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DRAFT Consultant Recommendations for South Delta Export Operations

December 16, 2008

Tidal hydrodynamics play an important role in determining estuarine functions, species response in terms of abundance and survival as well as geographic distribution that collectively influence aquatic habitat quality and availability for covered fish. Covered fish have evolved and adapted to environmental cues that affect migration timing and habitat use by various life history stages of each of the species. Estuarine hydrodynamics also affect trophic food web dynamics (e.g., residence time and the production of food resources for covered fish), migration pathways, and transport of nutrients, and the distribution of zooplankton and other aquatic organisms. South Delta export operations have several effects on local and regional estuarine hydrodynamics. Delta exports at high levels have the ability to reverse flows, resulting in a net tidal upstream flow rate, within several Delta channels, including Old and Middle Rivers (OMR) as well as the lower San Joaquin River (QWEST). Salvage of various fish, including delta and longfin smelt and juvenile salmonids, at the SWP and CVP export facilities has been correlated with the magnitude of OMR reverse flows. The reverse flow-fish salvage relationship, however, is not linear but rather appears to be an exponential function with increasing fish salvage as OMR reverse flows become greater than approximately -5,000 cfs (Figures 1-4).

There are several potential approaches to management of south Delta export operations and resulting hydrodynamic conditions within the Delta. Consideration was given to directly managing the seasonal level of SWP and CVP exports from the south Delta (maximum export rate (cfs) management approach used in D-1485). A second approach used the ratio of total Delta inflow to SWP and CVP south Delta exports as a seasonally adjusted percentage of inflow (E:I management approach used in D-1641). Consideration was given to managing south Delta exports using a base rate (e.g., 5,000 cfs) and a proportion of San Joaquin River flow (e.g., 50%). A variation on the San Joaquin River inflow concept relied on managing south Delta exports as a function of combined Delta inflow from the Mokelumne, Cosumnes, and San Joaquin Rivers. Consideration has also been given to managing south Delta export operations to reflect conditions that occurred in the Delta during the 1950s and 1960s, prior to initiation of SWP south Delta exports in 1968. There has also been considerable interest in recent years in managing south Delta export to reduce and avoid fish salvage by seasonally reducing the rate of OMR reverse flows. Interest has also been expressed in managing hydrodynamic considerations within the Delta to maintain a positive net downstream flow of water through the Delta and into Suisun Bay (reflected in a positive QWEST). As part of developing a recommendation for south Delta, each of these operational strategies was considered for inclusion in the initial phase of operational modeling of potential BDCP conservation actions. Two metrics were selected as operational criteria which included (1) maintaining positive net downstream flows through the Delta year round in all but critically dry water years when Delta inflows are very low and increased releases to maintain a net positive flow adversely impacted upstream reservoir storage and coldwater pool availability, and (2) seasonally managing OMR reverse flows within a range that the available data indicates that salvage of covered fish (e.g. ,delta and longfin smelt, juvenile Chinook salmon) would be substantially reduced. Both QWEST and OMR offer the advantage of integrating a number of environmental factors that collectively are important to hydrodynamic conditions within the central and southern regions of the Delta and as inflow to Suisun Bay.

Factors considered in developing the recommended south Delta export operations included:

- Seasonal timing when various life stages of covered fish inhabit the Delta in the vicinity of the existing south Delta export facilities;

- Seasonal changes in the biological processes within the Delta (e.g., differences in the biological processes of phytoplankton and zooplankton production between winter-spring and summer-fall);

- The relationship between constraints on Delta hydrodynamic conditions and water diversions and water supplies;

- The relationship between the magnitude and seasonal timing of OMR reverse flows and the risk of fish salvage and entrainment of fish eggs, larvae, and other aquatic organisms;

- The relationship between south Delta export rates and net positive downstream flows through the estuary (as reflected in QWEST at Jersey Point);

- The relationship between flows within Delta channels and attraction and upstream migration by adult Chinook salmon, steelhead, delta and longfin smelt, splittail, and other upstream migrating adults;

