

appendix **M**

Potential Effects of the WFP on Delta TDS

C-090104

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APPENDIX M

Modeling Approach and Assumptions

The Fischer Delta Model (FDM) was used to simulate the potential effects of the WFP on Delta TDS concentrations at various Delta locations. The PROSIM simulations conducted for the DEIR provided hydrologic input to the FDM on a monthly time-step. The PROSIM modeling simulation defining existing hydrologic conditions (henceforth referred to as the Base Condition) and the simulation depicting the WFP imposed on existing conditions (Base + WFP) were used as hydrologic input to the FDM. Delta water quality was then modeled for the 70-year hydrologic period of record (1922-1991) by combining results from the FDM with current (measured) and projected future TDS concentrations for the Sacramento and American rivers. The FDM simulations provided estimates of the fraction of the flow from each major water source (e.g., Sacramento River, San Joaquin River, Ocean intrusion, etc.) to the interior Delta at three different "receptor locations" within the Delta (i.e., Rock Slough, Old River at the Los Vaqueros intake, and adjacent to the inlet to Clifton Court Forebay).

Two FDM simulations were performed, including: 1) the Base Condition, which utilized the hydrologic flows at FDM model boundaries under conditions of current hydrology and existing CVP operating rules; and 2) the Base + WFP condition, which simulated hydrologic conditions that would occur if the WFP were fully implemented today.

It is important to note that a number of key assumptions were made in performing the FDM simulations, including the following:

- 1) The quantity of agricultural return flow is determined by PROSIM on a monthly basis, with the monthly flow divided among eighty-nine locations according to a fixed formula;
- 2) No temporally varying south Delta barriers were "installed" in either of the FDM simulations;
- 3) The Delta Cross Channel was operated according to the schedule provided as part of the PROSIM model input to the FDM;
- 4) A 19-year mean tide was used to simulate tidal influences at the downstream, Bay boundary of the FDM.

The contribution of the Sacramento River to the TDS at three interior Delta locations (Rock Slough, Old River, and Clifton Court Forebay) was then determined. This was done by multiplying the flow fractions calculated by the FDM with current (measured) and future (estimated) values of TDS for the Sacramento River, the American River, and for two wastewater discharges (the Roseville Wastewater Treatment Plant and the Sacramento Regional Wastewater Treatment Plant (SRWTP)). The region to be supplied with the additional water diverted under the WFP is, for the most part, the service area of the SRWTP. Exceptions include: 1) El Dorado County and Irrigation District; and 2) City of Roseville. Of these two exceptions, Roseville's

future wastewater discharges were accounted for in this modeling effort. Conversely, wastewater discharges by the El Dorado Irrigation District are sufficiently small that specifically accounting for them in this modeling effort was not warranted.

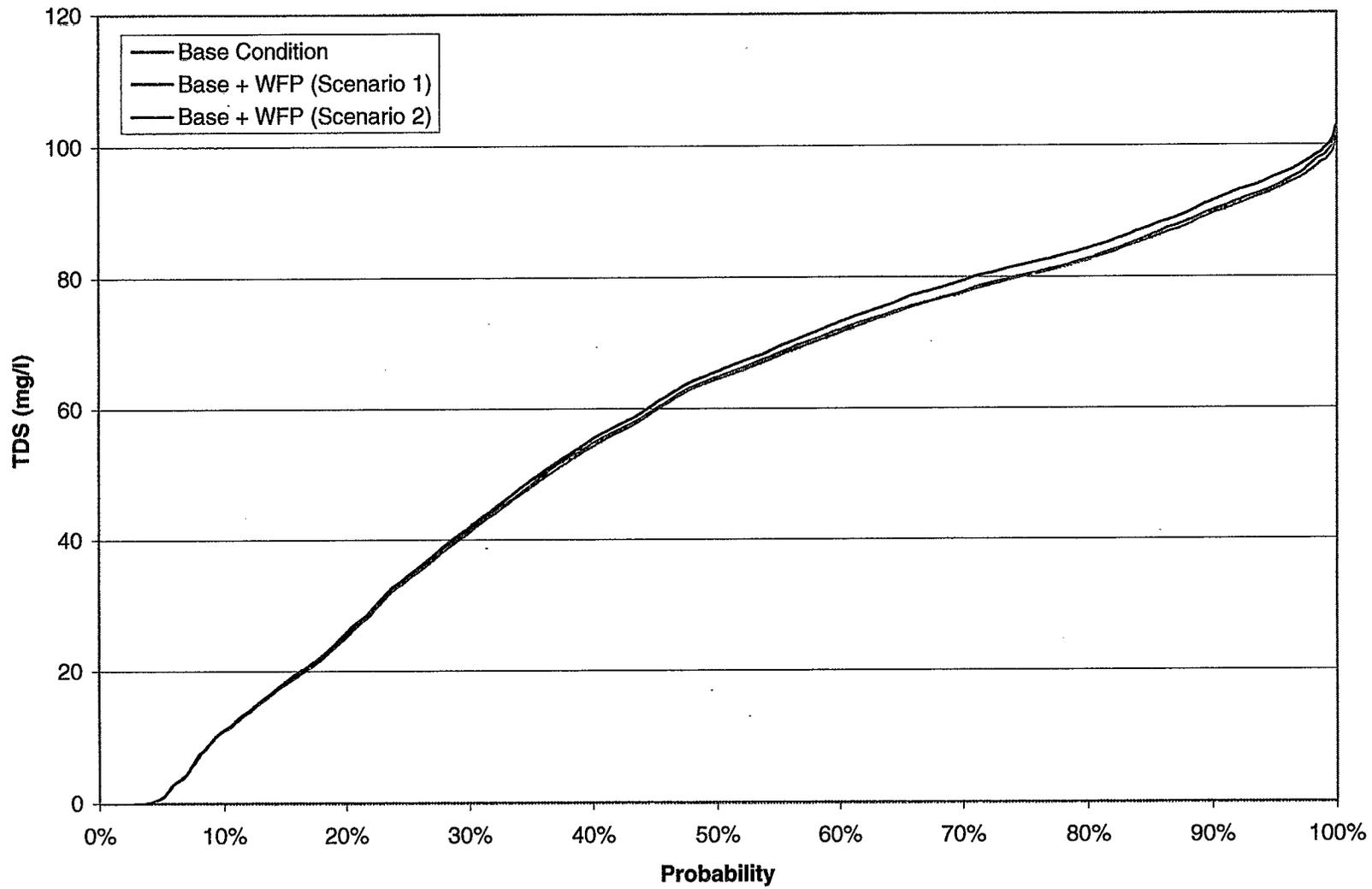
The three water quality simulations performed, based on output from the FDM, are defined below.

- 1) Base Condition: This simulation used the FDM flow fractions calculated using current hydrology and CVP operating criteria, and recent measured values of TDS in the rivers and wastewater flows.
- 2) Base + WFP ("Scenario 1"): Utilized the Base + WFP hydrology, current CVP operating criteria, and assumed that there would be no net increase in the total TDS load discharged from the SRWTP, as a result of future treatment upgrades). This was done by assuming that the concentration of TDS in the SRWTP effluent would decrease in proportion to the projected increase in wastewater flow so that the TDS "load" from the SRWTP would be the same as it is now. The load for the Roseville WWTP was allowed to increase, based on future projected effluent TDS and flow levels, because upgrades to decrease TDS levels for this plant are not anticipated in the future.
- 3) Base + WFP ("Scenario 2"): This simulation used the FDM flow fractions calculated using the Base + WFP hydrology, current CVP operating criteria, and projected TDS concentrations. It also assumed that the SRWTP effluent water quality (i.e., TDS) would be approximately the same in the future as it is now (i.e., no upgrade in the treatment process).

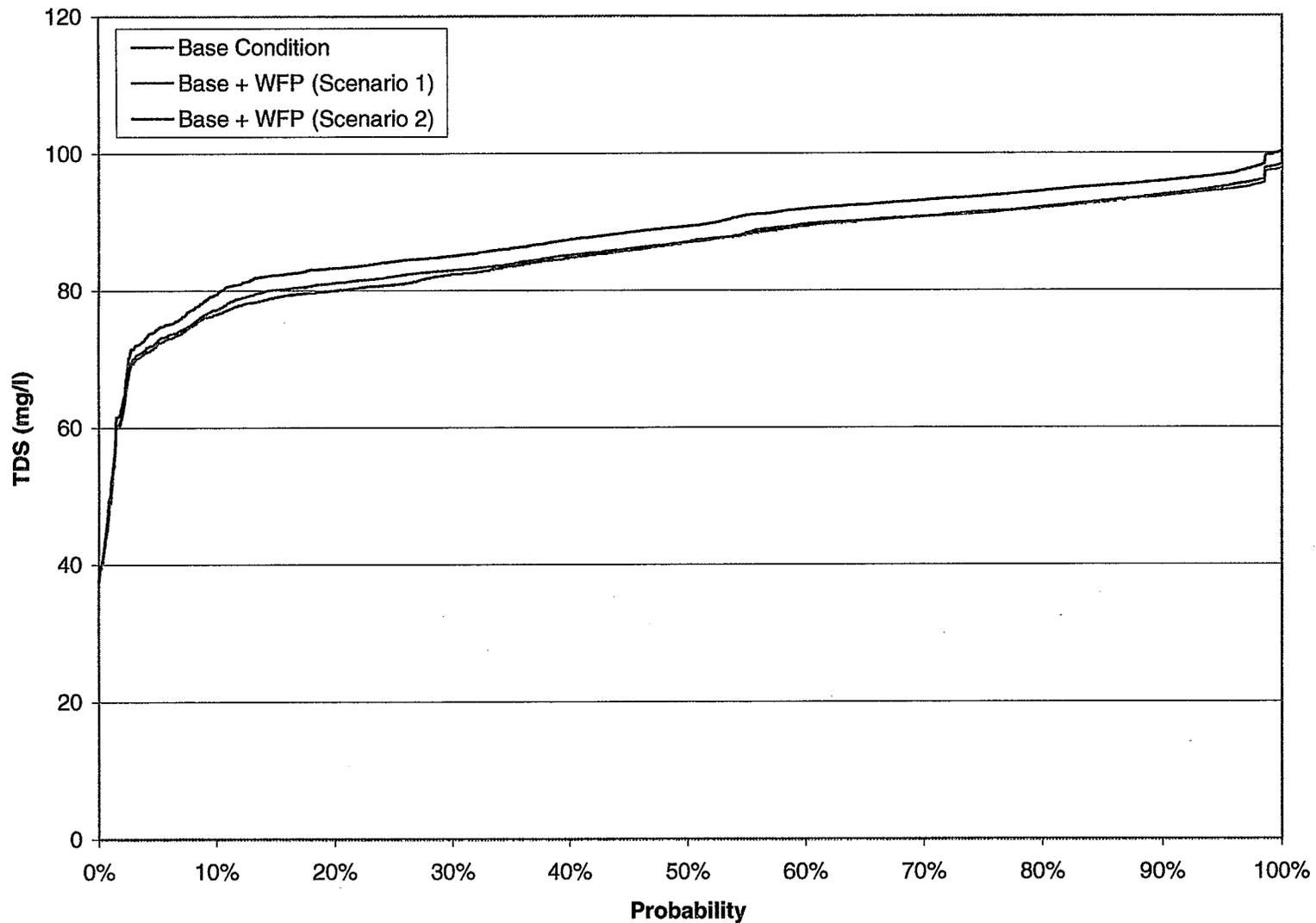
The contribution of the Sacramento River to water quality at each of the three receptor locations was estimated by assuming that TDS would mix conservatively (i.e., that no chemical or biological transformations or physical losses of TDS would occur as Sacramento River water mixed with water from other sources within the Delta). For each of the three water quality simulations performed, the cumulative probability distribution for the TDS at each of the three interior Delta locations (Rock Slough, Old River, and Clifton Court Forebay) was calculated for each calendar month.

Based on the three modeling simulations performed, the hydrologic or flow effects of the WFP on the Sacramento River's contribution to Delta TDS levels at the three locations modeled can be approximated by comparing the cumulative probability distributions for the Base Condition to those calculated for the Base + WFP ("Scenario 1"). In addition, the overall effect of the WFP, that is effects due to both hydrology and potential increases in TDS loading from the SRWTP and Roseville WWTP, can be approximated by comparing the Base Condition to the Base + WFP ("Scenario 2").

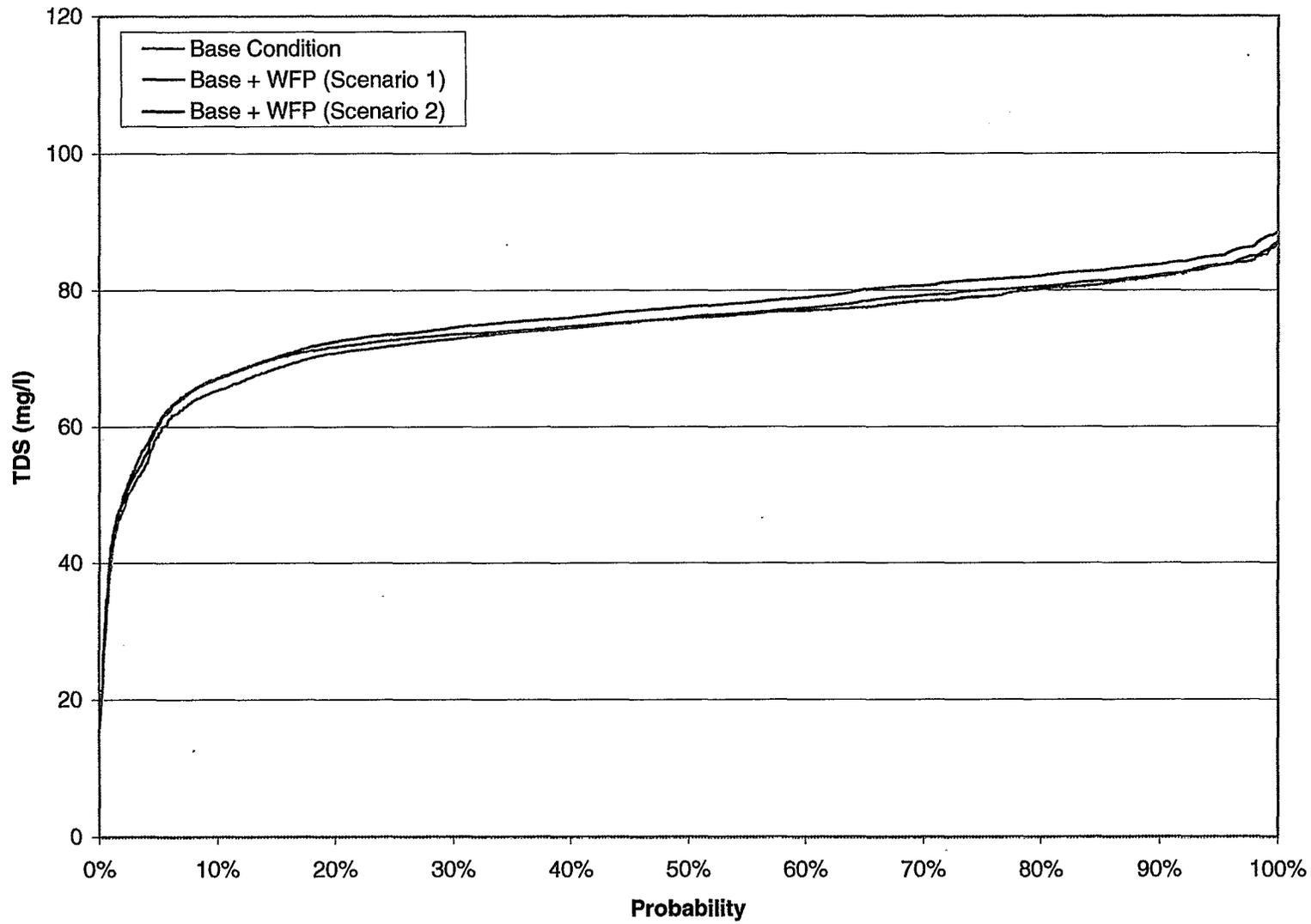
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River - Annual



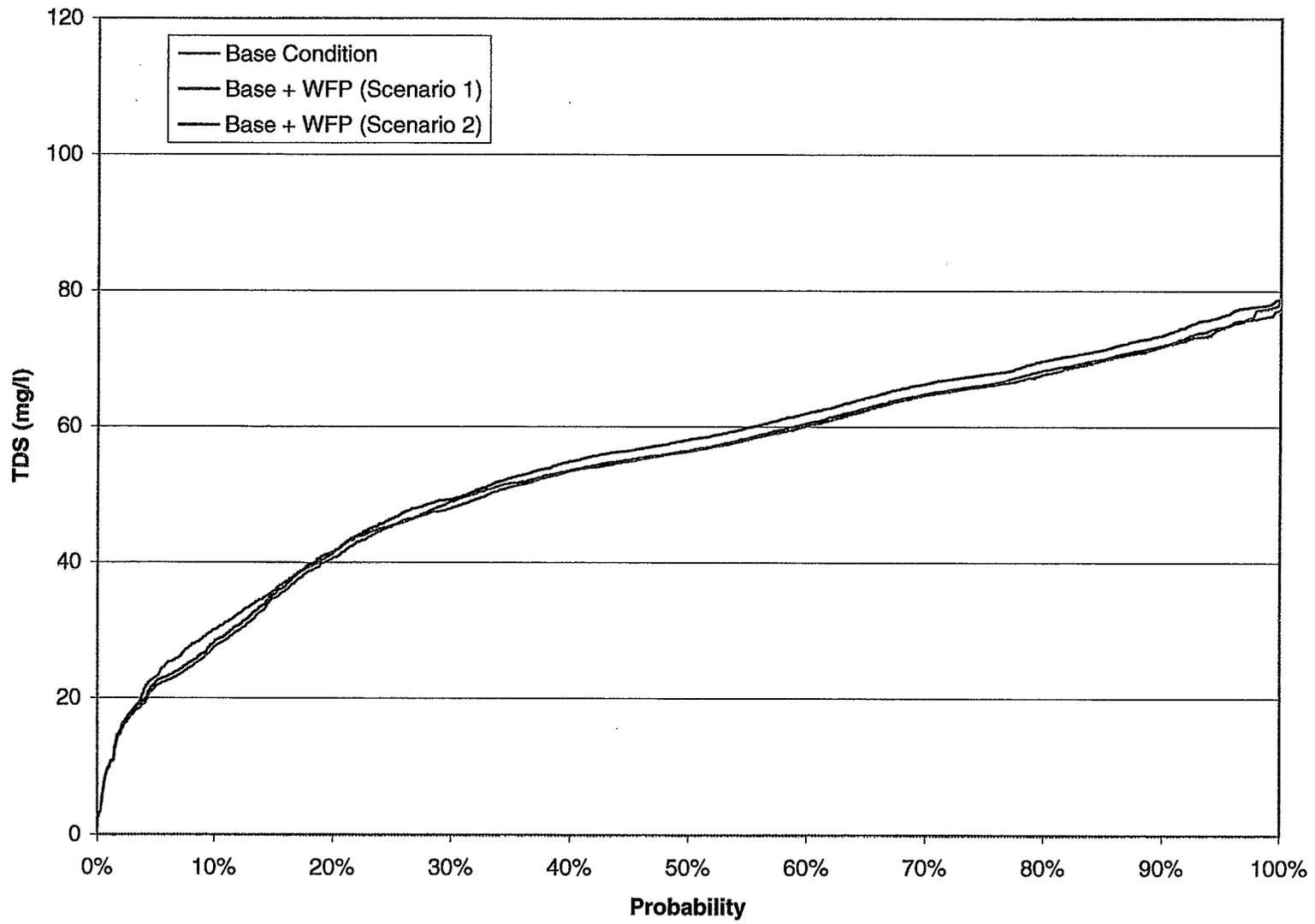
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River - September



