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Similar methodology used for Bromide analysis

Technical Information Report
Impact of San Joaquin River Source Water TDS on the Bay/Delta Salinity

by
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ABSTRACT

A sensitivity analysis tool has been developed to evaluate the impact of the San Joaquin River water quality on the Bay/Delta TDS. Based on the multi-component salinity analysis methodology, a spreadsheet tool has been developed that can estimated the changes of TDS for each DSM1 "channel" due to the changes on the San Joaquin River inflow TDS in a fraction of a second instead of hours computer run. The results indicated that only southern and southeastern Delta TDS could be significantly influenced by the San Joaquin River inflow TDS. Several plots are produced to geographically exhibit the relative significance of potential impact.

INTRODUCTION

CUWA's through delta and dual conveyance alternatives analyses indicated that portion of the southeastern Delta's TDS would degrade due to those proposed system changes. The source of the TDS degradation primarily came from the San Joaquin River water, since the system changes would alter the flow pattern such that the mixture of water of the said region would consist of more San Joaquin River water than that of the baseline's.

One potential remedy to this impact is to reduce the upstream San Joaquin River salt load through the practice of land retirement to reduce the agricultural salt drainage, and therefore improve the San Joaquin River TDS before it reaches the Delta. It is the objective of this Technical Information Report (TIR) to develop a method to quantitatively evaluate the Delta TDS improvement due to the practice.

DEVELOPMENT OF METHODOLOGY

The TDS sources for the Bay-Delta system consist of Sacramento River Water, San Joaquin River water, agricultural drainage and soil water, sea and brackish water, and other rim inflow. In this TIR, the multi-component salinity analysis method (Wang, 1996), which can estimate the salt contribution from each source at any given location, is applied to quantify the impact. To apply the method, one needs to simulate the fate and transport of the salinity of each source individually. For the purpose of this study, we can consider the TDS consists of two sources: the San Joaquin River water and others.

Due to the great uncertainties of what would be the potential salt load reduction to the San Joaquin River system due to the land retirement, it is proposed in this TIR to use "What-If" approach to quantify the impact. One first establishes the baseline scenario to reflect the existing San Joaquin River TDS at Vernalis. One can then assume a given percentage reduction in Vernalis TDS to reflect the salinity improvement upstream. The

Delta Simulation Model (DSM1) (or other simulation model) is then used to evaluate the TDS improvement in the Delta.

Since running DSM1 is time consuming, it is desirable to develop a method that can quickly quantify the TDS improvement due to various percentages of source TDS reduction. The multi-component salinity analysis method provides a perfect solution to serve the purpose. In the study, the water year 1989 re-operated historical condition is treated as the baseline hydrology. CUWA's through-Delta Alternative C defines the Delta channel geometry.

For the baseline condition the TDS at any channel i can be computed as

$$TDS^i_o = TDS^i_{sj} + TDS^i_{others} \quad (1)$$

For any "what-if" scenario, say, an α percent reduction in Vernalis TDS, the TDS at any channel i can be estimated as

$$TDS^i_\alpha = (1-\alpha)*TDS^i_{sj} + TDS^i_{others} \quad (2)$$

where

TDS^i_o = TDS of channel i of the baseline.
TDS^i_{sj} = TDS originated from the San Joaquin River of channel i of the baseline
TDS^i_{others} = TDS originated from sources other than SJ. River for channel i
TDS^i_α = TDS for channel i with α percent reduction of source TDS at Vernalis
α = percent reduction of the Vernalis TDS

TDS^i_{sj} and TDS^i_{others} are obtained through single-component simulations. Note that even though the change in Vernalis TDS would change the solute gradient which would prevent the Equation (2) to be exact, the error is insignificant. A spreadsheet tool based on Equation (2) is easily constructed in the study to enable quick turn-around what-if analyses.

TDS Contribution From San Joaquin River Water

In this TIR, CUWA's through Delta Alternative C is used as the baseline to illustrate the potential TDS improvement due to San Joaquin River salt reduction and the usefulness of the newly developed method. Figure 1 is a color coded tidally averaged daily TDS "contour" for the water year 1989. From the figure one can visualize the TDS concentration in various regions of the Bay-Delta. Figure 2 is a refined TDS contour map zooming in the south Delta region. Both figures are showing the DSM1 results of the baseline condition (C45_W89G).

By applying the multi-component method, one can examine the TDS source composition of each channel reach. Figure 3 exhibits the TDS contribution from the San Joaquin River water for the baseline. It is important to note that only south and southeastern Delta, which are bounded by dark blue color in Figure 3, show appreciable TDS contribution from the San Joaquin River. Therefore, those are only areas could have marked improvement on TDS due to the source salt reduction of the San Joaquin River water.

For example, say a 25% TDS reduction in Vernalis and no change for other TDS sources. The TDS improvement for any given channel is $0.25 * TDS^{i}_{sj}$, and the TDS contribution from the San Joaquin River is $0.75 * TDS^{i}_{sj}$. (Figure 4).

