Historic Central Valley Salmon Restoration Agreements –

Early Progress, Later Declines, Future Failure

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In the 1990s there were a series of regulatory agreements among state and federal agencies and water contractors that led to new water quality standards and programs to recover Central Valley salmon. Salmon populations had plummeted during the 1987-1992 drought. Because of the many actions under the agreements (e.g., CVPIA, CALFED, 4-Pumps, VAMP, BayDelta Plan, COAs, and ESA recovery plans) many of the salmon runs recovered by the turn of the century (Figure 1).

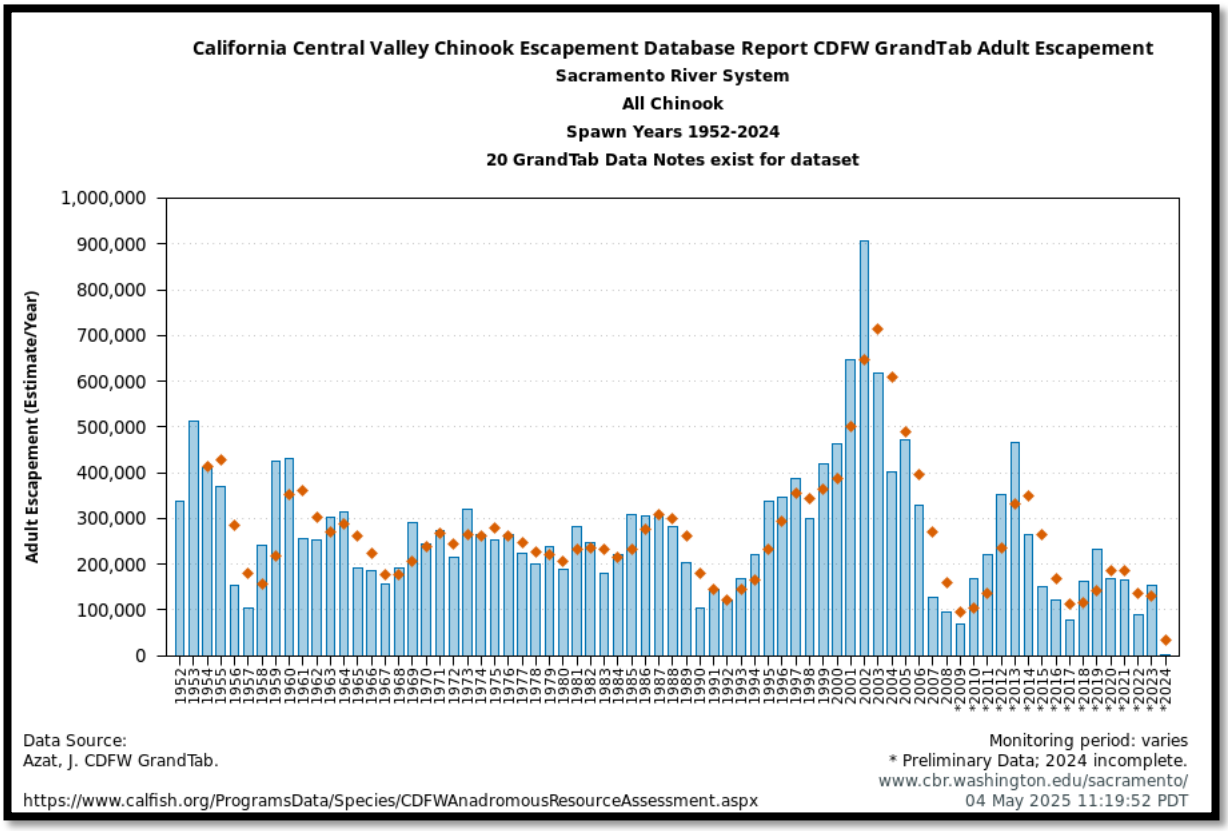


Figure 1. Central Valley salmon escapement 1952-2024. Three year running average are red dots. Note 2024 escapement tabulation is incomplete as of May 2025.

The recovery was short-lived when during and following recent droughts (2007-2009, 2013-2015, and 2020-2022) the salmon runs again dropped dramatically. Changes from 2000 included reduced hatchery production, lower Delta outflow, lower river flows and associated higher water temperatures, reduced fall flows that caused redd dewatering below Shasta/Keswick, more disease, and higher fishery exploitation rates.

