

testing to be completed for different pumping levels during infrequently occurring hydrologic conditions.

5.b. Within five years after issuance of the biological opinion, the FFTT shall complete and submit to NMFS for review and concurrence a NDD testing plan that includes provisions to monitor sweeping velocity and approach velocity at the intake faces, juvenile survival and reduction in fitness of juveniles related to impingement and entrainment, the rate of predator recruitment and efficacy of fish refugia for predator avoidance, and the ability of the operations of the north Delta diversions to respond to hydrodynamic conditions such that the operations of the NDD conform to the operational criteria of the NDD, as stated in BA Section 3.3.2.1, that flow reversals in the Sacramento River at the Georgiana Slough junction will not increase in magnitude, frequency, or duration above pre-north Delta diversion operations levels. If a plan is not submitted to and concurred with by NMFS within the specified timeline, then NMFS will provide a plan for use when operations commence.

5.c. DWR shall contract with the Delta Science Program to complete an independent science panel review of the NDD testing plan prior to implementation of the plan and a separate review of testing period results prior to full operations of the NDD.

**6. The following terms and conditions implement reasonable and prudent measure 6 (Ensure that the activities identified in BA Appendix 3.H Adaptive Management Program (AMP) are scientifically robust, in accordance with the implementation structure, and reasonably certain to occur as described in the administrative record for this biological opinion, regarding interagency assessments of AMP continuing and new funding needs.):**

6.a. Reclamation and DWR shall implement monitoring and scientific research actions detailed in the AMP, as coordinated through the IICG, as this effort is required for purposes of monitoring and continuous minimization of take associated with the scientific uncertainties outlined in the analysis contained in this biological opinion. Continuation of core monitoring specified in the NMFS (2009) biological opinion, or the then-governing biological opinion, is required as part of the AMP and included in this Opinion.

6.b. Reclamation and DWR shall prepare and submit to NMFS within one year of biological opinion issuance an initial Adaptive Management Program funding strategy for review and concurrence. The interagency adaptive management effort that developed the Adaptive Management Plan and Agreement for Implementation has identified existing and new monitoring and study efforts to be implemented as part of the AMP in the near term (i.e., 2019-2024) and longer term (i.e., 2025 and later) (see Implementation Schedule for this Adaptive Management Program for the Existing Biological Opinions and CESA Authorizations for the Long-term Operations of the CVP and SWP and for CWF, Appendix 8 to BA Appendix 3.H). The studies that have been identified as ongoing during the near term or required by this Opinion to begin within the near term are identified in the interagency funding assessment documents (e.g., Interagency AMP funding spreadsheet (Wilcox 2017)). The existing annual budget for the studies included in this subset is estimated at \$26,700,000. The estimated initial additional annual funding needed to implement the remaining salmonid and sturgeon related studies included in this subset is \$60,000,000. Actual funding may be higher or lower than this estimate. This additional funding should include, at a minimum, the following components:

- i. Implementation of SAIL recommendations, as an improvement to the core monitoring program
- ii. Baseline studies for the north Delta diversions
- iii. Improvements to acoustic arrays throughout the Delta, and improved capacity to process acoustic data
- iv. Effectiveness monitoring associated with Georgiana Slough barrier
- v. Implementation of Collaborative Adaptive Management Team (CAMT) recommendations for salmonids as a result of Salmon Scoping Team report (CAMT 2017)
- vi. Salmon life cycle modelling
- vii. Predation related studies, including monitoring components of CCF predator control
- viii. Baseline studies associated with habitat restoration required in this Opinion.
- ix. Additional modelling and decision support (including, for example, e-PTM and data access improvements)
- x. Genetic testing to supplement length at date criteria
- xi. Costs associated with independent science reviews of products associated with the AMP

Therefore, Reclamation and DWR shall develop a funding strategy that clearly identifies responsible parties and levels of annual and total program funding consistent with the above identified funding needs for implementation of the AMP starting in 2019. The strategy shall include detailed funding and commitments for the first five years (2019-2024), and lesser detail for the studies required after 2024.

Consistent with the role of the IICG as detailed in the AMP, Reclamation and DWR shall submit annual updates to the strategy to NMFS for review and concurrence. These updates should include extension of the detailed funding strategy for five years post submission date. To the degree that annual appropriations are relied upon, the funding strategy shall demonstrate that those funds have been appropriated, similar levels of annual appropriations have been consistently available in past years, and/or that those funds are planned for subsequent appropriations processes. NMFS anticipates that these conditions are fully consistent with the AMP, including the role of the IICG.

6.c. As identified in the Agreement for Implementation of an Adaptive Management Program for Project Operations (Appendix 8 of BA Appendix 3.H), IICG Manager shall manage preparation of the Annual Monitoring and Research Plan. Reclamation and DWR, in coordination with the IICG, shall refer management related actions or proposals, as appropriate, to the Delta Science Program for review by an independent science panel consistent with that agreement.

6.d. With technical assistance from NMFS, Reclamation shall continue development of a peer-reviewed Chinook salmon life-cycle model to refine understanding of how water operations, climate change, and habitat measures upstream and in the Delta, including those proposed as part of the PA, affect the continued existence of the species. Reclamation shall submit this model to NMFS for review and concurrence.