Sept. 13, 2019 *transmitted via e-mail*

TO: Mark Norton, SAWPA & Johnson Yeh, Geosciences

CC: Lauren Wicks, Geosciences & Tess Dunham, Somach, Simmons & Dunn

FROM: Tim Moore, Risk Sciences

RE: Questions & Comments on Tables 5 thru 18 and Table 28

Part 2 of 3 for the Draft Summary Report contains a number of additional tables that are not discussed or referenced anywhere in the main body (Part 1) of the report (see excerpts attached to this comment memo). As such, it is not clear exactly what these tables represent or how they are used in the WLAM. Below are several questions regarding these tables. To make it easier for Geosciences to prepare responses, I began numbering where I left off in the comments previously submitted on 9/12/2019.

43) Since the tables focus on Water Years 2007 thru 2016, I assume these tables reflect the calibration results for the WLAM not any of the predictive scenarios. Is that correct?

44) Consequently, the TDS & TIN values shown would be based on the actual concentrations discharged by the POTWs in those years not the maximum permitted concentrations. Is that correct?

45) If the Retrospective Analysis had been run on WY2007 thru 2016 instead of WY2005 thru 2016, would the results of that truncated RA be expected to be quite close to the results shown for the 10-year annual average shown in Tables 5 thru 18?

46) Does this explain why the estimated TDS of streambed percolation in each of these tables does not appear to match the 10-year rolling average for the same 2007-16 period in the Tables shown in Appendix H?

For example, Table 7 indicates the average TDS concentration for streambed percolation to the Colton GMZ for 2007-2016 is 236 mg/L. But, the Table shown on page H-20 indicates the average TDS concentration for the 10-year period ending in 2016 is 246 mg/L (Scenario B).

Another example: Table 5 indicates the average TDS concentration for streambed percolation to the Bunker Hill GMZ for 2007-2016 is 198 mg/L. But, the Table shown on page H-15 shows the average TDS concentration for the 10-year period ending in 2016 is 257 mg/L (Scenario B).

Is the difference due primarily to the fact that the Table in Appendix H include SNRC in Scenario B but Table 5 thru 18 do not because SNRC was not yet operating during the calibration period?

47) Are the Annual Averages shown in the last row of each table the volume-weighted average of the 10-year period or the arithmetic mean of the individual volume-weighed annual averages?

48) Looking at Table 9, why is the TDS concentration of the streambed recharge so much higher than the TDS concentration in the downstream outflow in nine out of ten years but not in 2007? Same question for TIN?

49) Have the streambed percolation values for TIN (shown in Tables 5 thru 18) already been reduced to account for the appropriate N-loss coefficient for each stream segment?

50) Does the denitrification column shown in Table 14 represent N-losses in the surface stream or N-losses thru streambed percolation to groundwater?

51) Tables 15 and 16 show both "Rising Water" and "Streambed Percolation" in SAR-Reach 3 overlying the PBMZ. The difference (15,853 - 17,263) appears to suggest a small net recharge (1,410) to groundwater. This is not consistent with the statements made in the text of the main report.

52) Table 15 indicates that 10-year average TDS in the downstream outflow of the PBMZ is 442 mg/L. However, using data from the annual Watermaster reports, I calculate the mean of the ten annual values to be about 547 mg/L (see table below). What accounts for the 100 mg/L difference?

Water Year	Flow-weighted Average TDS
2007	607 mg/L
2008	504 mg/L
2009	533 mg/L
2010	450 mg/L
2011	517 mg/L
2012	598 mg/L
2013	621 mg/L
2014	582 mg/L
2015	522 mg/L
2016	541 mg/L
Mean	**547 mg/L**

53) Table 15 also shows that the TDS concentration of the rising groundwater into Reach 3 from the PBMZ (1,062 mg/L) is more than 500 mg/L grams higher that the TDS concentration of water percolating from Reach 3 into the PBMZ (575 mg/L). Am I correct in concluding that we can use these results to support WEI's previous conclusion that the recent exceedances of the baseflow TDS objective (700 ug/L) in the summer sampling program are due almost entirely to the very high TDS in rising groundwater and not the TDS concentrations in POTW discharges?

54) Table 17 shows the average TDS in upstream inflow to Reach 2 is 442 mg/L and the average TDS of local runoff to that same reach is 148 mg/L. By merging the two on a mass-balance basis, I estimate that the flow-weighted average combined TDS is about 402 mg/L. However, the table indicates that the average streambed percolation in Reach 2 is only 256 mg. I am not clear how the WLAM arrives at this estimate given the two input values.

55) Table 28 summarizes Annual Stormwater Spreading for Scenarios A-F in Orange County. Where does this "Stormwater Spreading" occur and how is it used in the WLAM? Is this the off-channel recharge basins or the in-channel spreading that is promoted by OCWD's T-levees? Since table purports to represent stormwater, why are the TDS concentrations so much higher than one normally associates with stormwater runoff?

DRAFT
Table 5

TDS Mass Balance in Reach 5 of the Santa Ana River overlying the Bunker Hill-B GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow									Outflow								
	Upstream Inflow			Surface Runoff from Precipitation			San Bernardino WRP			Streambed Percolation			Evapotranspiration			Downstream Outflow		
	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	3,537	163	784	5,690	206	1,594	14	498	10	7,119	196	1,900	19	0	0	2,101	170	486
2008	8,014	163	1,776	27,996	150	5,695	562	509	390	14,822	191	3,854	30	0	0	21,712	136	4,002
2009	2,635	163	584	20,822	160	4,517	263	488	174	9,925	204	2,755	19	0	0	13,775	134	2,514
2010	10,648	163	2,360	50,027	171	11,646	545	506	375	18,481	201	5,047	39	0	0	42,700	161	9,332
2011	39,404	163	8,733	108,177	180	26,532	2,906	526	2,078	32,528	191	8,453	53	0	0	117,877	180	28,883
2012	5,397	163	1,196	12,707	181	3,127	76	515	54	11,210	192	2,925	25	0	0	6,943	154	1,450
2013	4,527	163	1,003	11,513	182	2,845	13	517	9	10,041	195	2,668	23	0	0	5,990	146	1,187
2014	1,891	163	419	13,502	133	2,446	175	501	119	6,802	202	1,867	18	0	0	8,751	94	1,115
2015	1,805	163	400	15,207	146	3,025	0	NA	0	8,045	195	2,132	18	0	0	8,949	106	1,290
2016	1,603	163	355	13,375	168	3,046	17	477	11	7,548	215	2,212	18	0	0	7,426	119	1,198
Annual Average	**7,946**	**163**	**1,761**	**27,902**	**168**	**6,447**	**457**	**504**	**322**	**12,652**	**198**	**3,381**	**26**	**0**	**0**	**23,622**	**140**	**5,146**