Reduced Delta outflow occurred after 2000 especially in drought years (Figure 2), which led to poorer hatchery and wild smolt survival, poor adult survival and reproduction, and delays in adult salmon migrations. Spring-summer lower outflows under drought Temporary Urgent Changes Orders (Figure 2, Apr-Jun 2014 and 2021) were especially damaging.

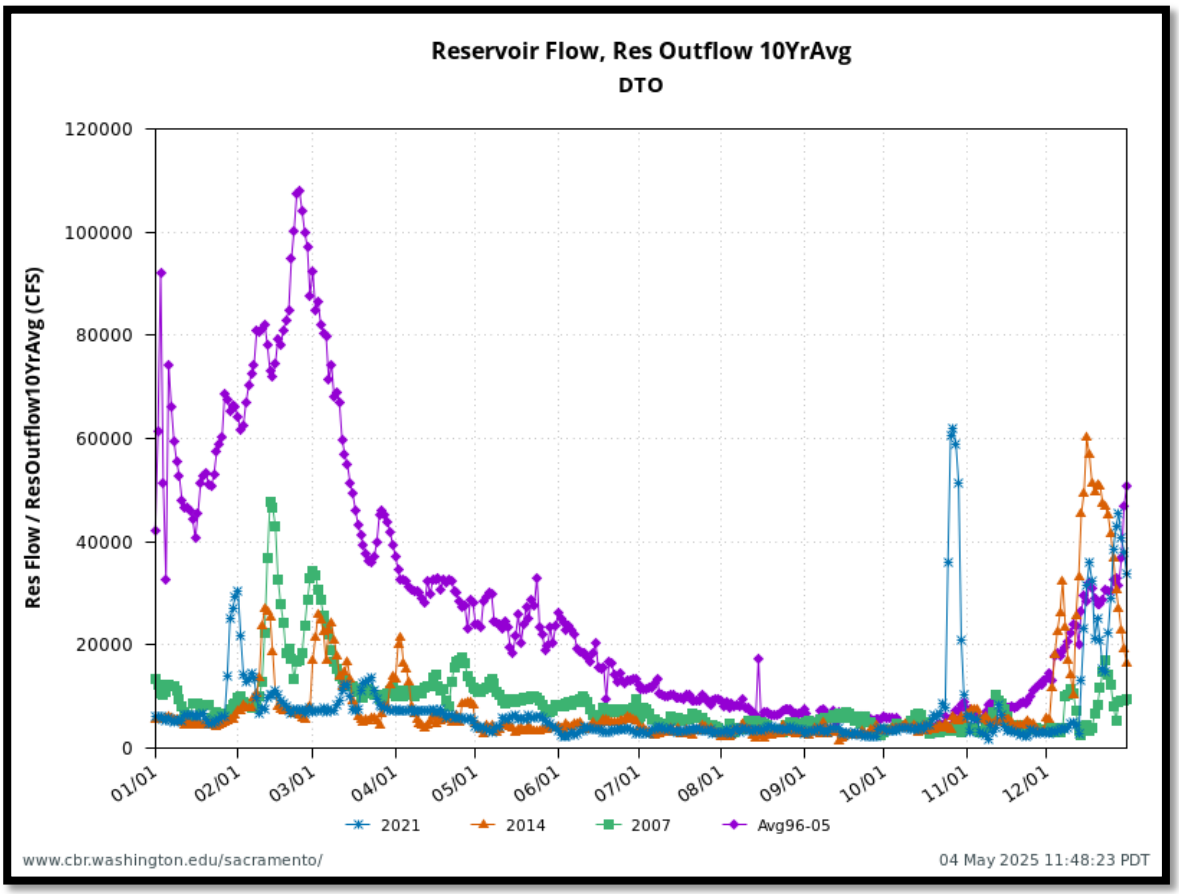


Figure 2. Delta outflow in three drought years in the 2000s along with the average for the wet decade 1996-2005.

Low Shasta Reservoir fall releases (Figure 3) led to delayed spawning and redd dewatering especially in drought years. Low winter flows below Shasta led to lower fry survival and reduced downstream transport and smolt numbers reaching the ocean. Lower spring through fall flows led to excessive warm water and violations of water quality standards in the upper Sacramento River (Red Bluff, 56°F, Figure 4, Map 1) and lower Sacramento River (Wilkins Slough, 68°F, Figure 4, Map 1).