CONCLUSION

Based on the multi-component salinity analysis methodology, a spreadsheet tool has been developed that can estimated the changes of TDS for each DSM1 "channel" due to the changes on the San Joaquin River inflow TDS in a fraction of a second instead of hours computer run. The results indicated that only southern and southeastern Delta TDS (Figure 3) could be significantly influenced by the San Joaquin River inflow TDS. For CUWA Alternative C, a 25 % TDS reduction at Vernalis would result in 40 mg/l TDS improvement at the Tracy Pumping plant and about 10 mg/l TDS improvement at Banks Pumping plant.

REFERENCES

Wang, Chuching, 1996, "Multi-component Salinity Analyses: Application of the Superposition Principle", Bay/Delta Modeling Forum.

Tidally Averaged TDS, mg/l (C45-W89)

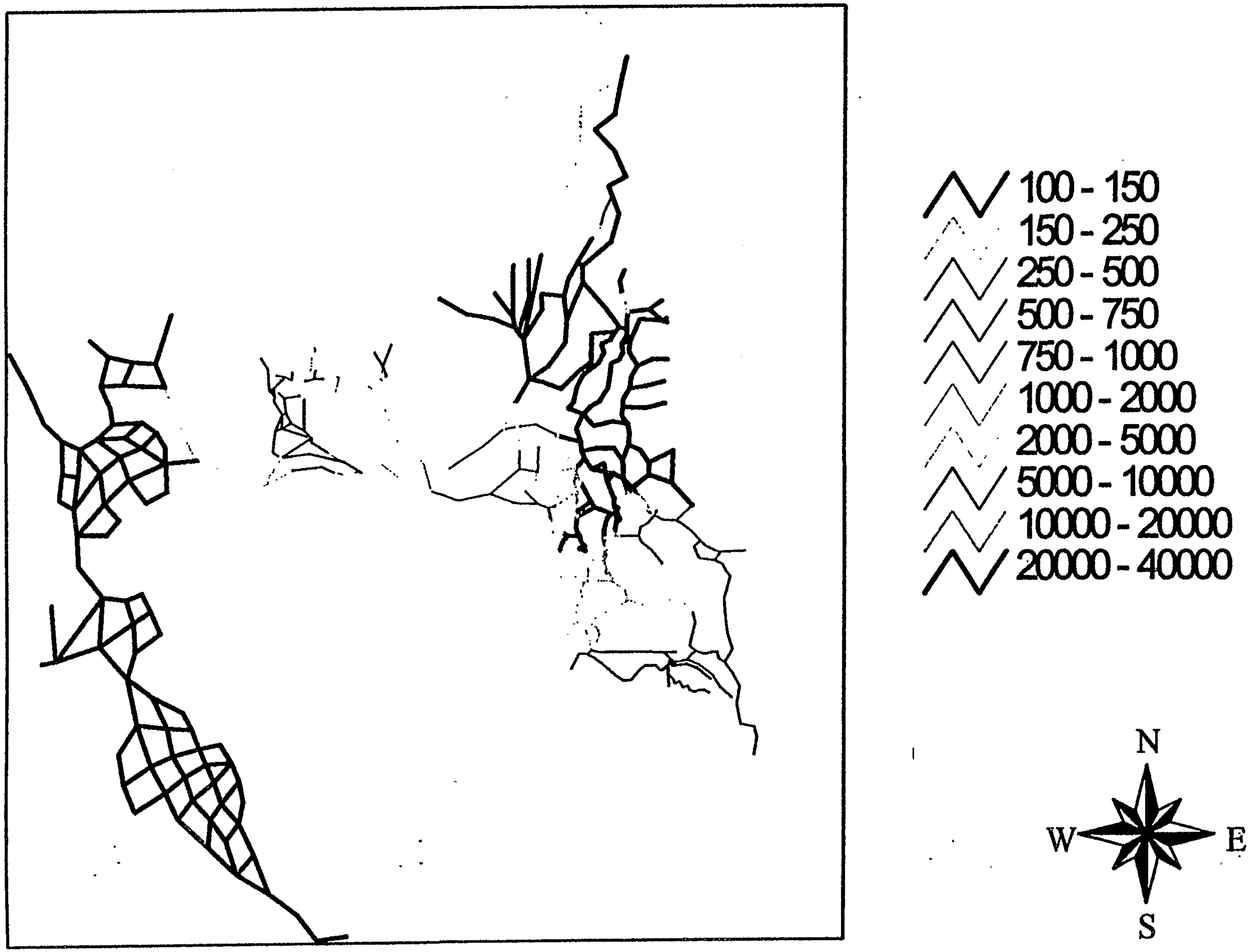

Figure 1

Tidally Averaged TDS, mg/l (C45-W89)