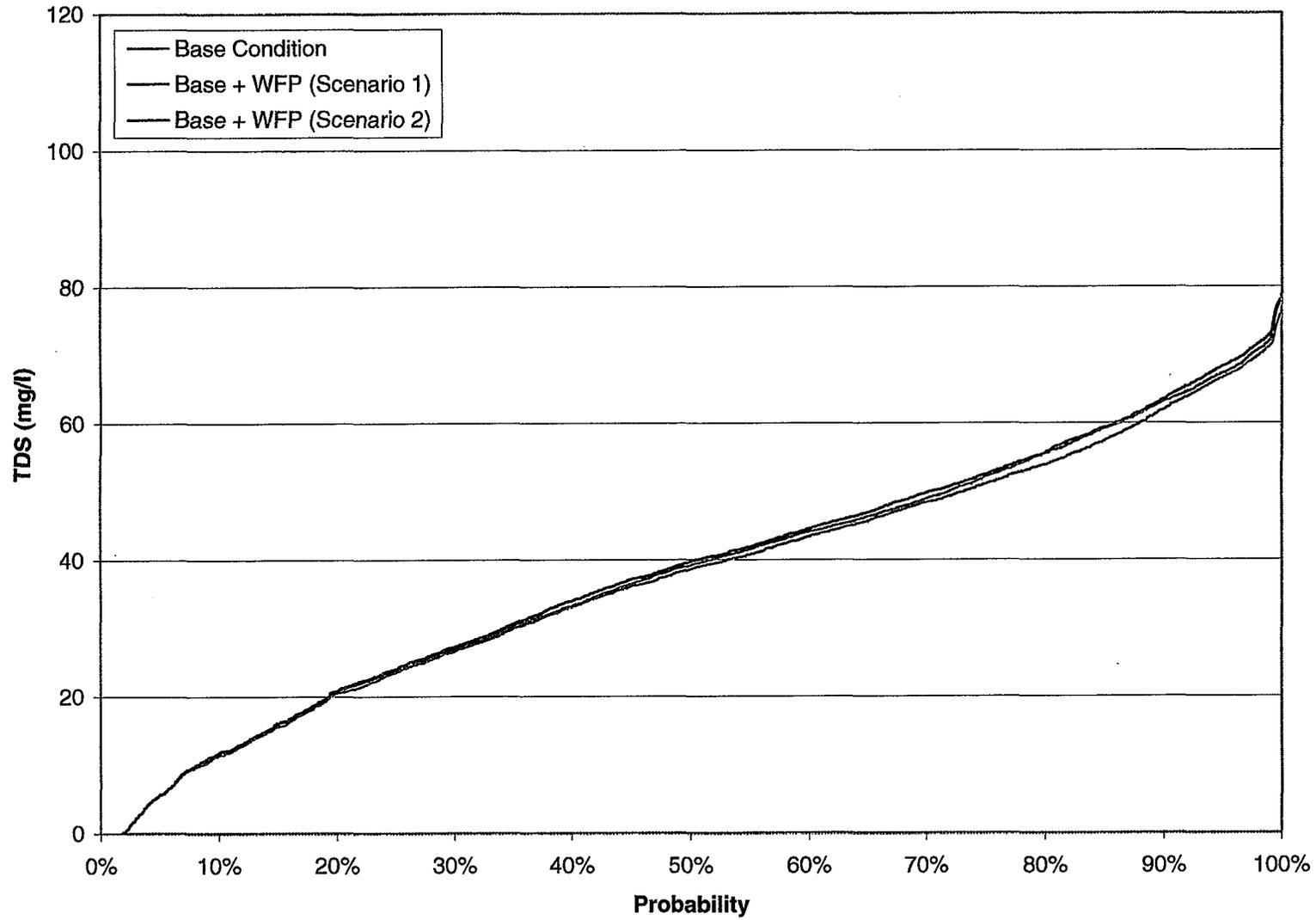
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River - August



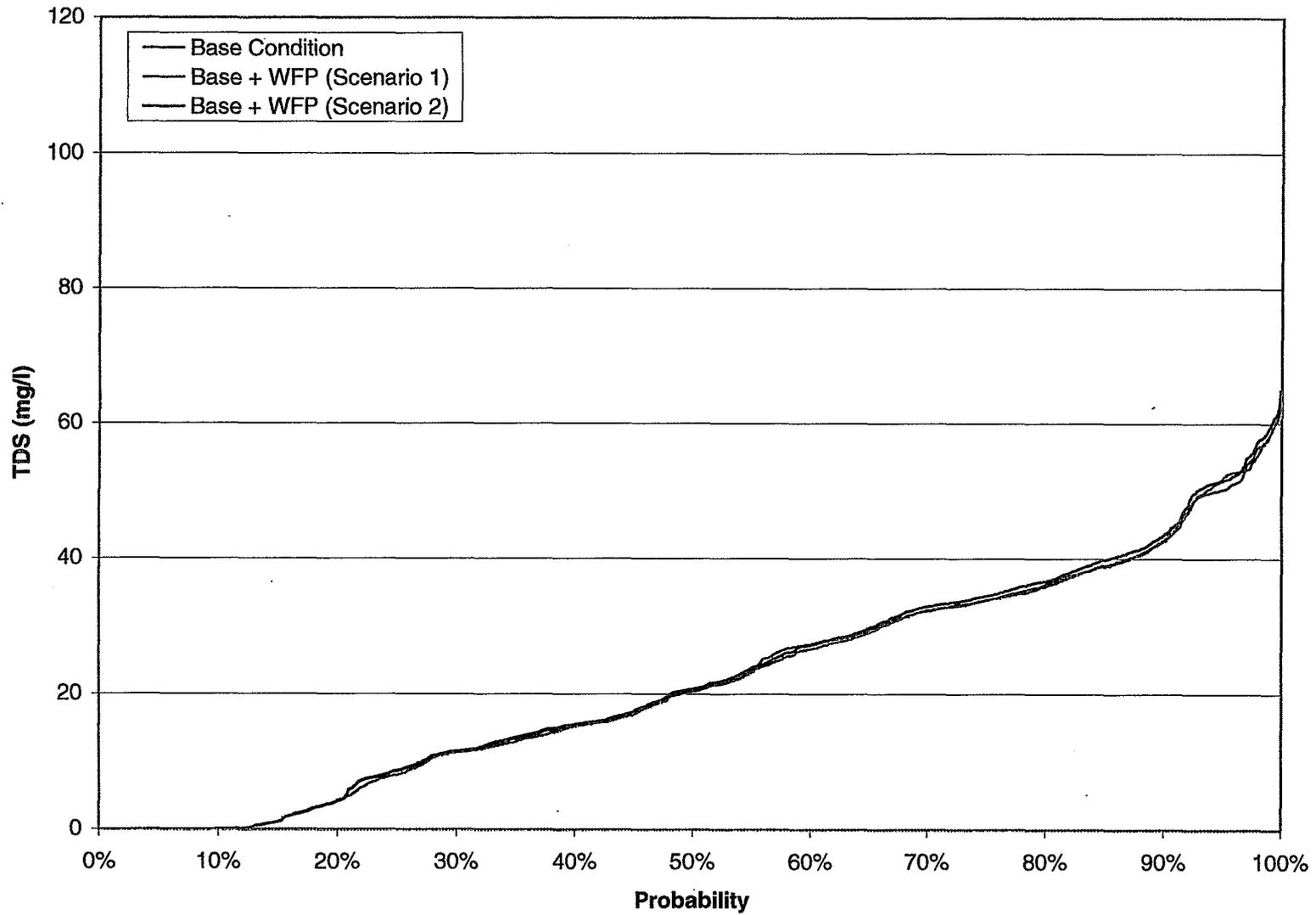
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River - July



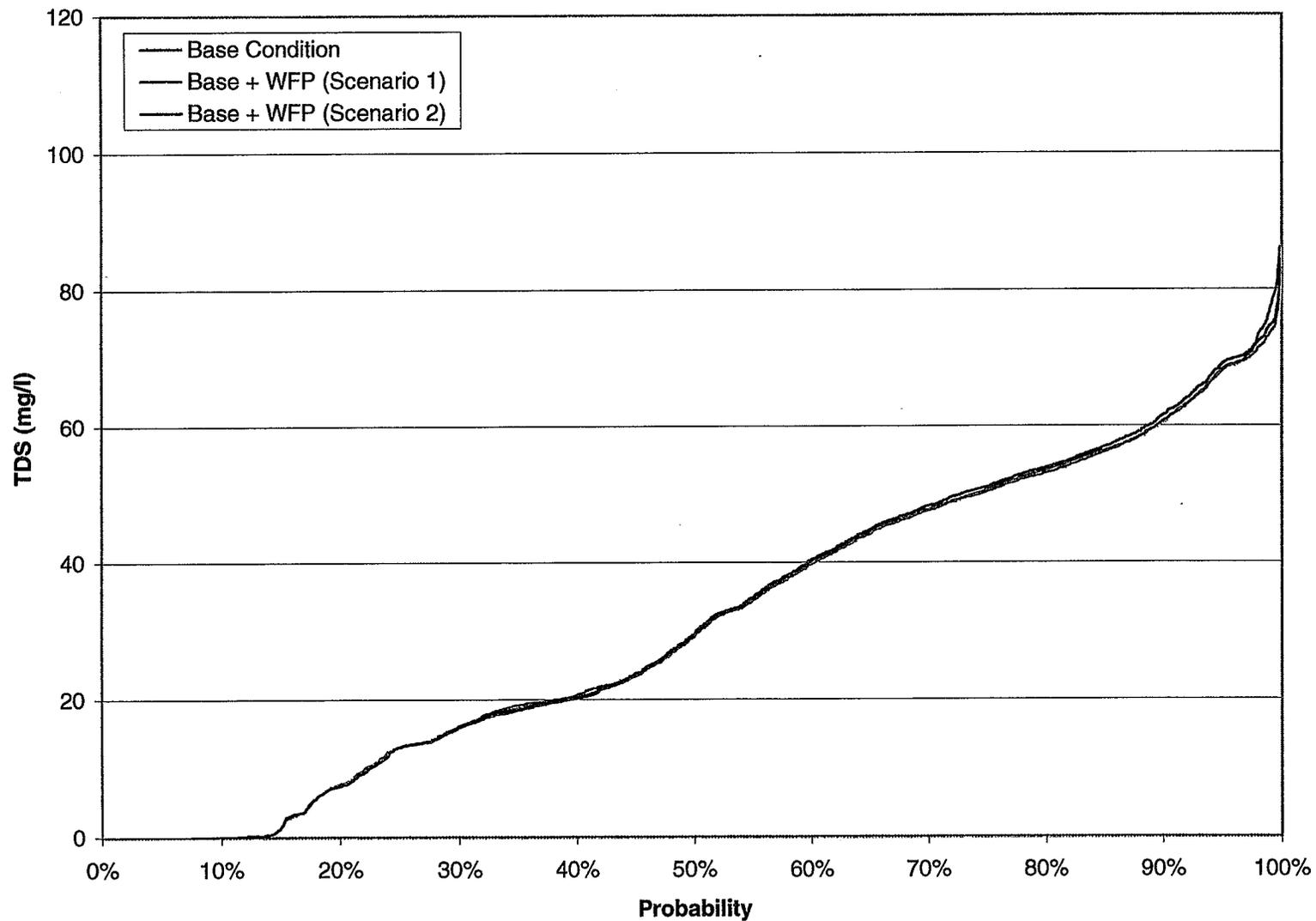
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River - June



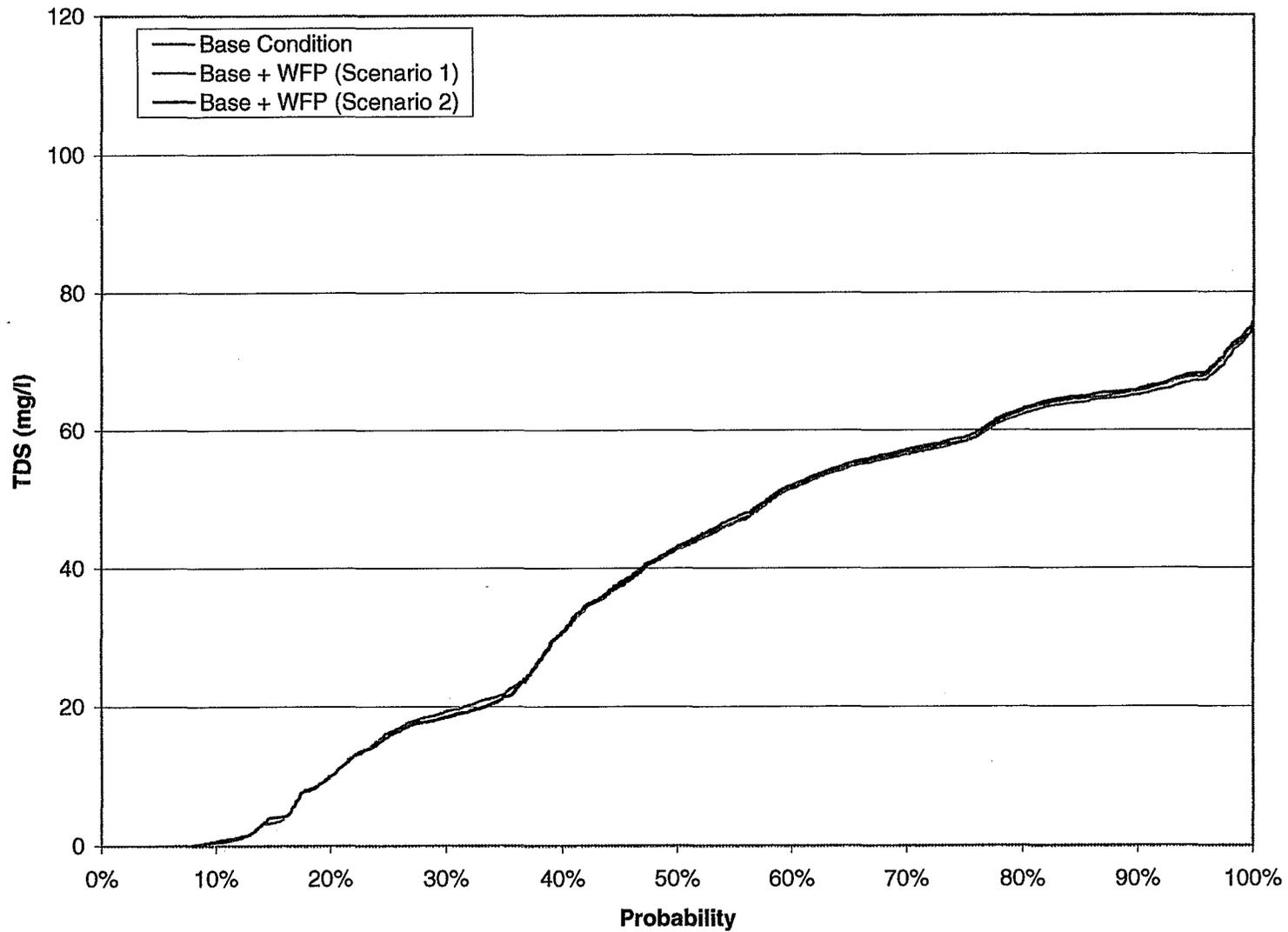
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River - May



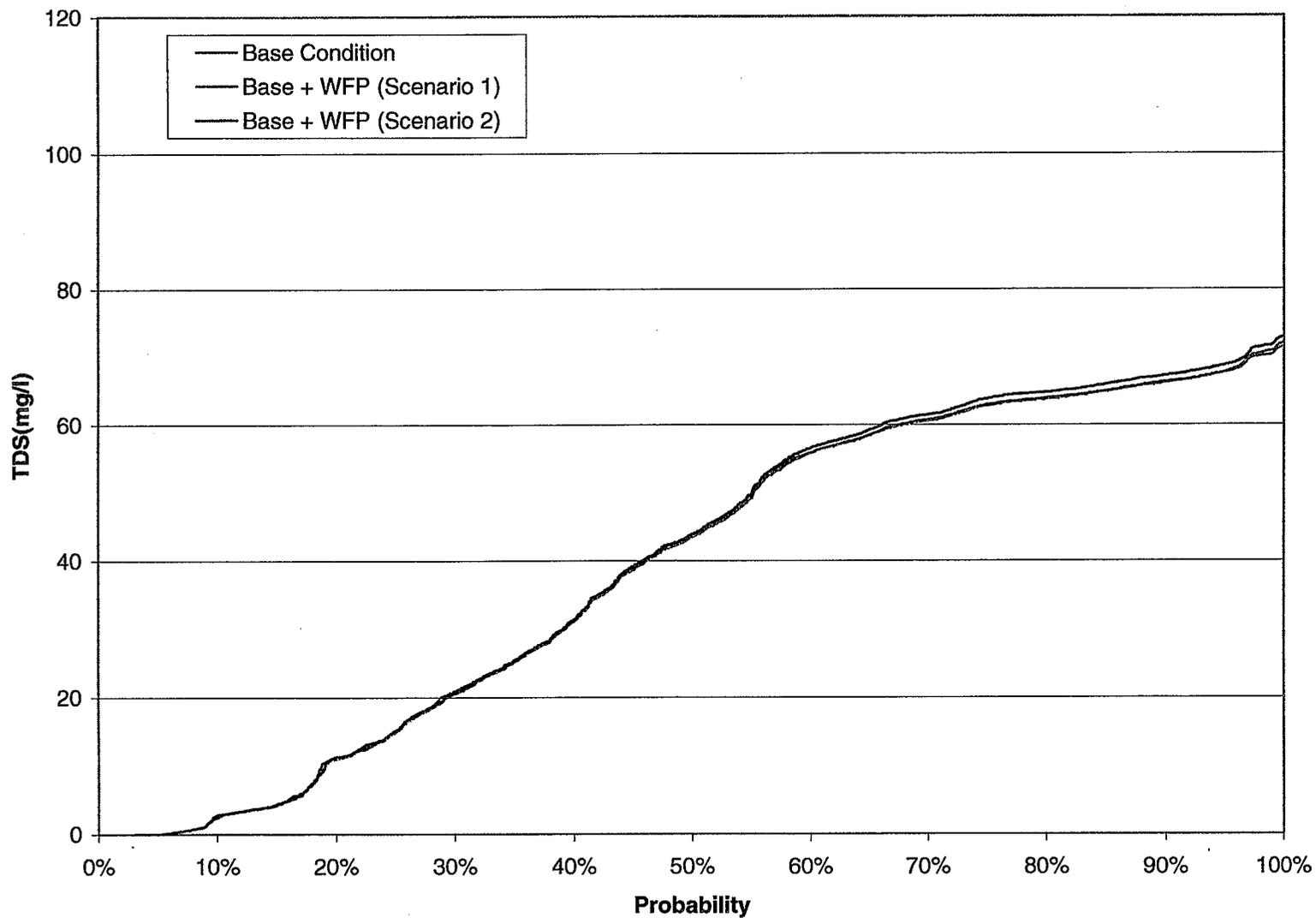
Probability distribution of salinity at Clifton Court Forebay contributed and Sacramento River-- April