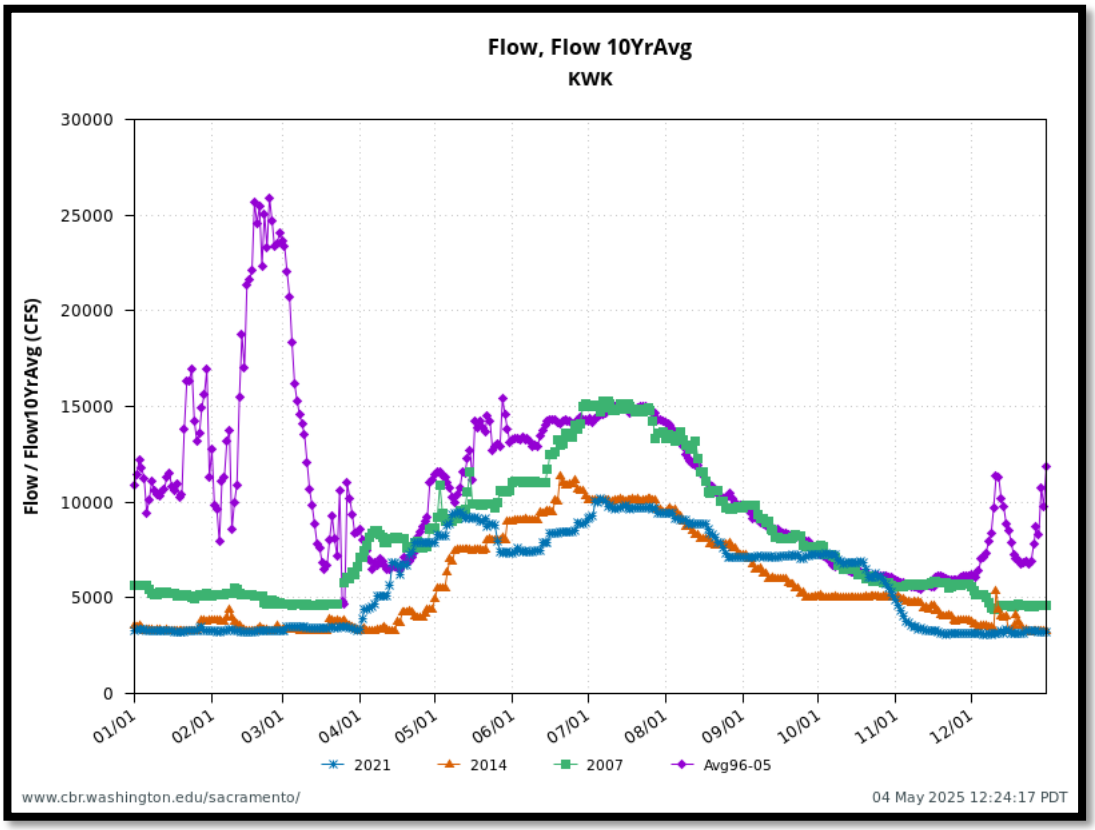


Figure 3. Daily average streamflow in the Sacramento River below Keswick Dam in three drought years along with averages for 1996-2005.