- Relationships between flows within Delta channels and juvenile downstream migration, dispersal, and survival rates;

- Relationships between export operations, river inflow rates, and tidal dynamics;

- Relationships between enhanced and expanded tidal marsh habitat (e.g., tidally inundated shallow water habitat) within the central and southern regions of the Delta and vulnerability of organic material, phytoplankton and zooplankton, fish and other aquatic organisms to increased mortality or losses from the Delta as a direct or indirect effect of south Delta exports;

- The relationship between operations and constraints on north Delta and south Delta export facilities and resulting south Delta export operations for water supply deliveries.

Results of hydrodynamic simulation modeling allow predictions of the relationship between south Delta export operations as part of a dual facility and the various metrics and biological and water supply objectives outlined above. South Delta flows (OMR and QWEST) which may be strongly influenced by south Delta export operations are intended to serve as an operational parameter for regulating water diversion operations in a way that minimizes and reduces the effects of diversions on entrainment and to support functions within the Delta and estuary. The Delta hydrodynamics act as operational criteria in which water diversions would only occur when OMR or QWEST flows were maintained above the minimum criteria. The minimum flow rates act as a restriction on south Delta water diversions during those years and seasons when flow entering the Delta is relatively low. Results of hydrodynamic modeling show the interaction among various operating parameters such as OMR and QWEST reverse flows, constraints on north Delta export operations and Sacramento River bypass flow requirements, downstream Delta outflow and maintenance of the low salinity zone of the estuary, and water supply diversions from both the northern and southern regions of the Delta. The recommended south Delta export operations assume the existing channel conditions within the central and southern Delta regions. Alternative hydrodynamic operations that include various operable gates (e.g., the two gate south Delta proposal) for flow control may provide substantial fishery protections and benefits that are not reflected in the proposed operational criteria outlined below. Based on these and other considerations the following recommendations are offered for south Delta export operations as part of the initial phase of

BDCP conservation planning, recognizing that further modeling and analyses will be required to assess the interactions among various habitat enhancements and other operating parameters that have not yet been identified:

- December 1 through June 30 maintain OMR reverse flows at a level of -3,500 cfs or less;
- July 1 through November 30 maintain OMR reverse flows at a level of -5,000 cfs or less;
- Maintain net flows in the lower San Joaquin River at Jersey Point (QWEST) greater than 0 cfs (positive net downstream flow) year round except in critically dry water years when QWEST would be maintained at -2,000 cfs or less
- Conduct additional hydrologic simulation and particle tracking modeling to examine the interactions among operating parameters and habitat enhancement proposals as part of re-evaluating and refining south Delta operating criteria as part of an integrated BDCP process for developing final conservation actions.