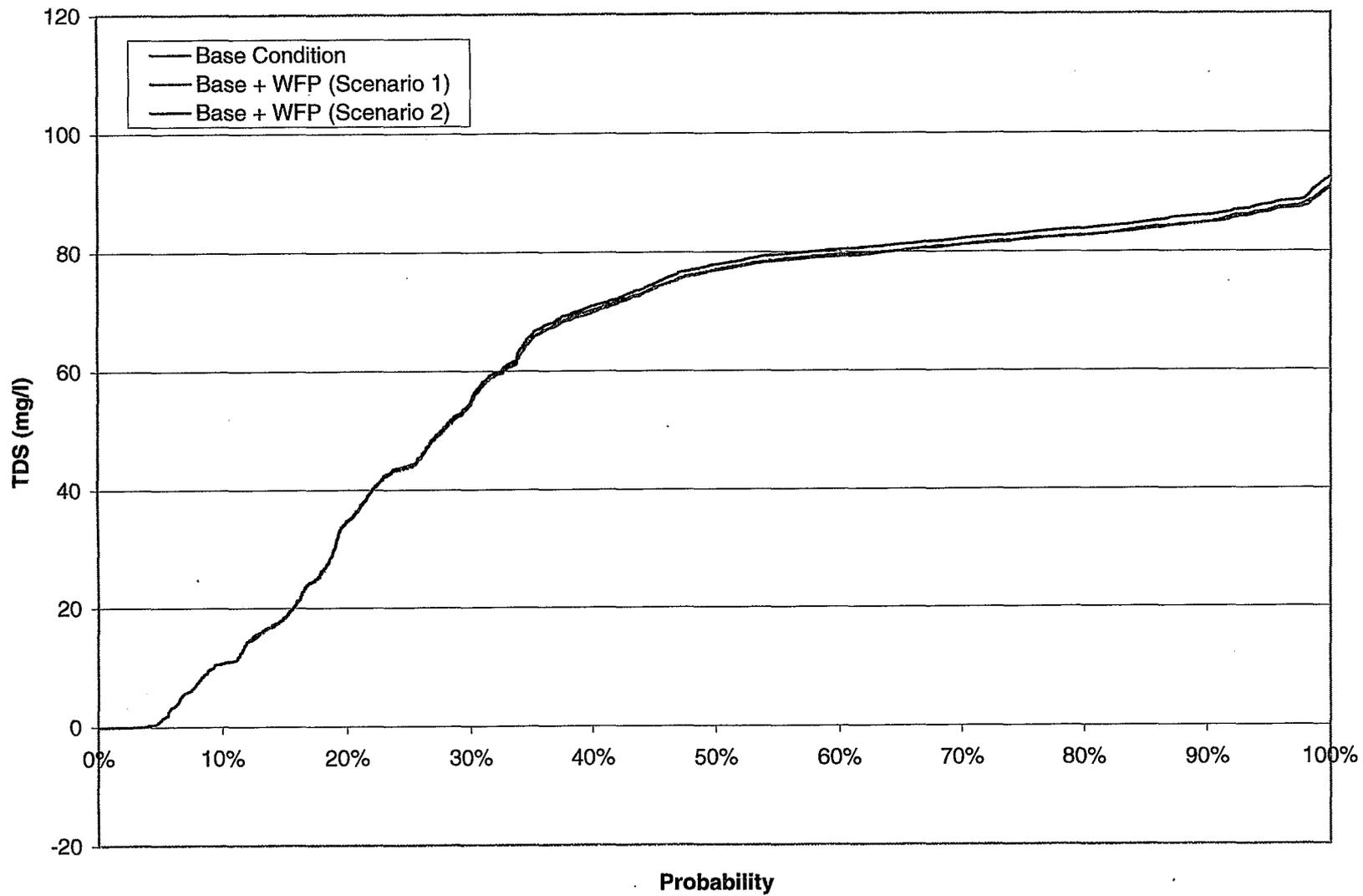
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River- March



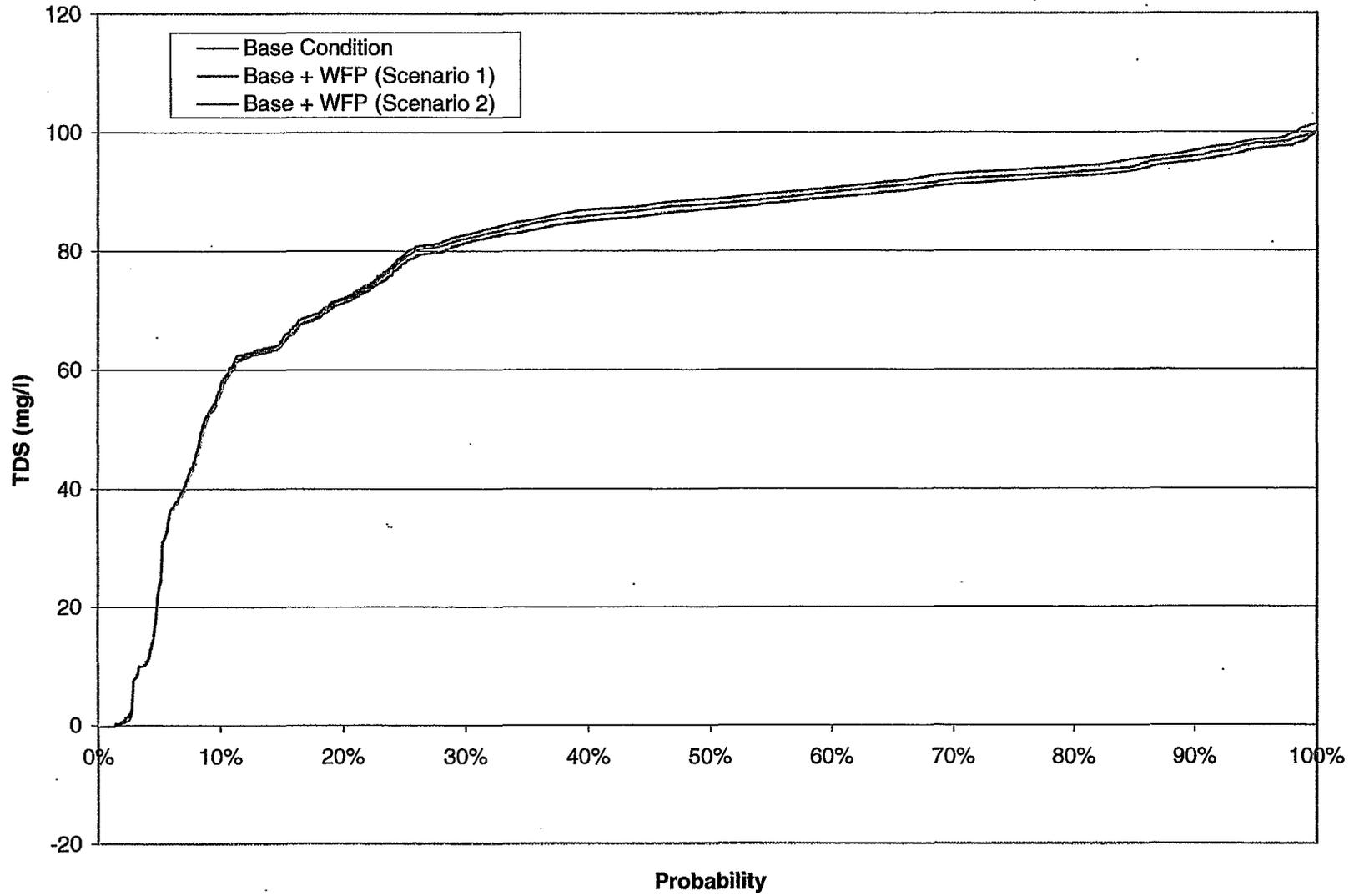
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River - February



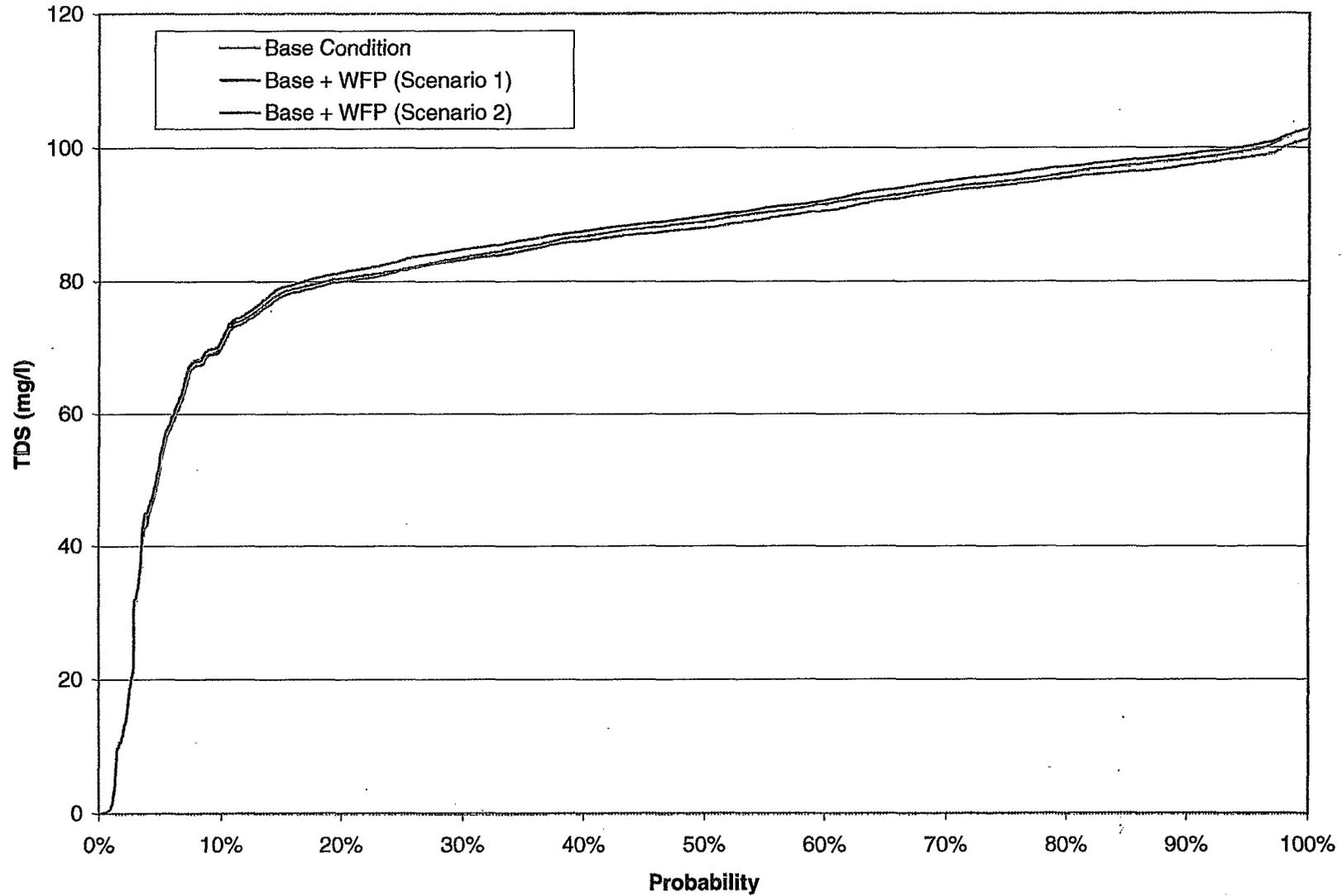
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River - January



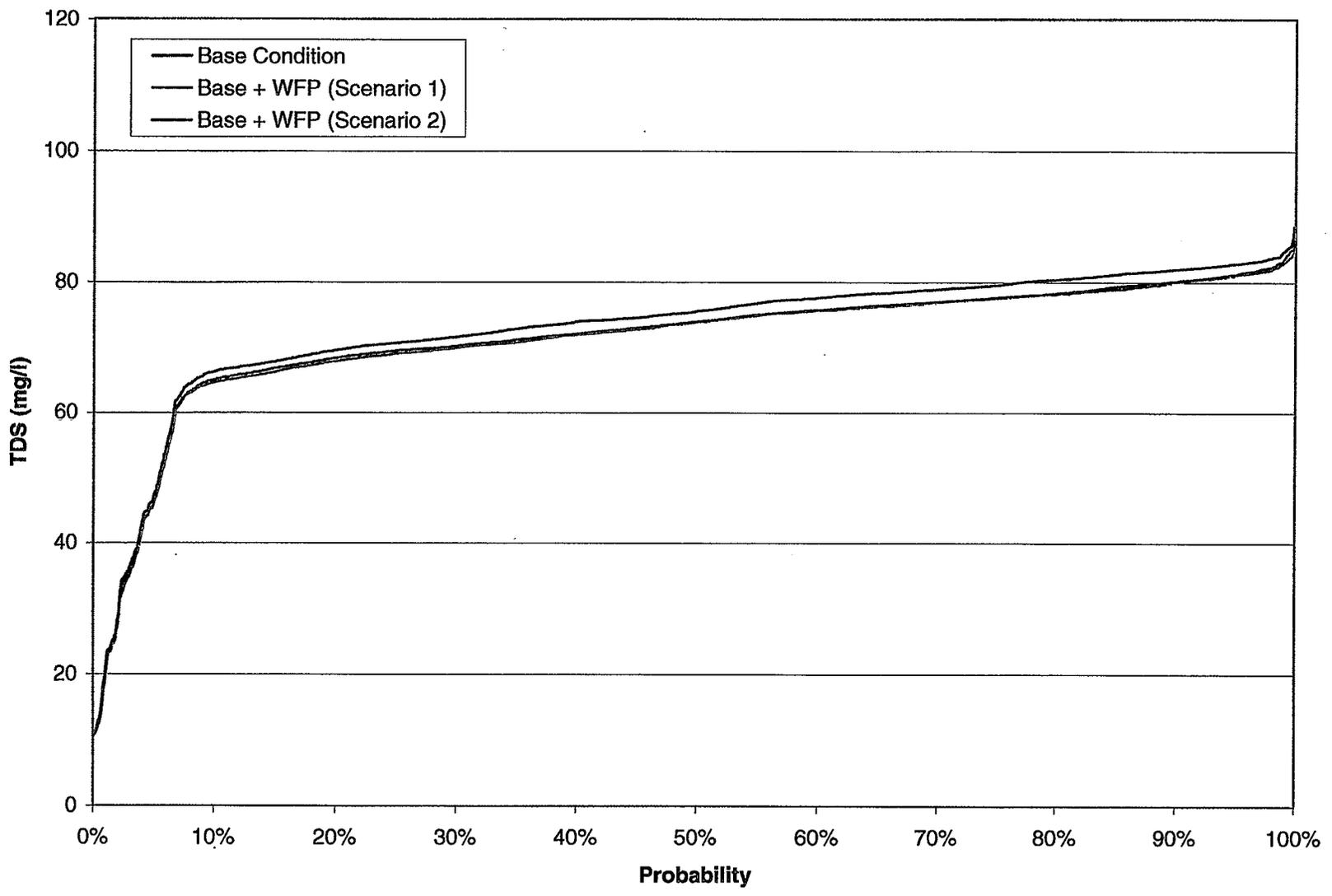
Probability distribuion of salinity at Clifton Court Forebay contributed by Sacramento River - December



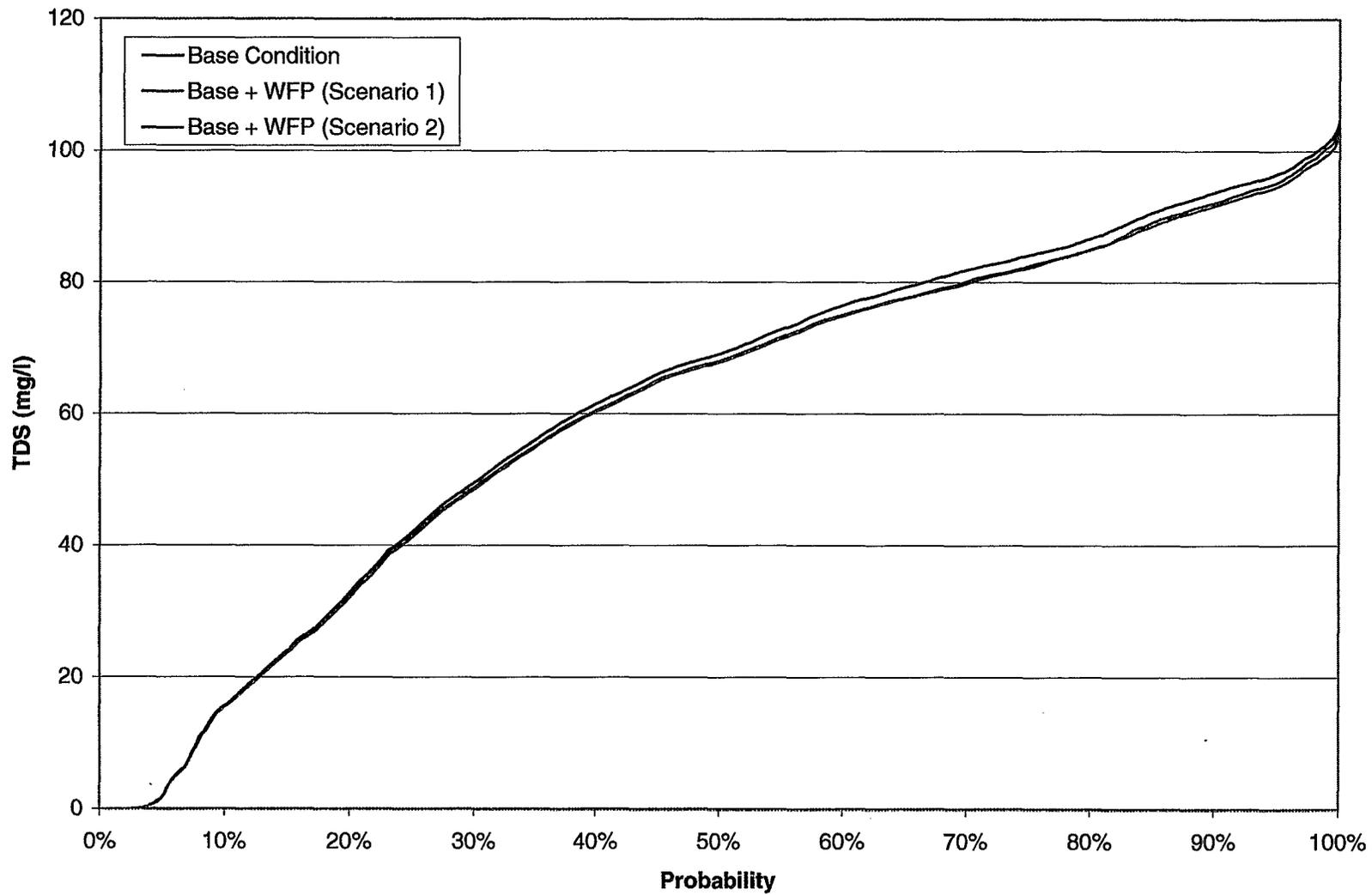
Probability distribution of salinity at Clifton Court Forebay Intake contributed by Sacramento River - November



