

**APPENDIX I – SANTA MARGARITA RIVER WMA  
TRANSITIONAL MS4 OUTFALL WET WEATHER EVENT AND ANNUAL LOADS**

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## MS4 Outfall Wet Weather Loads

During the 2017-2018 monitoring year, transitional wet weather MS4 outfall discharge monitoring was conducted at major MS4 outfalls in the Santa Margarita River Watershed Management Area (WMA) in accordance with Permit Provision D.2.a.(3). Event loads were calculated for each monitored outfall as well as an estimate of the volume of stormwater and pollutant loads discharged from the monitored MS4 outfalls annually based on each storm event with measurable rainfall greater than 0.10 inch as required by Provision D.4.b(2)(b)(i)[b]. Calculation methods and load results are described below.

### MS4 Outfall Wet Weather Event Loads

Flow-weighted or time-weighted composite samples were collected at each MS4 outfall station and analyzed for chemical and bacteriological parameters, and event wet weather loads were calculated for each location. Pollutant loads were estimated by multiplying the concentration of each monitored constituent by the cumulative discharge measured during the monitoring event. Event hydrographs for each MS4 outfall are provided in Appendix H. The concentration of the constituent used represents one of the following values:

- For detected constituents – the measured or estimated value (J-flagged result) reported by the contract laboratory,
- For detected constituents with a result reported above the upper method detection limit (e.g., bacterial indicators) – the upper detection limit, plus 1 unit.
- For constituents not detected – half the constituent method detection limit (MDL) was used to approximate a non-zero value to calculate wet weather instantaneous loads.

Wet weather loads were also calculated for constituents such as nitrate/nitrite as nitrogen (N) that were not universally monitored but could be easily calculated using available results (i.e., sum of discrete results for nitrate and nitrite). Total petroleum hydrocarbons were only sampled if sheen was observed. Hydrocarbons were measured at 902MS44034. Results were below the MDL and wet weather loads were estimated.

The 2017-2018 discharge volumes, cumulative rainfall measured during each monitoring event, and wet weather event loads for the monitored MS4 outfall locations in the Santa Margarita River WMA are presented in Table 1.

The Copermittees are required by Provision D.4.b.(2)(b) to conduct the land-use based wet weather storm drain outfall discharge monitoring assessments. One of the inputs to this analysis, the measured outfall runoff coefficient “C” value, was calculated for each event based on event rainfall and flow results. Measured outfall runoff “C” values are provided in Table 1. The measured runoff coefficient is a unit-less value that represents the percentage of total rainfall discharged during the monitoring event. It was calculated for each MS4 outfall monitoring event by dividing the cumulative wet weather discharge volume by the product of the tributary drainage area and the measured cumulative rainfall. The measured outfall runoff coefficient was not used to calculate wet weather event loads. Event wet weather loads were based on current-year discharge measurements.

Table I-1. 2017-2018 MS4 Outfall Wet Weather Event Loads

Analyte	Units	902MS45031	902MS41033	902MS44034	902MS43015	902MS442240	MS4-SMG-HST01	MS4-SMG-063
		Wildomar Outfall	District Outfall	Murrieta Outfall	Temecula Outfall	Riverside County Outfall	San Diego County	San Diego County
		902.31	902.42	902.33	902.32	902.51	902.23	902.23
Area	acres	106.1	107.4	54.3	106.2	5.5	93.2	18.4
Event Date	-	3/22/2018	2/27/2018	1/8/2018	2/27/2018	3/22/2018	1/9/2018	2/27/2018
Event Measured Rainfall	inches	0.26	0.36	1.8	0.36	0.55	1.36	0.4
Measured Outfall Runoff "C"	-	0.013	0.117	0.328	0.734	0.910	0.551	0.181
Event Volume	cf	1,284	16,462	115,031	102,465	10,012.9	253,411	4,836
<b>Bacteriological</b>								
<i>E. coli</i>	MPN	2.91E+09	1.07E+10	1.63E+11	3.77E+10	4.54E+11	NS	NS
<i>Enterococcus</i>	MPN	2.91E+09	9.32E+08	2.93E+12	6.67E+10	1.42E+10	1.15E+13	3.83E+09
Fecal Coliform	MPN	2.91E+09	1.07E+10	1.63E+11	3.77E+10	4.54E+11	5.74E+11	1.10E+09
Total Coliform	MPN	8.73E+09	1.40E+11	2.93E+12	6.67E+10	4.54E+10	3.59E+12	1.23E+10
<b>General Chemistry</b>								
Total Organic Carbon	lbs	1.52	18.50	172.35	49.25	4.94	395.49	5.74
Dissolved Organic Carbon	lbs	1.20	15.41	129.26	35.18	3.31	348.03	5.43
Sulfate	lbs	0.26	164.43	596.03	460.55	7.50	2,214.77	2.48
Surfactants (MBAS)	lbs	0.01	0.03	1.22	0.32	0.09	0.40	0.06
Chloride	lbs	NS	NS	NS	NS	NS	NS	NS
Total Hardness	lbs	2.32	308.30	1,005.35	831.56	28.75	4,018.22	11.84
Total Dissolved Solids	lbs	6.57	924.90	2,656.99	2,046.91	68.76	8,542.67	27.78
Total Suspended Solids	lbs	9.62	4.11	129.26	51.17	5.00	13,288.60	19.02
Biological Oxygen Demand	lbs	0.80	13.36	71.81	37.74	6.25	NS	NS

