Water Unavailability Methodology for the Delta Watershed: Possible Methods to Refine Return Flow Estimates

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This document provides an overview of possible refinements to return flow estimates for use in the Water Unavailability Methodology for the Sacramento-San Joaquin Delta (Delta) Watershed (Methodology) planned to be discussed at a public technical workshop on March 10, 2023.

Background

To account for additional supplies that may be available due to return flows, the Methodology presently scales back demands to account for return flows from reported diversions. The scaling is based on a return flow factor based on the ratios of return flows and diversions to meet surface water demands for the Sacramento and San Joaquin watersheds in CalSim3, a water resources planning model conventionally used to simulate operations in the Central Valley (baseline model used for pre-release in the Delta Conveyance Study). The State Water Resources Control Board (State Water Board) received public comments from representatives of water right holders and claimants that return flows in the Methodology may be over-estimated, and from others, that return flows may be under-estimated. Many of these comments called for an assessment of observed return flows to verify if they were produced in the same quantity and timing estimated in the Methodology. The U.S. Bureau of Reclamation (Reclamation) also commented that it retains the right to return flows from deliveries of water under the Sacramento River Settlement Contracts and that such return flows should be eliminated from the Methodology as a source of supply.

In order to address public comments, State Water Board staff are conducting further analysis of return flow characterizations and of return flows and other streamflow accretions observable with Delta Watershed streamflow gages. Staff are soliciting additional input on possible methods to address Reclamation's claim to control of its return flows.

Description of Return Flows

Return flows are those waters which return to surface water or groundwater after diversion or use. They can include the return of flows from agriculture, municipal and industrial uses and other human activities, or wetlands and other environmental land uses. The return flows can be diffuse or localized point sources. For example, they can flow from land or seep during conveyance, or they can be discharged to a river channel from wastewater effluent or an irrigation drainage outlet. Return flows are a type of river accretion to surface waters. As a general rule, they increase surface waters available for diversion where they return to the stream and re-distribute water availability. Return flows can return water to the river channel at a different time and place, and be of a different, often worse, quality, from when and where they were diverted or used.

Return flows have been challenging to quantify and to document. Return flow discharges are not generally required to be measured and reported in California although in some cases they may be estimated from other reported information. Measured discharges from wastewater effluent and irrigation runoff to drainage outlets in the Central Valley are neither widely available nor are they a comprehensive return flow characterization. Water budget estimations are the common means of characterizing return flows. Estimations are by place of use or point of discharge. For irrigation, for example, water budget estimations are often a simplified water balance of applied water (inflow versus outflow) or apportioning irrigation efficiencies. This presented return flows work done by

State Water Board staff leverages publicly available measurement information, and the insights garnered from previous return flow work, for specific insight to understand what actual return flows were in recent drought conditions, and how the water budget estimations of CalSim3 return flows implemented into the Methodology compare, and could be adjusted, based on measured information, to best characterize return flows in the Methodology, and potentially other modeling platforms, in the future.

Possible Refinements to Return Flow Estimates Based on Observed Return Flows

In response to comments on the current Methodology's treatment of return flows, State Water Board staff are developing a method for estimating historical return flows, including in 2021 and 2022, based on publicly available records of gaged flow measurements. This method calculates net accretions between active gaging stations, or in other words, the flow of a river or stream measured at a downstream gage in excess of the flow measured at the river's upstream gages. For example, if upstream flow gages from upstream tributaries A1 and A2 measure 100 and 50 cubic feet per second (cfs), and downstream gaging station B measures 160 cfs, accretions at river gage B are estimated to be 10 cfs. This method of calculating accretions adjusts to the gaged network as flow gages are added to or removed from watersheds and considers measured discharges from drainage outlets returning flows to streams. Calculations occur at 15-minute, daily, and monthly aggregations. The proportion of gaged flow that is return flow and other accretions is also tracked as water travels downstream. To isolate return flows from other accretions, accretions that could be attributed to sources other than return flow, like the landscape's distribution of precipitation, or storage withdrawals, are filtered from the calculation of measured accretions. Staff are applying this method to provide a rough estimation of return flows and other accretions using measured data in the Delta Watershed for the past 20 years in order to understand return flows during last summer as well as under a range of recent conditions. These estimated return flows are then compared with the return flow estimates used in the Methodology. Results from this analysis, including the estimations of historically observed return flows and other accretions and the comparison of these estimations with the return flows estimated in the Methodology, will be presented in the Workshop.

Future refinements to the Methodology's estimation of return flows are being considered based on the historical 20-year record of observed return flows and other accretions that is being developed and its comparison with the Methodology's estimation of return flows as well as return flow characterizations in other modeling platforms. With the time series of historical return flows being developed here, relationships between return flows, storage withdrawals, and unimpaired flows are being identified that could be applied to characterize future return flows for the Methodology and other water supply models. Staff is interested in technical input into this approach or any other possible future options for refining return flow estimates.