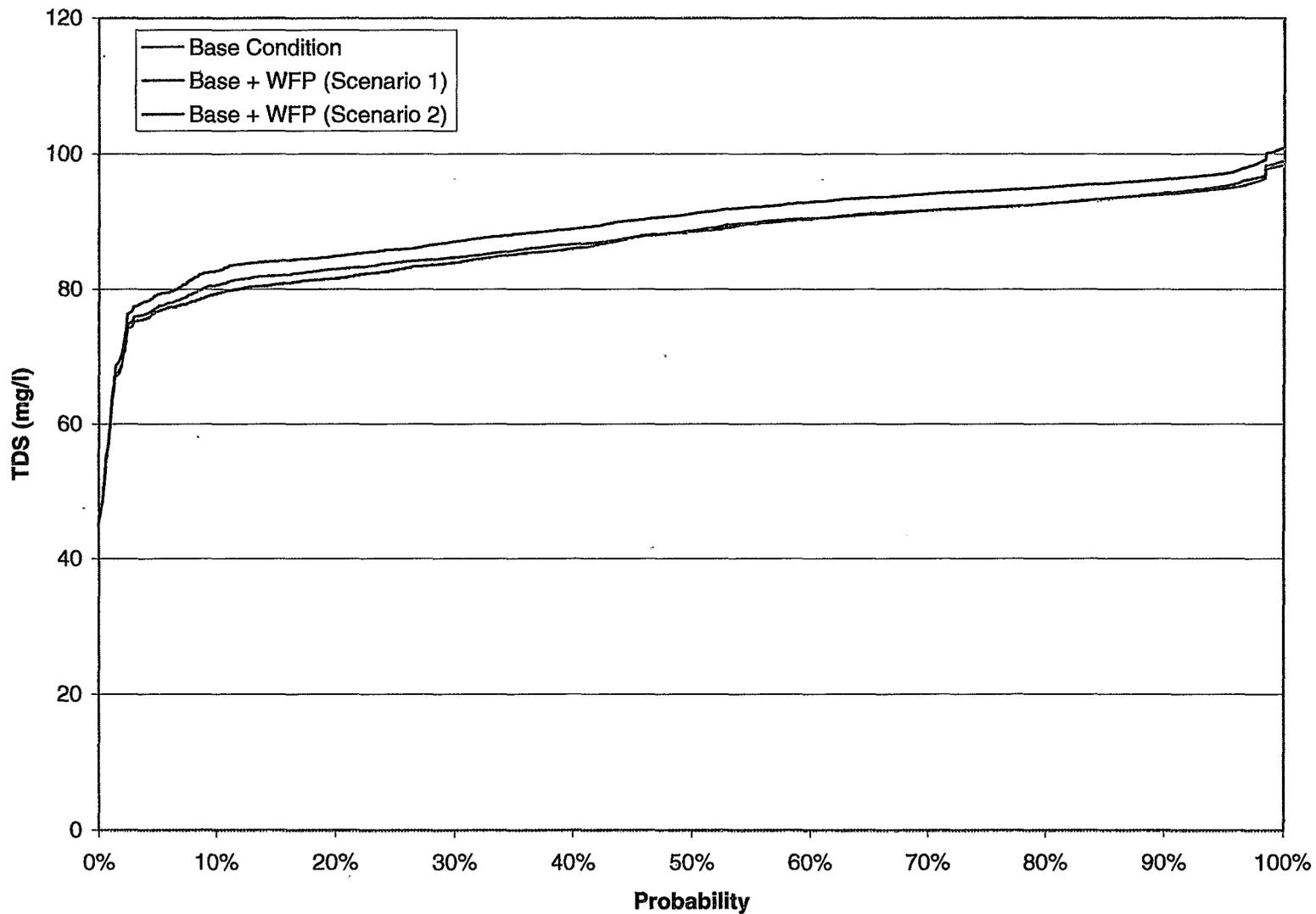
Probability distribution of salinity at Clifton Court Forebay contributed by Sacramento River - October



Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - Annual

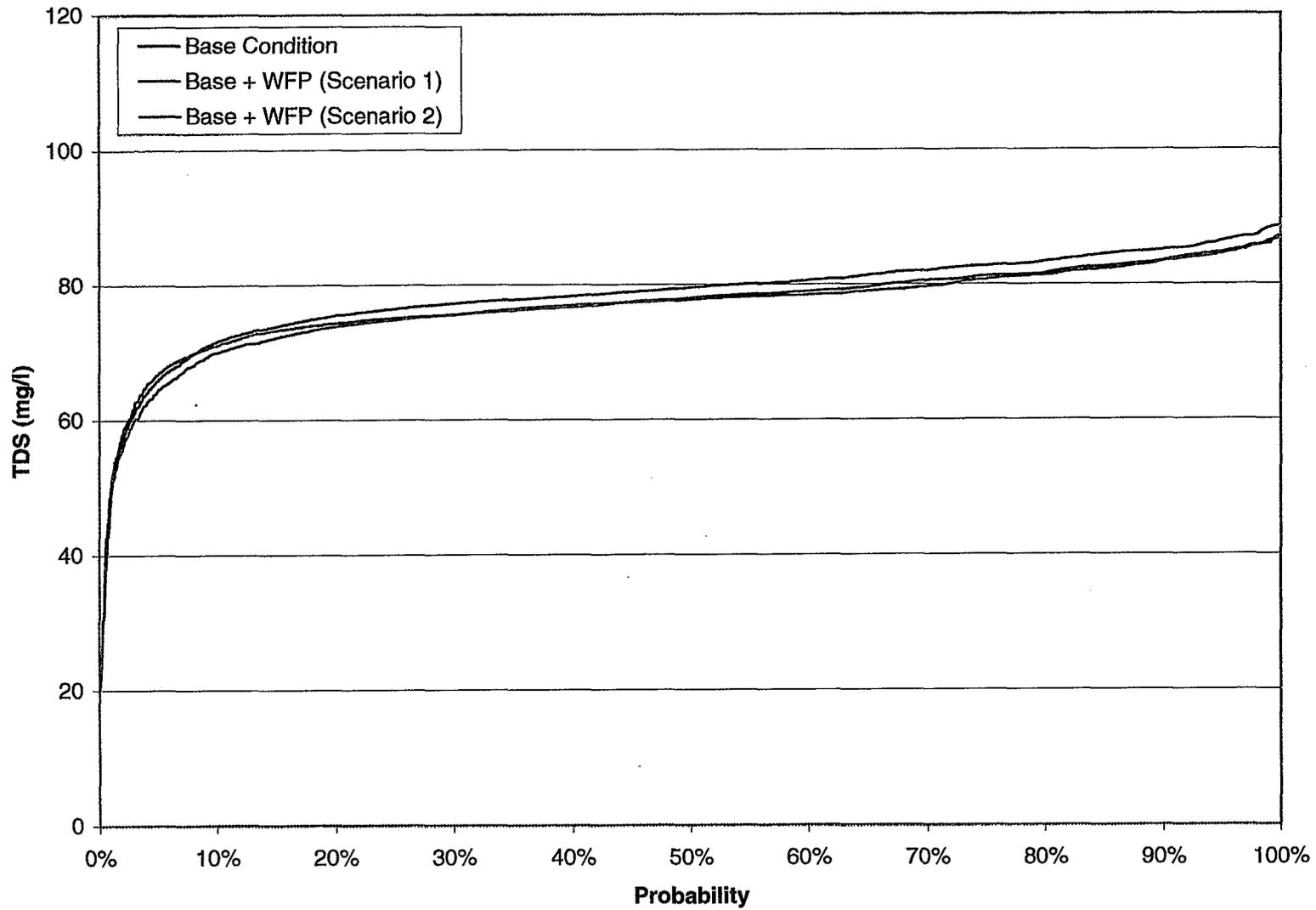


Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - September

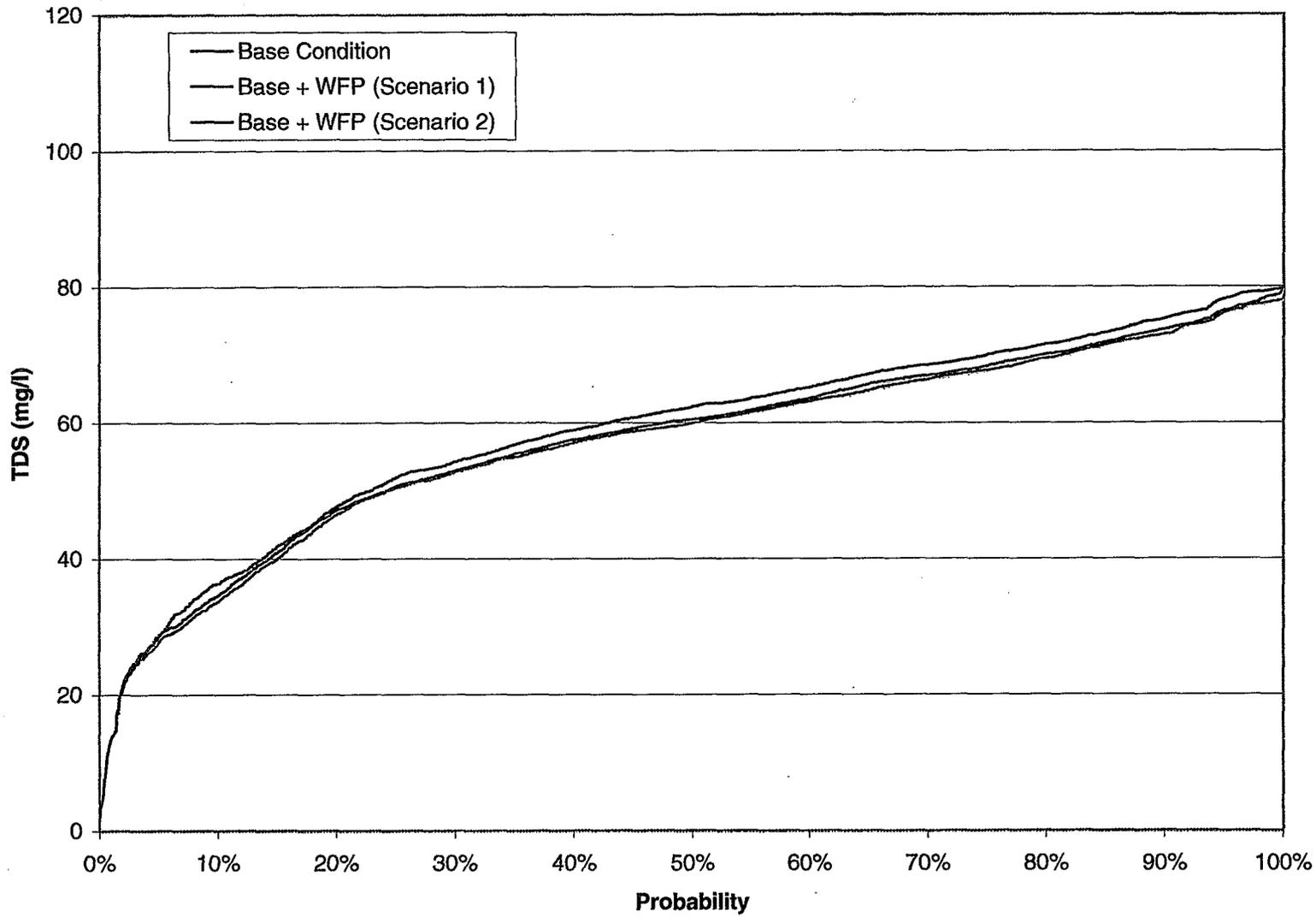


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Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - August

