

# CHAPTER 3 – APPENDIX G: OPTIONAL WATERSHED MANAGEMENT AREA ANALYSIS (WMAA) CANDIDATE PROJECTS

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**Table 3G- 1. El Cajon: San Diego River Watershed Management Area Assessment Projects List**

Project Identifier	Watershed Management Area	Hydrologic Area (HA)	Hydrologic Subarea (HSA)	Jurisdiction	Project Name	Ownership		Project Location				Project Origination/Originator		Project Category	Specific Project Type
						Type	Owner Information	Address	APN	Latitude	Longitude	Name	Contact Information		
SDR-10	San Diego River	Lower San Diego	El Cajon	El Cajon	MJ-R-D-1	Public	San Diego County	N. Marshall Ave. and Cuyamaca St., El Cajon, CA	3871900800	1882196.91	6336553.33	S.D. County, City Of San Diego, City of La Mesa, City of El Cajon, City of Santee		Regional BMPs	Gross Solids and Trash Removal

**Table 3G-2. City of San Diego: San Diego River Watershed Management Area Assessment Project List**

Project Identifier	Watershed Management Area	Jurisdiction	Ownership	Project Location				Project Size & Parameters				Other Notes
			Owner Information	Address	APN	Latitude (X-Coordinate)	Longitude (Y-Coordinate)	Contributing Drainage Area (acres)	Parcel Size (acres)	Project Footprint (acres)	Parameters (with units as necessary)	
Public Parcels Identified as Suitable for Further Assessment to Determine Feasibility of Retrofitting with Green Infrastructure												
Parcels on this list that are 0.25 acres or greater have been assessed using broad assumptions necessary for computer modeling and were found to be potentially effective as an opportunity for contributing to load reduction goals. Considerable further assessment would be required before determining any of these sites to be viable retrofit sites for implementation of Green Infrastructure. That assessment includes verifying public ownership, determining if land use agreements and financing can be established, assessing feasibility based upon further investigation of physical site constraints at a project design level, and determining that construction and necessary approvals, including approvals from regulatory agencies other than the City of San Diego, can be completed within the time constraints in the Municipal Storm Water Permit that pertain to Alternative Compliance.												
1	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4365400600	6271960.61690000000	1858885.13726000000	TBD	8.43	TBD	TBD	TBD
2	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4365400700	6271959.81782000000	1859293.03247000000	TBD	3.91	TBD	TBD	TBD
3	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4210305400	6291729.82911000000	1875381.08817000000	TBD	4.07	TBD	TBD	TBD
4	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4411600400	6263428.84682000000	1855426.39730000000	TBD	7.68	TBD	TBD	TBD
5	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4821705000	6339801.31690000000	1875760.30229000000	TBD	1.22	TBD	TBD	TBD
6	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4830212800	6340225.66102000000	1876652.51839000000	TBD	0.92	TBD	TBD	TBD
7	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4498608300	6258864.54200000000	1855043.39600000000	TBD	1.57	TBD	TBD	TBD
8	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4313202100	6278852.82234000000	1866133.79441000000	TBD	1.58	TBD	TBD	TBD
9	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4212910200	6290284.19036000000	1874074.87660000000	TBD	1.63	TBD	TBD	TBD
10	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3822601200	6349893.72700000000	1891724.34900000000	TBD	7.84	TBD	TBD	TBD
11	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4491100800	6258923.84207000000	1853753.85700000000	TBD	3.80	TBD	TBD	TBD
12	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4631110100	6312244.38913000000	1865532.18088000000	TBD	0.23	TBD	TBD	TBD
13	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3690402300	6289856.34251000000	1884716.71162000000	TBD	4.32	TBD	TBD	TBD
14	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4210305600	6292567.83850000000	1875157.25309000000	TBD	3.60	TBD	TBD	TBD
15	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4426212000	6271214.16355000000	1855369.84926000000	TBD	1.73	TBD	TBD	TBD
16	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4821902100	6338457.74796000000	1872745.29350000000	TBD	1.68	TBD	TBD	TBD
17	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3870300500	6342314.66959000000	1881981.04938000000	TBD	0.88	TBD	TBD	TBD
18	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3941410600	6355018.57753000000	1892436.00776000000	TBD	0.17	TBD	TBD	TBD
19	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4365400800	6271268.62875000000	1859124.10526000000	TBD	1.39	TBD	TBD	TBD
20	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4210305500	6292202.78233000000	1875304.80864000000	TBD	3.17	TBD	TBD	TBD
21	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4498700300	6260981.53292000000	1854769.59111000000	TBD	6.16	TBD	TBD	TBD
22	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4332501600	6294188.80695000000	1865293.28405000000	TBD	132.19	TBD	TBD	TBD
23	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3941410700	6355025.47597000000	1892389.32099000000	TBD	0.17	TBD	TBD	TBD
24	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4640901300	6320460.93349000000	1864753.29555000000	TBD	0.48	TBD	TBD	TBD
25	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4210400700	6285991.12254000000	1874972.35651000000	TBD	0.69	TBD	TBD	TBD
26	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4415900500	6264267.50968000000	1856432.59103000000	TBD	5.23	TBD	TBD	TBD
27	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4210306100	6291246.94719000000	1875814.34568000000	TBD	14.23	TBD	TBD	TBD
28	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3734900600	6304064.40091000000	1885160.24024000000	TBD	5.24	TBD	TBD	TBD
29	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4210306000	6291854.30037000000	1876419.91264000000	TBD	99.22	TBD	TBD	TBD
30	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4212901100	6287850.14331000000	1877338.88703000000	TBD	409.77	TBD	TBD	TBD
31	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4640700900	6319937.71057000000	1864931.80787000000	TBD	2.27	TBD	TBD	TBD

Project Identifier	Watershed Management Area	Jurisdiction	Ownership	Project Location				Project Size & Parameters				Other Notes
			Owner Information	Address	APN	Latitude (X-Coordinate)	Longitude (Y-Coordinate)	Contributing Drainage Area (acres)	Parcel Size (acres)	Project Footprint (acres)	Parameters (with units as necessary)	
32	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4210500100	6286133.58650000000	1874150.64150000000	TBD	11.35	TBD	TBD	TBD
33	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4425200800	6270702.20031000000	1856524.21687000000	TBD	11.90	TBD	TBD	TBD
34	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6724900500	6306195.90236000000	1869360.48157000000	TBD	0.52	TBD	TBD	TBD
35	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3562310300	6285679.78309000000	1880196.67901000000	TBD	1.33	TBD	TBD	TBD
36	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4367300500	6272175.03471000000	1858241.73568000000	TBD	18.93	TBD	TBD	TBD
37	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4312900200	6278823.67800000000	1867469.96914000000	TBD	0.22	TBD	TBD	TBD
38	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4495910300	6260495.09176000000	1850354.07084000000	TBD	0.26	TBD	TBD	TBD
39	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4494721300	6260320.56442000000	1850616.08091000000	TBD	0.23	TBD	TBD	TBD
40	San Diego River	City of San Diego	CITY OF SAN DIEGO (OCEAN BEACH RECREATION CENTER)	TBD	4484020800	6255666.55073000000	1852339.12233000000	TBD	1.23	TBD	TBD	TBD
41	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4446503600	6280232.33314000000	1853728.47389000000	TBD	0.45	TBD	TBD	TBD
42	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4495821800	6260245.76160000000	1849447.82320000000	TBD	0.13	TBD	TBD	TBD
43	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480230200	6253699.18708000000	1854690.32675000000	TBD	0.17	TBD	TBD	TBD
44	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480210200	6253562.15184000000	1854338.51592000000	TBD	0.29	TBD	TBD	TBD
45	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3690402200	6289474.02403000000	1885098.78900000000	TBD	1.78	TBD	TBD	TBD
46	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3921202000	6355379.75839000000	1896091.09117000000	TBD	0.66	TBD	TBD	TBD
47	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3690402500	6289738.99394000000	1885217.57139000000	TBD	3.30	TBD	TBD	TBD
48	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4212900900	6284861.04809000000	1876285.71277000000	TBD	4.64	TBD	TBD	TBD
49	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4905920200	6325682.31916000000	1863837.62462000000	TBD	0.19	TBD	TBD	TBD
50	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4641500500	6317490.68047000000	1864623.66893000000	TBD	3.74	TBD	TBD	TBD
51	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4365200600	6271142.44352000000	1859047.80426000000	TBD	0.43	TBD	TBD	TBD
52	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4213201100	6285346.12043000000	1874037.59826000000	TBD	2.48	TBD	TBD	TBD
53	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4381504100	6287165.54078000000	1858468.04078000000	TBD	0.05	TBD	TBD	TBD
54	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4212050700	6288077.35470000000	1873946.75638000000	TBD	0.34	TBD	TBD	TBD
55	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4332501900	6293802.54477000000	1863818.43052000000	TBD	0.75	TBD	TBD	TBD
56	San Diego River	City of San Diego	HOUSING AUTHORITY CITY OF SAN DIEGO	TBD	4410904300	6259836.56184000000	1855650.37597000000	TBD	30.18	TBD	TBD	TBD
57	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4365300700	6271285.86682000000	1858506.99406000000	TBD	3.59	TBD	TBD	TBD
58	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4481421500	6255760.59837000000	1855602.76543000000	TBD	4.72	TBD	TBD	TBD
59	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4483011200	6255031.53413000000	1852488.22504000000	TBD	0.31	TBD	TBD	TBD
60	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4483011300	6254970.71662000000	1852531.09105000000	TBD	0.17	TBD	TBD	TBD
61	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4405621400	6294451.46966000000	1858174.02469000000	TBD	0.19	TBD	TBD	TBD
62	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3690402400	6290053.71214000000	1884529.00398000000	TBD	0.12	TBD	TBD	TBD
63	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4292600500	6296323.32065000000	1870275.17901000000	TBD	0.94	TBD	TBD	TBD
64	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4406401500	6297100.41175000000	1858428.57650000000	TBD	1.61	TBD	TBD	TBD
65	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6724900400	6306327.73599000000	1869653.82859000000	TBD	3.81	TBD	TBD	TBD

