaxation, and Fremont Weir operable gates. No additional modifications were made to the BDCP ALT 4 CalSim II model, including any updates to the model since the analysis was done for the BDCP Draft EIR/EIS (p. B-3).

Appendix B is comprised of three pages of text and 613 pages of figures and tables of results from CalSim II. The conclusions from the sensitivity analysis are summarized in a single paragraph on page B-3.

> As shown in the figures Alt4A (H3) and Alt4A (H4) CALSIM II results are generally similar to A4_H3 and A4_H4, respectively. The results indicate that the incremental changes for Alt4A (H3) and Alt4A (H4) when compared to the No Action Alternative are trending similar to A4_H3 and A4_H4, at both ELT and LLT.

It is not reasonable or defensible to rely upon the results of modeling performed for the BDCP Draft EIS/EIR, which considered a project with different physical and operational effects, to accurately predict the environmental effects of a different project compared to a different no project/no action alternative as defined in the RDEIR/SDEIS because CalSim II model results are "generally similar" and "trending similar." Environmental effects should be determined through a project-specific analysis of the potential effects on species and resources. These non-specific conclusions do not provide sufficient information for the public to understand the basis for the RDEIR/SDEIS's conclusions about the significance of project effects. Project-related changes in flows and hydrodynamics can have a significant effect to aquatic species, water quality and beneficial uses of water, and it should not be assumed that environmental effects are the same because model results are "generally" or "trending" similar.

Lastly, the RDEIR/SDEIS includes an acknowledgement that the project description is inconsistent with the analysis.

> Nevertheless, there is notable uncertainty in the results of all quantitative assessments that refer to modeling results, due to the differing assumptions used in the modeling and the description of Alternative 4A and the No Action Alternative (ELT). (pp. 4.3.4-1 to 4.3.4-2)

In our opinion, this statement may suggest that preparers of the RDEIR/SDEIS recognized the weakness in the assumption that model results of a fundamentally different project could be compared to a different NAA than described in the RDEIR/SDEIS to "accurately predict" the environmental effects of the proposed project.

4. Previous Comments Remain Applicable

Analysis and conclusions in the RDEIR/SDEIS rely on the model runs developed for the BDCP Draft EIR/EIS, so many of the comments submitted based on our review of the BDCP Draft EIR/EIS apply to the RDEIR/SDEIS. These comments are described in the July 11, 2014 report by MBK Engineers and Daniel B. Steiner, Consulting Engineer, *Review of Bay Delta Conservation Program Modeling* (MBK Report). As described in Appendix B of the RDEIR/SDEIS, no updates were made to the CalSim II modeling to address these previous comments or any other issues previously identified.

The following is a summary of key findings in the MBK Report, which is attached to this technical memorandum.

4.1 Incorporation of Climate Change Ignores Reasonably Foreseeable Adaptation Measures

The following conclusion in the MBK Report's Executive Summary is applicable to the RDEIR/SDEIS:

> The BDCP Model uses assumed future climate conditions that obscure the effects of implementing the BDCP. The future conditions assumed in the BDCP model include changes in precipitation, temperature, and sea level rise. The result of this evaluation is that the modeled changes in water project operations and subsequent environmental impacts are caused by three different factors: (1) sea level rise; (2) climate change; and (3) implementation of the alternative that is being studied.
>
> Including climate change, without adaptation measures, results in insufficient water needed to meet all regulatory objectives and user demands. For example, the BDCP Model results that include climate change indicate that during droughts, water in reservoirs is reduced to the minimum capacity possible. Reservoirs have not been operated like this in the past during extreme droughts and the current drought also provides evidence that adaptation measures are called for long in advance to avoid draining the reservoirs. In this aspect, the BDCP Model simply does not reflect a real future condition. Foreseeable adaptations that the CVP and SWP could make in response to climate change include: (1) updating operational rules regarding water releases from reservoirs for flood protection; (2) during severe droughts, emergency drought declarations could call for mandatory conservation and changes in some regulatory criteria similar to what has been experienced in the current and previous droughts; and (3) if droughts become more frequent, the CVP and SWP would likely revisit the rules by which they allocate water during shortages and operate more conservatively in wetter years. The modifications to CVP and SWP operations made during the winter and spring of 2014 in response to the drought supports the likelihood of future adaptations. The BDCP Model is, however, useful in that it reveals that difficult decisions must be made in response to climate change. But, in the absence of making those decisions, the BDCP Model results themselves are not informative, particularly during drought conditions. With future conditions projected to be so dire without the BDCP, the effects of the BDCP appear positive simply because it appears that conditions cannot get any worse (i.e., storage cannot be reduced below its minimum level). However, in reality, the future