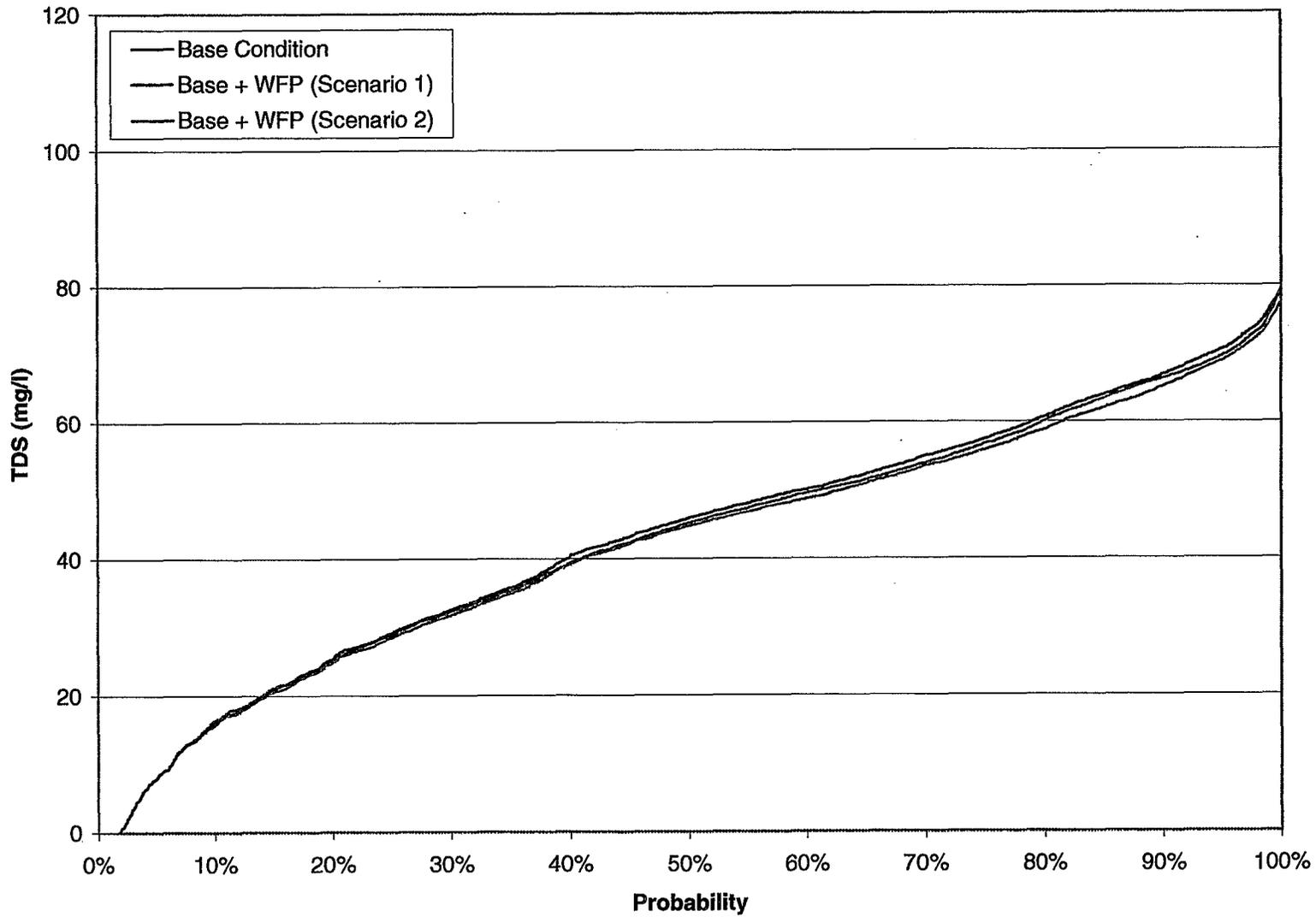


Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - July

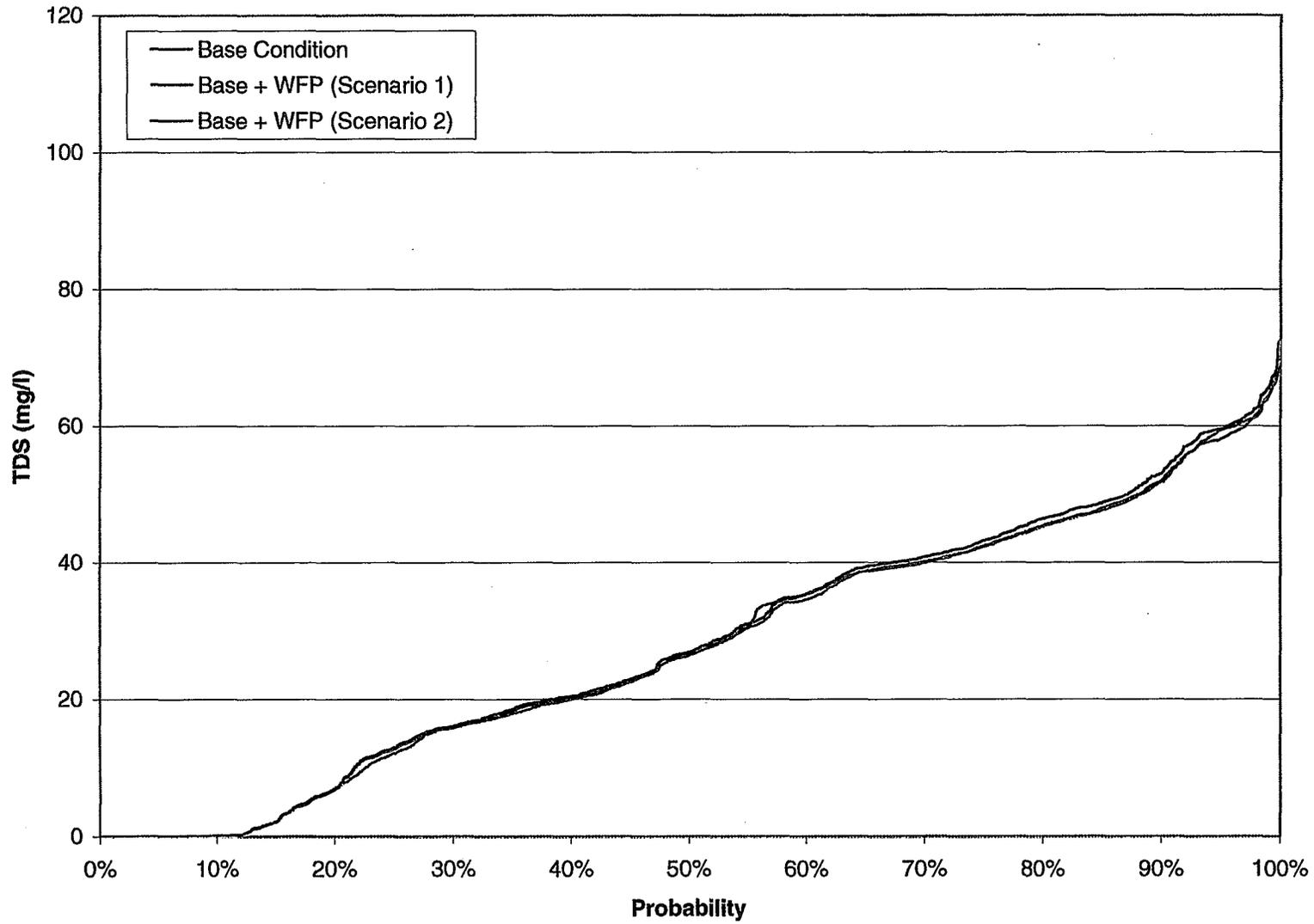


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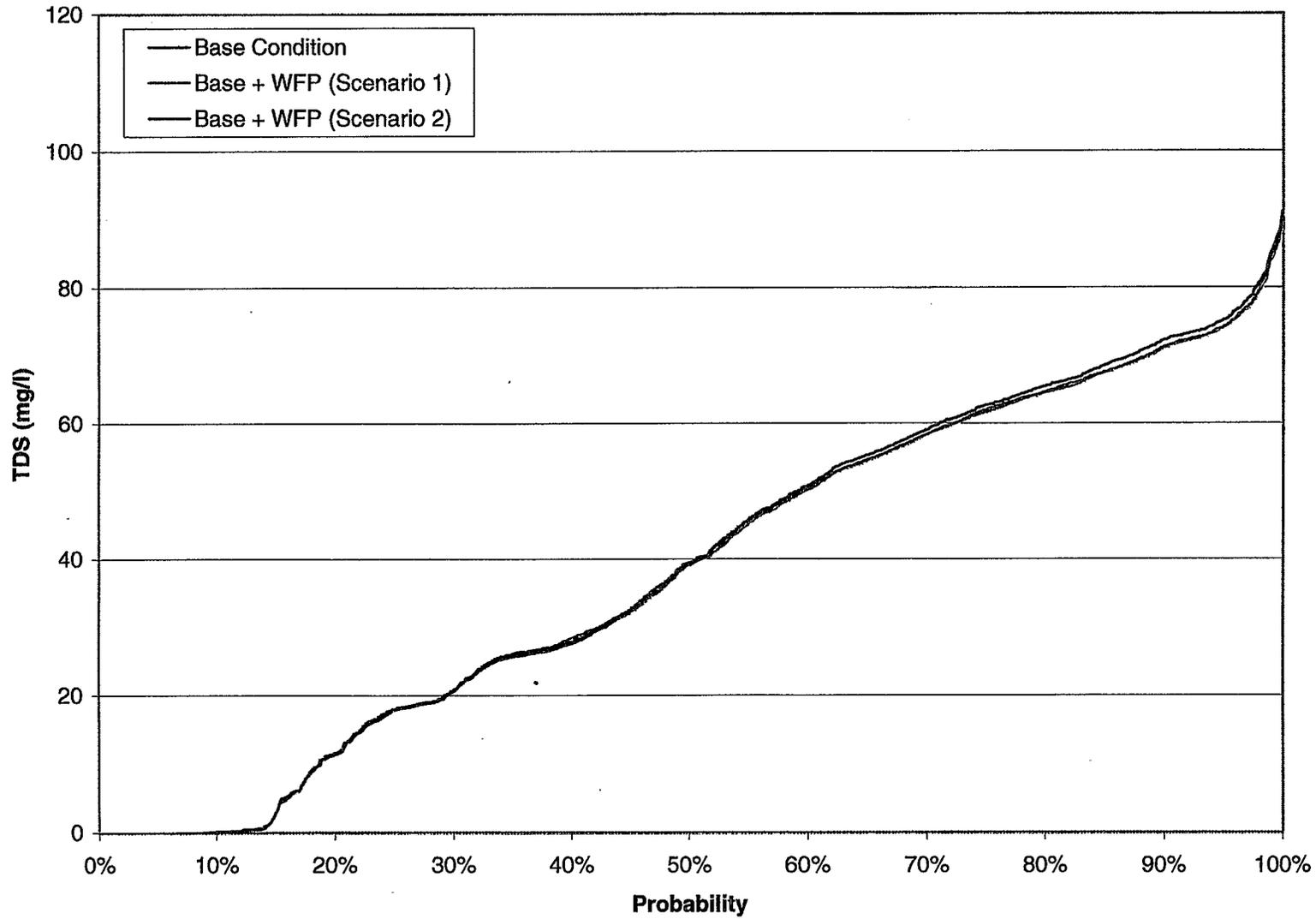
Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - June



Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - May

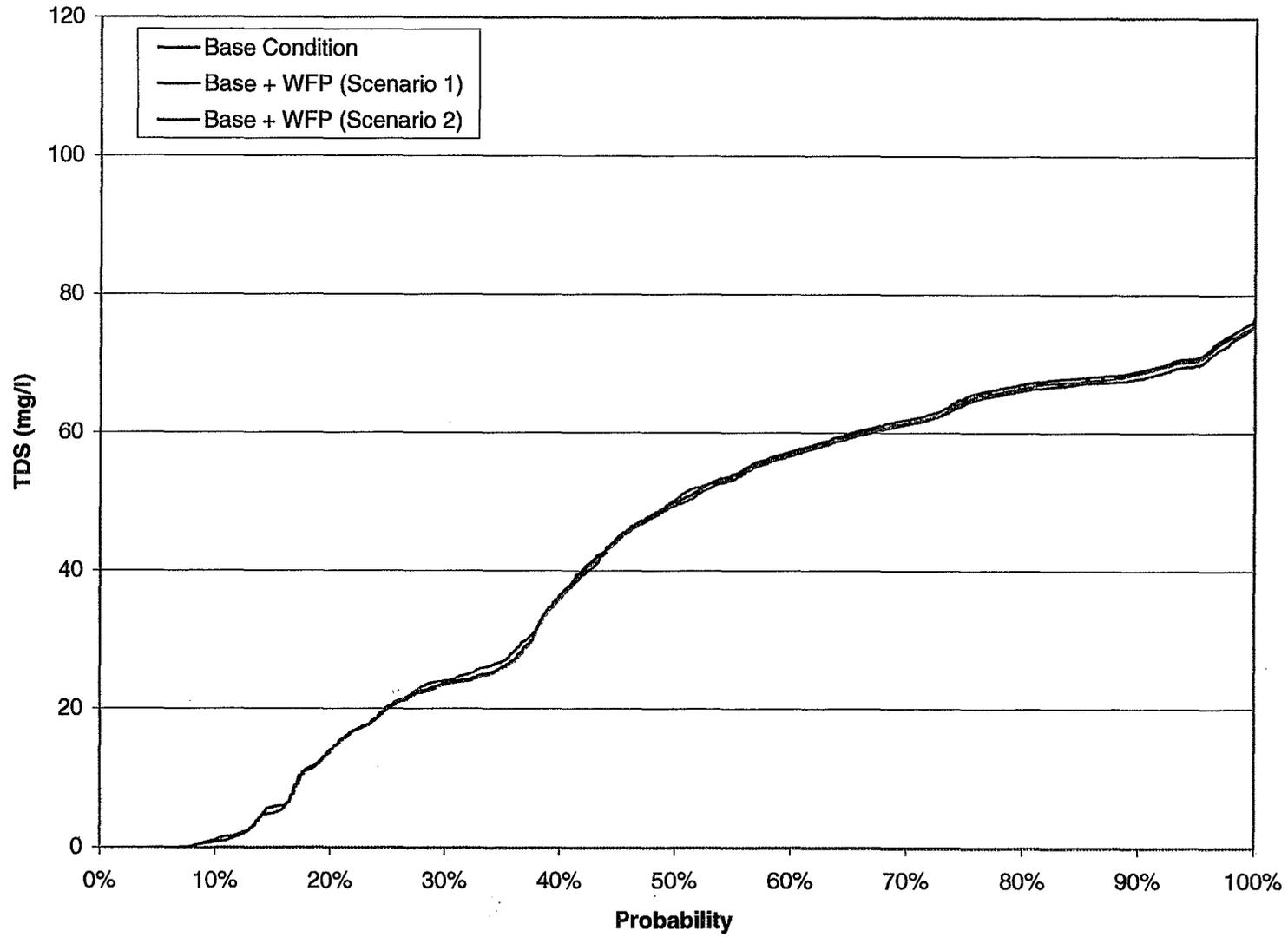


Probability distribution of salinity at Los Vaqueros Intake contributed and Sacramento River-- April



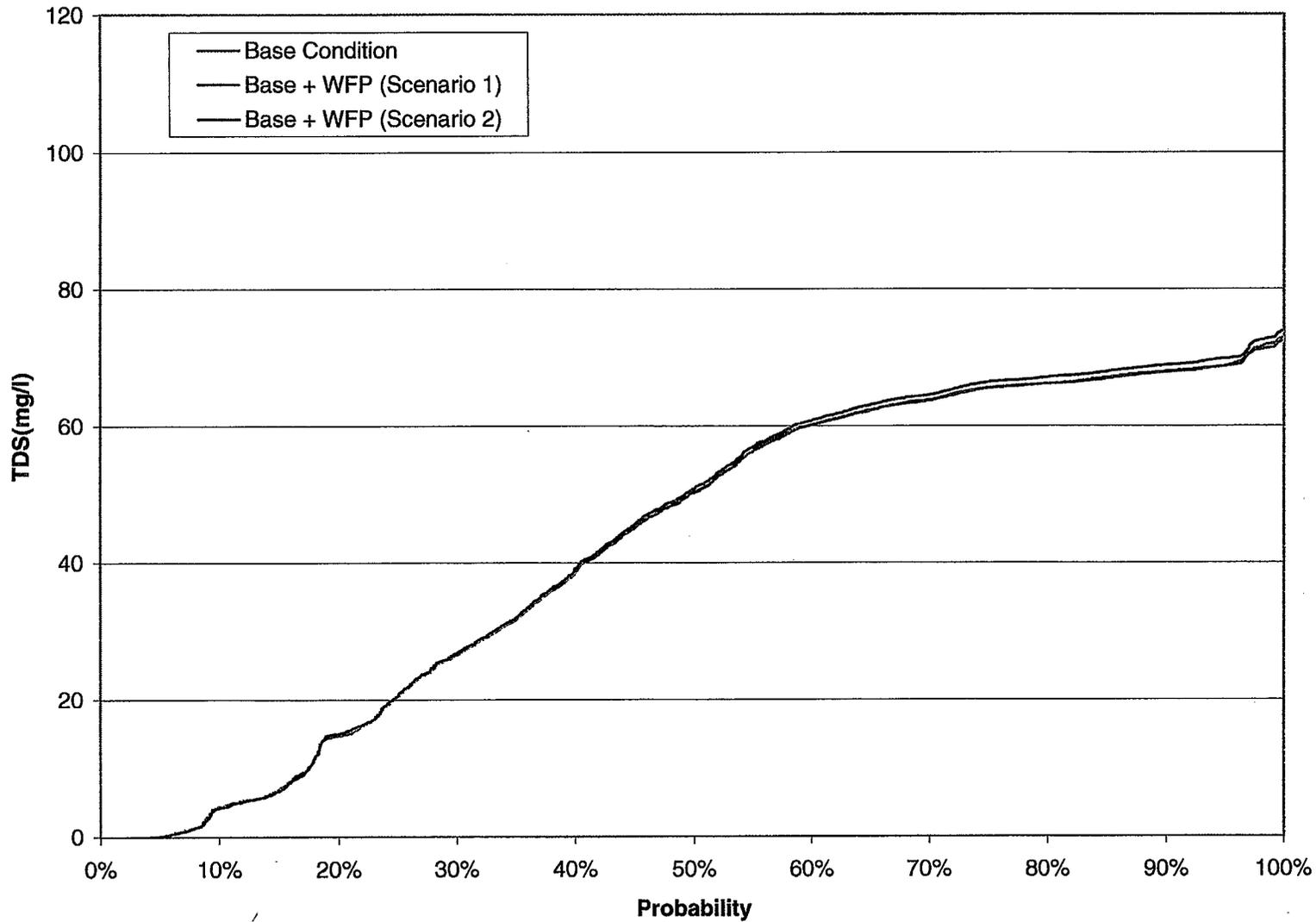
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Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River- March

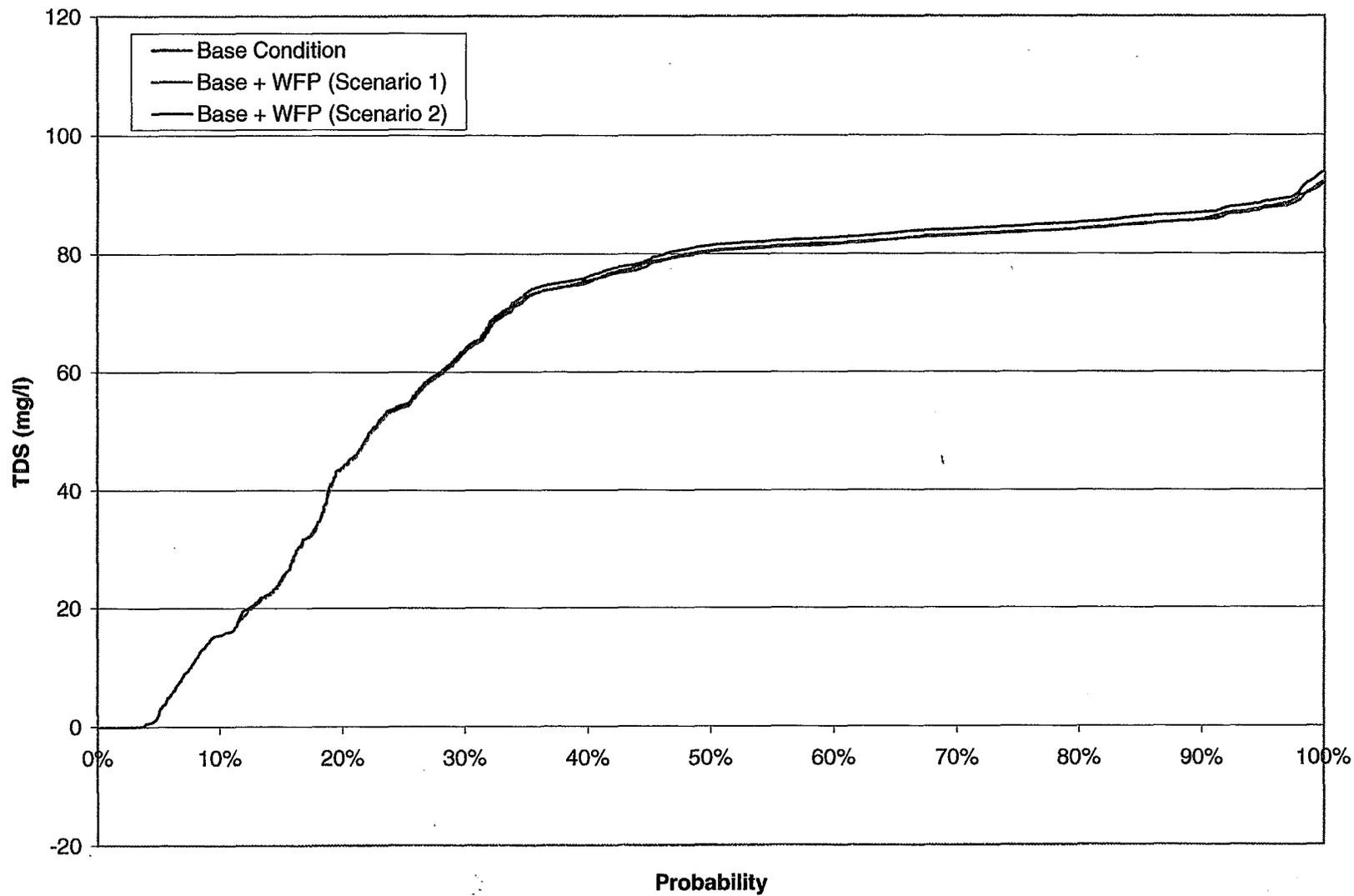


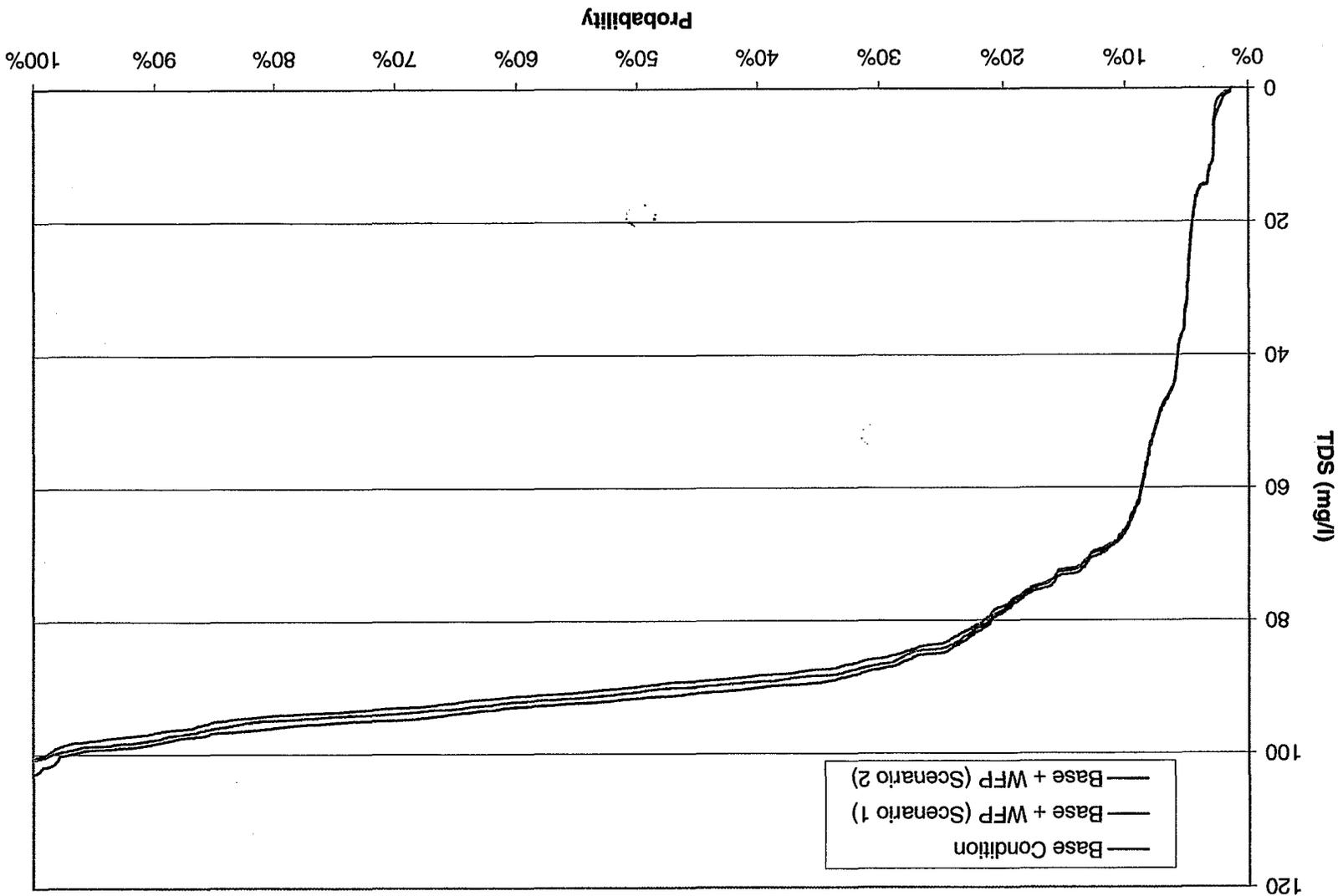
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Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - February



Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - January



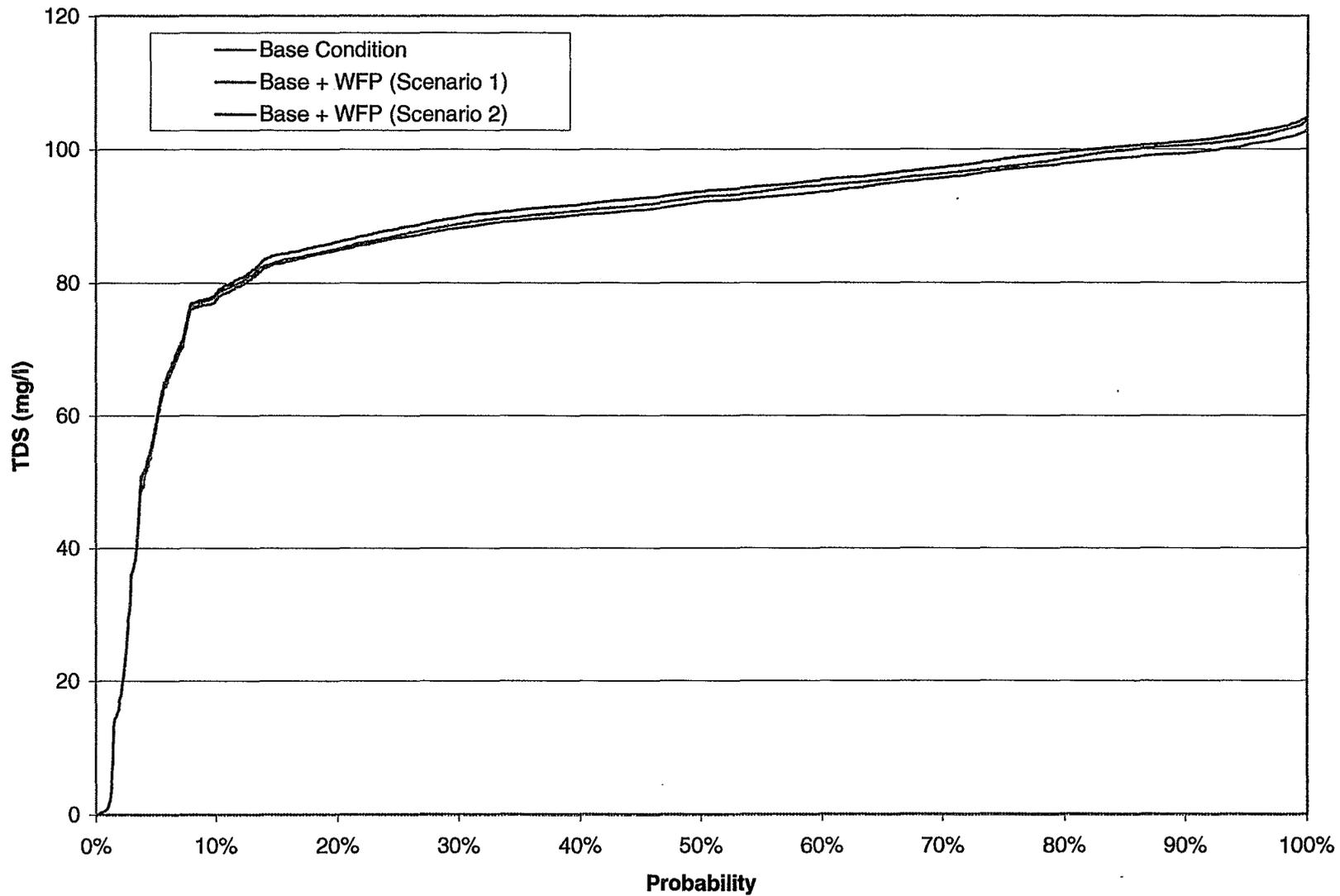


Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - December

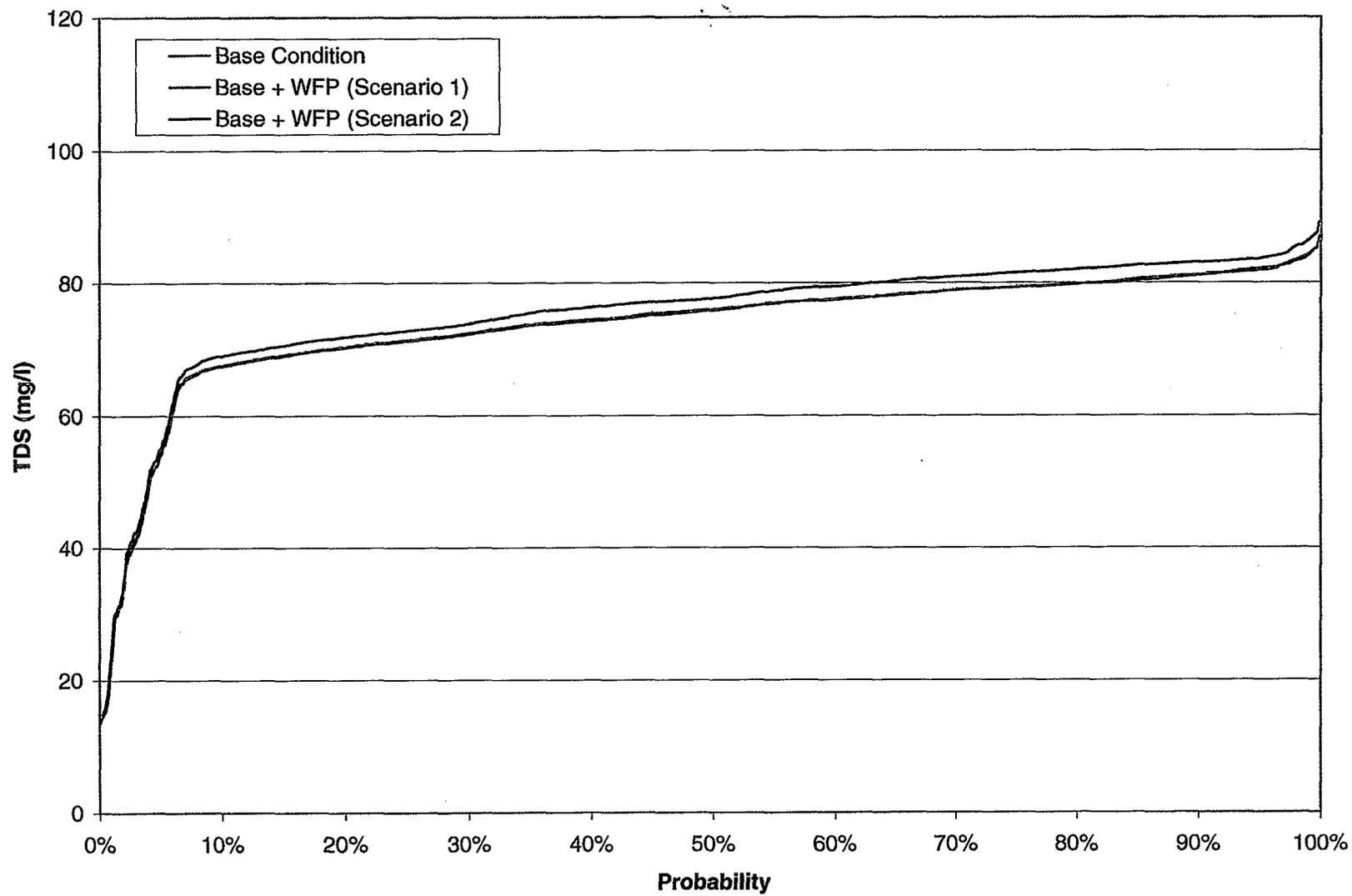
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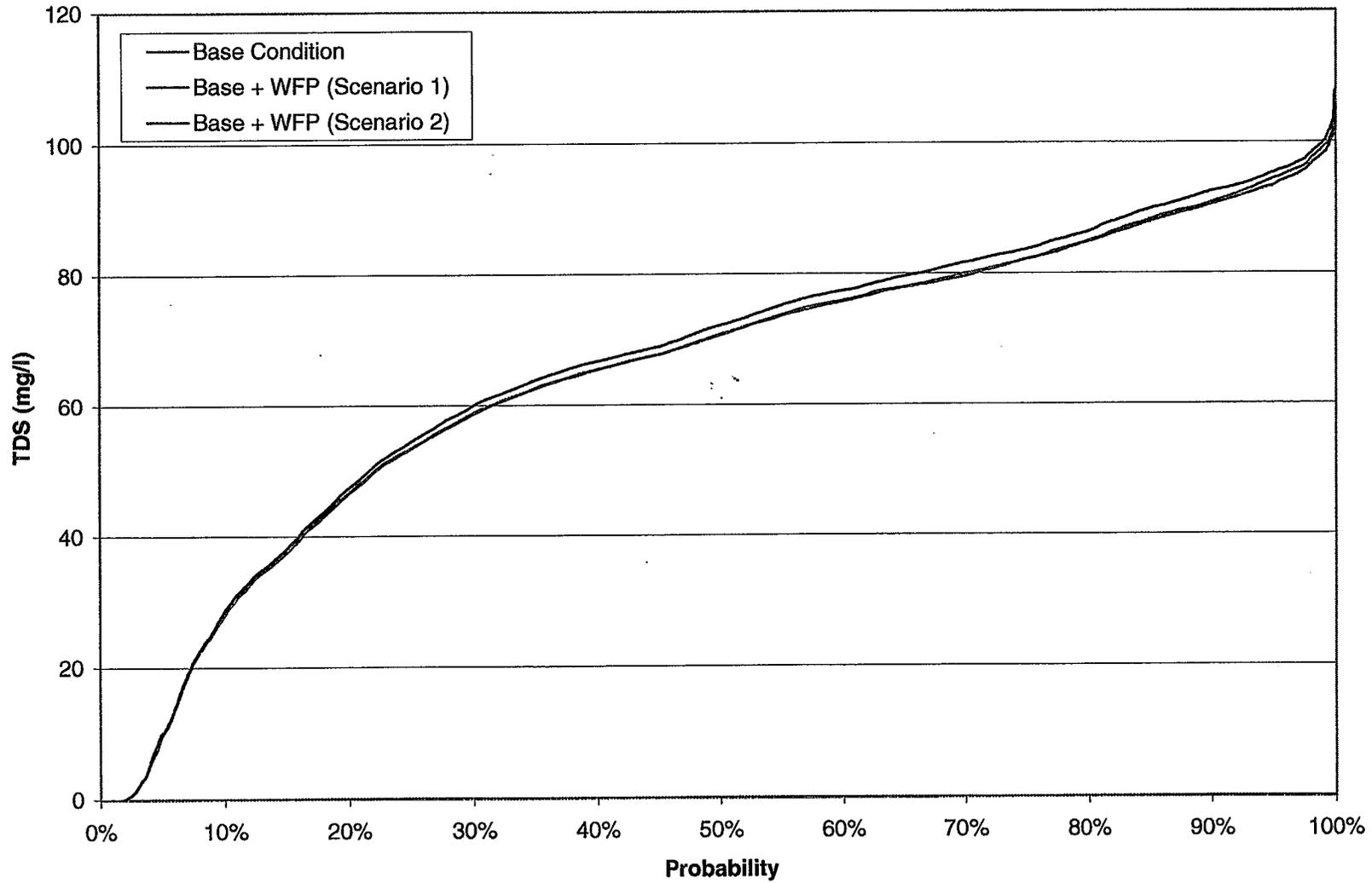
Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - November



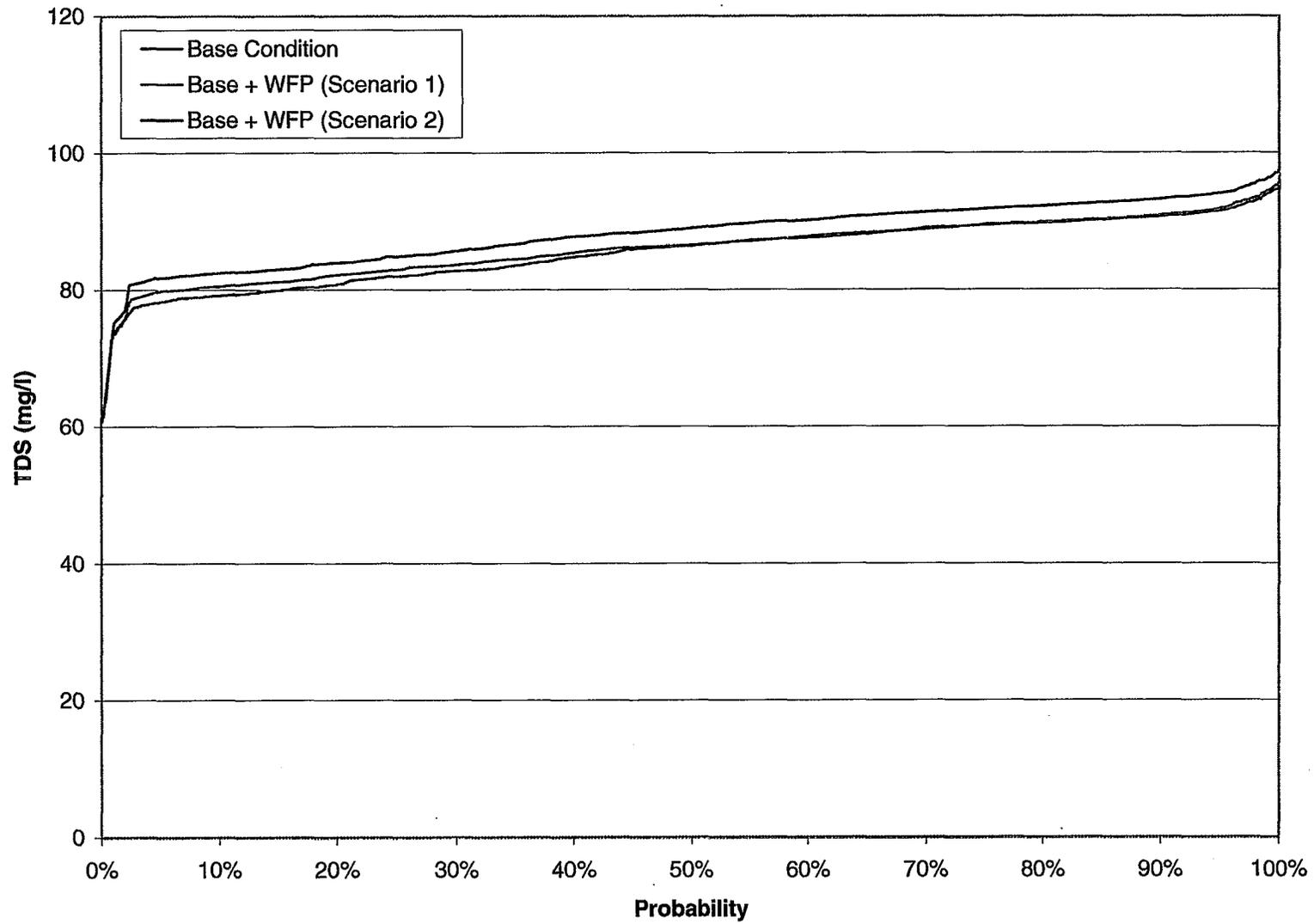
Probability distribution of salinity at Los Vaqueros Intake contributed by Sacramento River - October