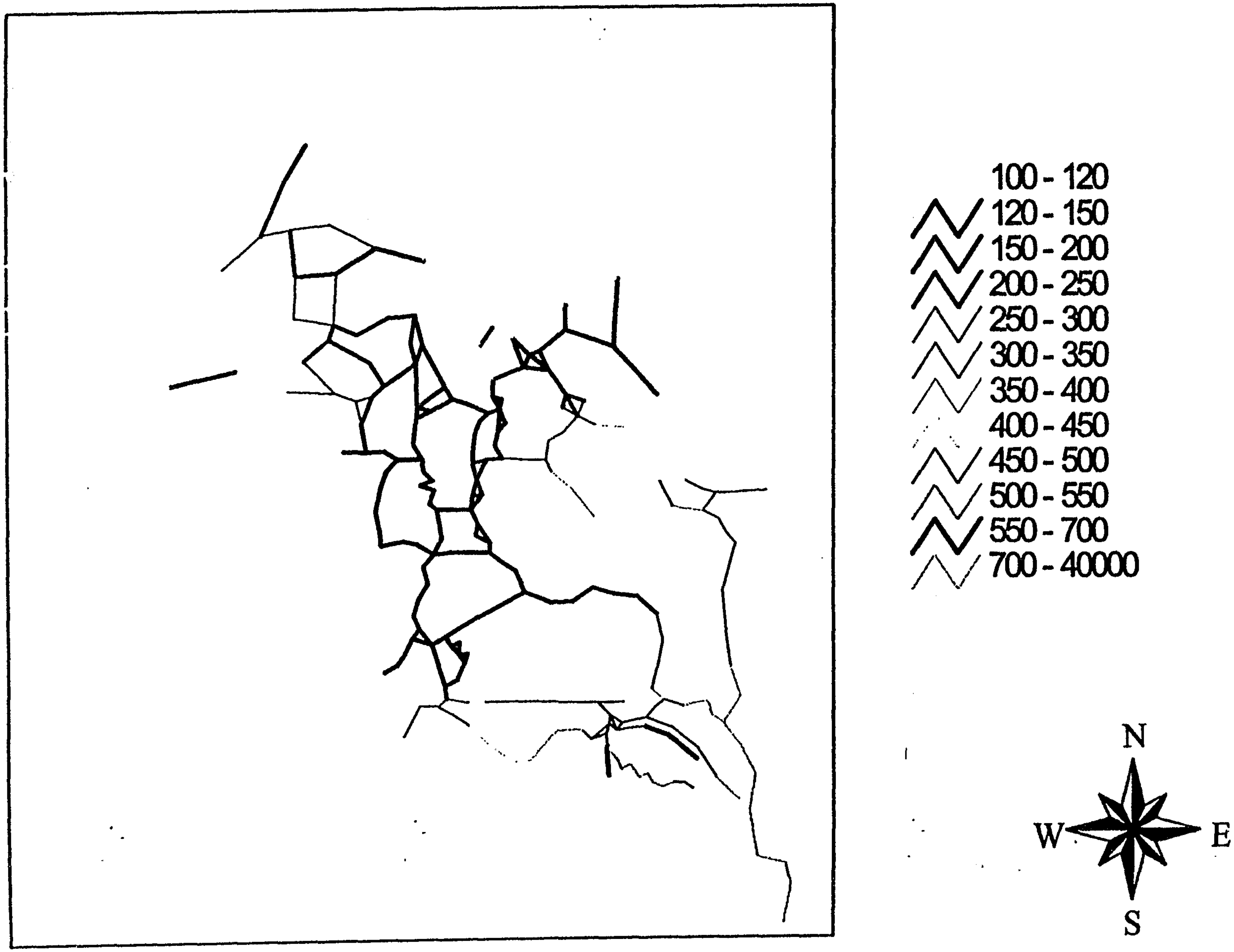

Figure 2

TDS from San Joaquin River , (C45-W89)