Project Identifier	Watershed Management Area	Jurisdiction	Ownership	Project Location				Project Size & Parameters				Other Notes
			Owner Information	Address	APN	Latitude (X-Coordinate)	Longitude (Y-Coordinate)	Contributing Drainage Area (acres)	Parcel Size (acres)	Project Footprint (acres)	Parameters (with units as necessary)	
66	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3734825700	6305446.72610000000	1885079.04244000000	TBD	0.05	TBD	TBD	TBD
67	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3691702400	6290461.04004000000	1879145.59875000000	TBD	4.38	TBD	TBD	TBD
68	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3920903300	6354563.85941000000	1896080.45007000000	TBD	11.43	TBD	TBD	TBD
69	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4571910900	6329229.84314000000	1872215.84076000000	TBD	0.06	TBD	TBD	TBD
70	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4488000100	6255963.33149000000	1855387.22038000000	TBD	2.24	TBD	TBD	TBD
71	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4631150200	6312874.15265000000	1865311.84055000000	TBD	0.20	TBD	TBD	TBD
72	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4480310400	6253701.82783000000	1855277.48305000000	TBD	2.29	TBD	TBD	TBD
73	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4406302100	6297336.59475000000	1857832.31025000000	TBD	0.13	TBD	TBD	TBD
74	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3920820500	6355272.81129000000	1896450.04317000000	TBD	0.95	TBD	TBD	TBD
75	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3690401800	6290155.86150000000	1884841.55675000000	TBD	2.26	TBD	TBD	TBD
76	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4571911000	6329230.68418000000	1872290.35859000000	TBD	0.05	TBD	TBD	TBD
77	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4413702100	6263016.97365000000	1855507.62373000000	TBD	0.31	TBD	TBD	TBD
78	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4571910800	6329229.09547000000	1872152.76529000000	TBD	0.09	TBD	TBD	TBD
79	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480233300	6253708.41501000000	1854889.23835000000	TBD	0.07	TBD	TBD	TBD
80	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6723000100	6306309.53263000000	1870229.29455000000	TBD	10.00	TBD	TBD	TBD
81	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480233100	6253747.05150000000	1854860.55682000000	TBD	0.09	TBD	TBD	TBD
82	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3830800500	6329701.97900000000	1885454.06300000000	TBD	0.56	TBD	TBD	TBD
83	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4213920100	6295098.51652000000	1879029.44163000000	TBD	2.51	TBD	TBD	TBD
84	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4415303800	6266415.00735000000	1857123.35748000000	TBD	0.35	TBD	TBD	TBD
85	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3921202100	6355446.89802000000	1896472.95302000000	TBD	0.18	TBD	TBD	TBD
86	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4562311800	6313898.75734000000	1875835.44960000000	TBD	0.14	TBD	TBD	TBD
87	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480230300	6253730.23269000000	1854666.11273000000	TBD	0.09	TBD	TBD	TBD
88	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3690401400	6289290.36376000000	1884800.26081000000	TBD	1.94	TBD	TBD	TBD
89	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4213920300	6295050.33905000000	1878608.69189000000	TBD	1.87	TBD	TBD	TBD
90	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4213330400	6295808.35125000000	1875844.90741000000	TBD	1.20	TBD	TBD	TBD
91	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4366700600	6269821.54600000000	1858353.65900000000	TBD	3.88	TBD	TBD	TBD
92	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4365200300	6270925.14225000000	1858614.33333000000	TBD	2.05	TBD	TBD	TBD
93	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480101700	6253469.27706000000	1853841.89713000000	TBD	1.59	TBD	TBD	TBD
94	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4673502300	6312536.28806000000	1859990.29226000000	TBD	1.57	TBD	TBD	TBD
95	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4391803100	6292003.03464000000	1859796.73346000000	TBD	0.08	TBD	TBD	TBD
96	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3921103000	6355080.12545000000	1894998.70528000000	TBD	0.03	TBD	TBD	TBD
97	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3562130800	6285671.42832000000	1880808.74547000000	TBD	1.77	TBD	TBD	TBD
98	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6730400100	6313197.82211000000	1868679.51397000000	TBD	10.69	TBD	TBD	TBD
99	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6720803600	6309440.61130000000	1871513.55714000000	TBD	0.13	TBD	TBD	TBD
100	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6720802100	6309247.09533000000	1871323.72432000000	TBD	0.16	TBD	TBD	TBD
101	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4213920400	6295037.38844000000	1878368.61079000000	TBD	2.04	TBD	TBD	TBD
102	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4332500500	6292768.98840000000	1863328.69635000000	TBD	2.95	TBD	TBD	TBD

Project Identifier	Watershed Management Area	Jurisdiction	Ownership	Project Location				Project Size & Parameters				Other Notes
			Owner Information	Address	APN	Latitude (X-Coordinate)	Longitude (Y-Coordinate)	Contributing Drainage Area (acres)	Parcel Size (acres)	Project Footprint (acres)	Parameters (with units as necessary)	
103	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3690401900	6289956.23750000000	1885008.15675000000	TBD	0.86	TBD	TBD	TBD
104	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6720704900	6309804.62783000000	1871882.58726000000	TBD	0.13	TBD	TBD	TBD
105	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4495910100	6260481.40736000000	1850483.58587000000	TBD	0.47	TBD	TBD	TBD
106	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480411900	6253967.48379000000	1855498.86086000000	TBD	0.42	TBD	TBD	TBD
107	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4392402800	6292006.20419000000	1859730.17894000000	TBD	0.07	TBD	TBD	TBD
108	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4870602500	6337670.66060000000	1871061.19595000000	TBD	1.12	TBD	TBD	TBD
109	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4674022400	6310442.05814000000	1858330.76174000000	TBD	0.12	TBD	TBD	TBD
110	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6720804300	6309620.77999000000	1871697.63665000000	TBD	0.13	TBD	TBD	TBD
111	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3871214800	6340834.31327000000	1878064.50841000000	TBD	0.25	TBD	TBD	TBD
112	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4366011000	6272889.10345000000	1859503.09661000000	TBD	0.32	TBD	TBD	TBD
113	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4674022500	6310443.18963000000	1858381.19714000000	TBD	0.12	TBD	TBD	TBD
114	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4415900600	6263915.25927000000	1856024.57909000000	TBD	5.55	TBD	TBD	TBD
115	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3830501500	6321576.30802000000	1886091.55834000000	TBD	19.83	TBD	TBD	TBD
116	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6740400100	6319421.21863000000	1868148.00000000000	TBD	0.49	TBD	TBD	TBD
117	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4830212700	6340556.01913000000	1877394.80076000000	TBD	0.15	TBD	TBD	TBD
118	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4480503600	6254577.81300000000	1855776.05200000000	TBD	1.00	TBD	TBD	TBD
119	San Diego River	City of San Diego	HOUSING AUTHORITY CITY OF SAN DIEGO	TBD	4411330100	6261951.48942000000	1856430.35004000000	TBD	0.53	TBD	TBD	TBD
120	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4405622900	6294888.89840000000	1858466.19678000000	TBD	1.46	TBD	TBD	TBD
121	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4213920200	6295077.95999000000	1878798.82755000000	TBD	1.67	TBD	TBD	TBD
122	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4332501300	6294341.45586000000	1866324.12220000000	TBD	81.07	TBD	TBD	TBD
123	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4415900400	6265417.40896000000	1856122.64545000000	TBD	69.11	TBD	TBD	TBD
124	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4674022300	6310440.91429000000	1858279.77033000000	TBD	0.12	TBD	TBD	TBD
125	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3690840500	6294037.67374000000	1884851.16667000000	TBD	7.57	TBD	TBD	TBD
126	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4364902000	6270654.93519000000	1858667.67901000000	TBD	0.11	TBD	TBD	TBD
127	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480220100	6253572.02370000000	1854949.79630000000	TBD	0.61	TBD	TBD	TBD
128	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6722702500	6307300.34738000000	1869232.44538000000	TBD	0.52	TBD	TBD	TBD
129	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3733022600	6301507.47354000000	1885150.07590000000	TBD	1.48	TBD	TBD	TBD
130	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4446901500	6282879.18699000000	1853393.90323000000	TBD	0.15	TBD	TBD	TBD
131	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4372911600	6281036.42990000000	1860056.26831000000	TBD	0.31	TBD	TBD	TBD
132	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4366900700	6270371.00000000000	1858512.65800000000	TBD	2.52	TBD	TBD	TBD
133	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4673601300	6313088.10930000000	1860503.49485000000	TBD	0.11	TBD	TBD	TBD
134	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480230100	6253631.08645000000	1854745.01676000000	TBD	0.40	TBD	TBD	TBD
135	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4681612700	6316028.85707000000	1860901.74285000000	TBD	0.22	TBD	TBD	TBD
136	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4394413700	6293575.62045000000	1858445.33155000000	TBD	0.15	TBD	TBD	TBD
137	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4332304600	6291814.77395000000	1863537.82652000000	TBD	2.35	TBD	TBD	TBD
138	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4622102900	6308564.81932000000	1865254.06555000000	TBD	4.02	TBD	TBD	TBD

Project Identifier	Watershed Management Area	Jurisdiction	Ownership	Project Location				Project Size & Parameters				Other Notes
			Owner Information	Address	APN	Latitude (X-Coordinate)	Longitude (Y-Coordinate)	Contributing Drainage Area (acres)	Parcel Size (acres)	Project Footprint (acres)	Parameters (with units as necessary)	
139	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4494720200	6260267.76877000000	1850650.71282000000	TBD	0.06	TBD	TBD	TBD
140	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480233400	6253689.11331000000	1854902.72886000000	TBD	0.08	TBD	TBD	TBD
141	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4586230100	6306150.05787000000	1867911.12374000000	TBD	0.73	TBD	TBD	TBD
142	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3735212800	6305183.90224000000	1886762.04497000000	TBD	0.16	TBD	TBD	TBD
143	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4422601900	6269417.11896000000	1856255.53774000000	TBD	0.09	TBD	TBD	TBD
144	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4394413600	6293574.78400000000	1858395.33598000000	TBD	0.15	TBD	TBD	TBD
145	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480210100	6253524.17471000000	1854285.49230000000	TBD	0.14	TBD	TBD	TBD
146	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480210400	6253552.32944000000	1854558.38742000000	TBD	0.32	TBD	TBD	TBD
147	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480210300	6253530.73423000000	1854453.20193000000	TBD	0.19	TBD	TBD	TBD
148	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4366601900	6269173.06771000000	1857962.88617000000	TBD	0.72	TBD	TBD	TBD
149	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4332303400	6291498.56307000000	1863079.31481000000	TBD	18.01	TBD	TBD	TBD
150	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4400313700	6299555.90072000000	1862888.94314000000	TBD	0.14	TBD	TBD	TBD
151	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3735004900	6303410.14495000000	1886765.03210000000	TBD	0.24	TBD	TBD	TBD
152	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4681700700	6314310.33009000000	1860315.32716000000	TBD	0.02	TBD	TBD	TBD
153	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3660814900	6323908.98108000000	1888514.07648000000	TBD	0.16	TBD	TBD	TBD
154	San Diego River	City of San Diego	CITY OF SAN DIEGO TR	TBD	4480233200	6253726.41679000000	1854875.74090000000	TBD	0.08	TBD	TBD	TBD
155	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4482302200	6256565.36122000000	1854564.37184000000	TBD	0.15	TBD	TBD	TBD
156	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4484211200	6256726.71361000000	1853674.35503000000	TBD	0.18	TBD	TBD	TBD
157	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3920810300	6354844.07132000000	1896530.61115000000	TBD	0.52	TBD	TBD	TBD
158	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4641500300	6317607.83356000000	1864865.33360000000	TBD	0.23	TBD	TBD	TBD
159	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6721203600	6308575.21401000000	1870690.59846000000	TBD	0.19	TBD	TBD	TBD
160	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6721303300	6308793.20165000000	1870904.81496000000	TBD	0.16	TBD	TBD	TBD
161	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4620511900	6309027.48574000000	1867188.01852000000	TBD	0.04	TBD	TBD	TBD
162	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6721300200	6309031.96128000000	1871125.51034000000	TBD	0.14	TBD	TBD	TBD
163	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4415810900	6266916.57254000000	1856500.37432000000	TBD	0.01	TBD	TBD	TBD
164	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4446901600	6282931.73301000000	1853394.16435000000	TBD	0.16	TBD	TBD	TBD
165	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3710310400	6310651.98763000000	1878510.00185000000	TBD	0.15	TBD	TBD	TBD
166	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	6770360900	6283662.03979000000	1868621.46220000000	TBD	0.14	TBD	TBD	TBD
167	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	3660503200	6329521.56912000000	1898594.50349000000	TBD	4.59	TBD	TBD	TBD
168	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4411821900	6263482.47362000000	1856195.71176000000	TBD	0.04	TBD	TBD	TBD
169	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	4400111700	6297774.14941000000	1862842.38430000000	TBD	0.02	TBD	TBD	TBD
<b>Public Parcels Identified as Suitable for Further Assessment to Determine Feasibility of Retrofitting</b>												
Parcels on this list have been assessed using broad assumptions necessary for computer modeling and were found to be potentially effective as an opportunity for contributing to load reduction goals. Considerable further assessment would be required before determining any of these sites to be viable retrofit. That assessment includes verifying public ownership, determining if land use agreements and financing can be established, assessing feasibility based upon further investigation of physical site constraints at a project design level, and determining that construction and necessary approvals, including approvals from regulatory agencies other than the City of San Diego, can be completed within the time constraints in the Municipal Storm Water Permit that pertain to Alternative Compliance.												
N/A	N/A	City of San Diego	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Canyon Site