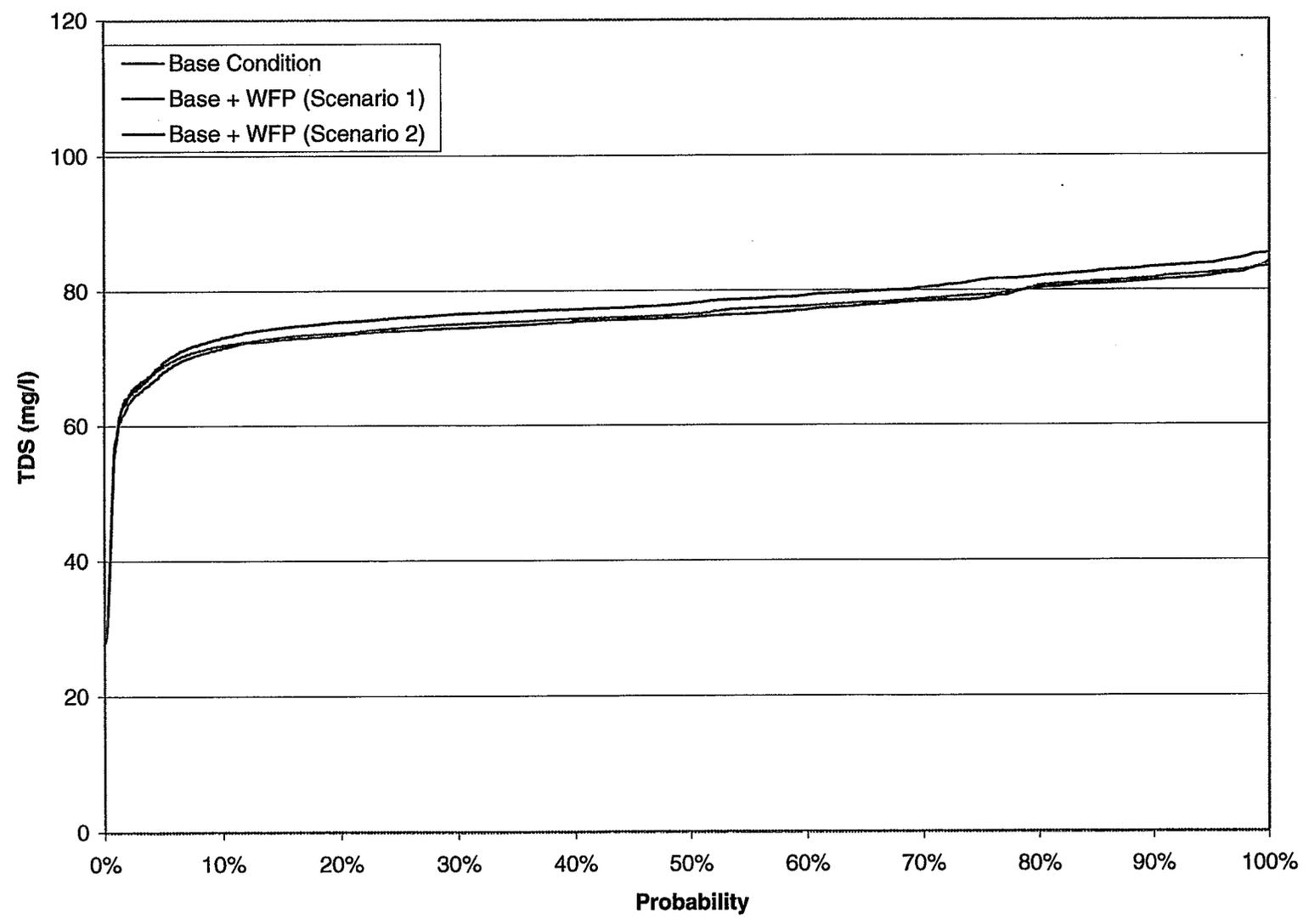
Probability distribution of salinity at Rock Slough contributed by Sacramento River - Annual



Probability distribution of salinity at Rock Slough contributed by Sacramento River - September

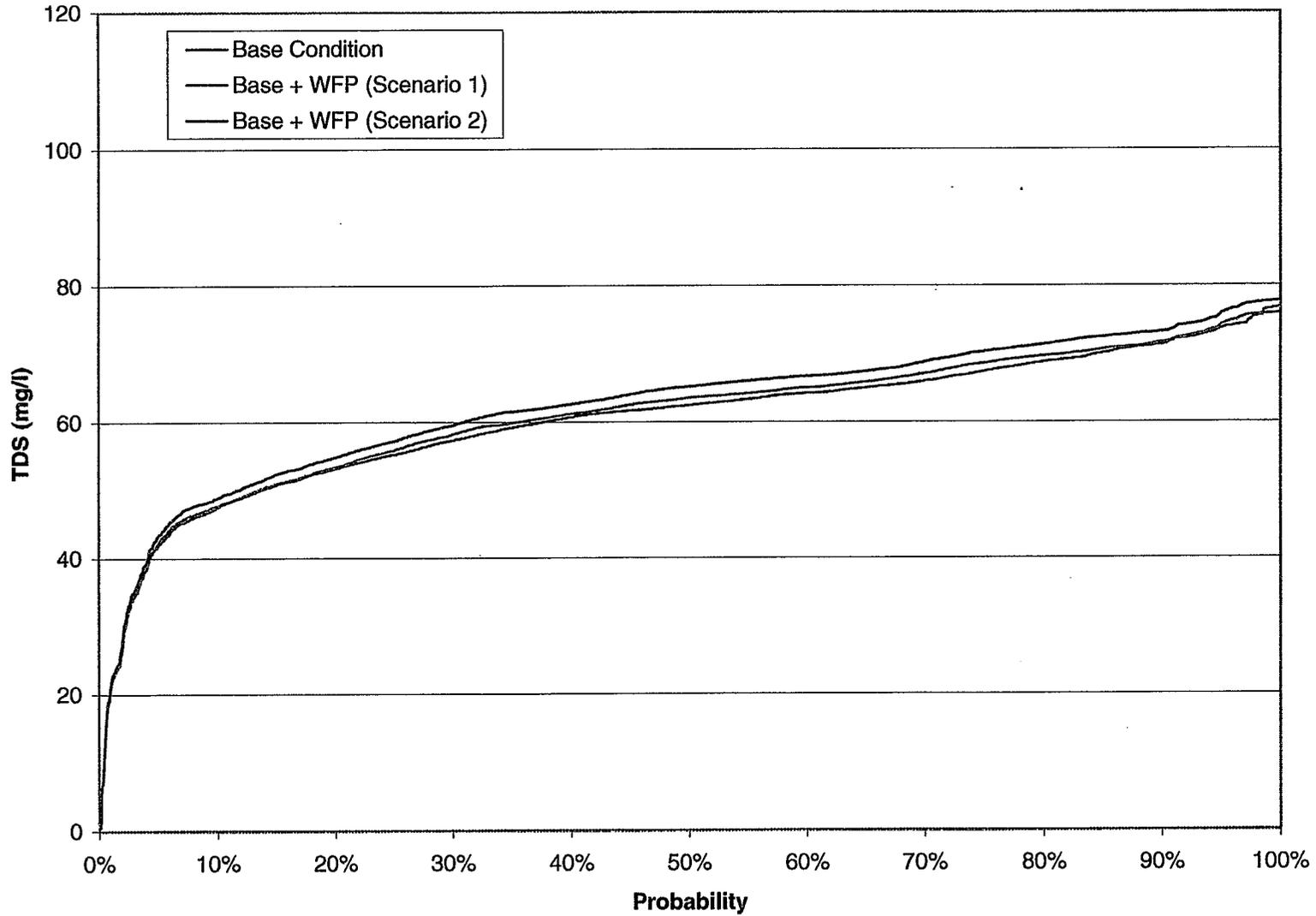


Probability distribution of salinity at Rock Slough contributed by Sacramento River - August



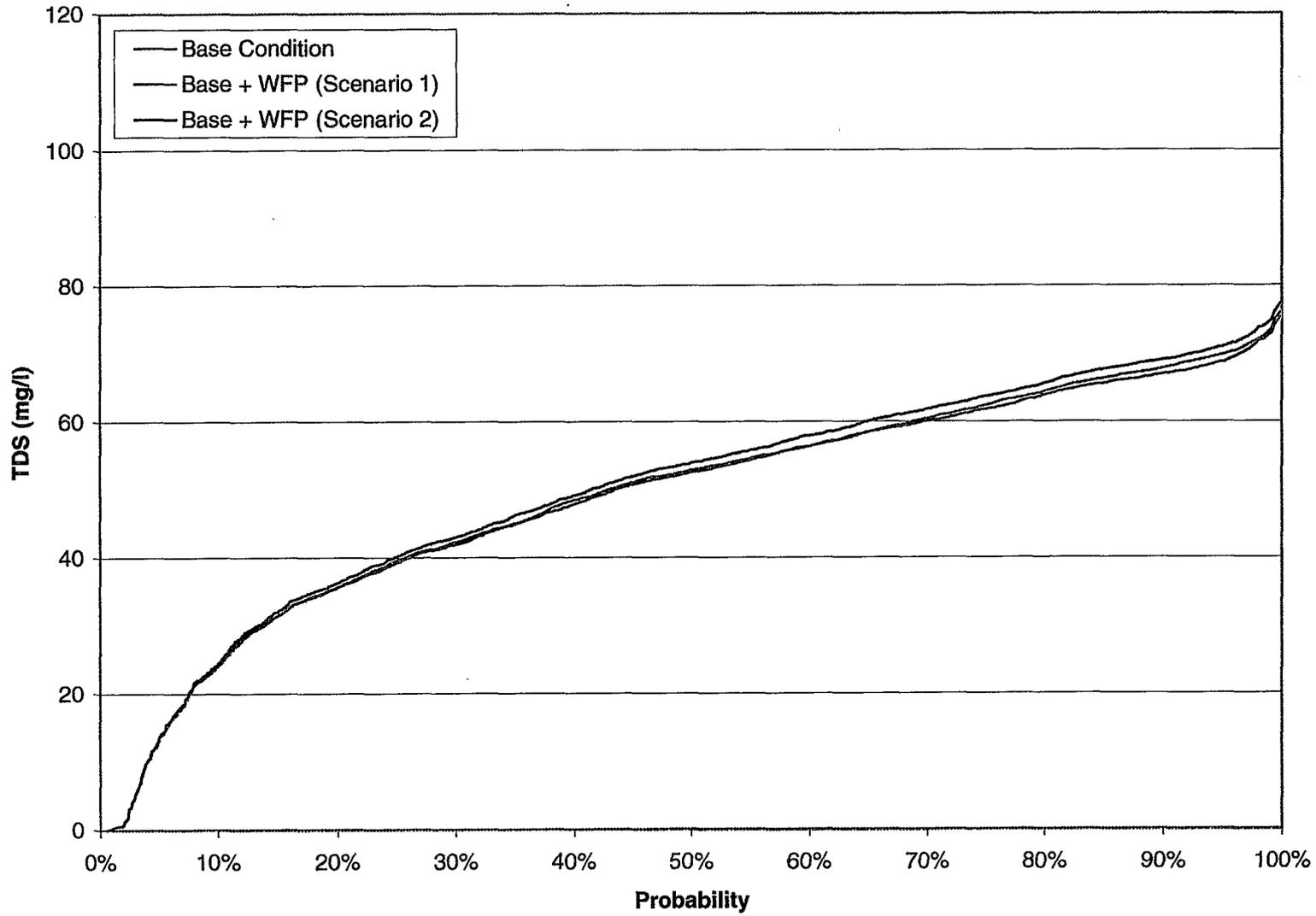
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Probability distribution of salinity at Rock Slough contributed by Sacramento River - July



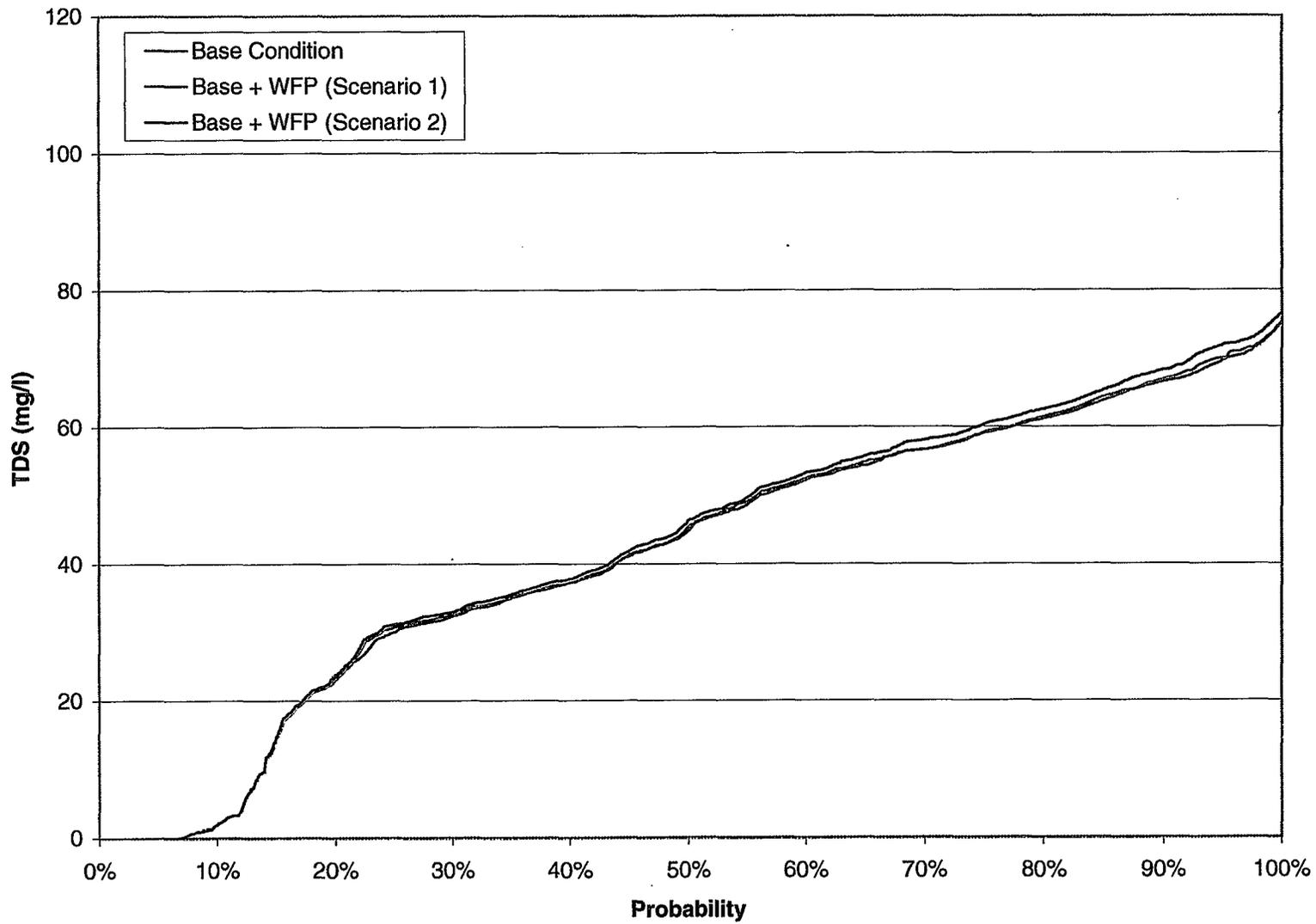
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Probability distribution of salinity at Rock Slough contributed by Sacramento River - June