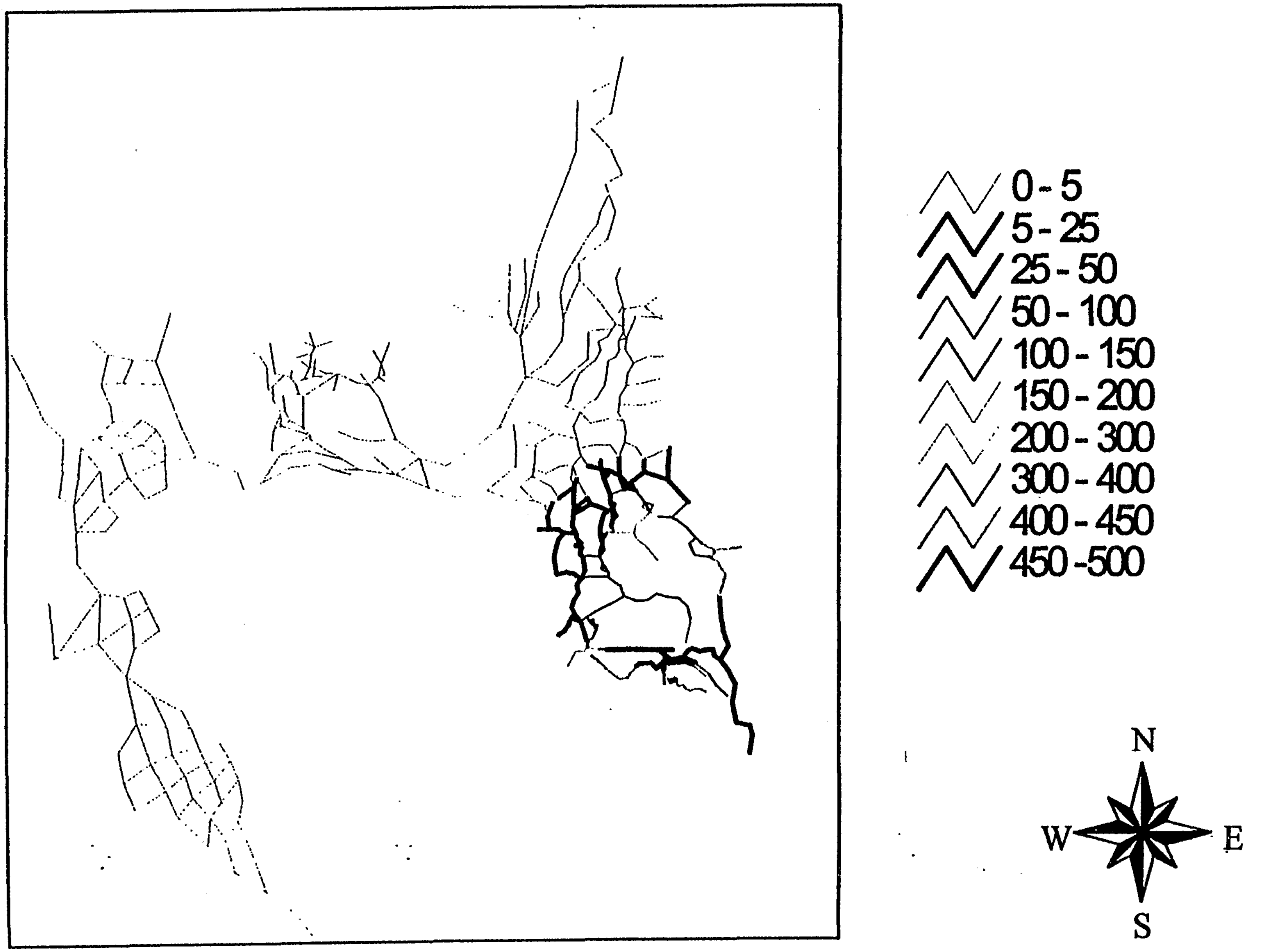

Figure 3

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TDS from San Joaquin R. (75 %), (C45-W89)