1. GMZ = Groundwater Management Zone

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Table 6

TIN Mass Balance in Reach 5 of the Santa Ana River overlying the Bunker Hill-B GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow									Outflow											
	Upstream Inflow			Surface Runoff from Precipitation			San Bernardino WRP			Streambed Percolation			Evapotranspiration			Downstream Outflow			Denitrification		
	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	3,537	1.3	6	5,690	1.8	14	14	12.2	0	7,119	1.7	16	19	0.0	0	2,101	1.5	4	NA	NA	0
2008	8,014	1.3	14	27,996	2.1	79	562	13.0	10	14,822	2.4	48	30	0.0	0	21,712	1.9	55	NA	NA	0
2009	2,635	1.3	5	20,822	2.0	58	263	11.7	4	9,925	2.4	33	19	0.0	0	13,775	1.8	34	NA	NA	0
2010	10,648	1.3	19	50,027	2.5	167	545	14.5	11	18,481	2.4	60	39	0.0	0	42,700	2.4	137	NA	NA	0
2011	39,404	1.3	70	108,177	2.8	409	2,906	12.7	50	32,528	2.2	95	53	0.0	0	117,877	2.7	434	NA	NA	1
2012	5,397	1.3	10	12,707	1.8	32	76	15.2	2	11,210	1.9	28	25	0.0	0	6,943	1.5	14	NA	NA	0
2013	4,527	1.3	8	11,513	1.8	28	13	11.5	0	10,041	1.9	25	23	0.0	0	5,990	1.3	10	NA	NA	0
2014	1,891	1.3	3	13,502	1.2	23	175	13.6	3	6,802	1.8	17	18	0.0	0	8,751	1.1	13	NA	NA	0
2015	1,805	1.3	3	15,207	1.3	27	0	NA	0	8,045	1.8	20	18	0.0	0	8,949	0.9	10	NA	NA	0
2016	1,603	1.3	3	13,375	1.7	32	17	10.8	0	7,548	2.2	23	18	0.0	0	7,426	1.2	12	NA	NA	0
Annual Average	**7,946**	**1.3**	**14**	**27,902**	**1.9**	**87**	**457**	**12.8**	**8**	**12,652**	**2.1**	**36**	**26**	**0.0**	**0**	**23,622**	**1.6**	**72**	**NA**	**NA**	**0**

1. GMZ = Groundwater Management Zone

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Table 7

TDS Mass Balance in Reach 4 of the Santa Ana River overlying the Colton GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow						Outflow								
	Upstream Inflow			Surface Runoff from Precipitation			Streambed Percolation			Evapotranspiration			Downstream Outflow		
	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass
	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]
2007	2,101	170	486	2,240	232	706	848	279	322	255	0	0	3,238	192	846
2008	21,712	136	4,002	8,458	127	1,457	1,562	222	470	414	0	0	28,187	130	4,988
2009	13,775	134	2,514	5,625	128	982	1,175	240	383	315	0	0	17,902	128	3,110
2010	42,700	161	9,332	11,432	105	1,630	1,811	224	551	531	0	0	51,767	148	10,411
2011	117,877	180	28,883	27,656	100	3,770	2,634	226	808	573	0	0	142,261	165	31,847
2012	6,943	154	1,450	4,402	165	988	1,254	234	399	382	0	0	9,707	154	2,038
2013	5,990	146	1,187	3,228	192	844	1,107	255	384	348	0	0	7,760	155	1,636
2014	8,751	94	1,115	5,130	133	924	1,044	229	325	273	0	0	12,560	100	1,709
2015	8,949	106	1,290	6,143	128	1,070	1,204	216	353	292	0	0	13,591	109	2,007
2016	7,426	119	1,198	4,463	143	865	1,106	240	361	313	0	0	10,466	119	1,699
Annual Average	**23,622**	**140**	**5,146**	**7,878**	**145**	**1,324**	**1,374**	**236**	**436**	**370**	**0**	**0**	**29,744**	**140**	**6,029**

1. GMZ = Groundwater Management Zone

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Table 8

TIN Mass Balance in Reach 4 of the Santa Ana River overlying the Colton GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow						Outflow											
	Upstream Inflow			Surface Runoff from Precipitation			Streambed Percolation			Evapotranspiration			Downstream Outflow			Denitrification		
	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass
	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]
2007	2,101	1.5	4	2,240	0.8	3	848	1.3	2	255	0.0	0	3,238	1.2	5	NA	NA	0
2008	21,712	1.9	55	8,458	0.5	6	1,562	2.1	5	414	0.0	0	28,187	1.5	57	NA	NA	0
2009	13,775	1.8	34	5,625	0.5	4	1,175	1.7	3	315	0.0	0	17,902	1.4	34	NA	NA	0
2010	42,700	2.4	137	11,432	0.5	8	1,811	2.0	5	531	0.0	0	51,767	2.0	139	NA	NA	0
2011	117,877	2.7	434	27,656	0.7	27	2,634	2.5	9	573	0.0	0	142,261	2.3	451	NA	NA	0
2012	6,943	1.5	14	4,402	0.6	4	1,254	1.4	2	382	0.0	0	9,707	1.2	16	NA	NA	0
2013	5,990	1.3	10	3,228	0.7	3	1,107	1.5	2	348	0.0	0	7,760	1.1	11	NA	NA	0
2014	8,751	1.1	13	5,130	0.5	3	1,044	1.2	2	273	0.0	0	12,560	0.8	14	NA	NA	0
2015	8,949	0.9	10	6,143	0.5	4	1,204	1.2	2	292	0.0	0	13,591	0.7	12	NA	NA	0
2016	7,426	1.2	12	4,463	0.6	3	1,106	1.5	2	313	0.0	0	10,466	0.9	13	NA	NA	0
Annual Average	**23,622**	**1.6**	**72**	**7,878**	**0.6**	**6**	**1,374**	**1.7**	**3**	**370**	**0.0**	**0**	**29,744**	**1.3**	**75**	**NA**	**NA**	**0**