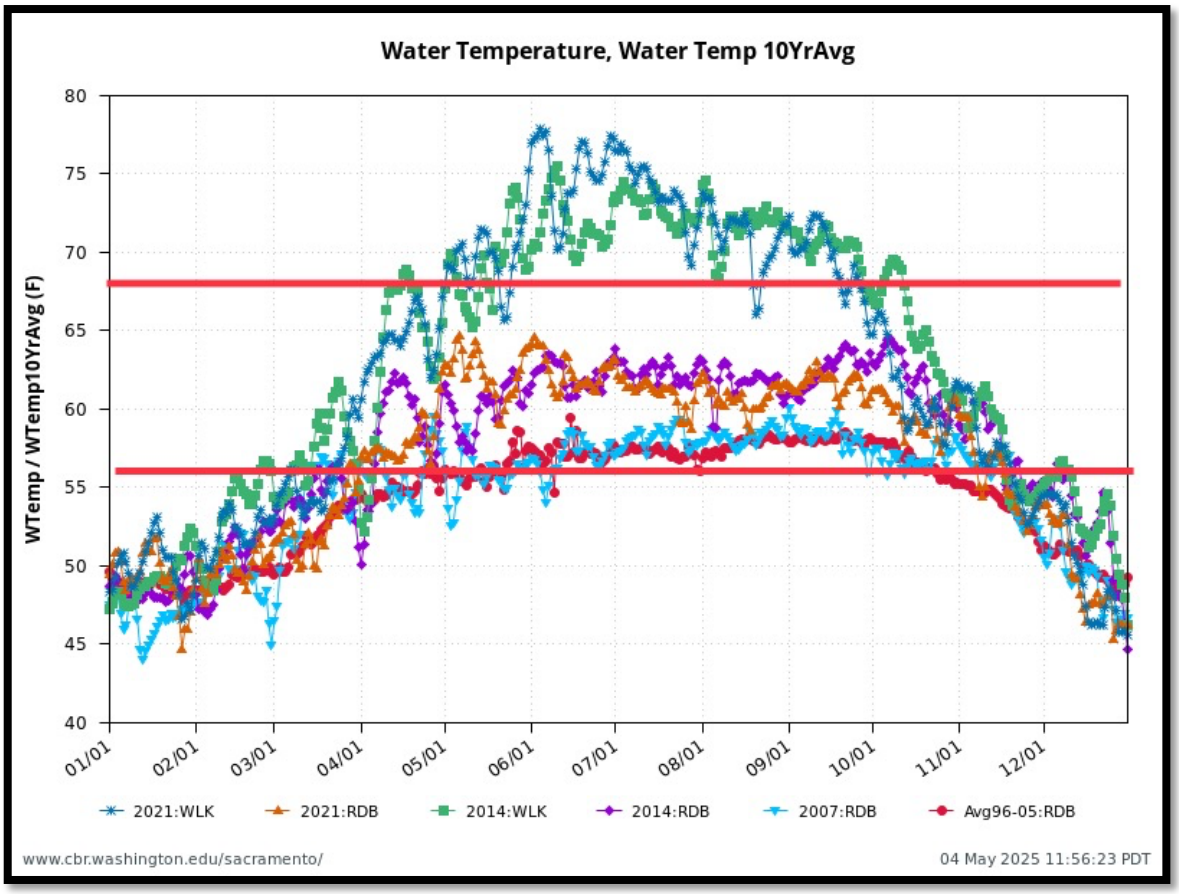


Figure 4. Daily average water temperatures in the upper Sacramento River at Red Bluff and lower Sacramento River below Wilkins Slough (Map 1) in drought years 2007, 2014, and 2021, as well as 1996-2005 average at Red Bluff. Red lines show water quality standards for Red Bluff (lower line) and Wilkins Slough.

The future does not bode well for Central Valley salmon as the state and federal governments add new water projects. Water right and endangered salmon permit applications are undergoing hearings in 2025 for the Sites Reservoir and Delta Tunnel projects (Map 2). Soon to follow is the process for raising Shasta and other dams.

The proposed Sites Reservoir would allow up to 2000 cfs of new water diversions to Sites Reservoir from uncontrolled tributary inflows between Shasta and Hamilton City in winter-spring. While this may seem a small portion of water at Hamilton City in wet years (Figures 5 and 6), it would not be in drier years (Figure 7).

The proposed Delta Tunnel (Delta Conveyance Project) would allow up to 6000 cfs of new water diversions from the Delta. The water would be available in fall-winter when the Delta would be in excess when Delta outflow is above about 10,000 cfs (see Figures 5-7). Again, that would seem a small percent of winter outflow in wet years and a more significant percentage in drier years. Water needs and demands would be greatest in the drier years.

Of final note, the 1990s agreements stipulated that further diversions of uncontrolled streamflows as proposed by these newest projects would not be allowed. Uncontrolled streamflow was to be protected for unmeasurable or unforeseen environmental values and public trust resources of the Bay-Delta watershed. Those individuals who were involved in the 1990s agreement negotiations might be disheartened by the further planned exploitation of Central Valley water resources. Neither Sites or the Delta Tunnel projects need take uncontrolled water to be considered viable projects. The appetite or greed for more of the uncontrolled water destined to reach the ocean will be the death knel of Central Valley native fishes.