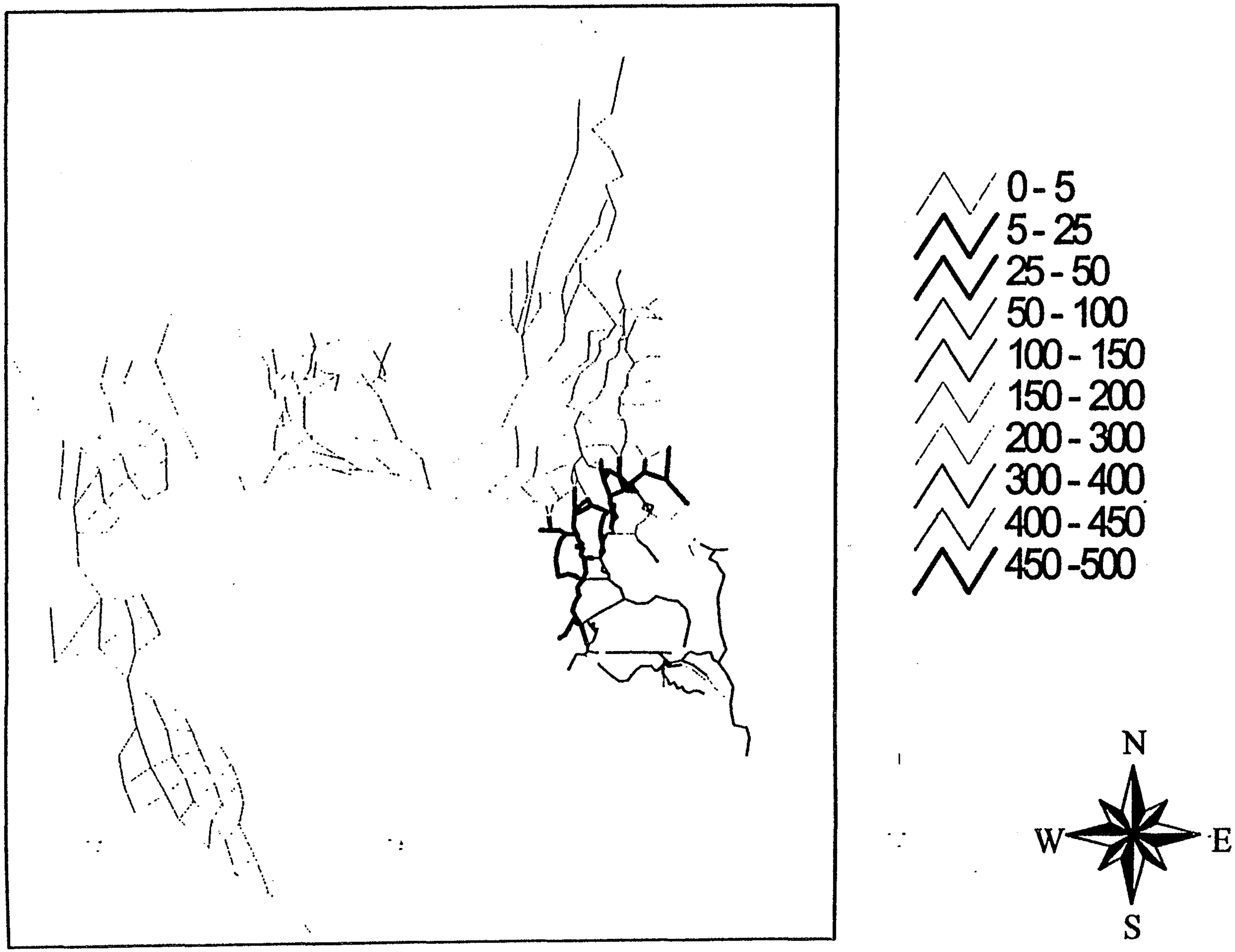
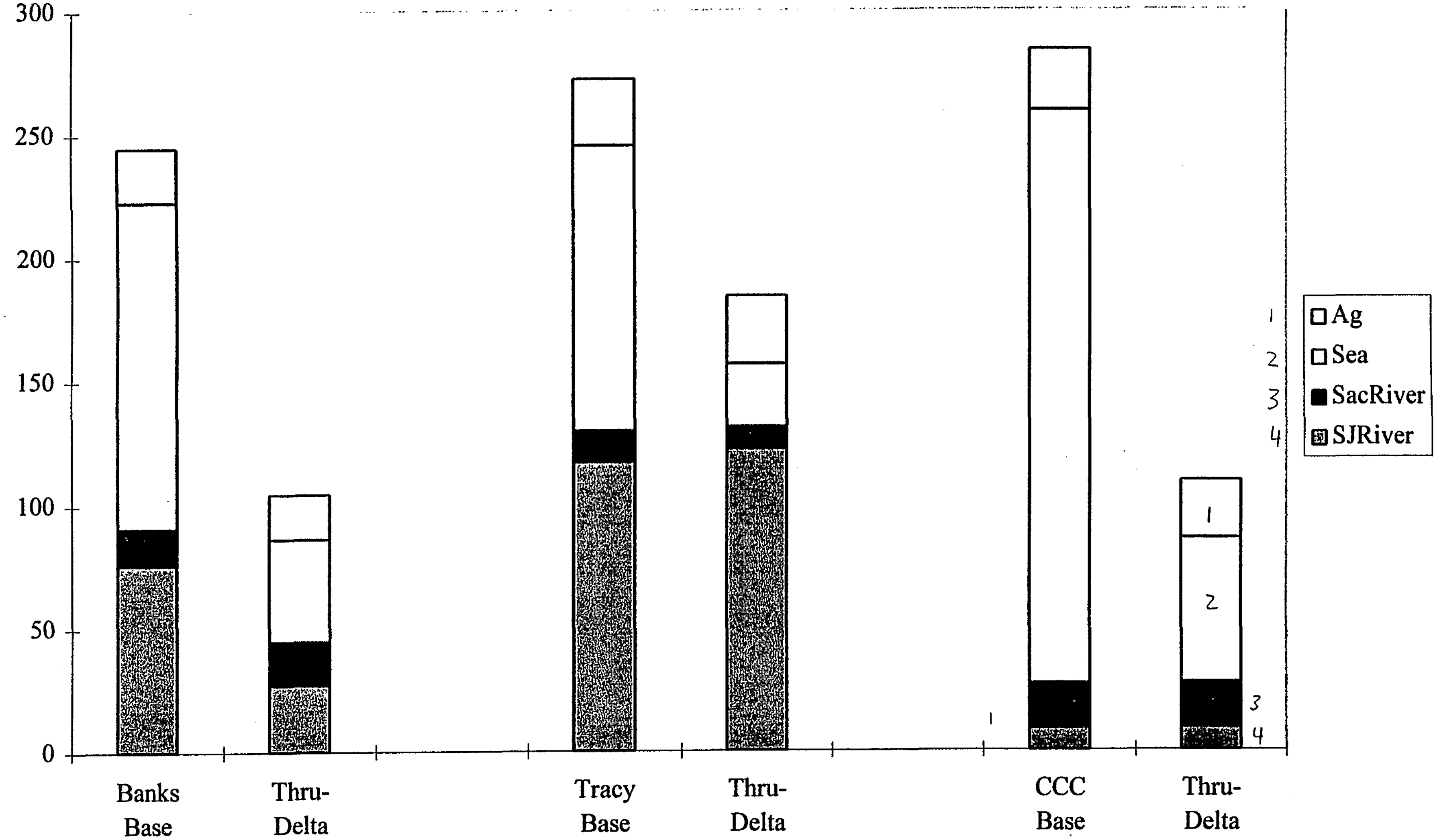