Project Identifier	Watershed Management Area	Jurisdiction	Ownership	Project Location				Project Size & Parameters				Other Notes
			Owner Information	Address	APN	Latitude (X-Coordinate)	Longitude (Y-Coordinate)	Contributing Drainage Area (acres)	Parcel Size (acres)	Project Footprint (acres)	Parameters (with units as necessary)	
Project Concept for Green Streets Retrofits – Quantity and Location of Suitable City Streets To-Be-Determined												
The City of San Diego is in the process of identifying potential public street locations that could feasibly be retrofitted with Green Infrastructure and provide a meaningful contribution to pollutant load reduction goals. As locations become verified for feasibility and effectiveness, funding mechanisms under an Alternate Compliance program could potentially be used to fill gaps in construction and maintenance funding necessary for the project to go forward. This is pending the ability to establish suitable legal mechanisms and verify that approvals and construction can be completed within the time constraints in the Municipal Storm Water Permit that pertain to Alternative Compliance.												
170	San Diego River	City of San Diego	CITY OF SAN DIEGO	TBD	N/A	N/A	N/A	TBD	89	TBD	TBD	Green Street TBD

**Table 3G-3. County of San Diego: San Diego River Watershed Management Area Assessment Project List**

Project Identifier	Watershed Management Area	Jurisdiction	Project Name	Ownership		Project Location				Project Category	Specific Project Type
				Type	Owner Information	Address	APN	Latitude	Longitude		
SDR-2	San Diego River	SAN DIEGO	Shepherd Canyon Wetlands Restoration, 6+ Acres		CITY OF SAN DIEGO	N/A	3730715500	1883859.653	6302019.348		
SDR-3	San Diego River	SAN DIEGO	Ruffin Canyon, Free Land from Church, Wetland-Water Filtration		ROMAN CATHOLIC BISHOP OF SAN DIEGO	GLENCOLUM DR	4290101000	1873409.984	6290364.132		
SDR-4	San Diego River	SAN DIEGO	Qualcomm Parking Lot		CITY OF SAN DIEGO	Qualcomm parking lot	4332501600	1865894.05	6294328.208		
SDR-5	San Diego River	SAN DIEGO	St. Columba church canyon area	Private	St. Columba Church	3327 Glencolum Drive, San Diego 92123 The above address is the church address, but the canyon is between the church parking area and Gramercy Drive	4290111000	1873045.19	6290152.379	Stream or Riparian Rehabilitation	Drainage area rehabilitation/restoration
SDR-6	San Diego River	SAN DIEGO	Library Canyon Creek	Public	City of San Diego	9020 Village Glen Drive San Diego, CA 92123	4210302200	1874517.998	6290493.141	Stream or Riparian Rehabilitation	Creek restoration
SDR-1	San Diego River	S.D. COUNTY	Lakeside Conservancy Treatment Wetlands	Public/ Private Partnership	Stephanie Gaines 858-694-3493	Lakeside River Park Conservancy 12108 Industry Rd, Lakeside 92040	3822503200	1892675.312	6350636.749	Regional BMP's	Subsurface Treatment Wetlands
SDR-11	San Diego River	S.D. COUNTY	MJ-R-D-4	Public	CITY OF S.D.	WOODSIDE AVE AND SUMMERSUN LANE, LAKESIDE	3822601200	1891735.691	6349833.62	Groundwater Recharge Projects	VEGETATED INFILTRATION BASIN
SDR-7	San Diego River	S.D. COUNTY	Lakeside Conservancy Treatment Wetlands	Public/ Private Partnership	Stephanie Gaines 858-694-3493	Lakeside River Park Conservancy 12108 Industry Rd, Lakeside 92040	3822503200	1892675.312	6350636.749	Regional BMP's	Subsurface Treatment Wetlands, REMOVE CONCRETE CHANNEL
SDR-10	San Diego River	EL CAJON	MJ-R-D-1	Public	S.D. COUNTY	N. MARSHALL AVE. AND CUYAMACA ST., EL CAJON, CA	3871900800	1882196.908	6336553.331	Regional BMP's	GROSS SOLIDS AND TRASH REMOVAL
SDR-12	San Diego River	EL CAJON	WING AVENUE FLOOD CONTROL IMPROVEMENTS	Public	S.D. COUNTY	WING AVE. AND BRADLEY AVE., EL CAJON	3871900800	1878741.197	6341639.357	Stream or Riparian Rehabilitation	CHANNEL WIDENING, DEEPENING, AND STABILIZATION
SDR-8	San Diego River	S.D. COUNTY	FLINN SPRINGS AT OAK CREEK	Public/ Private Partnership	S.D. COUNTY	FLINN SPRINGS RD AND OAK CREEK RD	3960700700	1892443.175	6374288.121	Regional BMP's	REGIONAL BMP
SDR-9	San Diego River	S.D. COUNTY	SDCO-R-D-2	Public	S.D. COUNTY	FLINN SPRINGS RD AND OAK CREEK RD	3960700300	1892183.914	6374271.571	Groundwater Recharge Projects	SUBSURFACE INFILTRATION
SDR-16	San Diego River	S.D. COUNTY	SDA7 BASIN 050525	Public	FISHBAUGH THOMAS A&ROBIN M	70 FT NW OF ARMENTROUT LN	4024300400	1889269.405	6403009.319	Regional BMP's	BASIN TREATMENT
SDR-13	San Diego River	S.D. COUNTY	SDA7 BASIN 010303	Public	N/A	2400 ALPINE BLVD	4034100800	1884428.875	6404094.705	Regional BMP's	BASIN TREATMENT
SDR-14	San Diego River	S.D. COUNTY	SDA7 BASIN 010317	Public	BRAR CHAMKAUR S&SUKHWINDER K	ALPINE BLVD AND VICTORIA, ALPINE	4040316700	1883968.114	6407286.83	Regional BMP's	BASIN TREATMENT
SDR-15	San Diego River	S.D. COUNTY	SDA7 IN-LINE TREATMENT 010643	Public	S.D. COUNTY	200 FT NE OF FLO DR AND ARNOLD WY	N/A	1884453.626	6401193.025	Regional BMP's	IN-LINE TREATMENT
SDR-17	San Diego River	S.D. COUNTY	SDA7 BASIN OR IN-LINE TREATMENT 011240	Public	POST ROSE M	ARNOLD WAY N OF HARBISON CANYON RD	4034511200	1886662.471	6390044.085	Regional BMP's	BASIN OR IN-LINE TREATMENT
SDR-18	San Diego River	S.D. COUNTY	SDA7 BASIN OR IN-LINE TREATMENT 010840	Public	LAFOND FAMILY TRUST A 08-06- 80	100 FT S OF ALPINE BLVD (OFF RAMP FROM I-8 EAST BOUND)	4033811600	1885189.049	6397590.795	Regional BMP's	BASIN OR IN-LINE TREATMENT
SDG-40	San Diego River	S.D. COUNTY	Coleman Creek Rehabilitation	Public	County of San Diego	Coleman Creek located along Julian Road and Coleman Circle	2910404100	1971849.985	6452903.195	Stream Rehabilitation	Filtration in the stream bed



# CHAPTER 3 – APPENDIX H: SAN DIEGO RIVER WATERSHED MANAGEMENT AREA ANALYSIS

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# San Diego River Watershed Management Area Analysis



*Lake Henshaw*

*October 3, 2014*

**Prepared for:**  
**San Diego County Copermittees**



**Prepared by:**

**Geosyntec**  
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**ATTACHMENT A      WATERSHED MANAGEMENT AREA CHARACTERIZATION**

- A.1      Dominant Hydrologic Process
- A.2      Stream Characterization
- A.3      Land Uses
- A.4      Potential Critical Coarse Sediment Yield Areas
- A.5      Physical Structures

**ATTACHMENT B      HYDROMODIFICATION MANAGEMENT APPLICABILITY/EXEMPTIONS**

- B.1      Additional Analysis for Hydromodification Management Exemptions
- B.2      Hydromodification Management Applicability/Exemption Mapping

**ATTACHMENT C      ELECTRONIC FILES**

**ATTACHMENT D      REGIONAL MS4 PERMIT CROSSWALK**

**ACRONYMS AND ABBREVIATIONS**

%	percent
>	greater than
<	less than
BMP	Best Management Practice
CB	Coarse Bedrock
CEG	Certified Engineering Geologist
CIP	Capital Improvement Project
CLRP	Comprehensive Load Reduction Plan
CSI	Coarse Sedimentary Impermeable
CSP	Coarse Sedimentary Permeable
$E_p$	Erosion Potential
ET	Evapotranspiration
FB	Fine Bedrock
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study
FSI	Fine Sedimentary Impermeable
FSP	Fine Sedimentary Permeable
GIS	Geographic Information System
GLU	Geomorphic Landscape Unit
HA	Hydrologic Area
HCP	Hydromodification Control Plan
HMP	Hydromodification Management Plan
HRU	Hydrologic Response Unit
HSA	Hydrologic Sub Area
HSG	Hydrologic Soil Group
IRWM	Integrated Regional Water Management
JURMP	Jurisdictional Urban Runoff Management Plan
LDW	Land Development Workgroup
LID	Low Impact Development
MAP	Mean Annual Precipitation

**ACRONYMS AND ABBREVIATIONS continued**

MHPA	Multiple Habitat Planning Area
MS4	Municipal Separate Storm Sewer System
MSCP	Multiple Species Conservation Program
NED	National Elevation Dataset
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
PDP	Priority Development Project
RCB	Reinforced Concrete Box
RCP	Reinforced Concrete Pipe
SCAMP	Southern California Aerial Mapping Project
SCCWRP	Southern California Coastal Water Research Project
SD	San Diego
SDRWQCB	San Diego Regional Water Quality Control Board
S <sub>p</sub>	Sediment Supply Potential
SSURGO	Soil Survey Geographic Database
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WMA	Watershed Management Area
WMAA	Watershed Management Area Analysis
WQIP	Water Quality Improvement Plan
WURMP	Watershed Urban Runoff Management Plan

## **1. Introduction**

### **1.1. Background**

On May 8, 2013 the California Regional Water Quality Control Board, San Diego Region adopted Order No. R9-2013-0001; NPDES No. CAS 0109266, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds within the San Diego Region (Regional MS4 Permit). The Regional MS4 Permit, which became effective on June 27, 2013, replaces the previous MS4 Permits that covered portions of the Counties of San Diego, Orange, and Riverside within the San Diego Region. There were two main goals for the Regional MS4 Permit:

1. To have more consistent implementation, as well as improve inter-agency communication (particularly in the case of watersheds that cross jurisdictional boundaries), and minimize resources spent on the permit renewal process.
2. To establish requirements that focused on the achievement of water quality improvement goals and outcomes rather than completing specific actions, thereby giving the Copermittees more control over how their water quality programs are implemented.

To achieve the second goal, the Regional MS4 Permit requires that Water Quality Improvement Plans (WQIPs) be developed for each Watershed Management Area (WMA) within the San Diego Region. As part of the development of WQIPs, the Regional MS4 Permit provides Copermittees an option to perform a Watershed Management Area Analysis (WMAA) through which watershed-specific requirements for structural BMP implementation for Priority Development Projects can be developed for each WMA. This report presents the Copermittees' approach and results for the regional elements of the WMAA developed for the San Diego County area.

### **1.2. Watershed Management Area Analysis (WMAA)**

The Regional MS4 Permit, through inclusion of the WMAA, provides an optional pathway for Copermittees to develop an integrated approach for their land development programs by promoting evaluation of multiple strategies for water quality improvement and development of watershed-scale solutions for improving overall water quality in the watershed. The WMAA comprises the following three components as indicated in the Regional MS4 Permit:

1. Perform analysis and develop Geographic Information System (GIS) layers (maps) by gathering information pertaining to the physical characteristics of the WMA (referred to herein as WMA Characterization). This includes, for example, identifying potential areas of coarse sediment supply, present and anticipated future land uses, and locations of physical structures within receiving streams and upland areas that affect the watershed hydrology (such as bridges, culverts, and flood management basins).
2. Using the WMA Characterization results, compile a list of candidate projects that could potentially be used as alternative compliance options for Priority Development Projects. Such projects may include, for example, opportunities for stream or riparian area

rehabilitation, opportunities for retrofitting existing infrastructure to incorporate storm water retention or treatment, or opportunities for regional BMPs, among others. Prior to implementing these candidate projects the Copermittees must demonstrate that implementing such a candidate project would provide greater overall benefit to the watershed than requiring implementation of the onsite structural BMPs. Note, compilation or evaluation of potential projects was not performed as part of this regional effort. Identification and listing of candidate projects will be performed for each WMA through the WQIP process for WMAs that elect to submit the optional WMAA as part of the WQIP.

