SJR Deep Water Ship Channel Water Not SJR Watershed Water below Columbia Cut[1]

G. Fred Lee PhD, PE, DEE and Anne Jones-Lee, PhD
G. Fred Lee & Associates, El Macero, California
Ph: (530)753-9630 Fx: (530)753-9956 Em: gfredlee@aol.com
www.gfredlee.com

Some authors of *IEP Newsletter* articles and others make reference to "San Joaquin River water" being in the San Joaquin River (SJR) Deep Water Ship Channel (DWSC) in the northern and eastern part of the Delta. However, the San Joaquin River Deep Water Ship Channel DO TMDL studies that have been conducted over the past four years have found that, except possibly under SJR flood flow conditions, the water in the San Joaquin River Deep Water Ship Channel downstream of Disappointment Slough/Columbia Cut is Sacramento River water, not San Joaquin River water. This situation is the result of the State and Federal Project pumps that export water from the South Delta creating a strong Sacramento River water flow through the Central Delta to the South Delta that crosses the SJR DWSC at and downstream of Turner Cut/Columbia Cut. These waterbodies are located seven and ten miles, respectively, downstream of the Port of Stockton (see Figure 1). The San Joaquin River water at these waterbodies is then mixed with the Sacramento River water on its way to the export pumps (at Clifton Court and, to some extent, at Tracy) via Middle River and Old River in the Central Delta.

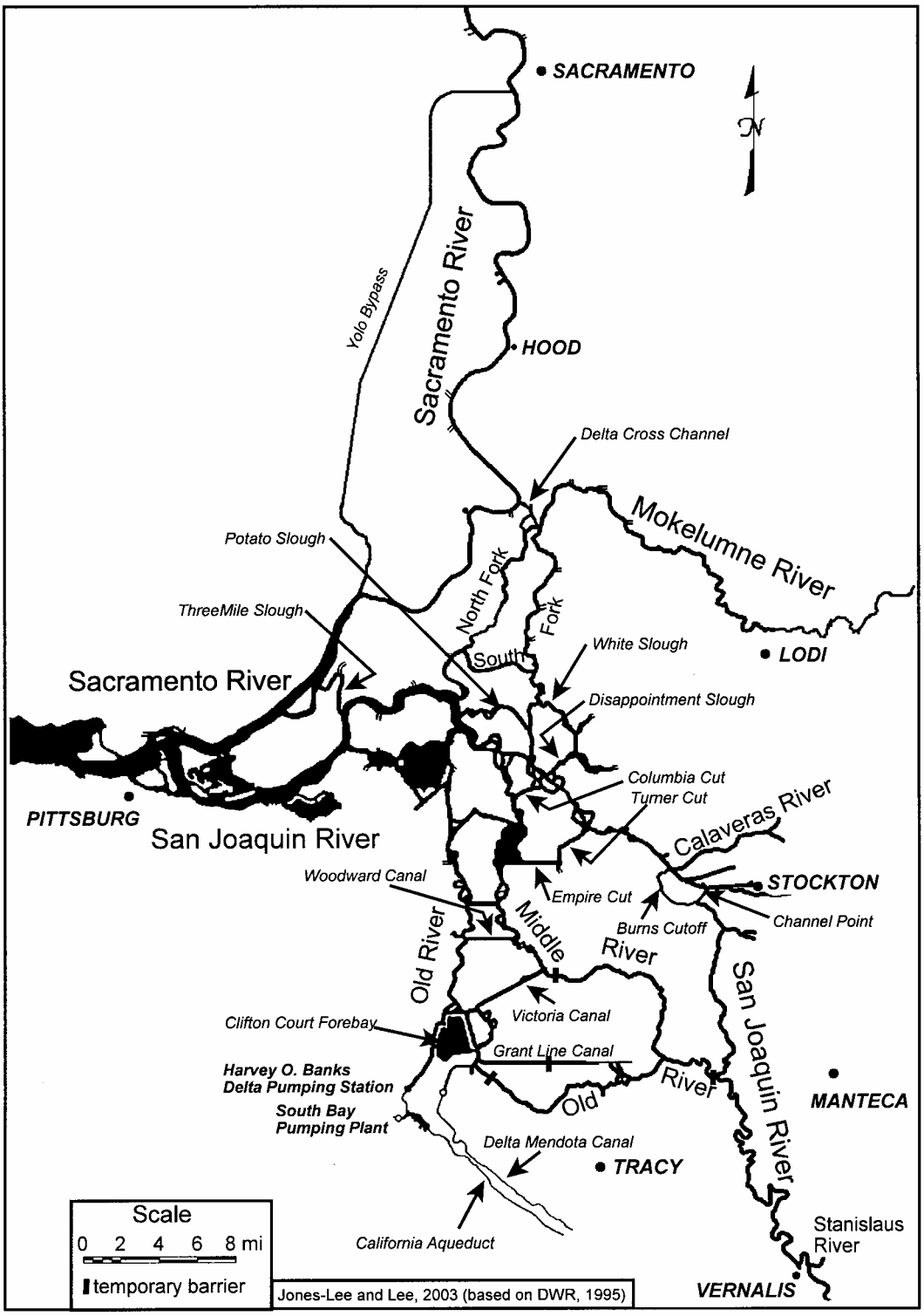
Information on Mixing of Sacramento River Water in the SJR DWSC