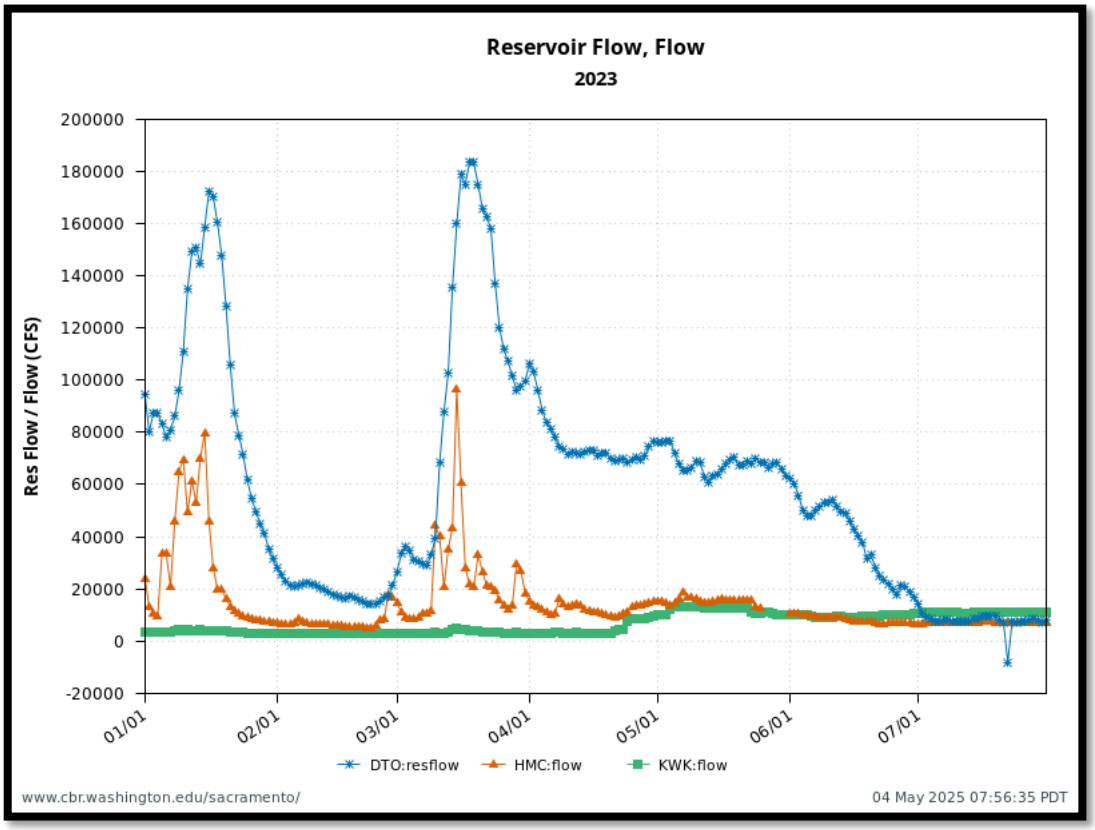


Figure 5. Sacramento River flow at two locations and Delta outflow Jan-Jul of wet year 2023. Difference between Keswick (KWK) and Hamilton City (HMC) represents tributary input. below Keswick Dam.