3. Additionally, using the WMA Characterization maps, identify areas within the watershed management area where it is appropriate to allow for exemptions from hydromodification management requirements that are in addition to those already allowed by the Regional MS4 Permit for Priority Development Projects. The Copermittees shall identify such cases on a watershed basis and include them in the WMAA with supporting rationale to support claims for exemptions.

### **1.3.Scope of Work for Regional WMAA**

In July 2013, the Copermittees elected to fund a regional effort to develop elements of the regional WMAA for the 9 San Diego-area WMAs within the County of San Diego that are currently subject to the Regional MS4 Permit, which include:

- Santa Margarita River (for portion in San Diego County)
- San Luis Rey River
- Carlsbad
- San Dieguito River
- Los Peñasquitos
- Mission Bay & La Jolla Watershed
- San Diego River
- San Diego Bay
- Tijuana River (for portion in San Diego County)

The regional-level information developed through this effort is intended to provide consistency across WMAs and serve as the foundation for developing watershed-specific information for each WMA to be developed through the WQIP process. The regional effort scope of work included:

1. Development of GIS map layers that characterize the WMAs using data previously collected, readily available, and provided by the Copermittees, including:
  - a. Description of dominant hydrologic processes, such as areas where infiltration or overland flow likely dominates;
  - b. Description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral;

- c. Current and anticipated future land uses;
  - d. Potential coarse sediment yield areas; and
  - e. Locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins.
2. Development of a Microsoft® Excel (Excel) template for use by Copermittees to compile lists of candidate projects for an optional alternative compliance program.
  3. Development of additional criteria and analyses to support reinstating the following proposed exemptions that were originally developed in the approved 2011 Final Hydromodification Management Plan but not included in the Regional MS4 Permit unless provided by the Copermittees in the WMAA. In addition, development of the associated Hydromodification Applicability/Exemption Mapping.
    - a. Exempt River Reaches including:
      - i. San Diego River;
      - ii. Otay River;
      - iii. San Dieguito River;
      - iv. San Luis Rey River; and
      - v. Sweetwater River
    - b. Stabilized Conveyance Systems Draining to Exempt Water Bodies
    - c. Highly Impervious/Highly Urbanized Watersheds and Urban Infill, and
    - d. Tidally Influenced Lagoons (where data/study provided)

The scope of work for the regional effort excluded performing analysis within the following areas unless data was readily available, as Copermittees do not have jurisdiction over these areas:

1. State Lands;
2. U.S. Departments of Defense land;
3. U.S. National Forest land;
4. U.S. Department of Interior land and
5. Tribal land

Additional description of excluded areas, for the purposes of the Regional WMAA, is indicated in Section 2.3 Land Uses.

#### **1.4. Project Process**

The process for developing the Regional WMAA included close coordination with the Land Development Workgroup (LDW) at key points during the project. The LDW is composed of the 21 San Diego-area Copermittees and serves to develop and implement regional land development plans and programs necessary to support the requirements of the Regional MS4 Permit. The consultant team (Geosyntec Consultants and Rick Engineering Company) presented

preliminary project assumptions and methodologies proposed to be used to develop the Regional WMAA to meet the requirements of the Regional MS4 Permit in December 2013. The consultant team incorporated workgroup feedback from this meeting and subsequently presented the preliminary Regional WMAA project results to the LDW in March 2014, again to receive direction and incorporate input on the preliminary results. Subsequently, the draft report was released to the public in July 2014, by a public workshop that included Consultation Panel members from each of the WMAs on July 29, 2014. This version of the report including all of the input described above is being issued for optional inclusion into the respective WQIP Provision B.3 submittals to the SDRWQCB in December 2014.

## **1.5. Report Organization**

This report is organized as follows:

- Chapter 1 provides the project background and purpose;
- Chapter 2 describes the technical basis for characterizing the WMAA;
- Chapter 3 describes the template that can be used by Copermittees to compile the list of candidate projects;
- Chapter 4 summarizes the analyses performed to support reinstating select exemptions from hydromodification control requirements for PDPs;
- Chapter 5 presents the WMAA conclusions;
- Chapter 6 presents the references used for the WMAA;
- Attachment A presents the exhibits and additional supporting information for watershed management area characterization;
- Attachment B presents the exhibits and additional supporting information for hydromodification management applicability/exemptions;
- Attachment C expands on the structure of the geodatabase that hosts the GIS data developed by the WMAA; and
- Attachment D provides a crosswalk between the Regional MS4 Permit requirements for WMAA and this report.

## **1.6. Terms of Reference**

The work described in this report was conducted by Geosyntec Consultants (Geosyntec) and Rick Engineering Company (RICK) on behalf of the County of San Diego and the regional Copermittees.

## 2. Watershed Management Area Characterization

Watershed health and function are strongly influenced by hydrological and geomorphological processes occurring in the watershed. Both hydrological response and geomorphological response of the watershed are dependent on a variety of physical characteristics of the watershed. To this end, the Regional MS4 Permit specifies a set of data that is required to adequately characterize overall watershed processes as a foundation to enhancing integration and effectiveness of watershed management and water quality programs. The following GIS map layers were developed to characterize the hydrological and geomorphological processes within the San Diego River WMA:

- **Dominant Hydrologic Processes:** A description of dominant hydrologic processes, such as areas where infiltration or overland flow likely dominates;
- **Stream Characterization:** A description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral;
- **Land Uses:** Current and anticipated future land uses;
- **Potential Critical Coarse Sediment Yield Areas;** and
- **Physical Structures:** Locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins.

These GIS layers can be used to:

- Identify the nature and distribution of key macro-scale watershed processes;
- Identify potential opportunities and constraints for regional and sub-regional storm water management facilities that can play a critical role in meeting water quality, hydromodification, water supply, and/or habitat goals within the watershed;
- Assist with determining the most appropriate management actions for specific portions of the watershed; and
- Suggest where further study is appropriate.

## 2.1. Dominant Hydrologic Processes

The Regional MS4 Permit identifies in the provisions related to the WMAA that a description of dominant hydrologic processes within the watershed must be developed, with GIS layers (maps) as output. The Permit specifically calls for processes “*such as areas where infiltration or overland flow likely dominates.*” These particular aspects of the hydrological mechanics of watersheds are particularly important when attempting to understand the macro-scale opportunities for locating projects that take advantage of either capturing overland flow for treatment or for infiltration.

Investigation of the dominant hydrologic processes in the San Diego-area watersheds indicates that evapotranspiration (ET) is the most dominant hydrologic process for the region based on review of a published study (Sanford and Selnick, 2013). ET is the sum of evaporation and plant transpiration in the hydrologic cycle that transports water from land surfaces to the atmosphere. This conclusion is supported by comparing the 30-year average annual rainfall for the study area (San Diego County east of the peninsular divide) of between 15 and 18 inches per year (San Diego County, 2005) to the average annual ET rates. According to the California Irrigation Management Information System (CIMIS) Reference Evapotranspiration Map (CIMIS, 1999), the study area (within Zones 4, 6, and 9) experiences annual reference ET of 46.6, 49.7 and 59.9 inches, respectively. Therefore, theoretically, if all of the annual precipitation for the San Diego-area watersheds remained stationary where it fell and did not either infiltrate or runoff to local waterbodies where it would be conveyed downstream ultimately to the ocean, it all would be consumed by ET. As such, the effect of ET on the overall hydrologic processes within the San Diego watersheds is a function of the temporal scale over which it acts. Precipitation events often produce runoff in these watersheds, particularly in the urbanized portions, based on the topography and land cover that tend to accelerate the conveyance of runoff downstream rather than collecting, storing, or spreading out that then would maximize the effect of ET.

Because this study is focused on developing information and mapping for the portion of the hydrologic process that informs watershed management decisions, i.e., locating beneficial projects in areas of greatest opportunity, the next tier of dominant hydrologic processes are studied and mapped by this project. As such, the study area was characterized, based on the methodology described in the following section, according to the predicted fate of runoff within the watersheds being either overland flow or infiltration after considering the effects of ET (as well as an intermediate category of interflow). Areas that were mapped as overland flow do not necessarily preclude infiltration but rather indicate the dominant expected process that runoff would experience if not intercepted for the express purpose of infiltrating storm water runoff. The Model BMP Design Manual will provide more detailed guidance and procedures for determining the potential for infiltrating captured storm water at the project level irrespective of the mapping produced in the WMAA. To reiterate, the WMAA mapping is to provide macro-scale processes for high-level analysis and to inform decisions affecting regional scales. Furthermore, the Model BMP Design Manual will indicate the degree to which site-scale BMPs can expect to benefit from ET or how ET is considered in the sizing of BMPs. In brief, typical storm water BMPs only store water for a few days and therefore are not really capable of significant volume disposal through ET. However, pervious area dispersion (i.e., directing storm water runoff to flat areas for spreading and infiltration) has appreciable benefits with regard to ET and is a practice promoted in the BMP Design Manual.

The processes of interest are further defined as follows:

**Overland flow:** This process can be thought of as the inverse of infiltration; precipitation reaching the ground surface that does not immediately soak in must run over the land surface (thus, “overland” flow). It reflects the relative rates of rainfall intensity and the soil’s infiltration capacity: wherever and whenever the rainfall intensity exceeds the soil’s infiltration capacity, some overland flow will occur. Most uncompacted, vegetated soils have infiltration capacities of one to several inches per hour at the ground surface, which exceeds the rainfall intensity of even unusually intense storms. In contrast, pavement and hard surfaces reduce the effective infiltration capacity of the ground surface to zero, ensuring overland flow regardless of the meteorological attributes of a storm, together with a much faster rate of runoff relative to vegetated surfaces.

**Infiltration and groundwater recharge:** These closely linked hydrologic processes are most apparent near ephemeral and perennial conveyances in the San Diego region. Their widespread occurrence is expressed by the common absence of surface-water channels on even steep (undisturbed) hillslopes. Thus, on virtually any geologic material on all but the steepest slopes (or bare rock), infiltration of rainfall into the soil is inferred to be widespread, if not ubiquitous. With urbanization, changes to the process of infiltration are also quite simple to characterize: some (typically large) fraction of that once infiltrating water is now converted to overland flow.

**Interflow:** Interflow takes place following storm events as shallow subsurface flow (usually within 3 to 6 feet of the surface) occurring in a more permeable soil layer above a less permeable substrate. In the storm response of a stream, interflow provides a transition between the rapid response from surface runoff and much slower stream discharge from deeper groundwater. In some geologic settings, the distinction between “interflow” and “deep groundwater” is artificial and largely meaningless; in others, however, there is a strong physical discrimination between “shallow” and “deep” groundwater movement. Development reduces infiltration and thus interflow as discussed previously, as well as reducing the footprint of the area supporting interflow volume.

The datasets used, methodology for creating the dominant hydrologic processes maps, and the results are described in the sections below.