Lee and Jones-Lee (2000, 2001, 2003a,b) reported, based on a review of data from the Department of Water Resources (DWR) Division of Operations and Maintenance "Hayes" SJR DWSC monitoring cruises (Hayes and Lee, 1998, 1999, 2000; Ralston and Hayes, 2002; Giovannini and Hayes, 2003) that have been conducted during the summer and fall over the years, that the low-DO problem that frequently occurs during the summer and fall and sometimes in the winter does not occur in the SJR DWSC downstream of Disappointment Slough/Columbia Cut. This arises from the fact that the Sacramento River water that is drawn to the South Delta by the Projects' export pumps has a low oxygen demand/low algal content. This situation is also evident from the specific conductivity (EC) data. The SJR has a summer/fall EC typically greater than 500 µmhos/cm (µS/cm), while the Sacramento River water EC is typically less than 200 µmhos/cm. Brown (Jones & Stokes, 2002) conducted a study of upstream in the SJR DWSC mixing of Sacramento River water with the SJR DWSC near Turner Cut. He reported that, at times under low SJR DWSC flow, the SJR DWSC downstream of Turner Cut is dominated by tidally induced upstream migration of Sacramento River water.

An example of this type of situation occurred on July 17, 2003, when the author and his associates (Lee and Morgan, 2003), with DeltaKeeper boat and staff support, conducted a monitoring tour of the SJR DWSC, Turner Cut down to Clifton Court via Empire Cut, Middle River, Victoria Canal, and then north from Clifton Court to Columbia Cut via Old River (see Figure 1). The specific conductivity (corrected to 25°C) of the SJR DWSC water upstream of and near Turner Cut was about 400 µmhos/cm. Beginning at Turner Cut, under high tide

[1] Reference as Lee, G. F., "SJR Deep Water Ship Channel Water Not SJR Watershed Water below Columbia Cut," Report of G. Fred Lee & Associates, El Macero, CA (2003). Submitted for publication in the *IEP Newsletter*, October (2003).

Figure 1
Simplified Map of Delta Channels



conditions on July 17, 2003, the specific conductivity dropped to about 155 µmhos/cm, and remained in the range of about 150 to 270 µmhos/cm throughout this part of the tour. Headreach Cutoff, which connects the SJR DWSC to Columbia Cut, had an EC of 145 µmhos/cm. The decreased specific conductivity beginning at Turner Cut, through the Central Delta, was due to the low EC of the Sacramento River water mixing with the SJR DWSC water.

On September 11, 2003, the first of the 2003 summer-fall DWR Hayes cruises of the San Joaquin River Deep Water Ship Channel was conducted. Giulian (2003) has made the preliminary data from this cruise available for review. In 2003 the DWR cruises have been expanded to include EC measurements. Examination of these data shows that the seven stations monitored in the SJR DWSC from Prisoners Point to just downstream of Turner Cut had specific conductance values typically less than 300 µmhos/cm. However, at the station just upstream of Turner Cut, the EC increased to 623 µmhos/cm, and remained from 600 to about 660 µmhos/cm for the seven stations in the DWSC monitored from Turner Cut to within the Port of Stockton. Coincidentally, the DO in the SJR DWSC in the surface and bottom waters upstream of Turner Cut was found to be less than the 6 mg/L water quality objective, which was established to protect Chinook salmon homing migration. Just downstream of Rough and Ready Island, the DO in the bottom waters at the time of measurement was about 3 mg/L, with the surface waters having a DO of about 4.5 mg/L. At the DWR Rough and Ready Island continuous monitoring station, the early morning DO was about 3 mg/L. Similar EC results have been obtained in subsequent Hayes cruises, as well as a subsequent tour conducted by the author on September 17, 2003 (Lee and Morgan, 2003). It is clear from these data that the water in the SJR DWSC from the Port of Stockton to Turner Cut is derived from the SJR DWSC watershed, while the water in the SJR DWSC below Turner Cut to Prisoners Point is derived from the Sacramento River.