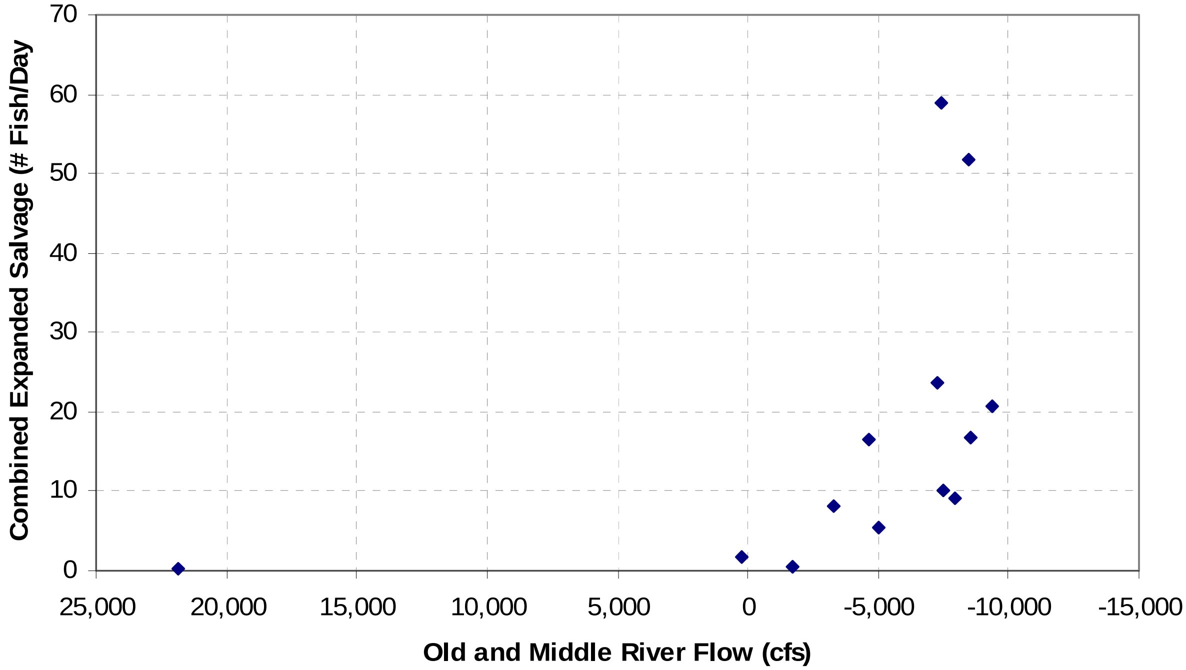

Figure 1. Example of OMR reverse flow and combined SWP and CVP salvage of juvenile winter-run Chinook salmon in January.

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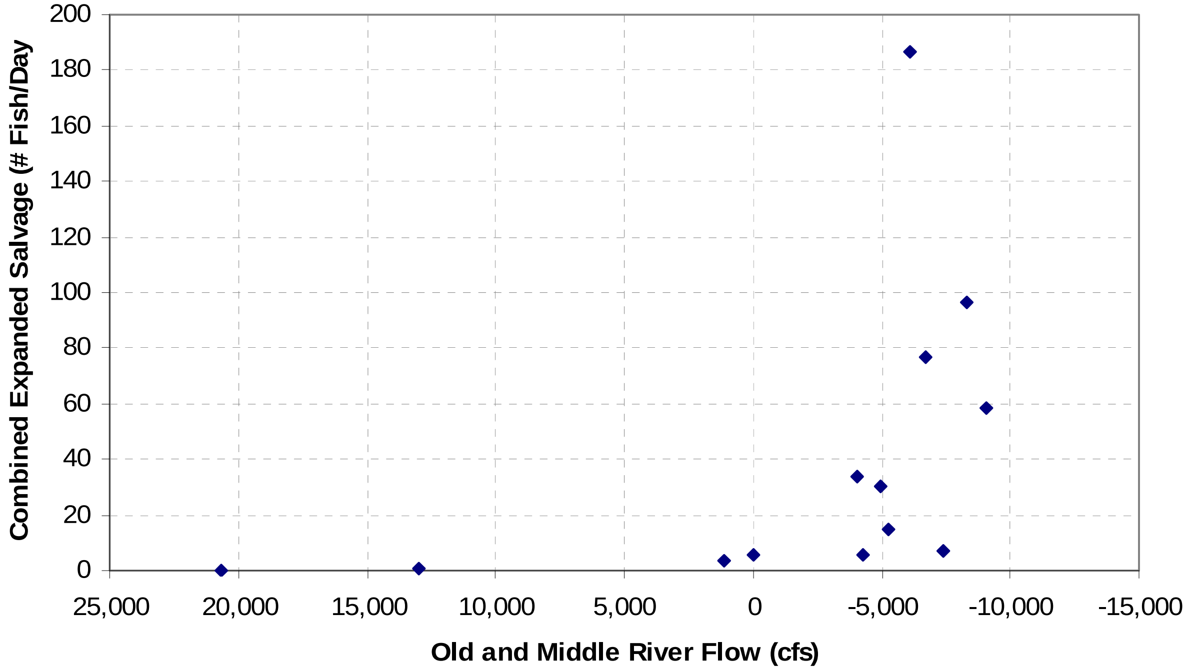

Figure 2. Example of OMR reverse flow and combined SWP and CVP salvage of juvenile winter-run Chinook salmon in February.