### 2.1.1. Datasets Used for identifying dominant hydrologic processes

The following datasets were used in the analysis:

Dataset	Source	Year	Description
Elevation	USGS	2013	1/3 <sup>rd</sup> Arc Second (~10 meter cells) digital elevation model for San Diego County
Soils Data	SanGIS	2013	NRCS (SSURGO) Database for San Diego County downloaded from SanGIS
Land Cover	SanGIS	2013	Ecology-Vegetation layer for San Diego County downloaded from SanGIS

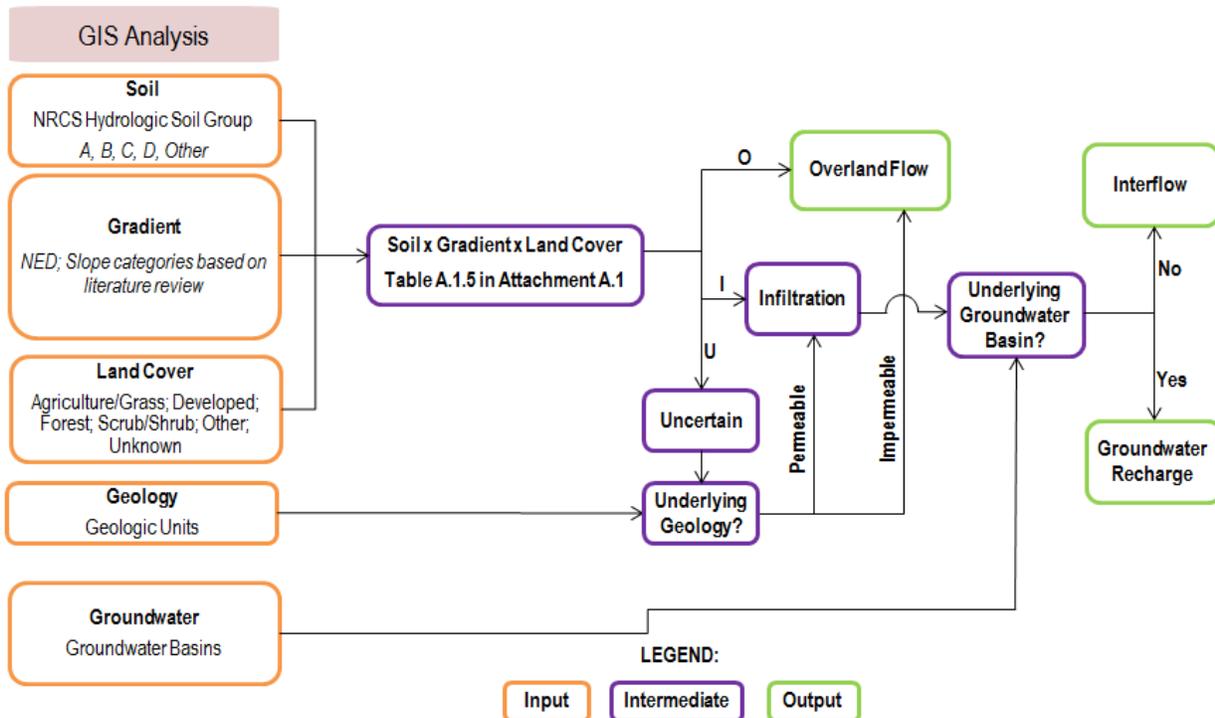
Dataset	Source	Year	Description
Geology	Kennedy, M.P., and Tan, S.S.	2002	Geologic Map of the Oceanside 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale.
	Kennedy, M.P., and Tan, S.S.	2008	Geologic Map of the San Diego 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 3, 1:100,000 scale.
	Todd, V.R.	2004	Preliminary Geologic Map of the El Cajon 30'x60' Quadrangle, Southern California, United States Geological Survey, Southern California Aerial Mapping Project (SCAMP), Open File Report 2004-1361, 1:100,000 scale.
	Jennings et al.	2010	“Geologic Map of California,” California Geological Survey, Map No. 2 – Geologic Map of California, 1:750,000 scale
Groundwater Basins	SanGIS	2013	Groundwater Basins in San Diego County downloaded from SanGIS

### 2.1.2. Methodology/Assumptions/Criteria for identifying dominant hydrologic processes

The methodology used to describe dominant hydrologic processes is based on recommendations included in the Southern California Coastal Water Research Project’s (SCCWRP) Technical Report 605 titled “Hydromodification Screening Tools: GIS-Based Catchment Analyses of Potential Changes in Runoff and Sediment Discharge” (SCCWRP, 2010). The foundation for this analysis was to incorporate the Report’s concept of grouping common hydrologic attributes into Hydrologic Response Units (HRUs). The report states the following:

*“Grouping common hydrologic attributes across a watershed into a tractable number of Hydrologic Response Units (HRUs: a term first used by England and Holtan 1969) has become a well-established approach for condensing the near-infinite variability of a natural watershed into a tractable number of different elements. The normal procedure for developing HRUs is to identify presumptively similar rainfall–runoff characteristics across a watershed by combining spatially distributed climate, geology, soils, land use, and topographic data into areas that are approximately homogeneous in their hydrologic properties (Green and Cruise 1995, Becker and Braun 1999, Beven 2001, Haverkamp et al. 2005). As noted by Beighley et al (2005), this process of merging the landscape into discrete HRUs is a common and effective method for reducing model complexity and data requirements. Using watershed characteristics to predict runoff is the explicit task of hydrologic models, and there is a host of such models available for application to hydromodification evaluation. For purposes of “screening,” however, the goal is simplicity and ease of application even if the precision of the resulting analysis is crude.”*

The following process describes the methodology used to define Hydrologic Response Units (HRUs) and then relate the HRUs to the dominant hydrologic processes (i.e., overland flow, interflow, and groundwater recharge) in the San Diego River WMA.



The first step is to define the HRUs. Once these are defined, the remaining steps determine the dominant hydrologic process.

1. **Integrate data sets used to determine HRU:** Categories for soil type, gradient, and land cover were defined based on readily available GIS datasets for the region and classifications found in relevant literature, as indicated below. The different combinations of these three categories comprise the distinct HRUs.

- **Soil Categories:** based on National Resource Conservation Service (NRCS) Hydrologic Soil Group (HSG) classifications, which are commonly used to describe runoff/infiltration potential of soils on a regional scale. These categories include: A, B, C, and D. HSG A soils have the lowest runoff potential, while HSG D soils have the highest runoff potential.
- **Gradient Categories:** based on slope ranges found in a review of relevant literature identified in Chapter 6. The spatial processing of the slope categories utilized the United States Geologic Survey (USGS) National Elevation Dataset (NED). Slopes were grouped (bins) into the following ranges: 0% to 2%; 2% to 6%; 6% to 10%; and greater than 10%. The 2% and 6% slope thresholds were based on slope ranges included in Table A.1.1 (McCuen, 2005) presented in Attachment A.1. This table provides runoff coefficients as a function of slope, soil group, land cover, and return period and was used for subsequent steps in the mapping effort. The 10% slope threshold was used in SCCWRP's Technical

Report 605 (SCCWRP, 2010) and is a logical cutoff since slopes steeper than 10% are assumed to be dominated by overland flow.

- **Land Cover Categories:** were defined using the Ecology Vegetation GIS map layer developed by the City of San Diego, the County of San Diego and SANDAG and downloaded from SanGIS (2013). The vegetation categories in the GIS layer were grouped (Table A.1.2 in Attachment A.1) to match the following categories used in SCCWRP's Technical Report 605 (SCCWRP, 2010): Agriculture/Grass; Developed; Forest; Scrub/Shrub, Other (Water), and Unknown.
2. **Evaluate Land Cover:** Land cover categories for Agriculture/Grass, Forest, Scrub/Shrub and Other were related to land use categories defined in Table A.1.1 as shown in Table A.1.3 in Attachment A.1. Relating a land use category for the Developed land cover category was not necessary because all Developed cover was assumed to have overland flow as its dominant hydrologic process.
  3. **Determine Hydrology Characteristics for Land Covers:** For each of the land cover/land use categories listed in Table A.1.3, the ratio of precipitation lost to evapotranspiration (i.e. an evapotranspiration coefficient) was estimated using Table A.1.1 using the process described below. Since precipitation is considered to be the sum of the resulting runoff, infiltration, and evapotranspiration, the coefficients for these three hydrologic pathways sum to one, as indicated below.

$$\text{Runoff Coefficient} + \text{Infiltration Coefficient} + \text{Evapotranspiration Coefficient} = 1$$

- i) **Estimate Evapotranspiration:** To estimate the evapotranspiration (ET) coefficient for each land cover, first the runoff coefficient was identified in Table A.1.1 for the highest runoff potential (i.e., Group D soil and 6%+ slope) and most common storm conditions (i.e., storm recurrence intervals less than 25 years). The infiltration for these high runoff conditions was assumed to be negligible, resulting in an infiltration coefficient of zero. Since the sum of the three coefficients should sum to one, the ET coefficient was assumed to be the remaining difference (i.e., ET Coefficient = 1 – Runoff Coefficient). The ET coefficient calculated for the highest runoff potential was then applied to all soil types and slopes within that land use category. The calculated ET coefficient for each applicable HRU is provided in Table A.1.4 in Attachment A.1. The ET coefficient for HRUs that have a Developed land cover or a gradient greater than 10% were not calculated since these HRUs were assumed to have overland flow as the dominant hydrologic process.
- ii) **Estimate Infiltration:** The infiltration coefficient for each applicable HRU (i.e., combination of soil, gradient, and land cover) was estimated by subtracting both the runoff coefficient, provided in Table A.1.1, and the ET coefficient, calculated in step 3(i), from one (i.e., Infiltration Coefficient = 1 – Runoff Coefficient – ET Coefficient). The calculated infiltration coefficient for each applicable HRU is provided in Table A.1.4 in Attachment A.1.
- iii) **Estimate Runoff:** For each applicable HRU, the runoff coefficient was divided by

the infiltration coefficient to obtain a ratio representing the potential for runoff or infiltration. The higher the ratio, the greater the potential for runoff to be a more dominant hydrologic process than infiltration. Similarly, the lower the ratio, the greater the potential for infiltration to be a more dominant hydrologic process than runoff. The calculated runoff to infiltration ratios are provided in Table A.1.4 in Attachment A.1.

4. **Associate Runoff and Infiltration to HRUs:** The following designations were assigned to each applicable HRU based on the runoff to infiltration ratio (i.e., runoff coefficient/infiltration coefficient). These designations were based on best engineering judgment with the underlying assumption that if a runoff or infiltration coefficient is more than 50% greater than its counterpart, then the prevailing process is considered dominant.
  - HRUs with runoff to infiltration ratios greater than 1.5 (3:2 ratio) were assumed to have relatively high runoff and overland flow was considered its dominant hydrologic process. These HRUs are designated by the letter “O” (Overland flow is dominant process) in Tables A.1.4 and A.1.5 in Attachment A.1.
  - HRUs with runoff to infiltration ratios less than 0.67 (2:3 ratio) were assumed to have relatively high infiltration and its dominant hydrologic process was either interflow or groundwater recharge, based on analysis described in subsequent steps. These HRUs are designated by the letter “I” (Interflow is dominant process) in Tables A.1.4 and A.1.5.
  - For HRUs with runoff to infiltration ratios between, and including, 1.5 and 0.67 it was uncertain whether it was dominated by overland flow or infiltration. These HRUs are designated by the letter “U” (Dominant process is uncertain) in Tables A.1.4 and A.1.5.
  - For HRUs that have a Developed land cover or a gradient greater than 10%, the runoff to infiltration ratios were not calculated because these HRUs were assumed to have overland flow as the dominant hydrologic process. These HRUs are designated by the letter “O” (Overland flow is dominant process) in Table A.1.5.
5. **Uncertain HRUs Assignment:** For HRUs with an uncertain designation (“U”) in Table A.1.5 in Attachment A.1, the underlying regional geology (Kennedy and Tan, 2002 & 2008; Todd, 2004 and Jennings et al., 2010) was used to evaluate whether overland flow or infiltration were dominant. If the underlying geology was considered impermeable, then these uncertain areas were considered to have overland flow as its dominant hydrologic process. If the underlying geology was considered permeable, then these uncertain areas were considered to be dominated by infiltration. The determination of whether a geologic unit is impermeable or permeable was based on desktop evaluation and the best professional judgment of a Certified Engineering Geologist (CEG). This analysis was performed in GIS and is illustrated in the flowchart above.