Jassby, et al. (2003) have recently summarized a number of their papers and reports on the lack of phytoplankton in the Delta as part of the Delta aquatic food web. One of the consequences of the diversion of the SJR DWSC water into the Central Delta via Turner Cut and Columbia Cut is to provide additional phytoplankton into the Central Delta, and thereby help support the Delta food web.

Typical SJR DWSC/Sacramento River Water Flow through the Central Delta

The typical summer recent-year San Joaquin River at Vernalis flows have been on the order of 1,100 to about 2,500 cfs. The SJR Vernalis water splits at the intersection with Old River, where at times, when the Head of Old River barrier is not in place, much of the SJR Vernalis water is drawn into the South Delta via Old River, which, in turn, is pumped from the South Delta by the Tracy export pump. At times, during a wet year or when there are major SJR watershed reservoir releases, the flows of the SJR through the DWSC can be >1,500 cfs. During these times, much of the SJR Vernalis water is carried through the DWSC to Turner Cut and Columbia Cut. If it is assumed that the flow of the SJR at Vernalis is 1,500 cfs and half of it is drawn down Old River into the South Delta, then there is 750 cfs of SJR watershed water that mixes with the Sacramento River water at Turner Cut and Columbia Cut.

According to DWR Operations and Maintenance records, the State Project and the Federal Project pumps typically export on the order of 10,000 to 13,000 cfs from the South Delta, which

means that since the total SJR Vernalis water that is either drawn into the South Delta or that passes through the SJR DWSC to Turner Cut and Columbia Cut into the Central Delta is on the order of 1,000 to 2,000 cfs, the Sacramento River watershed water that is drawn to the South Delta by the export pumps is about 10,000 to 12,000 cfs during the summer and fall. The amount of the Sacramento River water that is drawn to the Central Delta/South Delta is somewhat greater than the difference between the SJR Vernalis water flow and the export pumping, due to irrigation consumption of water in the Delta. Some of the Sacramento River water/SJR DWSC water that is transported through Turner Cut/Columbia Cut via Middle River that is drawn to the South Delta enters the South Delta channels through the temporary barriers on Middle River, Grant Line Canal and Old River during high tide. Since the State Project pumps at Tracy typically export about 4,600 cfs, and the maximum SJR Vernalis water that enters the South Delta is on the order of 1,000 to 2,000 cfs, over 2,000 cfs of Sacramento River water must be added to the South Delta to meet the needs for the State Project pumps and South Delta irrigation.

Impact of SJR DWSC Water into the Central Delta on Chinook Salmon Homing

The diversion of all of the San Joaquin River DWSC water at Turner Cut/Columbia Cut to the Central Delta has important implications for Sacramento River watershed fish homing during much of the year. Fish entering the Delta from San Francisco Bay that originally develop in the San Joaquin River watershed rivers have little or no home stream chemical signal until they reach the SJR DWSC water at Columbia Cut and Turner Cut or in Middle River where it mixes with Empire Cut. Even then, the signal may be weak, because of upstream diversions of their home stream water. There would also be a weak signal of SJR watershed water in the South Delta, to the extent that there is home stream water in the South Delta that has been derived from the SJR at Vernalis before this water is drawn to the State Project pumps.

At the August 2003 CA Bay-Delta Authority Science Program workshop on Chinook salmon and Steelhead restoration, several investigators (such as K. Williamson of UCD) reported that the Chinook salmon that are found in the SJR watershed tributaries do not have a population genetic structure that is associated with a particular river. This is not surprising, since the fall-run Chinook salmon do not have a chemical signal to return to their home stream waters because of the diversion of their home stream water upstream of the SJR and through the split of the SJR at Old River, as well as the complete diversion of the SJR DWSC water at Columbia Cut/Turner Cut.

To the extent that the export pumping is reduced or shut down, the cross-SJR DWSC flow of the Sacramento River water downstream of Turner Cut will be reduced or eliminated. Under those conditions, some Sacramento River DWSC water that is present upstream of Turner Cut could make it further down the SJR DWSC, past Turner Cut. It appears, however, that this situation would be rare. With the proposed increase in export pumping, an even greater amount of Sacramento River water will be drawn south to the export pumps.

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