Figure 4

Estimated Bromide Concentration from Different Sources (ppb) Water Year 1989



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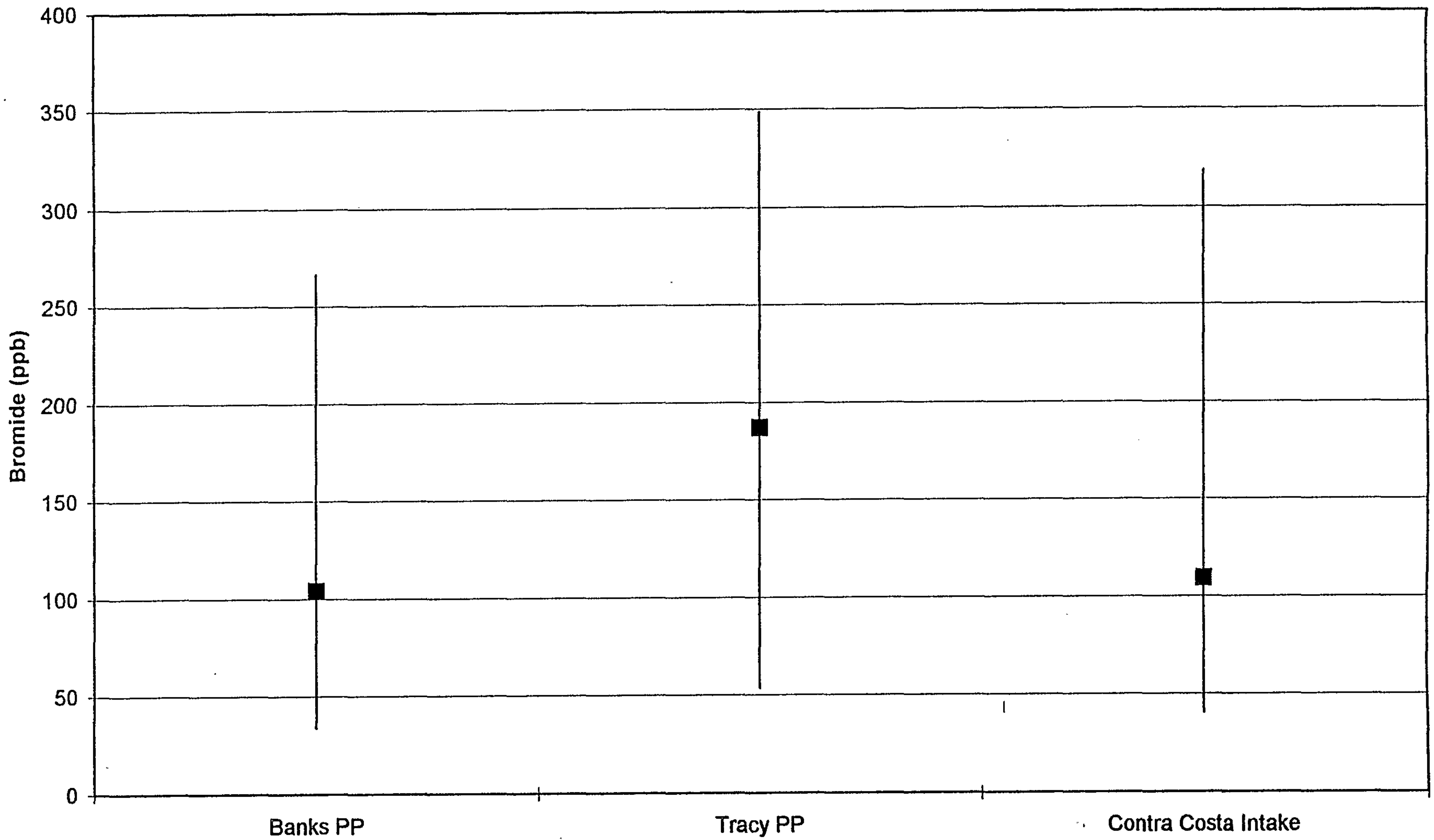
Estimated Bromide Concentrations for Through-Delta Alternative Water Year 1989