6. **Associate Infiltration HRUs with Known Groundwater Basins:** For HRUs with relatively high infiltration and have a designation of “T” in Table A.1.5 in Attachment A.1, the presence or absence of a regional groundwater basin (SanGIS, 2013) underlying these areas determined whether the dominant hydrologic process was designated as interflow or groundwater recharge. The groundwater recharge hydrologic process was assigned as dominant for those applicable areas which had an underlying groundwater basin. The interflow hydrologic process was assigned as dominant for those applicable areas which did not have an underlying groundwater basin directly below it. This analysis was performed in GIS and is illustrated in the flowchart above.
7. **Resulting HRU Data:** The resulting GIS map of dominant hydrologic processes was reviewed by engineering professionals familiar with the hydrology in the County of San Diego to confirm that the mapping is consistent with their experience working in the region.

### **2.1.3. Results for identifying dominant hydrologic processes**

The resulting GIS map showing the spatial distribution of dominant hydrologic processes (i.e., overland flow, interflow, and groundwater recharge) within the San Diego River WMA is provided in Attachment A.1. An ArcMap document which presents the results from each step of the methodology is included in Attachment C, as well as Google Earth KMZ file. Based on this analysis, overland flow is the predominant hydrologic process in this WMA, which is consistent with the experience of engineering professionals familiar with the hydrology of the County of San Diego.

### Summary of Deliverables for Dominant Hydrologic Processes

Format	Item	Description	Location
Report	Figure	"Dominant Hydrologic Processes"	Attachment A.1
GIS	Map Group Title	Hydrologic Processes	Attachment C
	Map Layer Title	Soil Land Cover Slope Hydrologic Response Unit Initial Rating Permeability Groundwater Basin Dominant Hydrologic Processes	
	Geodatabase Feature Dataset	HydrologicProcesses	
	Geodatabase Feature Class	HRUAnalysis	
	Geodatabase Geometry Type	Polygon	
KMZ <sup>1</sup>	KMZ File Name	Dominant Hydrologic Processes	Attachment C
<sup>1</sup> To enhance the utilization of this data, the Dominant Hydrological Processes map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth ( <a href="http://www.google.com/earth/">http://www.google.com/earth/</a> ).			

#### 2.1.4. Limitations for identifying dominant hydrologic processes

The resulting GIS map layer only lists the dominant hydrological process (i.e., an HRU assigned a dominant process of overland flow can also experience small amounts of infiltration) and provides a useful, rapid framework to perform screening-level analysis that is appropriate for watershed-scale planning studies. When more precise estimates are required for a particular site and subarea it is recommended that this analysis be augmented with site-specific analysis.

## 2.2. Stream Characterization

For the purpose of WMAA, the Regional MS4 Permit requires a description of existing streams in the watershed, including bed material and composition, and if they are perennial or ephemeral. Under the Regional WMAA, this analysis was prepared for 27 streams throughout the San Diego Region agreed upon by the consultant team and Copermittees. Within the San Diego River WMA, stream characterization and detailed mapping is provided for San Diego River, Sycamore Creek, Woodglen Vista Creek, San Vicente Creek, and Forester Creek as shown on the exhibit titled "Watershed Management Area Streams" located in Attachment A.2.

### 2.2.1. Datasets Used for stream characterization

The following data were referenced for the purpose of stream characterization:

- USGS National Hydrography Dataset, downloaded from USGS November 2013
- USGS 7.5-minute quadrangles, compiled image of quadrangles covering San Diego County, various dates
- Floodplains: "National Flood Hazard Layer," provided by Federal Emergency Management Agency October 2012
- Various datasets provided by Copermittees depicting existing storm water conveyance infrastructure within their jurisdictions.
- Aerial photography by Digital Globe dated 2012

### 2.2.2. Methodology/Assumptions/Criteria for stream characterization

The analysis was prepared by digitizing each of the 27 streams based on review of data listed above. Within the pre-existing datasets depicting streams, floodplains, or infrastructure, no single dataset included a complete, accurate alignment of each stream. Digitizing the streams based on review of all of the data listed above allowed creation of GIS linework with a continuous corrected alignment for each stream. The following data were recorded as GIS attributes for each stream as the stream was digitized:

- River name
- Reach type (engineered or natural, constrained or un-constrained)
- Bed material
- Bank material
- Hydrographic category (perennial or intermittent)

The attributes listed above were collected manually based on interpretation of the reference data. Assumptions used in making the interpretations are listed below. The *Hydrographic Category* section below will provide the rationale as to why perennial and intermittent were the hydrographic categories chosen for this WMAA and not perennial and ephemeral.

Note that stream classification was not prepared within areas of Federal/State/Indian lands unless data was readily available. Stream lines were prepared within these areas for continuity, but some data fields were not populated within these areas.

#### *Reach Type*

Streams were classified as either engineered or natural, and either constrained or un-constrained. See the exhibit titled, "Watershed Management Area Streams by Reach Type" in Attachment A.2. The purpose of this exercise was to identify whether the stream has been modified by human activity within the stream itself, which may include addition of crossing structures, stabilization of banks, dredging, or any other human activity. This aids the identification of physical structures including stream armoring, constrictions, grade control, and other modifications as required by the Regional MS4 Permit.

Classification of the streams as either "**engineered**" or "**natural**" was based on the following criteria:

#### Engineered

- A classification of "engineered" was assigned where the stream itself has been modified by human activity.
- All culvert/bridge/pipe crossings either provided in the Copermittees' storm water conveyance system data or clearly visible on the aerial photo have been assigned as engineered within the limits of the crossing.
- If the Copermittees did not provide storm water conveyance system data for the dirt road crossings/dip sections the streams have been assigned as engineered within the limits of the crossing. These crossings may or may not have culverts.
- If the Copermittees' storm water conveyance system data stated the facility is a detention or desilting basin, they were assigned as engineered.
- Golf courses have been assigned as engineered.
- If aerial photography showed large water bodies (lake, pond, irrigation pond, etc.) they were assigned as engineered.
- If the storm water conveyance system data provided by the Copermittees has identified the stream as "rockbs", the assumption has been made that these streams have rocks on their bottom and the sides ("bs"), and have been assigned as engineered.
- Sand mining operations have been assigned as engineered. Sand mining is an operation that is in continuous flux and does not typically result in a discrete, engineered geometry in any given channel cross section until restoration is implemented at the conclusion of the sand mining operation. It is assigned as engineered to acknowledge human alteration of the stream.

#### Natural

- Streams that have no apparent alteration within the stream itself by human activity have been assigned as natural.

Classification of the streams as either "**constrained**" or "**un-constrained**" was based on the following criteria:

#### Constrained

- All culvers/bridge/pipe crossings either provided in the Copermittes' storm water conveyance system data or clearly visible on the aerial photo have been assigned as constrained.
- If the Copermittes did not provide storm water conveyance system data for the dirt road crossings/dip sections the streams have been assigned as constrained. These crossings may or may not have culverts.
- If the Copermittes' storm water conveyance system data stated the facility is a detention or desilting basin, they were assigned as constrained.
- Golf courses have been assigned as constrained if located within the Federal Emergency Management Agency (FEMA) floodway based on the "National Flood Hazard Layer" data.
- The USGS National Hydrographic Dataset in their hydrographic category had assigned some reaches as artificial paths. In these situations and if the aerial photography shows large water bodies (lake, pond, irrigation pond, etc.) these streams have been assigned as constrained.
- Sand mining operations located within the FEMA floodway based on the "National Flood Hazard Layer" have been assigned as constrained.

#### Un-constrained

- Golf courses have been assigned as un-constrained if not located within the FEMA floodway based on the "National Flood Hazard Layer" data.
- Sand mining operations not located within the FEMA floodway based on the "National Flood Hazard Layer" data have been assigned un-constrained.
- If the stream is located within the FEMA floodway based on the "National Flood Hazard Layer" and there is available land in the floodway fringe (the area between the floodway and the 100-year floodplain) the area has been assigned un-constrained. Note that there may be only one side or both sides of the stream with available land in the floodway fringe therefore a note was added as to which side of the stream is constrained and un-constrained.
- If the stream is located within a FEMA 100-year floodplain based on the "National Flood Hazard Layer" data with no floodway and the FEMA floodplain width is not within an existing development or bordered by roads have been assigned as un-constrained.

#### ***Bed Material and Bank Material***

The following bed and bank materials were identified:

- Concrete
- Riprap
- Pipe / culvert
- Earth

The assumptions made to identify the streams bed and bank materials were based on the following criteria:

- If the data provided by the Copermittees provided information about the stream bed and bank material, the provided data was used for the bed and bank material.
- Generally the data provided by the Copermittees did not identify the crossing type (pipe, box culvert, bridge with or without piers, etc.) or the material (RCP, RCB, earth, riprap, concrete, etc.). In that case, all culvert/bridge/pipe crossings were assigned as pipe/culvert for the bed and bank material.
- If the Copermittees did not provide data for the dirt road crossings/dip sections the bed and bank material have been assigned as pipe/culvert. These crossings may or may not have culverts.
- If the Copermittees' storm water conveyance system data stated the facility is a detention or desilting basin, the bed and bank material have been assigned as earth.
- If aerial photography showed large water bodies (lake, pond, irrigation pond, etc.) they were assigned as earth bed and bank material. The USGS National Hydrographic Dataset in their hydrographic category had assigned some of these types of reaches as artificial paths.
- Sand mining operations within the stream have been assigned as earth for bed and bank material.
- If the Copermittees did not provide data for the stream material the bed and bank material have been assigned based on the aerial photography.

See exhibits titled, "Watershed Management Area Streams by Bed Material" in Attachment A.2.

After stream bed and bank material was classified, earthen reaches were further classified by geologic group. This was accomplished by intersecting the streams with the geologic group layer that had been prepared for use in the dominant hydrologic process and potential coarse sediment yield analyses. The result is displayed in exhibits titled, "Watershed Management Area Streams by Geologic Group" in Attachment A.2.

### *Hydrographic Category*

Streams were classified as "perennial" or "intermittent." See exhibits titled, "Watershed Management Area Streams by Hydrographic Category" in Attachment A.2. Classification was obtained from the USGS National Hydrography Dataset (NHD). The definitions of these categories in the USGS National Hydrography Dataset are:

- **Perennial:** Contains water throughout the year, except for infrequent periods of severe drought.
- **Intermittent:** Contains water for only part of the year, but more than just after rainstorms and at snowmelt.

While the specific Regional MS4 Permit language requested classification of perennial or ephemeral, rather than perennial or intermittent, the data that was referenced in order to classify streams did not include "ephemeral" streams. For reference, the USGS National Hydrography Dataset definition of "ephemeral" is: "contains water only during or after a local rainstorm or heavy snowmelt." None of the stream reaches in the study were classified as ephemeral in the NHD dataset, therefore none are classified as ephemeral in the WMAA product. The City of San Diego provided a map titled "City of San Diego Stream Survey" dated April 3, 2013 prepared by AMEC that shows streams that are "dry" and streams that are "flowing". This information in conjunction with the other parameters listed in this section was used to determine if a stream was perennial or intermittent.

USGS NHD includes hydrographic category classification for many of the streams. However data was not available for all reaches of all streams. In order to classify reaches of streams that did not already contain this data in NHD, these assumptions were made:

- The USGS NHD information for the stream hydrographic category has been used when available.
- When USGS NHD has "artificial paths" for portions of the stream, the hydrographic category of the upstream portion of the stream have been assigned to the stream unless other assumptions took precedence.
- If aerial photography shows large waterbody (lake, pond, irrigation pond, etc.) perennial has been assumed for the hydrographic category.
- For ponded areas shown on the aerial photography and if the USGS 7.5-minute quadrangles shows cross hatching for the area, intermittent has been assigned unless the upstream portion of the stream was assigned as perennial pursuant to the USGS National Hydrography Dataset then assigned perennial for the ponded area.
- USGS has a dashed line for intermittent streams. USGS has a solid line for perennial streams. In some situations this information was used to assist in the determination of assigning perennial or intermittent to a stream.

**2.2.3. Results for stream characterization**

The 27 streams and data are contained in a GIS file titled "SD\_Regional\_WMAA\_Streams" located in Attachment C. The streams are shown in watershed maps included in Attachment A.2.