1. GMZ = Groundwater Management Zone

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Table 9

TDS Mass Balance in Reach 4 of the Santa Ana River overlying the Riverside-A GMZ[1] above Mission Blvd (Water Year 2007 to 2016)

Water Year	Inflow															Outflow								
	Upstream Inflow			Surface Runoff from Precipitation			Colton WWTP			Rialto WWTP			RIX Facility			Streambed Percolation			Evapotranspiration			Downstream Outflow		
	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	3,238	192	846	2,364	203	654	0	0	0	7,654	478	4,976	44,537	489	29,627	46,243	465	29,232	157	0	0	11,352	444	6,847
2008	28,187	130	4,988	8,092	100	1,099	0	0	0	7,257	503	4,962	42,737	500	29,079	50,939	422	29,240	169	0	0	35,118	228	10,869
2009	17,902	128	3,110	6,329	109	934	0	0	0	6,958	487	4,604	40,214	474	25,925	47,368	423	27,266	147	0	0	23,840	225	7,285
2010	51,767	148	10,411	10,856	88	1,292	0	0	0	6,651	383	3,468	40,107	487	26,538	52,224	384	27,267	176	0	0	56,922	186	14,421
2011	142,261	165	31,847	20,234	67	1,855	0	0	0	6,829	222	2,057	39,333	491	26,261	60,112	336	27,484	204	0	0	148,262	171	34,535
2012	9,707	154	2,038	4,901	147	981	0	0	0	6,766	352	3,242	37,966	498	25,714	46,184	425	26,717	161	0	0	12,960	297	5,241
2013	7,760	155	1,636	4,359	151	896	0	0	0	6,649	361	3,261	35,391	506	24,337	43,846	436	25,985	150	0	0	10,130	299	4,121
2014	12,560	100	1,709	5,822	107	850	0	0	0	6,527	355	3,151	33,270	496	22,429	42,094	423	24,227	158	0	0	15,891	180	3,894
2015	13,591	109	2,007	7,613	104	1,078	0	0	0	6,285	386	3,300	31,641	505	21,730	41,830	419	23,834	150	0	0	17,116	183	4,266
2016	10,466	119	1,699	4,807	128	837	0	0	0	6,437	469	4,108	32,431	479	21,143	41,650	428	24,239	147	0	0	12,310	211	3,529
Annual Average	**29,744**	**140**	**6,029**	**7,538**	**120**	**1,048**	**0**	**0**	**0**	**6,801**	**400**	**3,713**	**37,763**	**493**	**25,278**	**47,249**	**416**	**26,549**	**162**	**0**	**0**	**34,390**	**242**	**9,501**

1. GMZ = Groundwater Management Zone

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Table 10

TIN Mass Balance in Reach 4 of the Santa Ana River overlying the Riverside-A GMZ[1] above Mission Blvd (Water Year 2007 to 2016)

Water Year	Inflow															Outflow											
	Upstream Inflow			Surface Runoff from Precipitation			Colton WWTP			Rialto WWTP			RIX Facility			Streambed Percolation			Evapotranspiration			Downstream Outflow			Denitrification		
	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	3,238	1.2	5	2,364	1.7	6	0	0.0	0	7,654	8.1	84	44,537	7.0	424	46,243	6.6	418	157	0.0	0	11,352	6.4	99	NA	NA	1
2008	28,187	1.5	57	8,092	0.7	8	0	0.0	0	7,257	8.2	81	42,737	7.2	421	50,939	6.0	416	169	0.0	0	35,118	3.1	148	NA	NA	1
2009	17,902	1.4	34	6,329	0.8	7	0	0.0	0	6,958	8.8	83	40,214	8.3	451	47,368	7.1	459	147	0.0	0	23,840	3.5	115	NA	NA	1
2010	51,767	2.0	139	10,856	0.6	9	0	0.0	0	6,651	8.8	79	40,107	7.3	397	52,224	5.8	410	176	0.0	0	56,922	2.7	213	NA	NA	1
2011	142,261	2.3	451	20,234	0.5	13	0	0.0	0	6,829	8.7	81	39,333	7.1	378	60,112	5.0	410	204	0.0	0	148,262	2.5	511	NA	NA	1
2012	9,707	1.2	16	4,901	1.2	8	0	0.0	0	6,766	9.5	87	37,966	7.2	370	46,184	6.4	404	161	0.0	0	12,960	4.2	74	NA	NA	1
2013	7,760	1.1	11	4,359	1.2	7	0	0.0	0	6,649	9.0	81	35,391	7.5	363	43,846	6.7	401	150	0.0	0	10,130	4.4	60	NA	NA	1
2014	12,560	0.8	14	5,822	0.9	7	0	0.0	0	6,527	9.1	81	33,270	9.2	414	42,094	7.9	451	158	0.0	0	15,891	2.9	63	NA	NA	1
2015	13,591	0.7	12	7,613	0.8	8	0	0.0	0	6,285	9.5	81	31,641	6.9	296	41,830	6.0	343	150	0.0	0	17,116	2.2	52	NA	NA	1
2016	10,466	0.9	13	4,807	1.0	7	0	0.0	0	6,437	9.3	81	32,431	7.9	347	41,650	7.0	397	147	0.0	0	12,310	3.0	50	NA	NA	1
Annual Average	**29,744**	**1.3**	**75**	**7,538**	**0.9**	**8**	**0**	**0**	**0**	**6,801**	**8.9**	**82**	**37,763**	**7.5**	**386**	**47,249**	**6.5**	**411**	**162**	**0.0**	**0**	**34,390**	**3.5**	**139**	**NA**	**NA**	**1**