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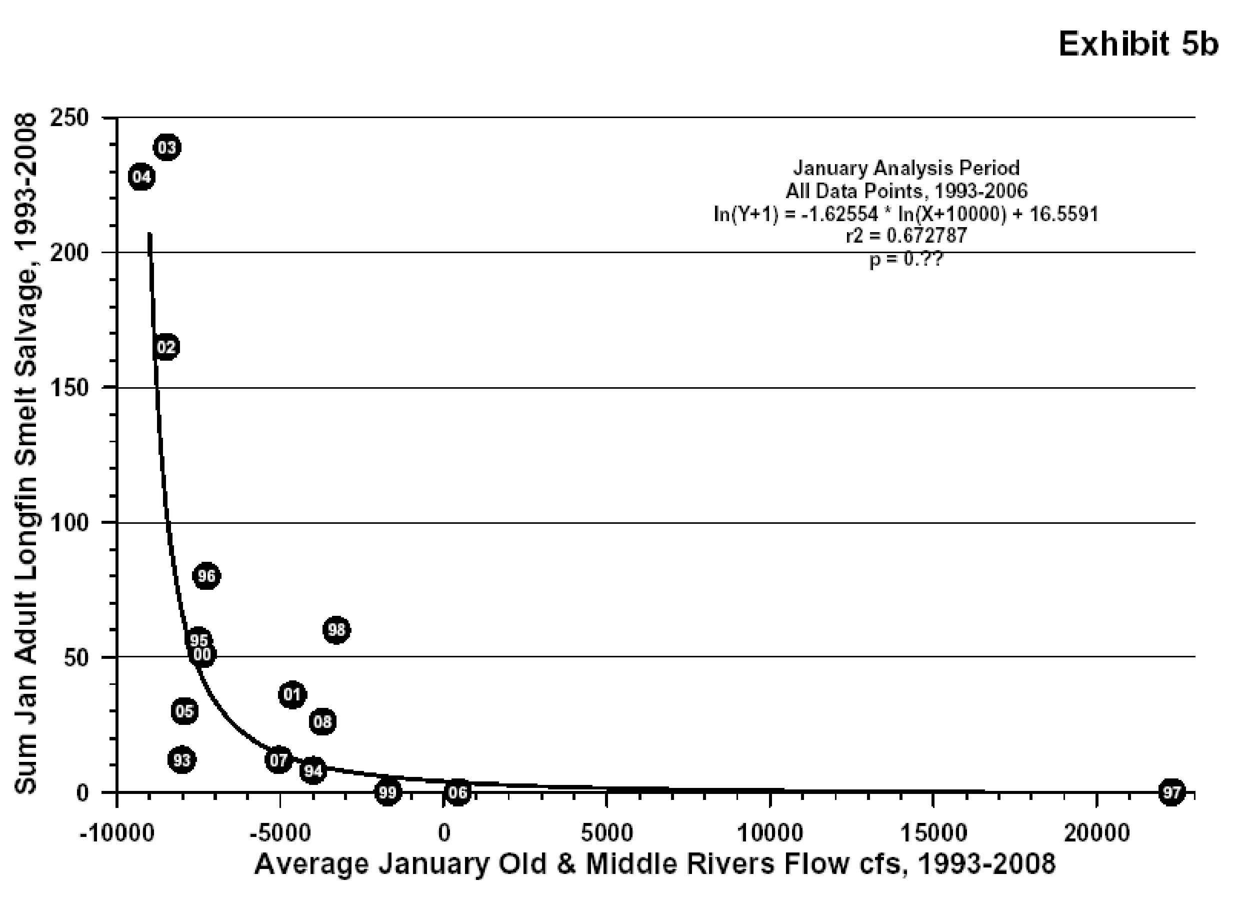

Figure 3. Example of OMR reverse flow and combined SWP and CVP salvage of pre-spawning adult longfin smelt in January.