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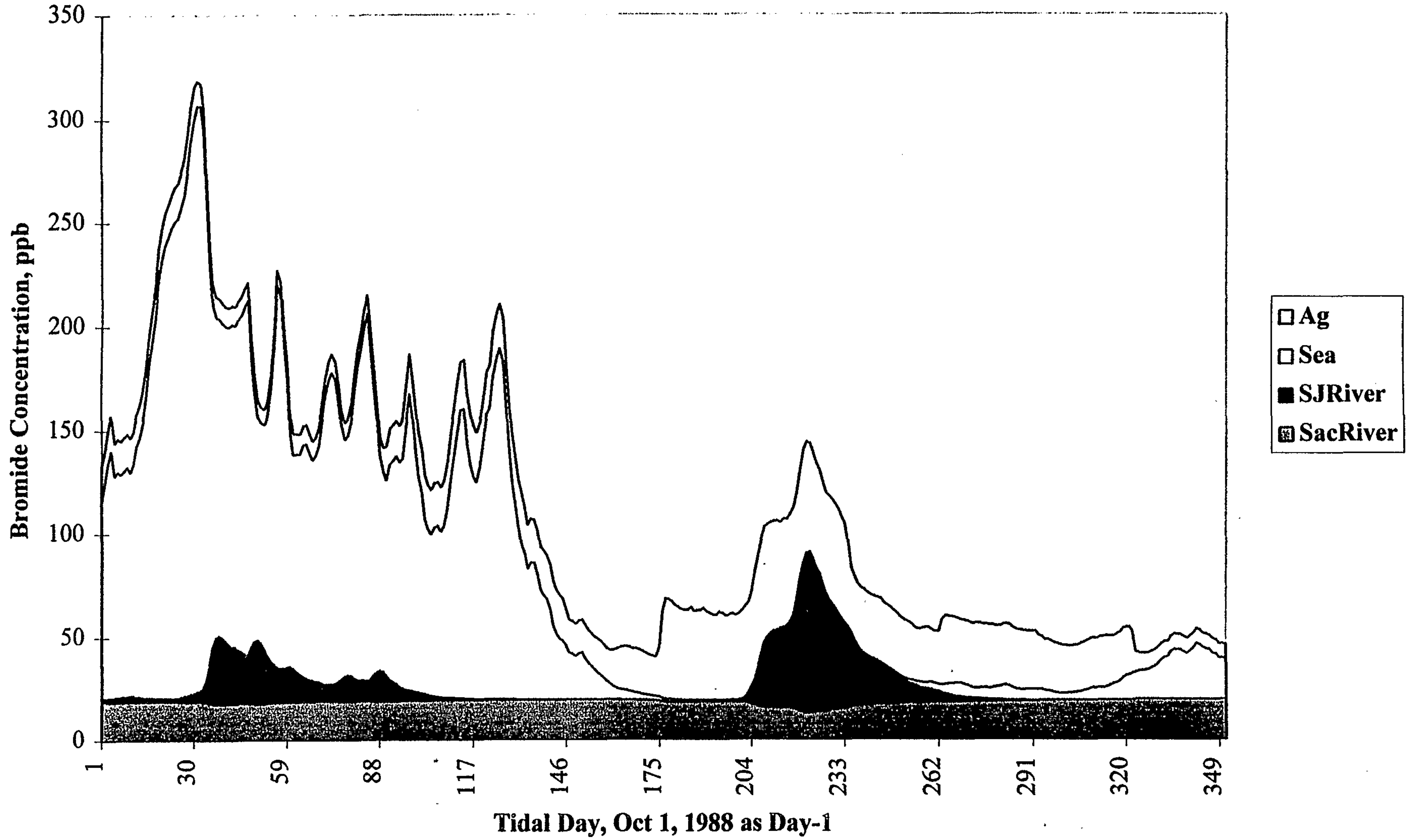
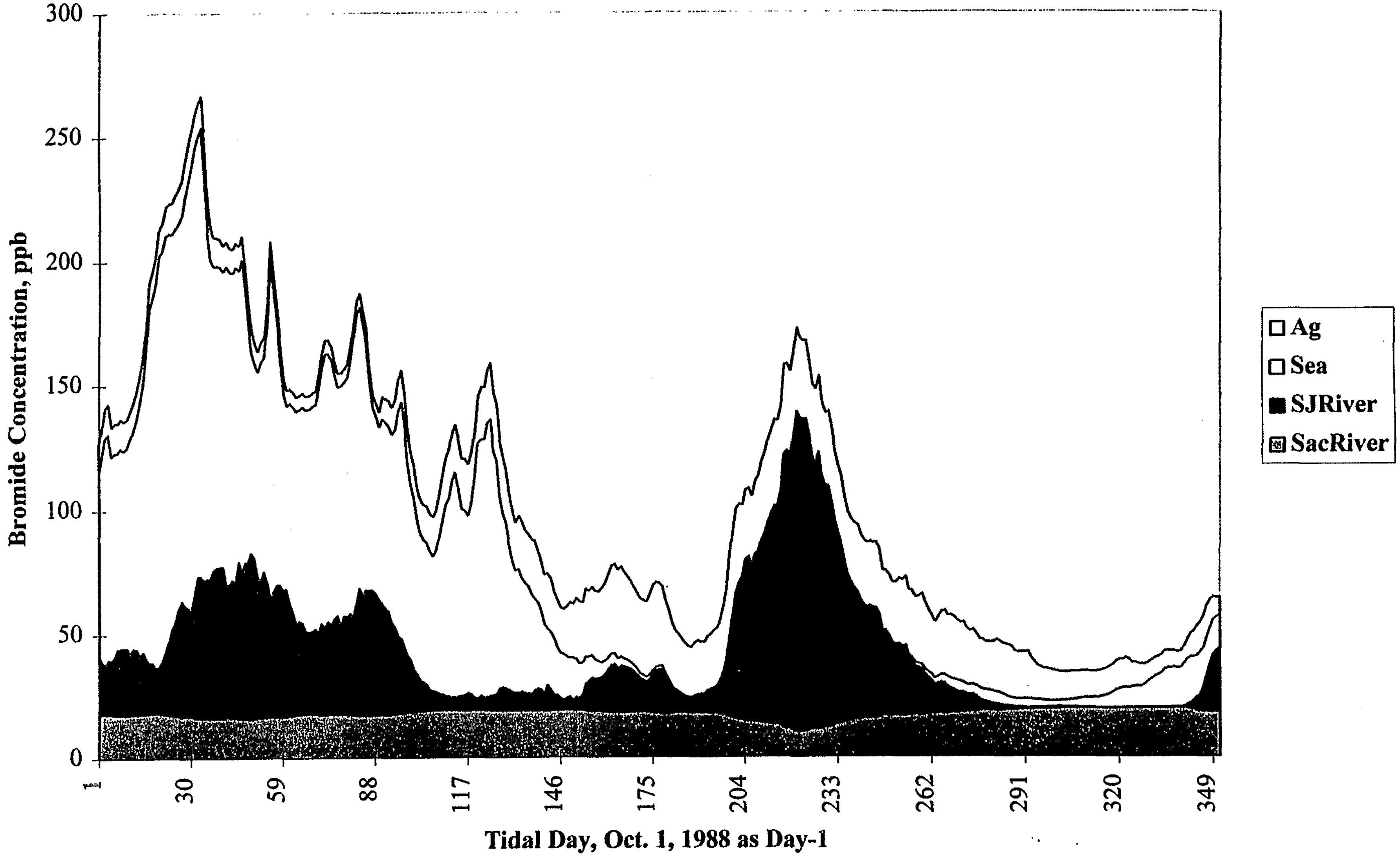
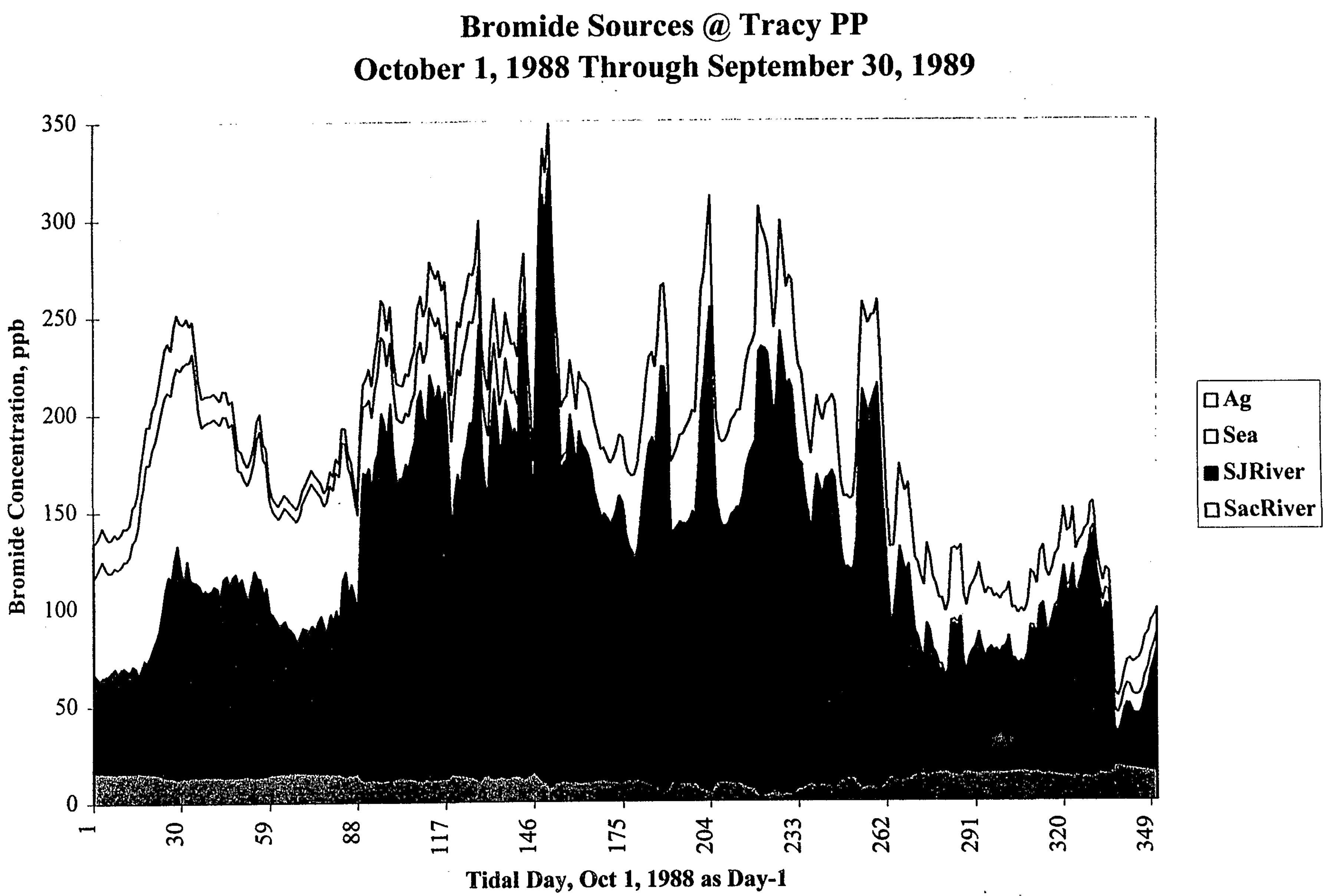
Bromide Sources @ CCC Intake
October 1, 1988 Through September 30, 1989



Bromide Sources @ Banks PP with New Intake
October 1, 1988 Through September 30, 1989





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