1. GMZ = Groundwater Management Zone

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Table 11

TDS Mass Balance in Reach 3 of the Santa Ana River overlying the Riverside-A GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow									Outflow								
	Upstream Inflow			Surface Runoff from Precipitation			Rising Water			Streambed Percolation			Evapotranspiration			Downstream Outflow		
	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	11,352	444	6,847	4,947	225	1,511	25,718	768	26,873	0	NA	0	82	0	0	41,937	618	35,233
2008	35,118	228	10,869	9,988	156	2,117	24,728	780	26,214	0	NA	0	81	0	0	69,749	413	39,199
2009	23,840	225	7,285	10,107	151	2,075	23,247	788	24,903	0	NA	0	79	0	0	57,113	441	34,262
2010	56,922	186	14,421	14,741	133	2,675	23,818	826	26,764	0	NA	0	75	0	0	95,404	338	43,857
2011	148,262	171	34,535	21,085	114	3,281	26,164	865	30,757	0	NA	0	80	0	0	195,369	258	68,574
2012	12,960	297	5,241	8,086	188	2,068	23,616	778	24,971	0	NA	0	86	0	0	44,577	533	32,280
2013	10,130	299	4,121	8,913	170	2,066	22,375	790	24,035	0	NA	0	83	0	0	41,339	538	30,222
2014	15,891	180	3,894	8,150	168	1,867	21,844	781	23,195	0	NA	0	88	0	0	45,798	465	28,956
2015	17,116	183	4,266	10,997	149	2,235	21,368	788	22,890	0	NA	0	84	0	0	49,399	438	29,391
2016	12,310	211	3,529	8,019	171	1,860	21,687	781	23,026	0	NA	0	82	0	0	41,934	498	28,415
Annual Average	**34,390**	**242**	**9,501**	**10,503**	**163**	**2,175**	**23,456**	**794**	**25,363**	**0**	**NA**	**0**	**82**	**0**	**0**	**68,262**	**454**	**37,039**

1. GMZ = Groundwater Management Zone

DRAFT
Table 12

TIN Mass Balance in Reach 3 of the Santa Ana River overlying the Riverside-A GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow									Outflow											
	Upstream Inflow			Surface Runoff from Precipitation			Rising Water			Streambed Percolation			Evapotranspiration			Downstream Outflow			Denitrification		
	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	11,352	6.4	99	4,947	2.0	13	25,718	10.5	369	0	NA	0	82	0.0	0	41,937	8.4	480	NA	NA	1
2008	35,118	3.1	148	9,988	1.3	17	24,728	10.7	359	0	NA	0	81	0.0	0	69,749	5.5	523	NA	NA	1
2009	23,840	3.5	115	10,107	1.2	17	23,247	11.5	363	0	NA	0	79	0.0	0	57,113	6.3	493	NA	NA	1
2010	56,922	2.7	213	14,741	1.0	21	23,818	10.8	351	0	NA	0	75	0.0	0	95,404	4.5	584	NA	NA	1
2011	148,262	2.5	511	21,085	0.9	26	26,164	10.6	378	0	NA	0	80	0.0	0	195,369	3.4	914	NA	NA	1
2012	12,960	4.2	74	8,086	1.6	17	23,616	10.9	349	0	NA	0	86	0.0	0	44,577	7.3	440	NA	NA	1
2013	10,130	4.4	60	8,913	1.4	17	22,375	11.1	337	0	NA	0	83	0.0	0	41,339	7.4	414	NA	NA	0
2014	15,891	2.9	63	8,150	1.4	16	21,844	10.8	322	0	NA	0	88	0.0	0	45,798	6.4	401	NA	NA	0
2015	17,116	2.2	52	10,997	1.2	18	21,368	10.8	314	0	NA	0	84	0.0	0	49,399	5.7	384	NA	NA	0
2016	12,310	3.0	50	8,019	1.5	16	21,687	11.0	325	0	NA	0	82	0.0	0	41,934	6.9	391	NA	NA	0
Annual Average	**34,390**	**3.5**	**139**	**10,503**	**1.4**	**18**	**23,456**	**10.9**	**347**	**0**	**NA**	**0**	**82**	**0.0**	**0**	**68,262**	**6.2**	**502**	**NA**	**NA**	**1**

1. GMZ = Groundwater Management Zone

DRAFT
Table 13

TDS Mass Balance in Reach 3 of the Santa Ana River overlying the Chino-South GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow									Outflow								
	Upstream Inflow			Surface Runoff from Precipitation			Riverside RWQCP			Streambed Percolation			Evapotranspiration			Downstream Outflow		
	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	41,937	618	35,233	6,110	162	1,350	36,375	599	29,638	21,625	597	17,557	520	0	0	62,249	575	48,657
2008	69,749	413	39,199	25,597	88	3,068	35,703	635	30,836	40,129	389	21,217	515	0	0	90,351	422	51,868
2009	57,113	441	34,262	22,775	80	2,469	34,541	644	30,223	36,916	410	20,588	500	0	0	76,973	443	46,370
2010	95,404	338	43,857	42,345	77	4,437	33,780	594	27,285	51,113	320	22,261	477	0	0	119,863	327	53,323
2011	195,369	258	68,574	57,638	84	6,598	33,487	605	27,530	88,509	261	31,368	504	0	0	197,321	266	71,323
2012	44,577	533	32,280	16,162	120	2,644	32,323	618	27,161	27,648	502	18,866	547	0	0	64,828	490	43,219
2013	41,339	538	30,222	14,366	122	2,390	33,094	626	28,180	28,043	503	19,184	530	0	0	60,180	508	41,608
2014	45,798	465	28,956	11,011	110	1,654	30,302	622	25,644	28,980	476	18,754	560	0	0	57,531	479	37,500
2015	49,399	438	29,391	22,141	90	2,699	29,766	622	25,192	34,569	416	19,571	536	0	0	66,166	419	37,710
2016	41,934	498	28,415	14,846	107	2,158	29,074	625	24,718	27,535	492	18,421	522	0	0	57,759	469	36,868
Annual Average	**68,262**	**454**	**37,039**	**23,299**	**104**	**2,947**	**32,844**	**NA**	**27,641**	**38,507**	**437**	**20,779**	**521**	**0**	**0**	**85,322**	**440**	**46,844**