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Analyte	Units	902MS45031	902MS41033	902MS44034	902MS43015	902MS442240	MS4-SMG-HST01	MS4-SMG-063
		Wildomar Outfall	District Outfall	Murrieta Outfall	Temecula Outfall	Riverside County Outfall	San Diego County	San Diego County
		902.31	902.42	902.33	902.32	902.51	902.23	902.23
Chemical Oxygen Demand	lbs	0.80	49.33	610.39	83.16	23.13	NS	NS
Diesel Range Hydrocarbons	lbs	NS	NS	1.65	NS	NS	NS	NS
Gasoline Range Organics	lbs	NS	NS	0.09	NS	NS	NS	NS
Oil and Grease	lbs	0.11	3.60	6.46	13.43	0.28	NS	NS
<b>Nutrients</b>								
Total Nitrogen	lbs	0.24	4.73	27.29	7.68	1.00	265.36	1.24
Ammonia as N	lbs	0.08	0.10	2.30	0.70	0.14	2.37	0.23
Ammonia as N (Unionized)	lbs	0.001	0.002	0.19	0.01	0.004	NS	NS
Nitrate as N	lbs	0.06	3.08	10.77	3.84	0.38	189.84	0.48
Nitrite as N	lbs	0.002	0.03	0.44	0.08	0.02	1.17	0.00
Nitrate/Nitrite as N	lbs	0.06	3.11	11.21	3.92	0.40	191.01	0.49
Total Kjeldahl Nitrogen	lbs	0.18	1.64	15.80	3.84	0.63	74.35	1.24
Total Phosphorus	lbs	0.03	0.14	3.30	5.37	0.16	49.04	0.10
Dissolved Phosphorus	lbs	0.008	1.64	10.05	0.90	0.12	NS	NS
Orthophosphate	lbs	NS	NS	NS	NS	NS	31.64	0.06
<b>Total Metals</b>								
Arsenic	lbs	0.0003	0.0025	0.0151	0.0115	0.0008	0.0712	0.0004
Cadmium	lbs	0.000005	0.0001	0.0004	0.0004	0.00004	0.0071	0.0001
Chromium	lbs	0.0006	0.0015	0.0208	0.0077	0.0009	0.2531	0.0009
Copper	lbs	0.0014	0.0164	0.0862	0.0326	0.0042	0.6328	0.0066