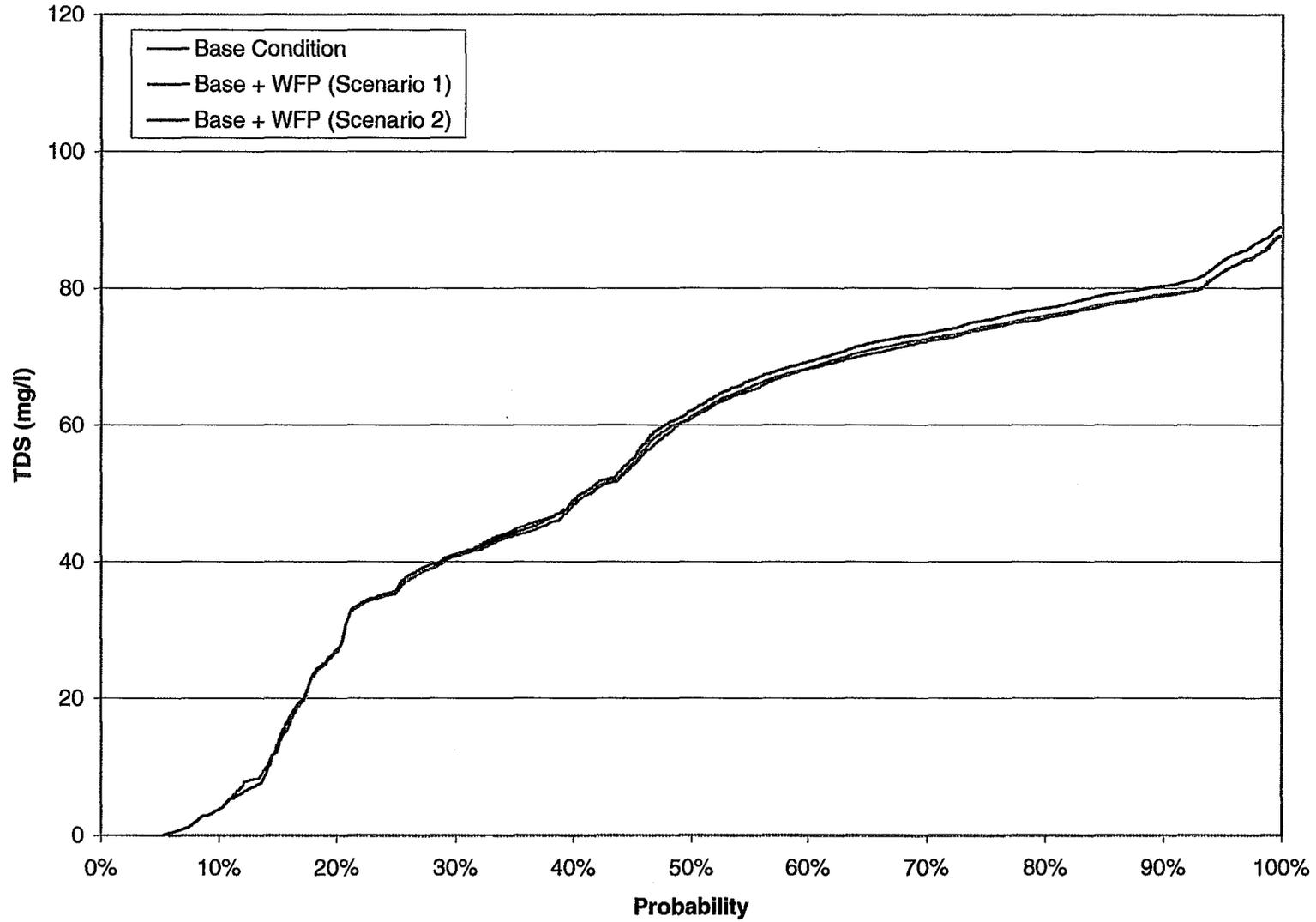


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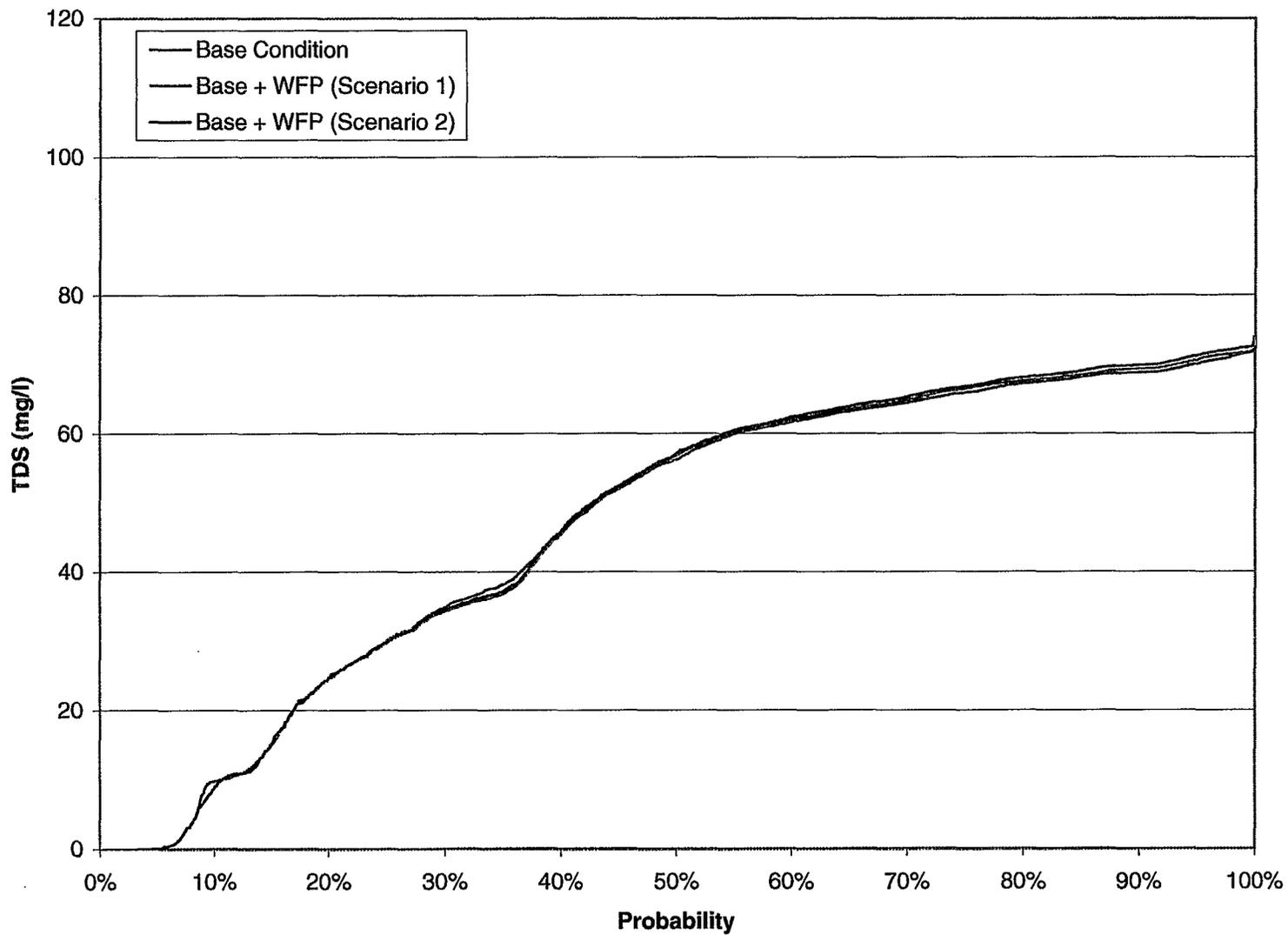
Probability distribution of salinity at Rock Slough contributed by Sacramento River - May



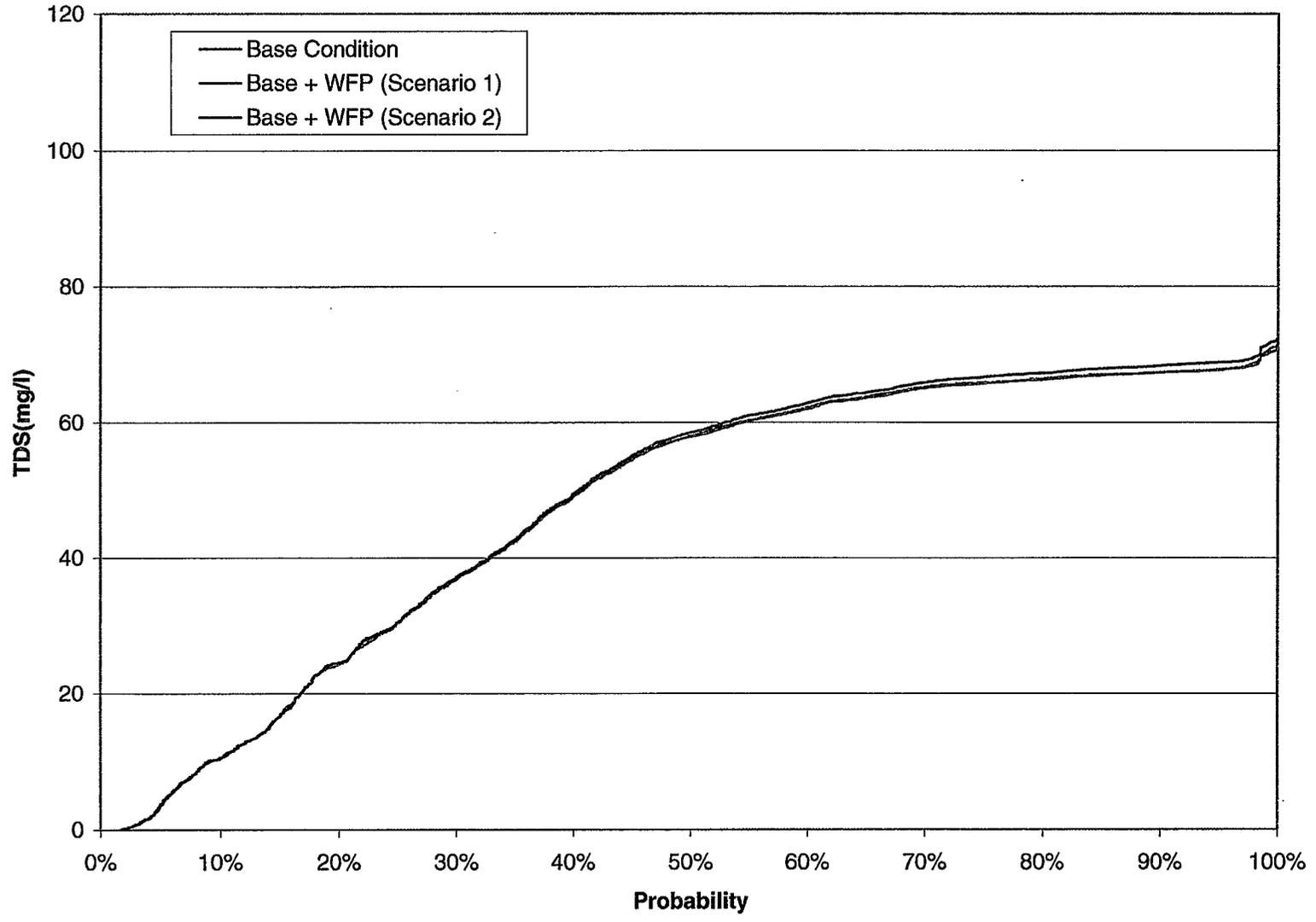
Probability distribution of salinity at Rock Slough contributed and Sacramento River-- April



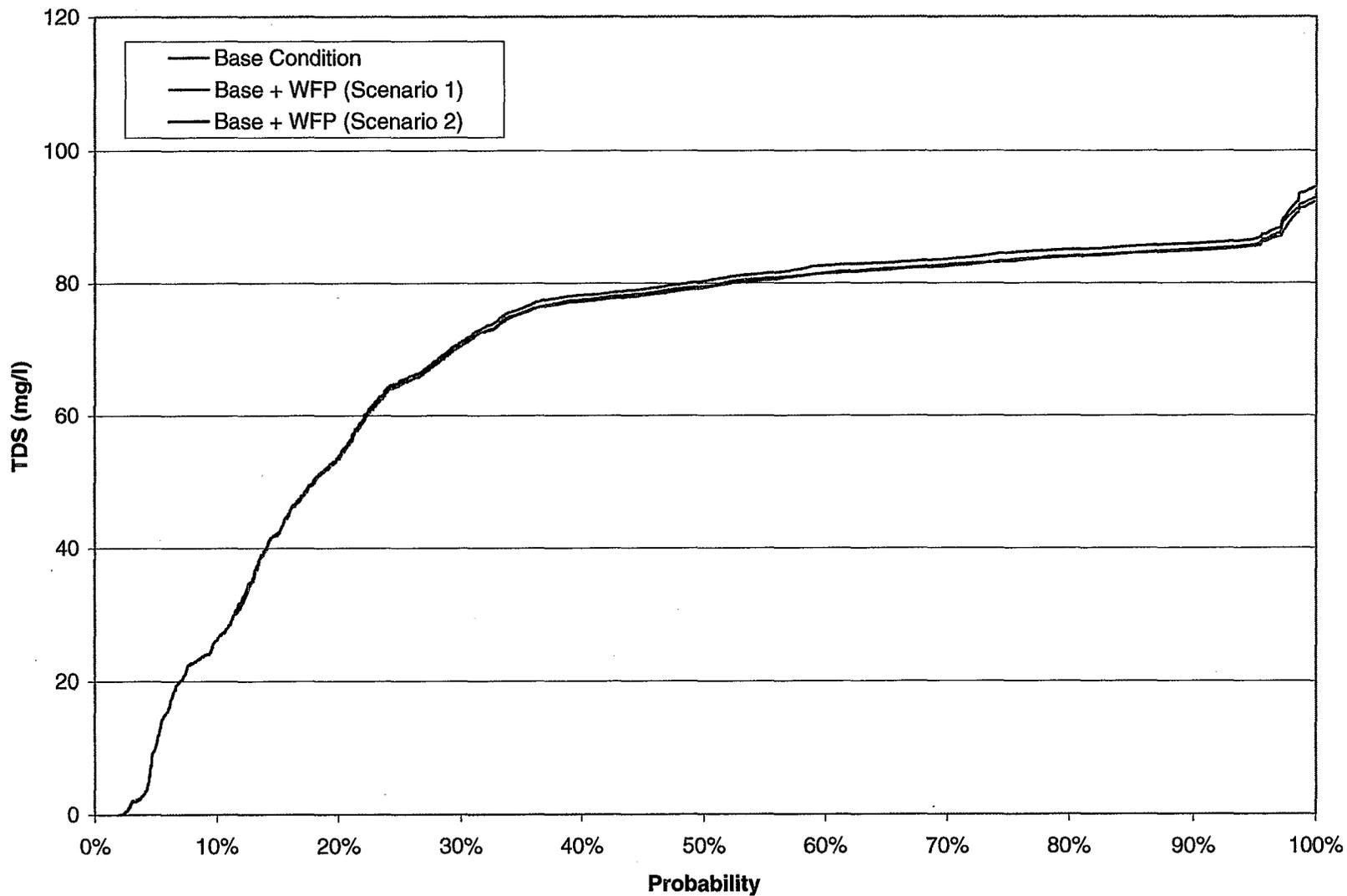
Probability distribution of salinity at Rock Slough contributed by Sacramento River- March



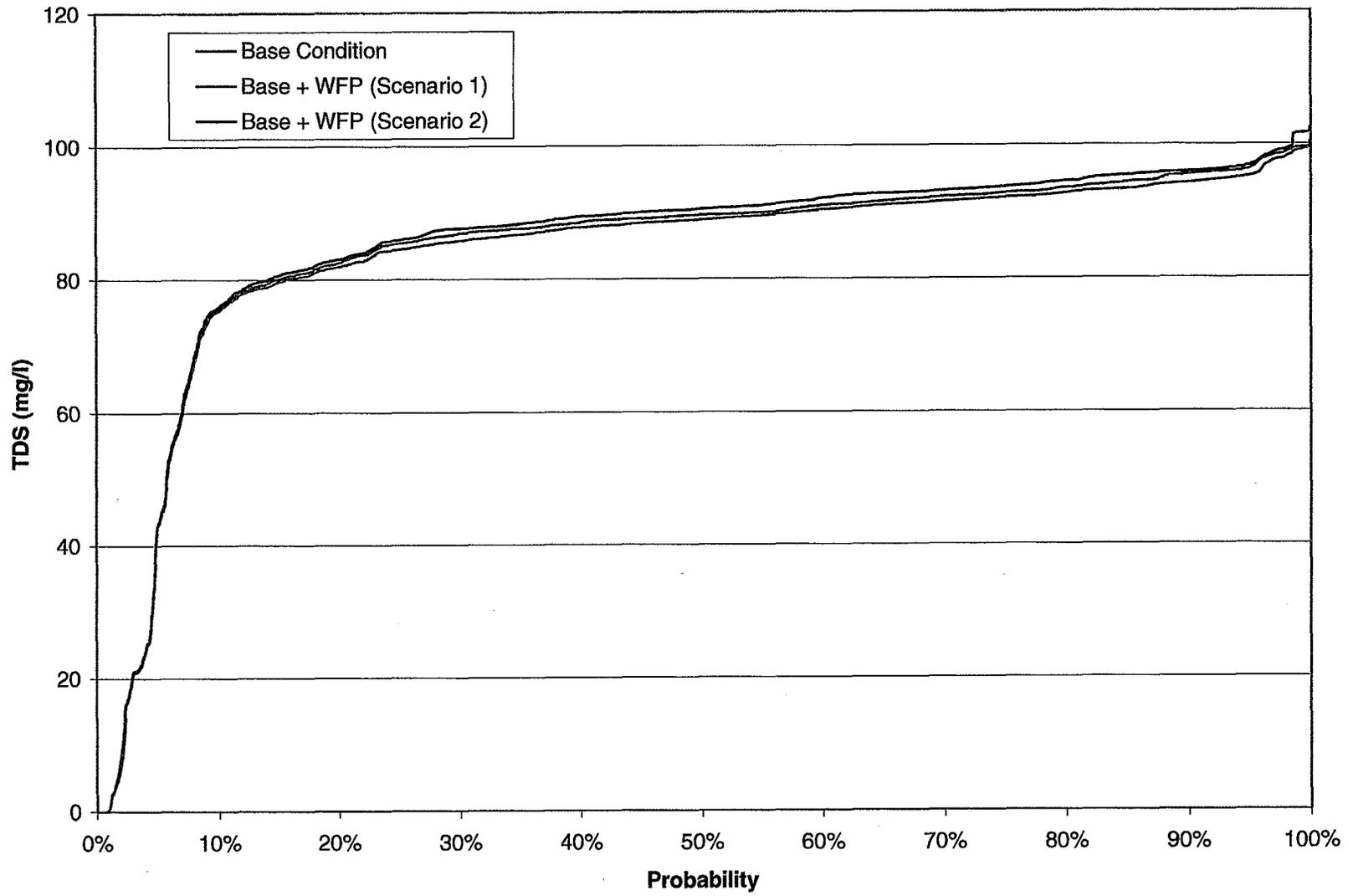
Probability distribution of salinity at Rock Slough contributed by Sacramento River - February



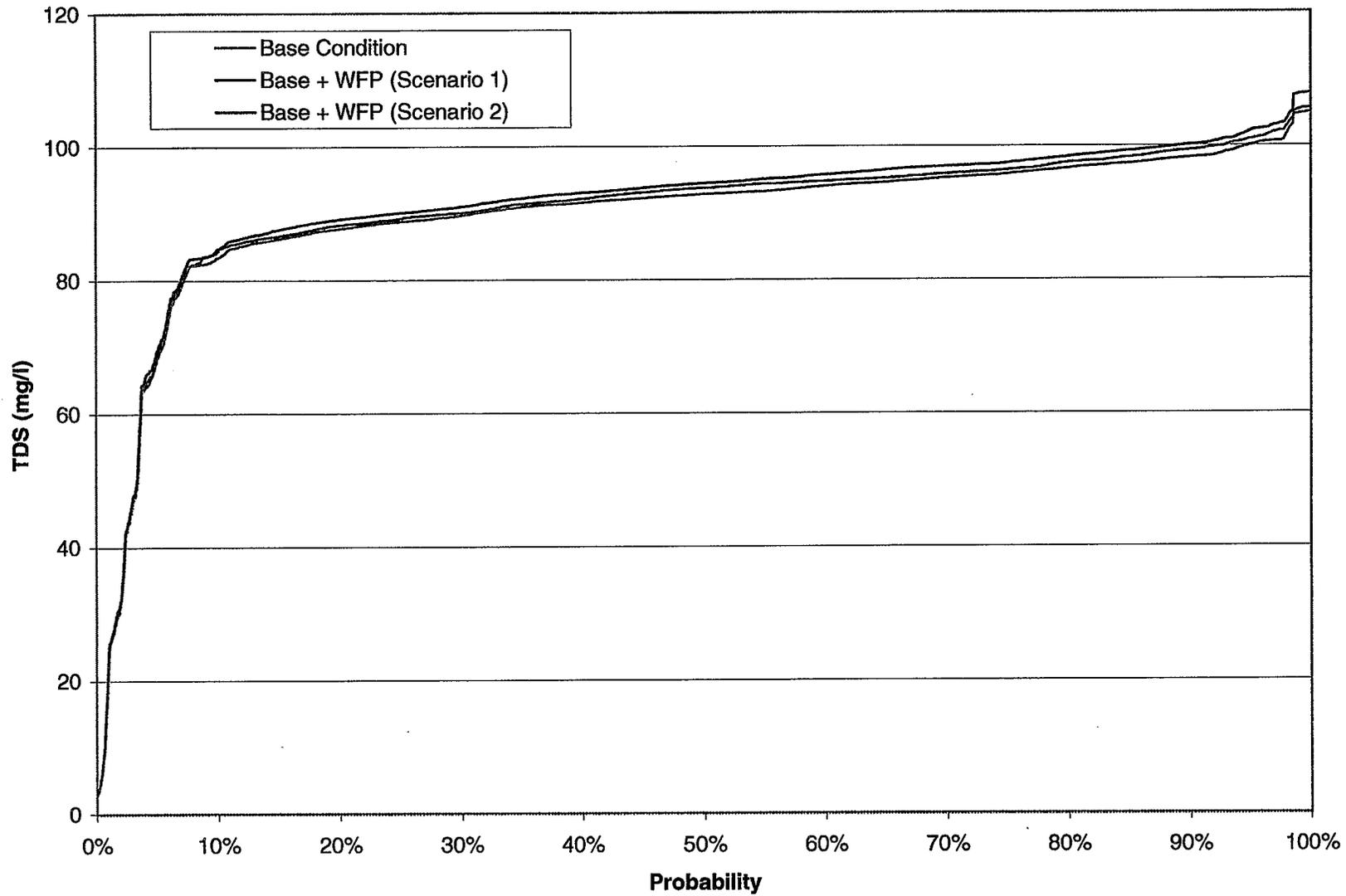
Probability distribution of salinity at Rock Slough contributed by Sacramento River - January



Probability distributuion of salinity at Rock Slough contributed by Sacramento River - December



Probability distribution of salinity at Rock Slough contributed by Sacramento River - November



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