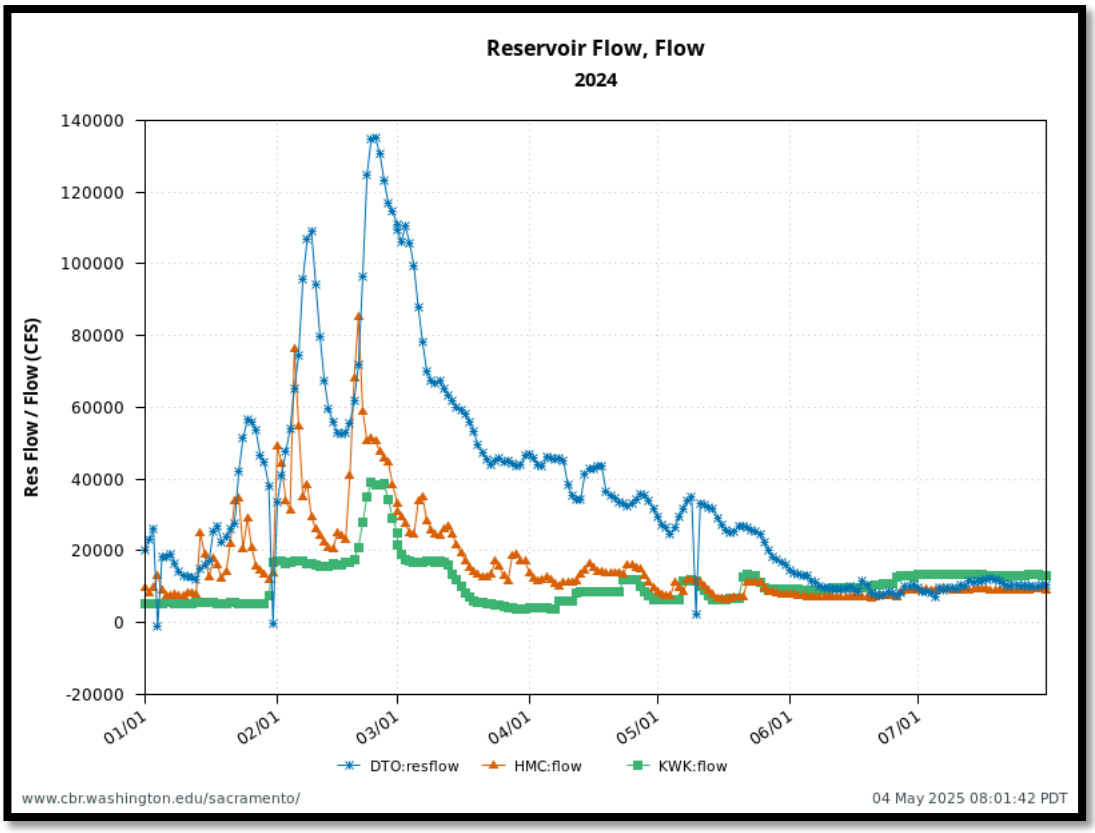


Figure 6. Sacramento River flow at two locations and Delta outflow Jan-Jul of wet year 2024. Difference between Keswick (KWK) and Hamilton City (HMC) represents tributary input. below Keswick Dam.