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Analyte	Units	902MS45031	902MS41033	902MS44034	902MS43015	902MS442240	MS4-SMG-HST01	MS4-SMG-063
		Wildomar Outfall	District Outfall	Murrieta Outfall	Temecula Outfall	Riverside County Outfall	San Diego County	San Diego County
		902.31	902.42	902.33	902.32	902.51	902.23	902.23
Iron	lbs	0.5210	0.2364	3.0160	3.1983	0.2563	442.9532	0.7850
Lead	lbs	0.0004	0.0002	0.0057	0.0026	0.0003	0.2848	0.0016
Manganese	lbs	0.0112	0.0298	0.2801	0.1343	0.0094	12.8140	0.0217
Mercury	lbs	0.000002	0.00003	0.0002	0.0002	0.00002	NS	NS
Nickel	lbs	0.0004	0.0055	0.0201	0.0096	0.0008	0.1582	0.0011
Selenium	lbs	0.0001	0.0007	0.0036	0.0019	0.0004	0.0125	0.00004
Silver	lbs	0.000005	0.0001	0.0004	0.0004	0.00004	NS	NS
Thallium	lbs	0.000020	0.0003	0.0018	0.0016	0.0002	0.0076	0.00001
Zinc	lbs	0.0078	0.0473	0.1293	0.1151	0.0094	3.4803	0.0513
<b>Dissolved Metals</b>								
Arsenic	lbs	0.0001	0.0021	0.0129	0.0090	0.0007	0.0285	0.0002
Cadmium	lbs	0.000005	0.0001	0.0004	0.0004	0.0000	0.0014	0.00002
Chromium	lbs	0.0002	0.0016	0.0151	0.0026	0.0006	0.0060	0.0001
Copper	lbs	0.0006	0.0134	0.0610	0.0243	0.0031	0.1424	0.0039
Iron	lbs	0.0021	0.0391	0.2370	0.1215	0.0061	1.7402	0.0263
Lead	lbs	0.000008	0.0001	0.0014	0.0006	0.0001	0.0022	0.0001
Manganese	lbs	0.0014	0.0078	0.1508	0.0454	0.0016	2.0566	0.0033
Mercury	lbs	0.000002	0.0000	0.0002	0.0002	0.00002	NS	NS
Nickel	lbs	0.0001	0.0049	0.0172	0.0083	0.0006	0.0269	0.0005
Selenium	lbs	0.000012	0.0009	0.0018	0.0010	0.0003	0.0052	0.0001
Silver	lbs	0.000005	0.0001	0.0004	0.0004	0.00004	NS	NS
Thallium	lbs	0.000020	0.0003	0.0018	0.0016	0.0002	0.0016	0.0000
Zinc	lbs	0.0014	0.0349	0.0862	0.0704	0.0038	0.3322	0.0242
<b>Pesticides</b>								

**Table I-1. 2017-2018 MS4 Outfall Wet Weather Event Loads**

Analyte	Units	902MS45031	902MS41033	902MS44034	902MS43015	902MS442240	MS4-SMG-HST01	MS4-SMG-063
		Wildomar Outfall	District Outfall	Murrieta Outfall	Temecula Outfall	Riverside County Outfall	San Diego County	San Diego County
		902.31	902.42	902.33	902.32	902.51	902.23	902.23
Chlorpyrifos	lbs	0.000002	0.00003	0.0002	0.0002	NS	0.0001	0.000002
Diazinon	lbs	0.000002	0.00003	0.0002	0.0002	NS	NS	NS

**Table I-1 Notes:**

NS – not sampled

HUC – hydrologic unit code

cf – cubic feet

lbs – pounds

MPN – most probable number

\*Hydrocarbon samples were collected only if sheen was observed.

## MS4 Outfall 2017-2018 Annual Wet Weather Loads

Annual wet weather pollutant loads for the 2017-2018 monitoring year were estimated for each monitored MS4 outfall location by multiplying the concentration of each monitored constituent (determined using the same methods described above) by estimated annual discharge volumes for each outfall. Flow monitoring equipment was only installed at MS4 outfall locations during wet weather monitoring events. Therefore, annual discharge volumes were modeled for the remainder of the compliance year. Wet weather discharge volumes were modeled using the rational method, a land-use based washoff model. The rational method is traditionally used to estimate peak storm flows from drainage areas to properly size flood management infrastructure. Recognizing that the regional hydrology manuals for San Diego and Riverside Counties have slightly different rational method analytical approaches, a standardized calculation approach was used for all MS4 outfalls in the WMA. Equation 1 was used to estimate annual wet weather discharge for each MS4 outfall.

**Equation 1.  $Q = A * C * I$**

Where:

Q = cumulative discharge per calendar day, in cubic feet (cf)

A = drainage area contributing to the MS4 outfall, in acres (constant)

C = measured outfall runoff coefficient “C”, a unique value for each MS4 outfall based on the average measured C values from 2016-2017 and 2017-2018

I = cumulative rainfall (inches) for the 2017-2018 monitoring year represented for each 24 hour calendar day greater than or equal to 0.1 inch

Riverside County – based on local precipitation data (see Table I-2 for gauge)

San Diego County – based on precipitation data for Sandia Creek (Alert Station #139).

The 2017-2018 annual wet weather loads for the monitored MS4 outfall locations in the Santa Margarita River WMA are presented in Table 2.