1. GMZ = Groundwater Management Zone

DRAFT
Table 14

TIN Mass Balance in Reach 3 of the Santa Ana River overlying the Chino-South GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow									Outflow											
	Upstream Inflow			Surface Runoff from Precipitation			Riverside RWQCP			Streambed Percolation			Evapotranspiration			Downstream Outflow			Denitrification		
	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	41,937	8.4	480	6,110	1.2	10	36,375	9.8	486	21,625	8.6	253	520	0.0	0	62,249	8.2	695	NA	NA	27
2008	69,749	5.5	523	25,597	0.6	20	35,703	8.4	408	40,129	5.0	270	515	0.0	0	90,351	5.3	655	NA	NA	25
2009	57,113	6.3	493	22,775	0.5	15	34,541	9.8	462	36,916	5.8	291	500	0.0	0	76,973	6.2	652	NA	NA	27
2010	95,404	4.5	584	42,345	0.5	30	33,780	7.9	362	51,113	4.1	286	477	0.0	0	119,863	4.1	667	NA	NA	23
2011	195,369	3.4	914	57,638	0.6	49	33,487	7.9	359	88,509	3.3	403	504	0.0	0	197,321	3.3	894	NA	NA	24
2012	44,577	7.3	440	16,162	0.9	19	32,323	6.9	304	27,648	6.1	229	547	0.0	0	64,828	5.8	511	NA	NA	23
2013	41,339	7.4	414	14,366	0.8	15	33,094	7.3	326	28,043	6.2	235	530	0.0	0	60,180	6.1	497	NA	NA	23
2014	45,798	6.4	401	11,011	0.8	12	30,302	6.7	275	28,980	5.7	227	560	0.0	0	57,531	5.6	440	NA	NA	22
2015	49,399	5.7	384	22,141	0.6	18	29,766	6.8	276	34,569	4.8	228	536	0.0	0	66,166	4.8	429	NA	NA	21
2016	41,934	6.9	391	14,846	0.7	14	29,074	4.6	184	27,535	5.2	196	522	0.0	0	57,759	4.8	374	NA	NA	18
Annual Average	**68,262**	**6.2**	**502**	**23,299**	**0.7**	**20**	**32,844**	**NA**	**344**	**38,507**	**5.5**	**262**	**521**	**0.0**	**0**	**85,322**	**5.4**	**581**	**NA**	**NA**	**23**

1. GMZ = Groundwater Management Zone

DRAFT
Table 15

TDS Mass Balance in Reach 3 of the Santa Ana River overlying the Prado Basin GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow															Outflow											
	Upstream Inflow			Surface Runoff from Precipitation			Western Riverside County RWAP			Corona WWTP-1			Rising Water			Streambed Percolation			Evapotranspiration			OCWD Prado Wetland Diversion			Downstream Outflow		
	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	62,249	575	48,657	85,379	501	58,170	4,437	579	3,494	5,837	820	6,510	18,006	1,093	26,757	17,243	600	14,066	769	0	0	24,371	572	18,970	133,512	609	110,552
2008	90,351	422	51,868	110,532	374	56,187	6,002	560	4,566	3,512	715	3,412	17,664	1,038	24,933	17,302	581	13,659	762	0	0	27,665	511	19,222	182,301	436	108,083
2009	76,973	443	46,370	99,965	366	49,716	6,373	549	4,753	3,308	712	3,203	16,125	1,166	25,572	17,250	596	13,980	739	0	0	23,578	530	16,998	161,146	450	98,648
2010	119,863	327	53,323	133,380	271	49,226	6,404	532	4,630	1,708	699	1,624	17,668	1,097	26,359	17,264	539	12,654	705	0	0	29,681	466	18,808	231,300	330	103,698
2011	197,321	266	71,323	181,787	232	57,367	6,563	517	4,611	3,632	651	3,216	15,134	1,060	21,816	17,284	512	12,041	745	0	0	37,182	443	22,372	349,129	261	123,903
2012	64,828	490	43,219	73,421	357	35,599	6,435	518	4,536	3,139	658	2,808	14,881	1,066	21,567	17,290	576	13,530	809	0	0	23,881	503	16,318	120,705	475	77,888
2013	60,180	508	41,608	58,767	383	30,625	6,906	522	4,901	2,299	718	2,244	14,749	1,018	20,408	17,239	588	13,785	783	0	0	22,417	515	15,699	102,442	505	70,304
2014	57,531	479	37,500	46,914	381	24,310	7,114	532	5,143	1,822	693	1,717	14,749	1,017	20,388	17,235	596	13,973	827	0	0	18,990	529	13,665	91,057	496	61,422
2015	66,166	419	37,710	76,979	301	31,470	6,931	532	5,010	1,722	710	1,663	14,749	1,059	21,236	17,239	574	13,448	792	0	0	20,887	473	13,425	127,596	405	70,213
2016	57,759	469	36,868	67,482	334	30,638	7,601	524	5,410	6,530	682	6,056	14,802	1,009	20,315	17,285	586	13,768	771	0	0	19,448	513	13,577	116,643	454	71,937
Annual Average	**85,322**	**440**	**46,844**	**93,461**	**350**	**42,331**	**6,477**	**536**	**4,705**	**3,351**	**706**	**3,245**	**15,853**	**1,062**	**22,935**	**17,263**	**575**	**13,490**	**770**	**0**	**0**	**24,810**	**506**	**16,905**	**161,583**	**442**	**89,665**

