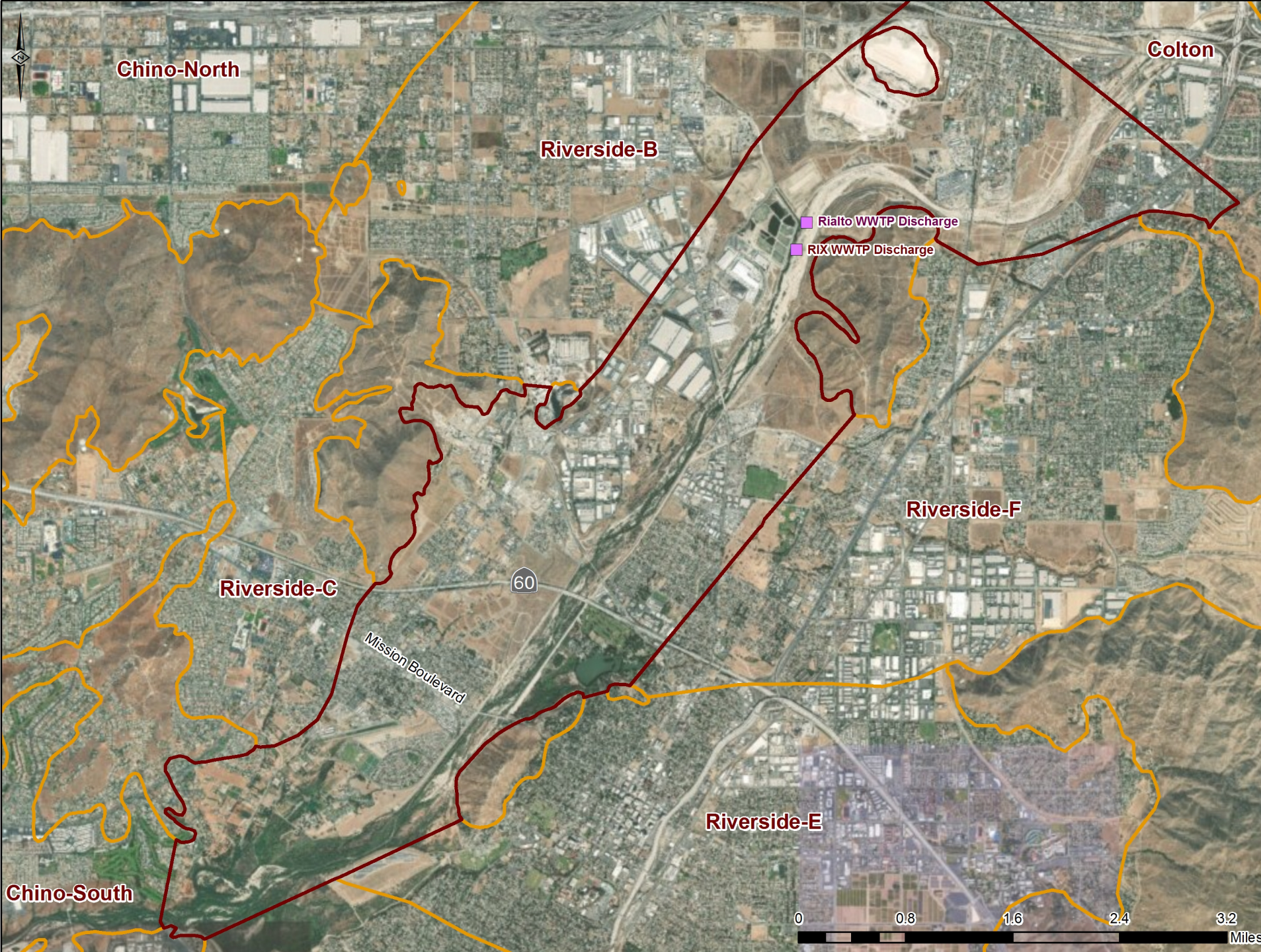


Questions and Answers Related to Streambed Recharge in the Santa Ana River in the Riverside A GMZ

March 6, 2019



Riverside A GMZ

WEI Question 1: *What does the real world look like? E.g., how surface water discharge and streambed infiltration vary along the axis of the Riverside-A GMZ for (1) wet weather conditions and (2) dry weather conditions?*

The characterization of surface water discharge and streambed infiltration is illustrated in the schematic profile. The profile shows the spatial distribution of dry-weather discharge along the Santa Ana River in the Riverside GMZ.

Starting at the upstream end of Riverside A, under dry weather conditions, the discharge is generally zero, becomes positive at the confluence with the Rialto Channel with Rialto discharge and increases immediately downstream with the discharge from RIX.

Downstream of RIX, the discharge decreases gradually, due to streambed infiltration until it is augmented with rising groundwater. Historically streambed infiltration ceases, and rising groundwater begins

in the reach between Hwy-60 and the Mission Boulevard bridges: the exact point being variable over time for a variety of reasons.



WEI Question 2: *How does each version of the WLAM represent the real world in Riverside A?*
4The characterization of surface water discharge and streambed infiltration is illustrated in the schematic profile.