**Table I-2. 2017-2018 MS4 Outfall Annual Wet Weather Loads**

Analyte	Units	902MS45031	902MS41033	902MS44034	902MS43015	902MS442240	MS4-SMG-HST01	MS4-SMG-063
		Wildomar Outfall	District Outfall	Murrieta Outfall	Temecula Outfall	Riverside County Outfall	San Diego County	San Diego County
		902.31	902.42	902.33	902.32	902.51	902.23	902.23
<b>Area</b>	<b>acres</b>	106.1	107.4	54.3	106.2	5.5	93.2	18.4
<b>Precipitation Station (Rain Gage)</b>	-	246 Wildomar	217 Temecula NWS	128 Tenja at Murrieta Ck	217 Temecula NWS	217 Temecula NWS	139 Sandia Creek	139 Sandia Creek
<b>2017-18 Qualifying Measured Rainfall (≥0.1")</b>	<b>inches</b>	4.9	5.89	3.63	5.89	5.89	6.81	6.81
<b>Measured Outfall Runoff "C"</b>	-	0.013	0.117	0.328	0.734	0.910	0.551	0.181
<b>Average Runoff "C" (2016-2018)</b>	-	0.024	0.082	0.297	0.574	1.035	0.280	0.258
<b>2017-2018 Annual Volume</b>	<b>cf</b>	44,972	189,192	212,817	1,304,045	121,824	644,431	117,318
<b>Bacteriological</b>								
<i>E. coli</i>	MPN	1.02E+11	1.23E+11	3.01E+11	4.80E+11	5.52E+12	NS	NS
<i>Enterococcus</i>	MPN	1.02E+11	1.07E+10	5.42E+12	8.49E+11	1.72E+11	2.92E+13	9.30E+10
Fecal Coliform	MPN	1.02E+11	1.23E+11	3.01E+11	4.80E+11	5.52E+12	1.46E+12	2.66E+10
Total Coliform	MPN	3.06E+11	1.61E+12	5.42E+12	8.49E+11	5.52E+11	9.12E+12	2.99E+11
<b>General Chemistry</b>								
Total Organic Carbon	lbs	53.34	212.59	318.85	626.84	60.08	1,005.75	139.15
Dissolved Organic Carbon	lbs	42.11	177.16	239.14	447.74	40.31	885.06	131.83
Sulfate	lbs	9.26	1,889.72	1,102.70	5,861.37	91.26	5,632.21	60.06
Surfactants (MBAS)	lbs	0.39	0.30	2.26	4.07	1.14	1.01	1.39
Chloride	lbs	NS	NS	NS	NS	NS	NS	NS
Total Hardness	lbs	81.42	3,543.22	1,859.98	10,583.03	349.84	10,218.44	287.10

**Table I-2. 2017-2018 MS4 Outfall Annual Wet Weather Loads**

Analyte	Units	902MS45031	902MS41033	902MS44034	902MS43015	902MS442240	MS4-SMG-HST01	MS4-SMG-063
		Wildomar Outfall	District Outfall	Murrieta Outfall	Temecula Outfall	Riverside County Outfall	San Diego County	San Diego County
		902.31	902.42	902.33	902.32	902.51	902.23	902.23
Total Dissolved Solids	lbs	230.21	10,629.65	4,915.66	26,050.54	836.57	21,724.24	673.79
Total Suspended Solids	lbs	336.89	47.24	239.14	651.26	60.84	33,793.27	461.40
Biological Oxygen Demand	lbs	28.07	153.54	132.86	480.31	76.05	NS	NS
Chemical Oxygen Demand	lbs	28.07	566.91	1,129.27	1,058.30	281.39	NS	NS
Diesel Range Hydrocarbons	lbs	NS	NS	3.06	NS	NS	NS	NS
Gasoline Range Organics	lbs	NS	NS	0.16	NS	NS	NS	NS
Oil and Grease	lbs	3.93	41.34	11.96	170.96	3.42	NS	NS
<b>Nutrients</b>								
Total Nitrogen	lbs	8.42	54.33	50.49	97.69	12.17	674.82	30.12
Ammonia as N	lbs	2.72	1.18	4.25	8.95	1.67	6.03	5.49
Ammonia as N (Unionized)	lbs	0.03	0.02	0.36	0.15	0.05	NS	NS
Nitrate as N	lbs	2.08	35.43	19.93	48.84	4.64	482.76	11.72
Nitrite as N	lbs	0.08	0.34	0.81	1.06	0.27	2.98	0.10
Nitrate/Nitrite as N	lbs	2.16	35.77	20.74	49.90	4.91	485.74	11.81
Total Kjeldahl Nitrogen	lbs	6.18	18.90	29.23	48.84	7.61	189.08	30.12
Total Phosphorus	lbs	1.21	1.65	6.11	68.38	1.90	124.71	2.34
Dissolved Phosphorus	lbs	0.27	18.90	18.60	11.40	1.44	NS	NS
Orthophosphate	lbs	NS	NS	NS	NS	NS	80.46	1.54