> condition will not be as depicted in the BDCP Model. The Reviewers recommend that Reclamation and DWR develop more realistic operating rules for the hydrologic conditions expected over the next half-century and incorporate those operating rules into any CalSim II Model that includes climate change. (p. 4)

The CVP's and SWP's operations during the current drought confirm this comment. Operations have been modified to meet human and environmental needs to the extent possible, and preserve some water in reservoir storage to continue to do so if drought condition persist. Modeling assumptions for the RDEIR/SDEIS and simulated operations with climate change are not consistent with recent operations.

4.2 The BDCP Model Was Built on a Benchmark Study with Numerous Inaccuracies

The following conclusion in the MBK Report is applicable to the RDEIR/SDEIS:

> CalSim II is continuously being improved and refined. As the regulatory environment changes and operational and modeling staff work together to improve the model's capability to simulate actual operations, the model is continually updated. The BDCP Model relied upon a version of CalSim II that dates back to 2009, immediately after the new biological opinions (BiOps) from the NMFS and the United States Fish and Wildlife Service (USFWS) significantly altered the operational criteria of the CVP and SWP. In the last 4 to 5 years, DWR, Reclamation, and outside modeling experts have worked together to improve the model. Changes include better (more realistic) implementation of the new BiOps and numerous fixes to the code. Since CalSim II is undergoing continual improvements, there will always be "vintage" issues in that by the time a project report is released, the model is likely slightly out of date. However, in this case – with the major operational changes that have occurred in the new regulatory environment – many issues have been identified and fixed in the last 4 to 5 years that have a significant effect on model results. CalSim II modeling for the DWR 2013 Delivery Reliability Report contains numerous modeling updates and fixes that significantly alter results of the BDCP Model. A key modeling revision in the 2013 DWR modeling was fixing an error regarding artificial minimum instream flow requirements in the Sacramento River at Hood. An "artificial" minimum instream flow requirement had been specified; the requirement is artificial in that it does not represent a regulatory requirement, but rather is a modeling technique to force upstream releases to satisfy Delta needs. (p. 14)

4.3 BDCP Model Coding and Data Issues Significantly Skew the Analysis and Conflict with Actual Real-Time Operational Objectives and Constraints

The following conclusion in the MBK Report is applicable to the RDEIR/SDEIS:

> Operating rules used in the BDCP Model, specifically regarding Alternative 4, result in impractical or unrealistic CVP and SWP operations. Reservoir balancing rules cause significant drawdown of upstream reservoirs during spring and summer months while targeting dead pool level in San Luis from September through December resulting in artificially low Delta exports and water shortages. CVP allocation rules are set to artificially reduce south of Delta allocations during wetter years resulting in underestimates of diversions at the NDD and the SDD. Operating rules for the Delta Cross Channel Gate do not reflect how the gates may be operated in "With Project" conditions.

> Operational logic is coded into the CalSim II model to simulate how DWR and Reclamation would operate the system under circumstances for which there are no regulatory or other definitive rules. This attempt to specify (i.e., code) the logic sequence and relative weighting so that a computer can simulate "expert judgment" of the human operators is a critical element to the CalSim II model. In the BDCP version of the CalSim II model, some of the operational criteria for water supply allocations and existing facilities such as the Delta Cross Channel and San Luis Reservoir are inconsistent with real-world conditions. (p. 18)

Because the RDEIR/SDEIS evaluates Alternative 4A, which is based on Alternative 4, these conclusions now apply to the RDEIR/SDEIS.

