The U.S. Fish and Wildlife Service's, Stockton Office is providing the following additional information relative to Dr. Chuck Hanson's "Review of the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento San Joaquin Delta Estuary, (X2 Standard), discussed on January 17, 2005 at the 2004 triennial review of the 1995 Bay Delta Plan. The Anadromous Fish Restoration Program (AFRP) has spent a number of years analyzing Chinook salmon abundance and distribution as related to the Delta Outflow - X2 standard.

Dr. Hanson's comments are in italics.

Slide 22 - February-June outflow varies in numerous ways

It was stated that *"Flow does not produce fish"*

There is overwhelming evidence supporting the critical role of flows in maintaining the abundance and distribution of fish populations. Please refer to the following studies included in the Delta outflow objective reference provided by the DOI: Arthur et al. 1996, Bennett and Moyle 1996, Brandes and McLain 2001, Estuarine Ecology Team 1997, Feyrer and Healey 2003, Kjelson and Raquel 1981, Kjelson et al. 1982, Kjelson and Brandes 1989, (Mesick 2001, Moyle et al. 1992).

Slide 24 - February-June X2 does not account for:

"In-Delta entrainment of egg, larval, juvenile (and some adult) fish"

The minimum critical flows required under X2 standards contribute to the prevention of salinity intrusion and favor net downstream delta outflow, and thus, help to limit entrainment of biological resources including all life stages of fish. For evidence of the role of X2 in helping to limit fish entrainment please refer to Jassby et al. (1995) and Estuarine Ecology Team (1997). These studies are included in the Delta outflow objective references provided by the USFWS (2005). In addition DOI (2005) provides background on the importance of X2 for delta smelt.

"Long-term climate change"

"Long-term sea level rise"

Although long-term climate change and sea level rise are beyond the scope of the 1995 Bay-Delta Plan, anticipated potential long-term climate changes (e.g. Roos 1994, Root et al. 2003, Van Rheenen et al. 2004) provide more justification to further maintain current standards to protect declining biological resources.

"Harvest of salmon and loss of salmon-derived nutrients from the watershed"

"Loss of nutrient loading in reservoirs over time"

Reduction of harvest and increase of salmon derived nutrients in the watershed are not among the high priority actions recommended in the Final Restoration Plan of the Anadromous Fish Restoration Program (USFWS 2001) and the (USFWS 1995A). Increased flows and adequate temperatures rank consistently high among the most critical needs to restore salmonid runs in the Central Valley streams. These documents were the product of significant effort and coordination among state, federal, and non-agency fishery biologists. Please refer to these documents (e.g. Working Paper (1995)) in the US Fish and Wildlife Service annotated references on Delta outflows and PDF files).

"Effects of reservoirs on mobilization and transport of sediments"

"Continued uncertainty about the mechanisms for:

- *sediment and nutrient recruitment*
- *loading, transport, dispersal, and conversion"*

While X2 was not intended to address or minimize all ecosystem disturbances caused by water development projects in the Bay-Delta and its tributaries, X2 standard benefits to biological resources are significant and multiple across trophic levels and provide a very practical tool for ecosystem-based management of the Bay-Delta system. Please refer to references in the Delta outflow objective included in USFWS (2005).

Slide 25 - February-June X2 does not account for:

*"Releases to meet X2 may flood upstream spawning gravels and dewater redds when releases are reduced***"**

The conflict between water needs of upstream fishery resources and Delta fishery resources is not the direct result of X2 standards to protect Delta biological resources. X2 standards only provide a minimum protection for declining delta fishery resources and should not be further undermined to compensate for excessive upstream water diversions and exports. Please refer to USFWS (2005) and corresponding PDF files under exports limit objectives, delta outflow objectives, Vernalis and Rio Vista flow objectives.

Slide 26 - Options for modifying the X2 releases

"Vary releases to vary the position of X2 in Suisun Bay

- *hydrologic conditions*
- *biological conditions*
- *alternative priorities for resource allocation"*

"Vary the timing of releases to enhance productivity and/or phytoplankton transport"

"Allow for changes in the timing and flow rate used to meet the Port Chicago X2"

X2 standards provide a highly necessary minimum protection to declining Delta biological resources by maintaining a limited low salinity mixing zone in the Delta. Effective protection of this critical low salinity mixing zone and conservation of Delta resources will be further undermined by moving the position of X2 further upstream. From USFWS (2001), Supplemental action requiring water**,** 8), the request was for **"**Increase the level of protection targeted by the May and June X2 requirements to a 1962 level of development". While there may be no direct relationship between the abundance of Chinook salmon and X2, there is a relationship between their survival through the Delta and outflow, where a positive relationship to outflow (increased flows) means a negative relationship to X2 (X2 further downstream) (Estuarine Ecology Team. 1997. P. 22-23). Kimmerer (2002) wrote that "The centerpiece of current flow management is the X2 standard, using salinity to maintain flow with the goal of broad ecosystem protection. Originally suggested by Williams (1989), the standard as implemented requires salinity at a control point at 81 km not to exceed 2 psu continuously, and at two control points (64 and 75 km) not to exceed 2 psu for a set number of days during January–June each year. The number of days when salinity must be less than or equal to 2 psu at each control point is determined using a sliding scale that depends on precipitation in the watershed and the amount of water stored in the reservoirs. Water for the environment is allocated on the same basis by which the federal and state water managers meet contractual obligations to supply water for human use. The actual standard incorporates operational flexibility to account for the lag between changes in flow and response of the salt field." Please refer to USFWS (2005) in relation to Delta outflow and Rio Vista flow objectives.

Slide 28 - Possible adaptive management strategies

"*Flexibility in the timing of compliance*

- *There is no apparent benefit to compliance tied directly to the triggering date of the Roe Island/Port Chicago Standard"*

There is clear evidence supporting the triggering date of this standard. This standard was adopted to ensure that the requirement addressed only flood events and was intended to protect ecological values of declining flood flows from future developments in water infrastructure. The descending limb of the flood hydrograph, the target aspect of the Port Chicago requirement, is thought to be important for outmigrating species. Similarly, variability in estuarine conditions is thought to be important for estuarine species. Timing and magnitude of flow standards for Chinook salmon and threatened steelhead are critical in terms of downstream migration and survival of juvenile salmonids. Positive relationships between juvenile salmon survival and delta outflows are very well documented in several studies and support the benefit of the Port Chicago standard. Please refer to USFWS (2005) and corresponding PDF files for Delta outflow and Rio Vista and Vernalis flow objectives.

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