The WEI WLAM represents the Santa Ana River as a losing stream from the upstream end of Riverside A to Hwy 60 and a rising groundwater reach from Mission Boulevard bridge to the MWD crossing.



WEI Question 3: *What are the hydrologic (flow/recharge) implications of the two model conceptualizations?*

The WEI WLAM is calibrated to reproduce historical discharge and recharge in Riverside A from the upstream end of Riverside A to the Hwy 60 bridge, incorporates an estimate of rising groundwater just upstream of MWD crossing and then to match the Santa Ana River discharge at the MWD crossing.

The model streambed infiltration rate was first calibrated to match dry-weather discharge, the prevalent discharge condition in the reach between the Rialto/RIX discharges and the MWD crossing.

The infiltration rate upstream of the RIX/Rialto discharge was estimated in calibration with storm and dry-weather conditions.

WEI WLAM should produce more streambed recharge under storm and dry-weather conditions.



WEI Question 4: *What are the associated implications for the water quality of surface water flow and recharge?*

Based on the information contained in TM No. 2 we are unclear as to what actually done in the 2017 WLAM to represent streambed recharge in Riverside A.

We may be able to provide an opinion when our understanding is complete.



TM Question 1: *What initial assumptions did the models make with respect to the permeability of streambed sediments in the upper half of Reach 3 (above the MWD gage)?*

The WEI WLAM streambed infiltration rate was first calibrated to match dry-weather discharge at the MWD crossing, the prevalent discharge condition in the reach between the Rialto/RIX discharges and the MWD crossing.

The infiltration rate upstream of the RIX/Rialto discharge was estimated in calibration with storm and dry-weather conditions.

The infiltration rate in Riverside A between the Rialto/RIX discharges and Hwy 60 was estimated to be 2.8 feet per day (fpd).

The streambed infiltration rate in the reaches upstream of Rialto/RIX ranged from 1.0 to 1.98 fpd.



TM Question 1: *Do the final calibrated values still align with our existing knowledge about the sediment characteristics in this area of the river?*

The streambed infiltration rate values estimated by WEI in the calibration seem reasonable based on the information used to estimate them.

It is unlikely the sediment characteristics would change significantly.

More reliable estimates of rising groundwater could be used to improve the reliability of streambed infiltration rates.



TM Question 2: *How much of the RIX and Rialto discharge is estimated to recharge in the upper half of Reach 3? (To keep this simple, let's focus only on dry weather baseflow conditions in August)*

By the framing of your question we assume you mean Reach 4 between the Rialto/RIX discharge point to Mission Boulevard bridge.

The WEI WLAM has a feature in it that computes the amounts of wastewater from each plant that recharge in each GMZ. The WEI WLAM has the capability to estimate the volume of streambed recharge from each wastewater plant and its associated TDS and TIN loads.

This capability was created to assist the Regional Board in the development of a wasteload allocation if required. WEI produced these estimates for the Task Force in 2002 and they were incorporated into the 2002 WLA report (Appendix C).

This can also be done with HSPF

We do not have comparable estimates for the currently planned discharges.



TM Question 3: *How was the amount of rising groundwater that occurs in upper half of Reach 3 estimated?*

In our 2002 and 2008 WEI WLAM model projections, the rising groundwater was estimated based on prior modeling work completed by CH2M-Hill for the design of the RIX facility.



TM Question 4

: How was the average TDS and TIN concentration of that same rising groundwater estimated?

The TDS and TIN concentrations in rising groundwater were estimated in calibration by:

- first completing the flow calibration for dry-weather conditions,
- simulating the discharge and recharge of Rialto/RIX recharge at their actual TDS and TIN concentrations, and then
- calibrating the rising water TDS and TIN concentrations to fit the dry-weather TDS and TIN concentrations at the MWD crossing.



TM Question 4: *Is there any way to know, with high confidence, what is happening in the upper half of Reach 3 without taking intermediate flow measurements at the Riverside Ave., Market St. and Mission Ave. bridges (above where we believe the rising groundwater starts to influence surface flows?)*

By the framing of your question we assume you mean Reach 4 between the Rialto/RIX discharge point to Mission Boulevard bridge.

Short answer - no.

There is limited recent monitoring and research that can be used to describe the losing water reach, gaining reach, streambed infiltration rates and rising groundwater.

Data sources include the USGS and WEI (SBMWD Clean Water Factory EIR)*. The time history of RIX discharges compared to the measured discharge at the MWD crossing can be used to tease out rising groundwater estimates and these should be used as a basis for rising water estimates.

* There may be other data sources.



TM Question 5: *Can we use a tool similar to Piper Diagrams to help sort out the relative flow contributions from RIX/Rialto vs. rising groundwater at the MWD gage?*

This is worthy of discussion. Piper diagrams and or intrinsic tracers may or may not be useful depending on the precise question(s) to be answered and hydrologic variability (intra annual and over wet and dry periods).

A reconnaissance effort could be done that would frame the precise questions to be answered, review the existing data and, data permitting, attempt to answer the questions.

We are skeptical.



End