1. GMZ = Groundwater Management Zone

DRAFT
Table 16

TIN Mass Balance in Reach 3 of the Santa Ana River overlying the Prado Basin GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow															Outflow														
	Upstream Inflow			Surface Runoff from Precipitation			Western Riverside County RWAP			Corona WWTP-1			Rising Water			Streambed Percolation			Evapotranspiration			OCWD Prado Wetland Diversion			Downstream Outflow			Denitrification		
	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass
	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons	acre-ft	mg/L	tons
2007	62,249	8.2	695	85,379	5	541	4,437	6.7	40	5,837	4.6	37	18,006	8.2	200	17,243	7.6	179	769	0.0	0	24,371	7	242	133,512	5.6	1,011	NA	NA	83
2008	90,351	5.3	655	110,532	3.4	510	6,002	2.4	20	3,512	5.0	24	17,664	5.7	137	17,302	6.4	150	762	0.0	0	27,665	6	210	182,301	3.7	914	NA	NA	73
2009	76,973	6.2	652	99,965	3.4	458	6,373	1.5	13	3,308	5.9	27	16,125	3.4	74	17,250	7.0	165	739	0.0	0	23,578	6	202	161,146	3.6	785	NA	NA	75
2010	119,863	4.1	667	133,380	2.5	453	6,404	0.0	0	1,708	5.1	12	17,668	4.5	108	17,264	5.6	132	705	0.0	0	29,681	5	197	231,300	2.7	853	NA	NA	62
2011	197,321	3.3	894	181,787	2.0	499	6,563	0.0	0	3,632	5.5	27	15,134	6.0	124	17,284	5.2	123	745	0.0	0	37,182	5	232	349,129	2.4	1,125	NA	NA	68
2012	64,828	5.8	511	73,421	3.1	314	6,435	1.3	12	3,139	6.6	28	14,881	4.9	99	17,290	5.6	133	809	0.0	0	23,881	5	161	120,705	3.7	609	NA	NA	63
2013	60,180	6.1	497	58,767	3.1	245	6,906	5.0	47	2,299	4.9	15	14,749	4.5	90	17,239	6.1	144	783	0.0	0	22,417	5	165	102,442	3.7	520	NA	NA	66
2014	57,531	5.6	440	46,914	2.9	185	7,114	3.7	36	1,822	7.7	19	14,749	4.5	90	17,235	5.9	138	827	0.0	0	18,990	5	137	91,057	3.5	435	NA	NA	61
2015	66,166	4.8	429	76,979	2.4	253	6,931	3.0	28	1,722	6.4	15	14,749	4.5	90	17,239	5.5	129	792	0.0	0	20,887	5	129	127,596	2.9	500	NA	NA	58
2016	57,759	4.8	374	67,482	2.4	219	7,601	2.3	24	6,530	6.0	54	14,802	4.5	90	17,285	4.9	115	771	0.0	0	19,448	4	115	116,643	3.0	482	NA	NA	50
Annual Average	**85,322**	**5.4**	**581**	**93,461**	**3.0**	**368**	**6,477**	**2.6**	**22**	**3,351**	**5.8**	**26**	**15,853**	**5.1**	**110**	**17,263**	**6.0**	**141**	**770**	**0.0**	**0**	**24,810**	**5**	**179**	**161,583**	**3.5**	**723**	**NA**	**NA**	**66**

1. GMZ = Groundwater Management Zone

DRAFT
Table 17

TDS Mass Balance in Reach 2 of the Santa Ana River overlying the Orange County GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow						Outflow											
	Upstream Inflow			Surface Runoff from Precipitation			Streambed Percolation			Evapotranspiration			OCWD Recharge Facilities Diversion			Downstream Outflow		
	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass	Flow	TDS Conc.	TDS Mass
	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]
2007	133,512	609	110,552	9,537	201	2,611	1,111	251	379	1,452	0	0	140,370	591	112,783	72	118	11
2008	182,301	436	108,083	22,926	138	4,310	12,902	266	4,665	1,496	0	0	157,655	448	96,024	33,135	260	11,714
2009	161,146	450	98,648	25,821	141	4,938	12,948	313	5,517	1,475	0	0	139,275	444	84,130	33,252	308	13,913
2010	231,300	330	103,698	47,695	109	7,091	28,585	292	11,344	1,481	0	0	150,996	302	62,103	97,918	281	37,355
2011	349,129	261	123,903	64,214	105	9,141	57,820	256	20,115	1,575	0	0	178,456	215	52,187	175,386	255	60,732
2012	120,705	475	77,888	19,948	155	4,201	3,127	265	1,127	1,587	0	0	132,232	443	79,638	3,696	264	1,329
2013	102,442	505	70,304	12,969	189	3,339	1,589	219	473	1,484	0	0	112,269	479	73,160	44	151	9
2014	91,057	496	61,422	11,700	165	2,632	1,574	209	448	1,549	0	0	97,992	475	63,301	1,605	129	283
2015	127,596	405	70,213	24,438	127	4,234	4,931	281	1,885	1,551	0	0	136,799	372	69,197	8,725	284	3,371
2016	116,643	454	71,937	18,252	148	3,678	2,946	211	847	1,513	0	0	127,156	429	74,136	3,263	145	642
Annual Average	**161,583**	**442**	**89,665**	**25,750**	**148**	**4,618**	**12,753**	**256**	**4,680**	**1,516**	**0**	**0**	**137,320**	**420**	**76,666**	**35,709**	**219**	**12,936**

1. GMZ = Groundwater Management Zone

DRAFT
Table 18

TIN Mass Balance in Reach 2 of the Santa Ana River overlying the Orange County GMZ[1]
(Water Year 2007 to 2016)

Water Year	Inflow						Outflow														
	Upstream Inflow			Surface Runoff from Precipitation			Streambed Percolation			Evapotranspiration			OCWD Recharge Facilities Diversion			Downstream Outflow			Denitrification		
	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass	Flow	TIN Conc.	TIN Mass
	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]	[acre-ft]	[mg/L]	[tons]
2007	133,512	5.6	1,011	9,537	1.7	22	1,111	2.2	3	1,452	0.0	0	140,370	5.4	1,023	72	1.0	0	NA	NA	6
2008	182,301	3.7	914	22,926	1.1	34	12,902	1.4	24	1,496	0.0	0	157,655	4.0	864	33,135	1.2	54	NA	NA	5
2009	161,146	3.6	785	25,821	1.1	38	12,948	1.4	24	1,475	0.0	0	139,275	3.9	740	33,252	1.2	54	NA	NA	5
2010	231,300	2.7	853	47,695	0.9	57	28,585	1.3	50	1,481	0.0	0	150,996	3.4	703	97,918	1.1	149	NA	NA	7
2011	349,129	2.4	1,125	64,214	0.9	74	57,820	1.0	79	1,575	0.0	0	178,456	3.5	849	175,386	0.9	222	NA	NA	50
2012	120,705	3.7	609	19,948	1.2	34	3,127	1.7	7	1,587	0.0	0	132,232	3.5	626	3,696	1.2	6	NA	NA	4
2013	102,442	3.7	520	12,969	1.4	25	1,589	1.7	4	1,484	0.0	0	112,269	3.5	538	44	1.2	0	NA	NA	4
2014	91,057	3.5	435	11,700	1.4	22	1,574	1.6	3	1,549	0.0	0	97,992	3.4	448	1,605	0.6	1	NA	NA	4
2015	127,596	2.9	500	24,438	1.0	34	4,931	1.4	10	1,551	0.0	0	136,799	2.7	507	8,725	1.1	13	NA	NA	4
2016	116,643	3.0	482	18,252	1.2	30	2,946	1.5	6	1,513	0.0	0	127,156	2.9	500	3,263	0.7	3	NA	NA	4
Annual Average	**161,583**	**3.5**	**723**	**25,750**	**1.2**	**37**	**12,753**	**1.5**	**21**	**1,516**	**0.0**	**0**	**137,320**	**3.6**	**680**	**35,709**	**1.0**	**50**	**NA**	**NA**	**9**