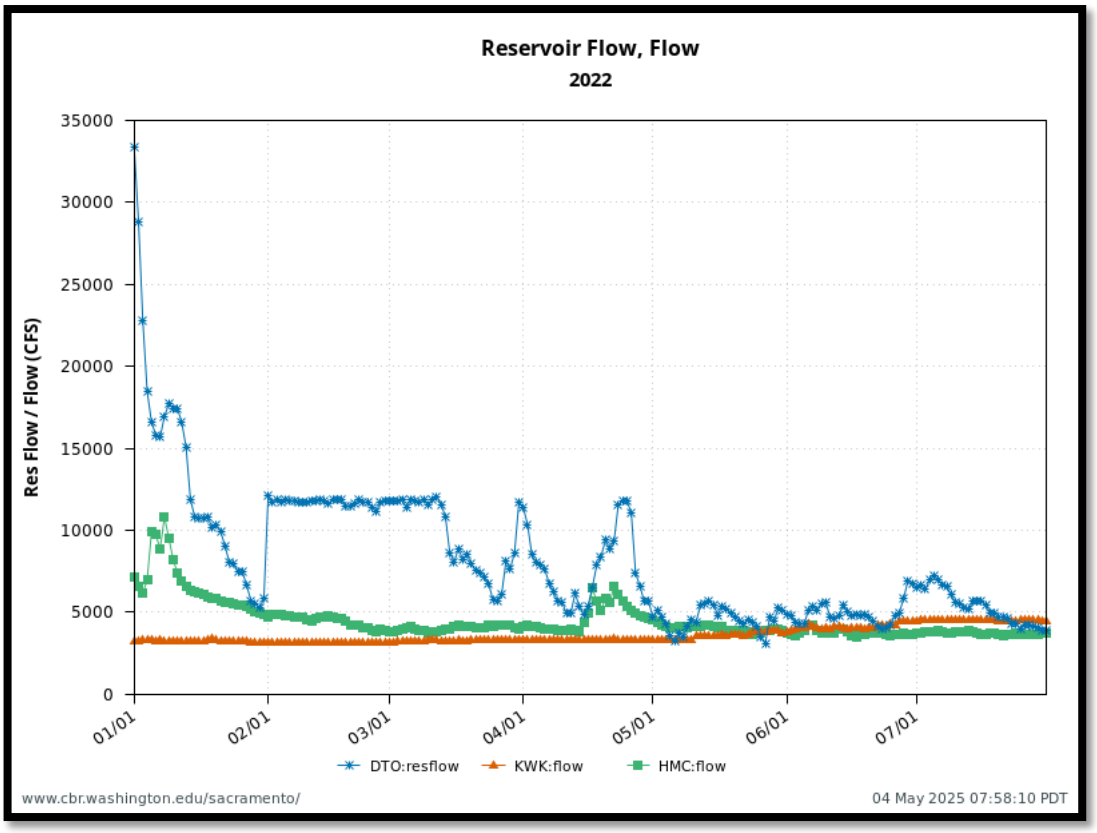
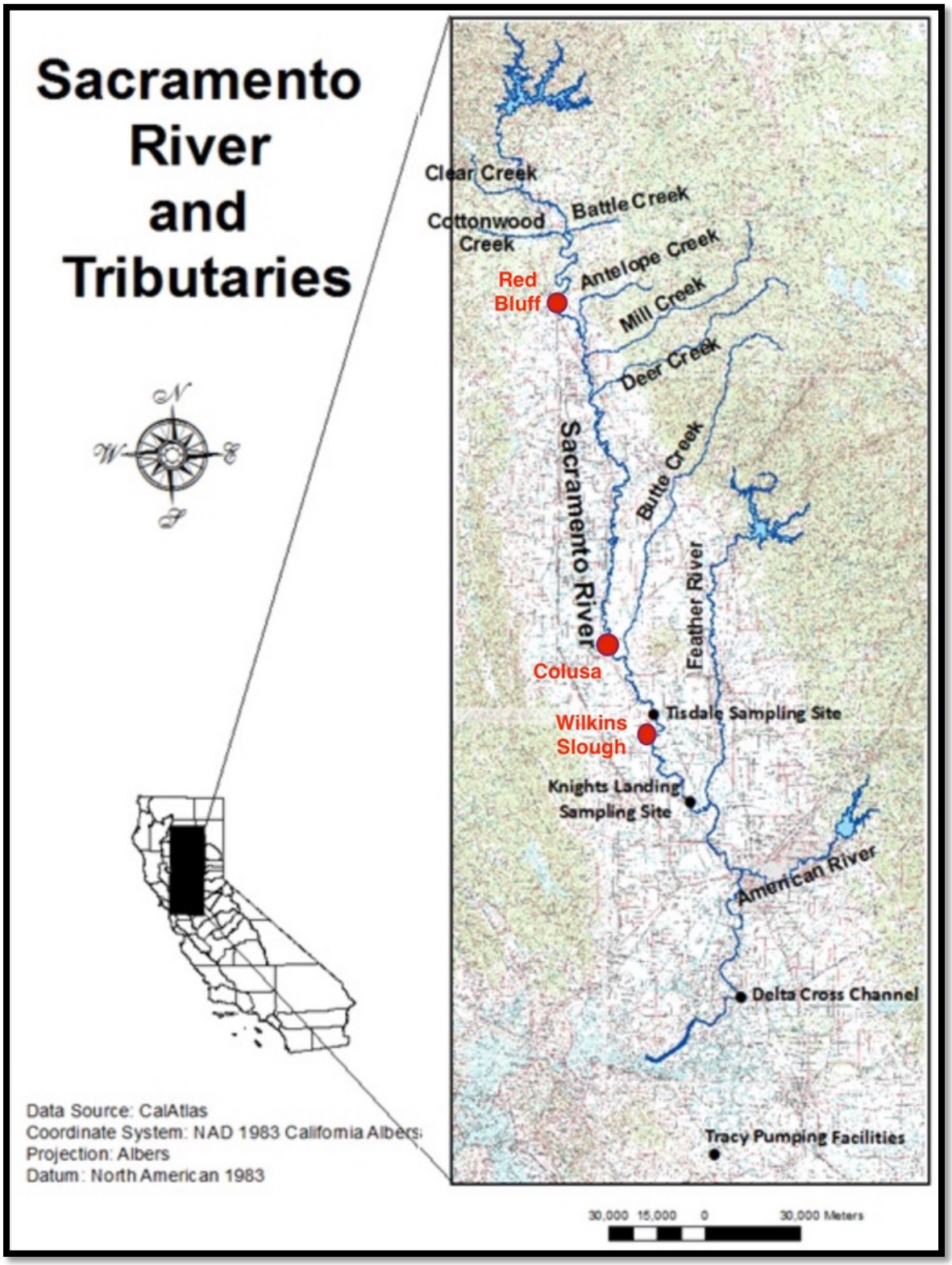


Figure 7. Sacramento River flow at two locations and Delta outflow Jan-Jul of critically dry year 2022. Difference between Keswick (KWK) and Hamilton City (HMC) represents tributary input. below Keswick Dam.

Map 1.