**Summary of Deliverables for Stream Characterization**

Format	Item	Description	Location
Report	Title of Figures	<ul style="list-style-type: none"> <li>• "Watershed Management Area Streams"</li> <li>• "Watershed Management Area Streams by Hydrographic Category"</li> <li>• "Watershed Management Area Streams by Bed Material"</li> <li>• "Watershed Management Area Streams by Geologic Group"</li> <li>• "Watershed Management Area Streams by Reach"</li> </ul>	Attachment A.2

		Type"	
GIS	Map Group Title	Not Grouped	Attachment C
	Map Layer Title	SD_Regional_WMAA_Streams	
	Geodatabase Feature Dataset	Streams	
	Geodatabase Feature Class	SD_Regional_WMAA_Streams	
	Geodatabase Geometry Type	Line	
KMZ <sup>1</sup>	KMZ File Name	SD_Regional_WMAA_Streams	Attachment C
<sup>1</sup> To enhance the utilization of this data, the Stream Characterization map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zippered) file that can be viewed with the free download version of Google Earth ( <a href="http://www.google.com/earth/">http://www.google.com/earth/</a> ).			

In addition to the 27 streams that were subject of detailed analysis, NHD streams have been included on maps and within the geodatabase for reference. The NHD stream alignments have not been corrected and in some cases may be inconsistent with the existing infrastructure. The NHD streams are contained in a GIS file titled, "SD\_NHD\_Streams."

#### 2.2.4. Limitations for stream characterization

- Only a desktop analysis was performed and no field verification was conducted.
- Infrastructure is only based on storm water conveyance system data provided by Copermittees or clearly visible on aerial photography. If the Copermittee used a numbering or lettering system for describing bed and bank material for example, since the metadata was not provided the bed and bank material could not be verified.
- In some instances concrete channels cannot be identified on aerial photography if it is filled with sediment and/ or vegetation.

## 2.3.Land Uses

For the purpose of the WMAA, the Regional MS4 Permit requires a description of current and anticipated future land uses. This is presented in the final GIS deliverable as "Land Use Planning" and includes the following representations of land uses in the watersheds: existing land uses, planned land uses, developable lands, redevelopment and infill areas, floodplains, Multiple Species Conservation Program (MSCP) designated areas, and areas not within the Copermittees' jurisdictions (tribal lands, state lands, and federal lands).

### 2.3.1. Datasets Used for land uses

The following existing regional datasets were referenced to meet this requirement:

- Municipal boundaries: "Municipal\_Boundaries" dated August 2012, available from SanGIS/SANDAG
- Ownership: "Parcels" dated December 2013, available from SanGIS/SANDAG
- Existing land use: "SANGIS.LANDUSE\_CURRENT" dated December 2012, available from SanGIS/SANDAG (existing land use)
- Planned land use: "PLANLU" (Planned Land Use for the Series 12 Regional Growth Forecast (2050)), dated December 2010, available from SanGIS/SANDAG
- Developable land: "DEVABLE" (Land available for potential development for the Series 12 Regional Growth Forecast), dated December 2010, available from SanGIS/SANDAG
- Redevelopment and infill areas: "REDEVINF" (Redevelopment and infill areas for the Series 12 Regional Growth Forecast), dated December 2010, available from SanGIS/SANDAG
- Floodplains: "National Flood Hazard Layer" provided by Federal Emergency Management Agency October 2012
- Multiple Species Conservation Program (MSCP), total of four datasets available from SanGIS/SANDAG: "MHPA\_SD," dated 2012, (Multiple Habitat Planning Areas for City of San Diego); "MSCP\_CN," dated 2009 (designations of the County of San Diego's Multiple Species Conservation Program South County Subregional Plan); "MSCP\_EAST\_DRAFT\_CN," dated 2009 (draft East County MSCP Plan); and "Draft\_North\_County\_MSCP\_Version\_8.0\_Categories," dated 2008 (draft North County MSCP Plan)

### 2.3.2. Methodology/Assumptions/Criteria for land uses

The existing regional datasets for existing land use, planned land use, developable land, redevelopment and infill areas, floodplains, and MSCP designated areas were referenced with no modifications. Areas not within the Copermittees' jurisdictions (tribal lands, state lands, and federal lands) were compiled from SanGIS parcel data (December 2013) based on the "ownership" value. The owners listed below were excluded from the Copermittees jurisdictions and represent the "Federal/State/Indian" layer, which is displayed on various maps included in Attachment A.2.

- Bureau of Land Management
- California Department of Fish and Game
- Indian Reservations
- Military Reservations

- Other Federal
- State
- State of California Land Commission
- State Parks
- U.S. Fish and Wildlife Service
- U.S. Forest Service

When available, relevant data from these areas was included in analyses (e.g., developable land areas within Federal/State/Indian areas). Stream lines were prepared within these areas for continuity. However, stream classification (e.g., bed and bank material) was not prepared within these areas unless data was readily available (e.g., hydrographic category data available from NHD)

**2.3.3. Results for land uses**

The existing regional datasets are compiled into the Geodatabase in a group titled, "Land Use Planning." Current and anticipated future land uses are depicted in watershed maps included in Attachment C. Federal/State/Indian Lands are also referenced on all other map exhibits included in Attachment A.2.

**Summary of Deliverables for Land Uses**

Format	Item	Description	Location
Report	Title of Figures	<ul style="list-style-type: none"> <li>• "Existing Land Use"</li> <li>• "Planned Land Use"</li> <li>• "Developable Land"</li> <li>• "Redevelopment and Infill Areas"</li> </ul>	Attachment A.3
GIS	Map Group Title	Land Use Planning	Attachment C
	Map Layer Title	Municipal Boundaries Federal/State/Indian Lands SanGIS_ExistingLandUse SanGIS_PlannedLandUse SanGIS_DevelopableLand SanGIS_RedevelopmentandInfill FEMA Floodplain MHPA_SD MSCP_CN MSCP_EAST_DRAFT_CN Draft_North_County_MSCP_Version_8_Categories	
	Geodatabase Feature Dataset	LandUsePlanning	
	Geodatabase Feature Class	SanGIS_MunicipalBoundaries Federal_State_Indian_Lands SanGIS_ExistingLandUse SanGIS_PlannedLandUse	

		SanGIS_DevelopableLand SanGIS_RedevelopmentandInfill FEMA_NFHL SanGIS_MHPA_SD SanGIS_MSCP_CN SanGIS_MSCP_EAST_DRAFT_CN SanGIS_Draft_North_County_MSCP_Version_8_Categories	
	Geodatabase Geometry Type	Polygon	
KMZ <sup>1</sup>	KMZ File Name	Municipal Boundaries Federal/State/Indian Lands Floodplains Due to file size limitations, SanGIS land use datasets were not converted to KMZ.	Attachment C
<sup>1</sup> To enhance the utilization of this data, the Land Uses map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zippered) file that can be viewed with the free download version of Google Earth ( <a href="http://www.google.com/earth/">http://www.google.com/earth/</a> ).			

#### 2.3.4. Limitations

Some jurisdictions may have compiled GIS land use layers that include more detailed or more current information than the regional datasets available from SanGIS. SanGIS layers were selected for the Regional WMAA to provide consistent land use characterization region-wide, and to provide for repeatability of GIS analyses when a land use layer is required for input data. The definition of non-Copermittee areas identified in this document as "Federal/State/Indian Lands" is for the Regional WMAA. Some WQIPs may define non-Copermittee areas differently.

## 2.4.Potential Critical Coarse Sediment Yield Areas

The Regional MS4 Permit identifies in the provisions related to the WMAA that potential coarse sediment yield areas within the watershed be identified, with GIS layers (maps) as output. With regard to the function and importance of coarse sediment, SCCWRP Technical Report 667 titled “Hydromodification Assessment and Management in California” states the following:

*“Coarse sediment functions to naturally armor the stream bed and reduce the erosive forces associated with high flows. Absence of coarse sediment often results in erosion of in-channel substrate during high flows. In addition, coarse sediment contributes to formation of in-channel habitats necessary to support native flora and fauna.”*

This report identifies the potential critical coarse sediment yield areas for the San Diego River WMA in compliance with this permit provision. The applied datasets and methodologies for identifying the coarse sediment yield areas, along with their respective results, are described in the sections below.

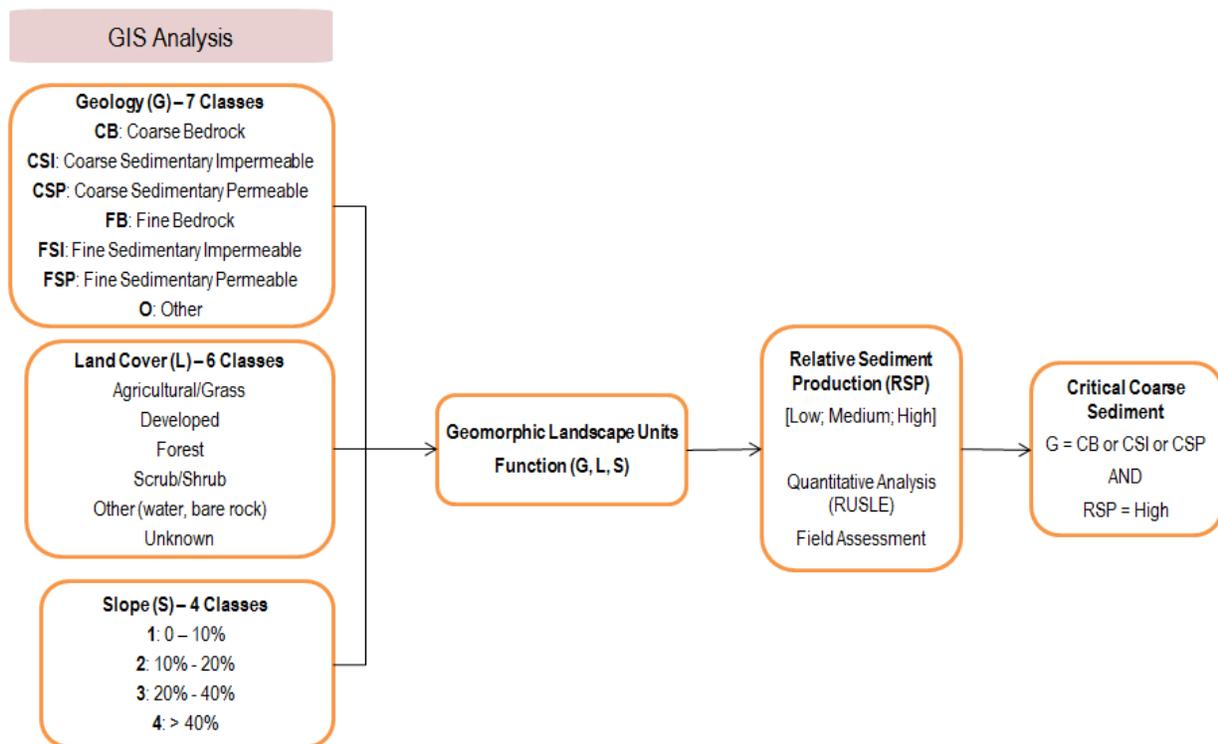
### 2.4.1. Datasets Used for identifying potential critical coarse sediment yield areas

The following datasets were used in the analysis

Dataset	Source	Year	Description
Elevation	USGS	2013	1/3 <sup>rd</sup> Arc Second (~10 meter cells) digital elevation model for San Diego County
Land Cover	SanGIS	2013	Ecology-Vegetation layer for San Diego County downloaded from SanGIS
Geology	Kennedy, M.P., and Tan, S.S.	2002	Geologic Map of the Oceanside 30’x60’ Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale.
	Kennedy, M.P., and Tan, S.S.	2008	Geologic Map of the San Diego 30’x60’ Quadrangle, California, California Geological Survey, Regional Geologic Map No. 3, 1:100,000 scale.
	Todd, V.R.	2004	Preliminary Geologic Map of the El Cajon 30’x60’ Quadrangle, Southern California, United States Geological Survey, Southern California Areal Mapping Project (SCAMP), Open File Report 2004-1361, 1:100,000 scale.
	Jennings et al.	2010	“Geologic Map of California,” California Geological Survey, Map No. 2 – Geologic Map of California, 1:750,000 scale

### 2.4.2. Methodology/Assumptions/Criteria for identifying potential critical coarse sediment yield areas

The methodology used to identify coarse sediment yield areas is based on Geomorphic Landscape Unit (GLU) methodology presented in the SCCWRP Technical Report 605 titled “Hydromodification Screening Tools: GIS-Based Catchment Analyses of Potential Changes in Runoff and Sediment Discharge” (SCCWRP, 2010). Geomorphic Landscape Units characterize the magnitude of sediment production from areas through three factors judged to exert the greatest influence on the variability on sediment-production rates: geology types, hillslope gradient, and land cover. The GLU approach provides a useful, rapid framework to identify sediment-delivery attributes of the watershed. The process to integrate these factors into GLUs is indicated in the flow chart below.