1. GMZ = Groundwater Management Zone

Annual Stormwater Spreading Summary for Scenarios A-F
Orange County

Water Year	Scenario A - 2020 Maximum Expected Discharge			Scenario B - 2020 Most Likely Discharge			Scenario C - 2020 Minimum Expected Discharge			Scenario D - 2040 Maximum Expected Discharge			Scenario E - 2040 Most Likely Discharge			Scenario F - 2040 Minimum Expected Discharge		
	Volume of Stormwater Recharge	Volume-weighted Average TDS Concentration	Volume-weighted Average TIN Concentration	Volume of Stormwater Recharge	Volume-weighted Average TDS Concentration	Volume-weighted Average TIN Concentration	Volume of Stormwater Recharge	Volume-weighted Average TDS Concentration	Volume-weighted Average TIN Concentration	Volume of Stormwater Recharge	Volume-weighted Average TDS Concentration	Volume-weighted Average TIN Concentration	Volume of Stormwater Recharge	Volume-weighted Average TDS Concentration	Volume-weighted Average TIN Concentration	Volume of Stormwater Recharge	Volume-weighted Average TDS Concentration	Volume-weighted Average TIN Concentration
	[acre-ft/yr]	mg/L	mg/L	[acre-ft/yr]	mg/L	mg/L	[acre-ft/yr]	mg/L	mg/L	[acre-ft/yr]	mg/L	mg/L	[acre-ft/yr]	mg/L	mg/L	[acre-ft/yr]	mg/L	mg/L
1950	128,288	637	4.3	53,712	657	4.2	45,023	754	3.7	138,110	589	4.8	62,836	643	4.3	51,873	734	3.7
1951	108,278	643	4.3	46,912	650	4.0	35,494	728	3.5	102,464	594	4.8	55,310	639	4.1	37,209	707	3.5
1952	127,030	570	3.9	87,272	512	3.3	68,610	490	2.8	123,152	528	4.3	80,326	481	3.3	75,403	481	2.7
1953	116,727	600	4.1	64,380	581	3.7	55,764	589	3.0	106,647	553	4.5	77,878	574	3.8	65,829	589	3.1
1954	121,749	628	4.3	52,043	573	3.7	46,740	642	3.3	120,673	579	4.7	64,733	605	3.9	57,978	654	3.3
1955	112,390	624	4.2	77,443	600	3.8	48,065	647	3.2	110,233	577	4.7	76,054	602	3.9	66,202	653	3.3
1956	114,674	641	4.3	43,093	654	4.1	43,325	755	3.6	119,376	587	4.7	59,425	634	4.1	43,464	724	3.5
1957	115,189	638	4.3	46,498	593	3.7	52,385	669	3.3	112,179	588	4.7	66,120	616	4.0	54,170	664	3.3
1958	102,557	569	3.9	85,100	522	3.3	76,643	507	2.7	111,320	529	4.3	84,734	523	3.4	80,229	516	2.8
1959	123,229	640	4.3	41,049	586	3.7	27,752	608	3.1	116,433	594	4.8	57,147	605	4.0	42,470	652	3.3
1960	104,622	643	4.3	49,620	610	3.8	35,892	692	3.3	96,717	590	4.8	68,824	629	4.1	58,566	693	3.4
1961	102,854	658	4.4	31,240	677	4.2	19,144	729	3.5	115,736	612	4.9	37,059	670	4.4	23,647	744	3.7
1962	119,422	632	4.3	64,124	601	3.9	54,646	688	3.4	111,650	594	4.8	72,818	601	3.9	55,064	639	3.3
1963	112,733	634	4.3	60,614	638	3.9	46,705	704	3.4	101,269	588	4.7	62,571	634	4.0	48,840	676	3.3
1964	119,820	650	4.4	58,894	673	4.2	38,900	763	3.7	121,722	596	4.8	71,363	663	4.3	57,192	744	3.7
1965	107,966	639	4.3	58,952	650	4.0	41,535	740	3.5	101,693	594	4.8	67,449	651	4.2	50,237	733	3.6
1966	100,065	614	4.2	55,137	550	3.7	47,128	582	3.2	116,829	577	4.7	54,197	588	3.9	53,768	615	3.3
1967	121,003	598	4.1	69,356	554	3.6	57,022	591	3.1	112,757	551	4.5	88,777	562	3.7	75,595	575	3.1
1968	107,403	644	4.4	43,000	641	4.1	53,107	731	3.6	121,419	596	4.8	67,757	641	4.2	52,418	721	3.6
1969	117,028	515	3.6	87,241	387	2.7	78,194	385	2.5	101,157	469	3.8	92,072	425	2.9	86,246	417	2.6
1970	110,789	643	4.4	54,288	652	4.1	31,449	718	3.6	120,275	597	4.8	63,148	654	4.3	47,969	726	3.7
1971	114,358	653	4.4	50,495	635	4.1	28,988	648	3.3	112,144	605	4.9	50,567	638	4.2	38,710	721	3.6
1972	121,399	660	4.5	33,446	697	4.3	26,164	808	3.9	135,381	611	4.9	37,001	683	4.4	26,329	786	3.9
1973	114,026	606	4.1	78,310	570	3.7	67,831	611	3.1	103,105	563	4.6	76,467	550	3.6	70,374	599	3.1
1974	123,962	640	4.3	56,271	618	4.0	43,103	701	3.5	128,991	593	4.8	50,270	598	4.0	47,343	681	3.5
1975	110,206	641	4.4	46,981	630	4.0	36,941	703	3.4	121,168	594	4.8	67,609	629	4.1	52,538	709	3.5
1976	119,728	649	4.4	38,006	648	4.0	29,035	735	3.6	128,728	600	4.8	50,339	660	4.3	35,348	746	3.7
1977	110,735	645	4.4	60,601	690	4.2	51,838	800	3.8	111,700	597	4.8	74,768	678	4.3	60,034	769	3.7