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Analyte	Units	902MS45031	902MS41033	902MS44034	902MS43015	902MS442240	MS4-SMG-HST01	MS4-SMG-063
		Wildomar Outfall	District Outfall	Murrieta Outfall	Temecula Outfall	Riverside County Outfall	San Diego County	San Diego County
		902.31	902.42	902.33	902.32	902.51	902.23	902.23
<b>Total Metals</b>								
Arsenic	lbs	0.0104	0.0283	0.0279	0.1465	0.0099	0.1810	0.0095
Cadmium	lbs	0.0002	0.0014	0.0008	0.0051	0.0005	0.0181	0.0014
Chromium	lbs	0.0225	0.0177	0.0385	0.0977	0.0114	0.6437	0.0212
Copper	lbs	0.0505	0.1890	0.1594	0.4152	0.0510	1.6092	0.1611
Iron	lbs	18.2485	2.7165	5.5799	40.7040	3.1181	1,126.4422	19.0420
Lead	lbs	0.0129	0.0024	0.0106	0.0326	0.0030	0.7241	0.0395
Manganese	lbs	0.3930	0.3425	0.5181	1.7096	0.1141	32.5864	0.5273
Mercury	lbs	0.0001	0.0003	0.0004	0.0022	0.0002	NS	NS
Nickel	lbs	0.0146	0.0638	0.0372	0.1221	0.0099	0.4023	0.0264
Selenium	lbs	0.0045	0.0083	0.0066	0.0244	0.0046	0.0318	0.0010
Silver	lbs	0.0002	0.0007	0.0008	0.0049	0.0005	NS	NS
Thallium	lbs	0.0007	0.0030	0.0033	0.0204	0.0019	0.0193	0.0002
Zinc	lbs	0.2723	0.5433	0.2391	1.4653	0.1141	8.8506	1.2451
<b>Dissolved Metals</b>								
Arsenic	lbs	0.0028	0.0236	0.0239	0.1140	0.0084	0.0724	0.0047
Cadmium	lbs	0.0002	0.0007	0.0008	0.0049	0.0005	0.0035	0.0004
Chromium	lbs	0.0059	0.0189	0.0279	0.0326	0.0076	0.0153	0.0034
Copper	lbs	0.0222	0.1535	0.1129	0.3094	0.0380	0.3621	0.0952
Iron	lbs	0.0730	0.4488	0.4384	1.5468	0.0745	4.4253	0.6372
Lead	lbs	0.0003	0.0012	0.0027	0.0081	0.0008	0.0056	0.0027
Manganese	lbs	0.0477	0.0898	0.2790	0.5780	0.0190	5.2299	0.0806
Mercury	lbs	0.0001	0.0003	0.0004	0.0022	0.0002	NS	NS
Nickel	lbs	0.0048	0.0567	0.0319	0.1058	0.0068	0.0684	0.0125

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Analyte	Units	902MS45031	902MS41033	902MS44034	902MS43015	902MS442240	MS4-SMG-HST01	MS4-SMG-063
		Wildomar Outfall	District Outfall	Murrieta Outfall	Temecula Outfall	Riverside County Outfall	San Diego County	San Diego County
		902.31	902.42	902.33	902.32	902.51	902.23	902.23
Selenium	lbs	0.0004	0.0106	0.0033	0.0122	0.0030	0.0133	0.0015
Silver	lbs	0.0002	0.0007	0.0008	0.0049	0.0005	NS	NS
Thallium	lbs	0.0007	0.0030	0.0033	0.0204	0.0019	0.0040	0.0007
Zinc	lbs	0.0477	0.4016	0.1594	0.8955	0.0456	0.8448	0.5859
<b>Pesticides</b>								
Chlorpyrifos	lbs	0.0001	0.0003	0.0003	0.0020	NS	0.0002	0.00004
Diazinon	lbs	0.0001	0.0003	0.0003	0.0020	NS	NS	NS

**Table I-2 Notes:**

NS – not sampled

HUC – hydrologic unit code

cf – cubic feet

lbs – pounds

MPN – most probable number

\*Hydrocarbon samples were collected only if sheen was observed.