Sacramento River and Tributaries
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S
Clear Creek
Cottonwood Creek
Battle Creek
Antelope Creek
Red Bluff
Mill Creek
Deer Creek
Sacramento River
Butte Creek
Feather River
Colusa
Tisdale Sampling Site
Wilkins Slough
Knights Landing Sampling Site
American River
Delta Cross Channel
Tracy Pumping Facilities
Data Source: CalAtlas
Coordinate System: NAD 1983 California Albers
Projection: Albers
Datum: North American 1983
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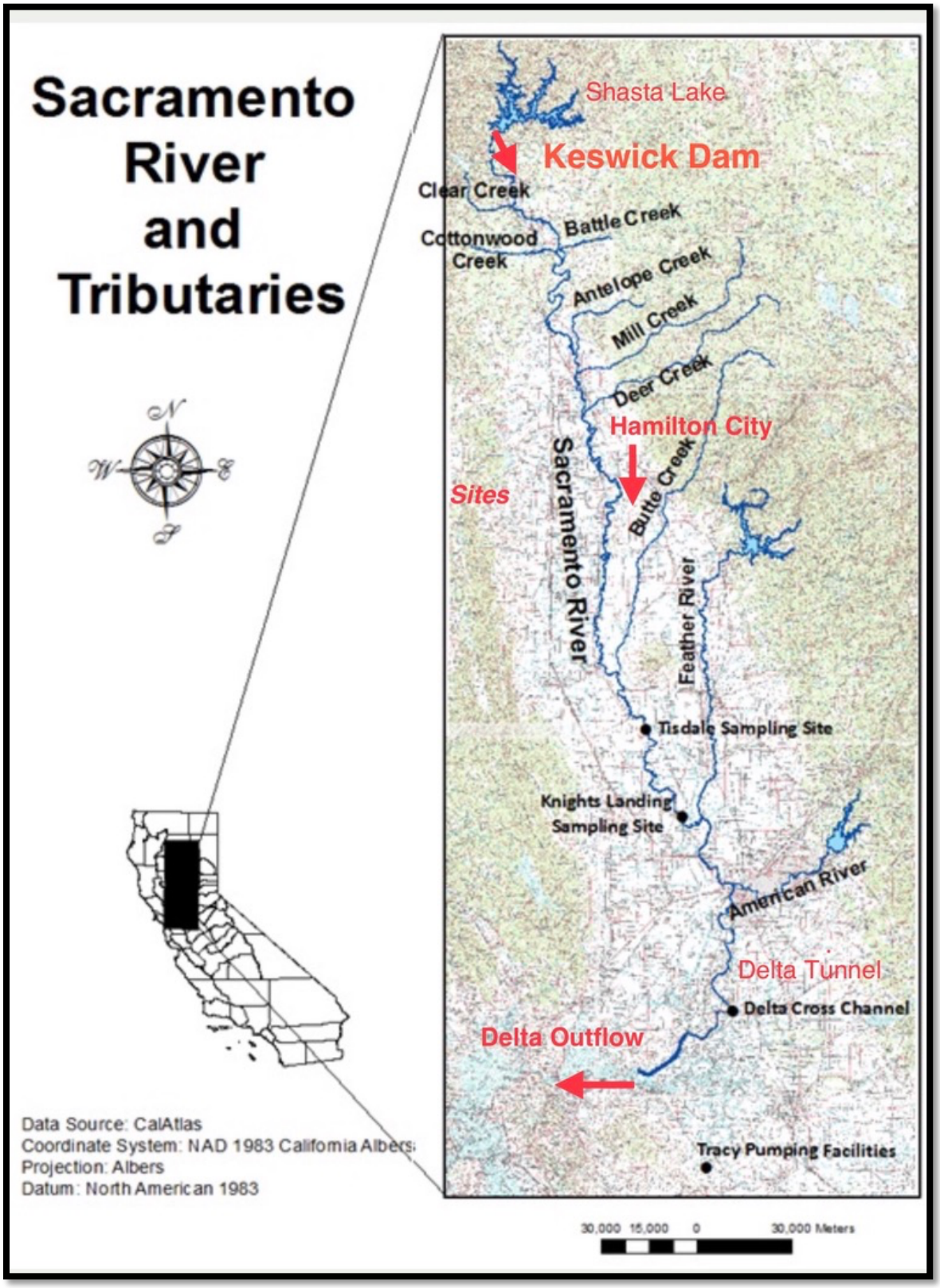
Map 2.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