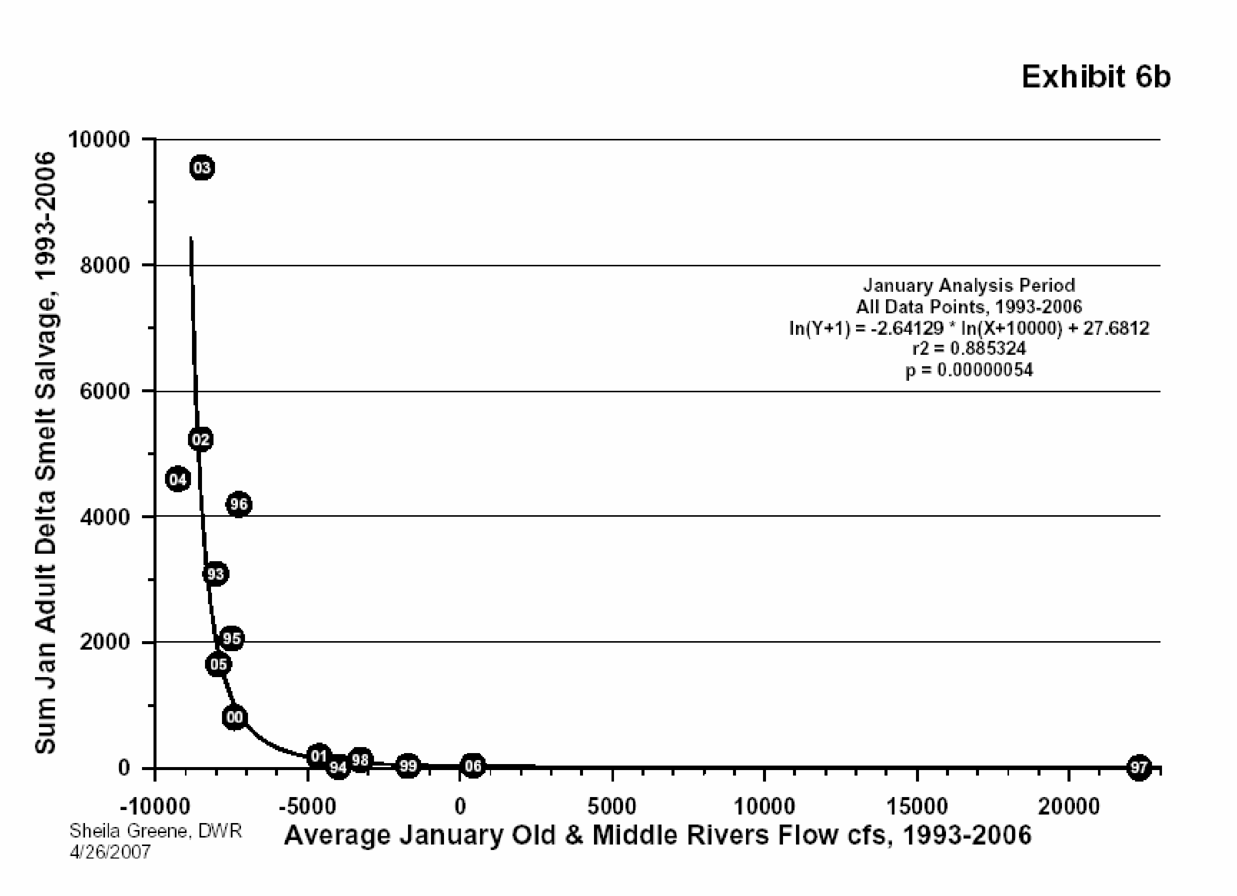

Figure 4. Example of OMR reverse flow and combined SWP and CVP salvage of pre-spawning delta smelt in January.