4.4 BDCP's "High Outflow Scenario" is Not Sufficiently Defined for Analysis

MBK and Steiner previously commented on the lack of definition for the additional spring outflow requirement contained in the BDCP Draft EIR/EIS. The following conclusion in the MBK Report Executive Summary is applicable to the RDEIR/SDEIS, which now includes additional spring outflow as an element of Alternative 4A:

> The effects of many critical elements of the BDCP cannot be analyzed because those elements are not well-defined. The Reviewers recommend that the BDCP be better defined and a clear and concise operating plan be developed so that the updated CalSim II model can be used to assess effects of the BDCP.
>
> The High Outflow Scenario (HOS) requires additional water (Delta outflow) during certain periods in the spring. The BDCP Model places most of the responsibility for meeting this new additional outflow requirement on the SWP. However, the SWP may not actually be responsible for meeting this new additional outflow requirement. This is because the Coordinated Operations Agreement ("the COA") would require a water allocation adjustment that would keep the SWP whole. Where one project (CVP or SWP) releases water to meet a regulatory requirement, the COA requires a water balancing to ensure the burden does not fall on only one of the projects. The BDCP Model is misleading because it fails to adjust project operations, as required by the COA, to "pay back" the water "debt" to the SWP due to these additional Delta outflow requirements. Unless there is a significant revision to COA, the BDCP Model overstates the impacts of increased Delta outflow on the SWP and understates the effects on the CVP.
>
> Furthermore, after consulting with DWR and Reclamation project operators and managers, the Reviewers conclude that there is no apparent source of CVP or SWP water to satisfy both the increased Delta outflow requirements and pay back the COA "debt" to the SWP without substantially depleting upstream water storage. It appears, through recent public discussions regarding the HOS, that BDCP anticipates additional water to satisfy the increased Delta outflow requirement and to prevent the depletion of cold water pools will be acquired through water transfers from upstream water users. However, this approach is unrealistic. During most of the spring, when BDCP proposes that Delta outflow be increased, agricultural water users are not irrigating. This means that there is not sufficient transfer water available to meet the increased Delta outflow requirements and therefore, additional release of stored water from the reservoirs would be required. Releasing stored water to meet the increased Delta outflow requirements could potentially impact salmonids on the Sacramento and American River systems due to reductions in the available cold water pool. (p. 5)

4.5 Delta Cross Channel Operational Assumptions Overestimate October Outflow

The following conclusion in the MBK Report is applicable to the RDEIR/SDEIS:

> When south Delta exports are low due to regulatory limits, and upstream reservoirs are making releases to meet the instream flow objectives at Rio Vista, operators have the ability to close the Delta Cross Channel (DCC) in order to reduce the required reservoir releases (by closing the DCC a greater portion of water released from the reservoirs stays in the Sacramento River to meet the Rio Vista requirements). As long as the Delta salinity standards are met, operators have indicated that they would indeed close the DCC in this manner (as was done in October and November 2013). In the BDCP Model, the DCC is not closed in this manner. The net result is that the BDCP Model overestimates outflow under such circumstances typically occurring in October.
>
> The overestimated outflow leads to incorrect conclusions regarding the effects of BDCP. For instance, an actual increase in fall outflow could be beneficial for the endangered fish species delta smelt (USFWS, 2008). Therefore, by overestimating outflow in October, the BDCP studies likely overestimate the benefit to delta smelt (Mount et al., 2013). Similarly, an actual increase in fall outflow would reduce salinity in the western Delta, which could be beneficial for in-Delta diverters; therefore, overestimating outflow in October artificially reduces salinity, incorrectly reducing the net impacts on in-Delta diverters. (p. 17)

4.6 San Luis Reservoir Operational Assumptions Produce Results Inconsistent with Real-World Operations

The following conclusion in the MBK Report is applicable to the RDEIR/SDEIS:

> San Luis Reservoir (SLR) is an off-stream reservoir located south of the Delta and jointly owned and operated by CVP and SWP. The reservoir is used to store water that is exported from the Delta when available and used to deliver water to CVP and SWP Contractors when water demands exceed the amount of water that can be pumped from the Delta. The decision of when to move water that is stored in upstream reservoirs, such as Shasta, Folsom, or Oroville, through the Delta for export to fill SLR is based on the experience and expert judgment of the CVP and SWP operators.
>
> CalSim II attempts to simulate the expert judgment of the operators by imposing artificial operating criteria; the criteria are artificial in the sense that they are not imposed by regulatory or operational constraints but rather imposed as a tool to simulate expert judgment. One such artificial operating criteria is the SLR target storage level: CalSim II attempts to balance upstream Sacramento Basin CVP and SWP reservoirs with storage in SLR by setting artificial target storage levels in SLR, such that the CVP and SWP will release water from upstream reservoirs to meet target levels in SLR. The artificial target storage will be met as long as there is ability to convey water (under all regulatory and physical capacity limits) and as long as water is available in upstream reservoirs. SLR target storage criteria are also sometimes described in section 4.2 as the "San Luis rule-curve."
>
> In the BDCP Model, CVP and SWP reservoir operating criteria for Alternative 4 H3 ELT differ from the corresponding without project scenario (e.g. NAA-ELT). The difference in criteria and result is primarily driven by changes to the artificial constraint used to determine when to fill SLR: the

SLR target storage. In Alternative 4 H3 ELT, SLR target storage is set very high in the spring and early summer months, and then reduced in August and set to SLR dead pool from September through December. This change in SLR target storage relative to the no action alternative causes upstream reservoirs to be drawn down from June through August and then recuperate storage by cutting releases in September. This change to the artificial operating criteria SLR target storage causes changes in upstream cold water pool management and affects several resource areas.

In addition to changes in upstream storage conditions, changes in SLR target storage cause SLR storage to drop below a water supply concern level (300,000 acre-feet) in almost 6 out of every 10 years under ELT conditions and more than 7 out of every 10 years under LLT conditions for Alternative 4 H3. When storage in SLR drops below this 300,000 acre-foot level, algal blooms in the reservoir often cause water quality concerns for drinking water at Santa Clara Valley Water District. The change in SLR target storage also causes SLR levels to continue to drop and reach dead pool level for the SWP in 4 out of every 10 years and also dead pool level for the CVP in 1 out of every 10 years under the ELT conditions.

Reaching dead pool level in SLR creates shortages to water users south of the Delta. Although some delivery shortages are due to California Aqueduct capacity constraints, the largest annual delivery shortages are a result of inappropriately low SLR target storage. Average annual Table A shortages due to artificially low SLR storage levels increased from 3 TAF in the NAA-ELT scenario to 35 TAF in the Alt4-ELT scenario. Such shortages occurred in 2% of simulated years in the NAA-ELT scenario and 23% of years in the Alt4-ELT scenario. In addition to the inability to satisfy Table A allocations, low storage levels cause loss of SWP Contractors' Article 56 water stored in SLR. Average annual Article 56 shortages were 43 TAF in the Alt4-ELT scenario because of low San Luis storage and 5 TAF in the NAA-ELT scenario. Low San Luis storage causes Article 56 shortages in 27% of simulated years in the Alt4-ELT scenario as compared to 5% of simulated years in the NAA-ELT. Another consequence of low storage levels in SLR is a shift in water supply benefits from Article 21 to Table A.

In summary, the operational assumptions for SLR are unrealistic in Alternative 4 because they create problems in upstream storage reservoirs and create shortages for south of Delta water users that would not occur in the real world. In reaching this conclusion, the Reviewers met with operators from CVP and SWP to review the BDCP Model results and discussed real-time operations. (p. 16)

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Subject: CCVFCA comment letter - BDCP/CA WaterFix RDEIR/SDEIS
Attachments: MBK BDCP_ModelingReviewAppendix14-5-15.pdf; CCVFCA comments, CA WaterFix, 10-30-2015.pdf; MBK Tech Memo, BDCP_Modeling 07-25-2014_DRAFT (2).pdf; MBK, Tech Memo-FINAL, CA Water Fix, Oct 2015.pdf

Attached is the CCVFCA comment letter and associated Exhibits on BDCP/WaterFix project alternatives and EIR/EIS.

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