1978	99,551	534	3.7	92,630	411	2.8	81,666	408	2.5	119,988	504	4.1	93,112	444	3.0	85,530	393	2.4
1979	123,904	597	4.1	68,930	523	3.4	71,218	535	2.9	111,910	549	4.4	85,277	551	3.6	74,503	541	2.9
1980	99,712	518	3.6	95,858	458	3.0	87,533	436	2.6	102,754	504	4.1	95,886	451	3.0	85,534	438	2.6
1981	117,675	643	4.3	52,238	629	3.9	36,159	704	3.4	121,097	601	4.9	56,606	640	4.1	42,207	691	3.4
1982	109,864	618	4.2	75,267	593	3.7	68,506	649	3.2	107,152	564	4.6	75,420	571	3.7	71,768	623	3.2
1983	104,767	528	3.7	104,892	478	3.1	101,165	482	2.7	114,703	492	4.0	108,456	476	3.1	103,756	477	2.7
1984	118,901	645	4.4	67,195	625	3.9	50,723	668	3.3	111,697	587	4.7	72,921	624	4.1	57,595	678	3.5
1985	112,811	630	4.3	63,411	604	3.9	51,788	666	3.4	109,497	590	4.8	69,163	600	4.0	55,505	640	3.3
1986	119,404	610	4.1	82,593	595	3.7	69,051	651	3.2	116,501	573	4.6	80,133	586	3.8	71,699	625	3.1
1987	107,994	642	4.3	45,162	638	4.0	38,383	714	3.5	98,746	591	4.8	65,797	624	4.1	46,940	692	3.5
1988	101,777	616	4.2	65,261	613	3.9	52,236	696	3.5	117,129	583	4.7	82,002	613	4.0	62,242	679	3.5
1989	126,722	628	4.2	63,783	606	3.9	48,179	663	3.4	111,054	589	4.7	64,175	612	4.0	55,439	655	3.4
1990	107,587	638	4.3	49,551	639	4.0	42,492	706	3.5	99,913	595	4.8	56,992	621	4.0	45,839	676	3.4
1991	118,495	621	4.2	52,213	583	3.7	44,992	656	3.3	121,018	582	4.7	59,880	609	3.9	48,720	644	3.3
1992	113,128	600	4.1	68,981	515	3.3	64,304	566	2.9	102,340	554	4.4	72,655	544	3.5	64,838	549	2.9
1993	108,380	490	3.4	99,681	393	2.6	96,784	379	2.2	113,832	439	3.6	102,477	408	2.7	97,303	386	2.3
1994	136,765	606	4.1	71,716	558	3.5	55,123	593	3.1	141,837	565	4.5	77,125	554	3.6	61,813	583	3.1
1995	109,878	533	3.7	91,571	431	2.8	81,122	410	2.4	109,394	495	4.0	88,322	436	2.9	83,575	411	2.4
1996	124,834	615	4.2	52,223	589	3.7	46,538	577	3.0	121,067	570	4.6	64,559	573	3.7	45,205	575	3.1
1997	109,282	582	4.0	60,711	511	3.3	64,504	511	2.8	108,040	541	4.4	70,222	537	3.6	66,003	507	2.9
1998	116,079	515	3.5	101,818	440	2.8	107,949	442	2.5	124,603	482	3.9	100,525	441	2.9	109,651	421	2.4
1999	109,450	624	4.2	49,152	573	3.6	35,354	639	3.2	107,330	580	4.6	59,682	582	3.8	43,888	642	3.3
2000	115,200	631	4.3	44,281	559	3.5	36,413	591	3.0	113,782	587	4.7	52,967	572	3.7	44,054	611	3.1
2001	116,272	633	4.3	48,146	569	3.7	42,274	598	3.1	118,780	589	4.7	55,007	560	3.7	56,557	602	3.2
2002	105,146	652	4.4	25,161	656	4.1	13,911	695	3.5	101,949	604	4.9	29,622	640	4.2	20,391	702	3.6
2003	118,319	604	4.1	72,749	564	3.6	58,228	593	3.1	116,388	565	4.5	77,513	562	3.7	77,071	626	3.2
2004	109,236	631	4.3	59,614	622	3.9	45,247	677	3.4	114,325	583	4.7	61,800	606	3.9	48,262	669	3.4
2005	101,670	490	3.4	95,225	418	2.7	105,841	420	2.4	107,584	473	3.8	100,541	406	2.8	101,580	422	2.4
2006	119,455	604	4.0	79,168	570	3.5	61,327	579	2.9	118,668	576	4.6	85,592	588	3.8	70,211	606	3.1
2007	112,678	650	4.3	32,945	647	3.9	17,675	725	3.5	96,407	606	4.8	30,476	643	4.2	19,627	700	3.5
2008	120,223	623	4.2	64,700	571	3.6	64,752	629	3.2	116,096	572	4.6	68,314	564	3.8	65,248	615	3.2
2009	108,224	633	4.3	65,272	601	3.8	46,724	617	3.1	111,921	590	4.7	57,951	607	4.0	56,147	634	3.3
2010	103,679	577	3.9	73,620	511	3.3	64,870	527	2.9	104,394	547	4.4	77,172	509	3.4	73,629	535	2.9
2011	118,356	544	3.7	87,898	487	3.1	88,745	468	2.6	125,396	514	4.1	88,018	460	3.1	81,840	474	2.7
2012	114,250	623	4.2	64,347	621	3.9	48,599	650	3.3	102,425	575	4.6	60,517	597	3.9	51,546	661	3.4
2013	119,990	638	4.3	49,722	623	3.9	31,063	693	3.4	121,264	588	4.7	42,714	611	4.0	39,724	679	3.5
2014	107,685	651	4.4	40,918	677	4.2	26,942	760	3.7	113,816	603	4.8	36,060	658	4.2	34,375	747	3.7
2015	115,741	624	4.2	67,894	630	3.9	41,490	682	3.3	112,859	579	4.7	74,133	625	4.0	57,435	692	3.5
2016	131,535	633	4.3	48,063	624	3.9	38,895	693	3.4	137,912	586	4.7	52,394	612	4.0	41,699	679	3.4
Average	**114,072**	**612**	**4.2**	**62,517**	**582**	**3.7**	**52,480**	**628**	**3.2**	**114,158**	**569**	**4.6**	**68,504**	**582**	**3.8**	**58,716**	**625**	**3.2**