The following steps were used to define Geomorphic Landscape Units (GLUs), which were then related to the coarse sediment and critical coarse sediment yield areas in the San Diego River WMAA.

1. **Integrate data sets used to determine GLU:** Categories for geology, gradient, and land cover were defined based on readily available GIS datasets for the region and classifications found in relevant literature listed in Chapter 6. The different combinations of these categories make up distinct GLUs.
  - **Geologic Categories:** based on methodology listed in Attachment A.4.1 of Attachment A.4. Resulting geologic categories from this analysis are: Coarse Bedrock (CB), Coarse Sedimentary Impermeable (CSI), Coarse Sedimentary Permeable (CSP), Fine Bedrock (FB), Fine Sedimentary Impermeable (FSI), Fine Sedimentary

Permeable (FSP), and Other (O). An exhibit showing the regional geology groupings is presented in Attachment A.4.

- **Land cover categories:** defined using the Ecology Vegetation GIS map layer developed by the City of San Diego, the County of San Diego and SANDAG which were downloaded from SanGIS (2013). The vegetation categories in the GIS layer were grouped (Table A.1.2 in Attachment A.1) to match the following categories used in SCCWRP's Technical Report 605 (SCCWRP, 2010): Agriculture/Grass; Developed; Forest; Scrub/Shrub, Other (Water) and Unknown.
  - **Gradient Categories:** based on slope ranges found in a review of relevant literature (GLU methodology applied in California) listed in Chapter 6. The spatial processing of the slope categories utilized the USGS National Elevation Dataset (NED). Slope ranges used include: 0% to 10%, 10% to 20%, 20% to 40%, and greater than 40%.
2. **GLU Union Results:** GIS mapping exercise for the study area resulted in 166 GLUs within the 9 WMAs in San Diego County. Table A.4.2 in Attachment A.4 provides the list of the 166 GLUs.

For implementing hydromodification management performance standards in the Regional MS4 Permit, the Copermitees need to identify Critical Coarse Sediment Yield areas in the study region. To provide information on the identification of Critical Coarse Sediment yield, the study assumed that critical coarse sediment would be generated from GLUs that are composed of geologic units likely to generate coarse sediment (based on the methodology listed in Step 3) and have the potential for high relative sediment production (as estimated using the methodology listed in Step 4).

3. **Define Pertinent Geologic groups:** the geologic groups (Attachment A.4.1) considered in this study to have the potential to generate coarse sediment are Coarse Bedrock (CB), Coarse Sedimentary Impermeable (CSI), and Coarse Sedimentary Permeable (CSP). An exhibit showing the regional geologic grouping is presented in Attachment A.4.
4. **Relate GLU to Sediment Production:** For assigning GLUs with a relative sediment production, the following methodology was utilized:
- Conducted quantitative analysis to assign relative sediment production. Analysis was performed based on the assumption that sediment production from an area is proportional to the soil loss from the area, as evaluated using standard soil loss equation. Detailed analysis steps are documented in Attachment A.4.2;
  - To validate the quantitative assignment above, a qualitative field assessment was conducted for 40 sites. Site selection and findings from the field assessment is documented in Attachment A.4.3.
  - The result of the field assessment indicated a 65% match between field conditions and the quantitative assignments. The mismatches are attributed to differences in percent land cover as assumed for the quantitative analysis and those observed in the field. As such, the quantitative assignments were considered to be valid for the purposes of assigning relative sediment production.

### 2.4.3. Results for identifying potential coarse sediment yield areas

The resulting GIS maps showing the spatial distribution of geologic grouping and critical coarse sediment yield areas within the San Diego River WMA are provided in Attachment A.4. An ArcMap document which presents the results from each step of the methodology is included in Attachment C. Based on this analysis it was estimated that 22.8% of the study area is a potential critical coarse sediment yield area.

As a result of the regional-scale datasets, and commensurate data resolution, used to map the potential critical coarse sediment yield areas, some areas may have been mapped that in reality do not produce critical coarse sediment as they are existing developed areas. As such, an opportunity for jurisdictions to incorporate more refined data into the preliminary WMAA GIS dataset based on local knowledge and review of current aerial images was provided. The County of San Diego provided augmented data in the San Diego River WMA within the unincorporated jurisdictional area.

**Summary of Deliverables for Potential Coarse Sediment Yield Areas**

Format	Item	Description	Location
Report	Figures	“Geologic Grouping” "Potential Critical Coarse Sediment Yield Areas"	Attachment A.4
GIS	Map Group Layer Name	Potential Coarse Sediment Yield	Attachment C
	Map Layer Title	Geologic Grouping Land Cover Slope Category Geomorphic Landscape Unit Potential Coarse Sediment Yield Area Relative Sediment Production Potential Critical Coarse Sediment Yield Area	
	Geodatabase Feature Dataset	PotentialCoarseSedimentYield	
	Geodatabase Feature Class	GLUAnalysis PotentialCoarseSedimentYieldAreas PotentialCriticalCoarseSedimentYieldAreas	
	Geodatabase Geometry Type	Polygon	
KMZ <sup>1</sup>	KMZ File Name	Potential Critical Coarse Sediment Yield Areas	Attachment C

<sup>1</sup> To enhance the utilization of this data, the Geomorphic Landscape Unit Analysis is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zippped) file that can be viewed with the free download version of Google Earth (<http://www.google.com/earth/>).

### 2.4.4. Limitations for identifying potential critical coarse sediment yield areas

The resulting GIS layers were developed using regional datasets and provide a useful, rapid framework to perform screening-level analysis that is appropriate for watershed-scale planning studies. The methodology used to identify potential coarse sediment yield areas does not account

for instream sediment supply and sediment production from mass failures like landslides which are difficult to estimate on a regional scale without performing extensive field investigation. This data set also does not account for potential existing impediments that may hinder delivery of coarse sediment to receiving waters or downstream locations within the watershed as this was beyond the scope of a regional study. Where more precise estimates are required for a particular site or subarea it is recommended that this analysis be augmented with site-specific analysis. It is also recognized that this regional data set is a function of the inherent data resolution and therefore may not conform to all site conditions, or does not reflect changes to particular areas that have occurred since the underlying data was developed. As such, the WMAA data for the potential critical coarse sediment yield areas should be verified in the field according to the procedures outlined in the Model BMP Design Manual and/or jurisdiction specific BMP Design Manual.

## 2.5. Physical Structures

The Regional MS4 Permit requires the Copermitees to identify information regarding locations of existing flood control structures and channel structures, such as stream armoring, constrictions, grade control structures, and hydromodification or flood management basins with GIS layers (maps) as output, for each WMA being analyzed for the purpose of developing watershed-specific requirements for structural BMP implementation. This study identified the physical structures using a desktop-level analysis for the stream(s) identified in Section 2.2 in compliance with this permit provision.

### 2.5.1. Approach for identifying physical structures

The intent of this portion of the WMAA project was to provide an initial assessment of the structures of interest for the stream(s) identified in Section 2.2. This desktop-level analysis was conducted primarily as a visual survey of aerial imagery and FEMA flood insurance study (FIS) profiles where available. The collected information was entered into a GIS layer for inclusion into the overall WMAA geodatabase containing the characterization layers required by the Regional MS4 Permit. To support overall WMA characterization, the information derived in this task provides insight into water and sediment movement through the watershed (SCCWRP, 2012), the opportunities and limitations for infrastructure retrofits and also informs efforts to identify appropriate locations for habitat or riparian area rehabilitation in relation to proximate infrastructure. Specific information regarding how the survey was performed and the attributes of the generated data is presented in Attachment A.5. Note that concrete channels, pipes/culverts, riprap or other artificial stream armoring, and basins have also been identified in the linework generated for the streams (see Section 2.2).

### 2.5.2. Results for identifying physical structures

The resulting GIS mapping provided in Attachment A.5 shows the spatial locations of the physical structures within the mapped stream(s).

#### Summary of Deliverables for Physical Structures

Format	Item	Description	Location
Report	Figure	Watershed Management Area Streams by Reach Type with Channel Structures	Attachment A.5
GIS	Map Group Layer Name	Channel Structures	Attachment C.1
	Map Layer Title	Channel Structures	
	Geodatabase Feature Dataset	ChannelStructures	
	Geodatabase Feature Class	ChannelStructures	
	Geodatabase Geometry Type	Point	
KMZ <sup>1</sup>	Kmz File Name	ChannelStructures	Attachment C.2

<sup>1</sup> To enhance the utilization of this data, the Physical Structures map is provided in both traditional GIS file format (ESRI software license purchase required) and as a Google Earth KMZ (Keyhole Markup Language/Zipped) file that can be viewed with the free download version of Google Earth (<http://www.google.com/earth/>).

### 3. Template for Candidate Project List

The Regional MS4 Permit requires each WMA to use the results from the WMA characterization to compile a list of candidate projects that could potentially be used as alternative compliance options for Priority Development Projects should an agency or jurisdiction opt to develop an alternative compliance program. Copermittees must first conclude that implementing such a candidate project would provide greater overall benefit to the watershed than requiring implementation of structural BMPs onsite prior to implementing these candidate projects as alternative compliance projects.

The Copermittees elected to identify potential candidate projects as a separate effort from this regional project, and therefore the process for identifying candidate projects is not documented in this report. Instead, this project only developed a template, in a spreadsheet format, for use by the Copermittees to compile lists of potential candidate projects. The template is intended to enhance regional consistency of the information that is gathered for candidate projects. The template spreadsheet file was distributed to the Copermittees on January 28, 2014. A table of the template components is indicated below:

Column	Primary Heading	Secondary Heading	Guidance for Completing the Project List
A	Project Identifier	-	Unique identifier for the project.
B	Watershed Management Area	-	Dropdown menu to select the watershed management area the project is located in
C	Hydrologic Area (HA)	-	Dropdown menu to select the hydrologic area the project is located in Select a WMA in column B for HA (Column C) dropdown menu to activate.
D	Hydrologic Subarea (HSA)	-	Dropdown menu to select the hydrologic subarea the project is located in. Select a HA in column C for HSA (Column D) dropdown menu to activate.
E	Jurisdiction	-	Dropdown menu to select the jurisdiction the project is located in. Select a HSA in column D for Jurisdiction (Column E) dropdown menu to activate.
F	Project Name	-	Indicate the name of the project.
G	Ownership	Type	Dropdown menu to select if the project is a public project, private project, or public-private partnership.
H	Ownership	Ownership Information	List the details for the owner.
I	Project Location	Address	List the address of the project site.
J	Project Location	APN	List the APN of the parcel.
K	Project Location	Latitude	List the latitude of the project site.
L	Project Location	Longitude	List the longitude of the project site.

Column	Primary Heading	Secondary Heading	Guidance for Completing the Project List
M	Project Origination/ Originator	Name	List the name of the report/organization/individual that provided the idea for the project. Potential origination sources: WQIP, WMAA, JURMPs, WURMPs, CLRPs, IRWM, MSCP, MHPA, Other.
N	Project Origination/ Originator	Contact Information	Link or report title if the proposed project is from a report [or] contact information if from an organization/individual.
O	Project Category	-	Drop Down menu to select the project category; In addition to the 6 project categories explicitly listed in the Regional MS4 Permit, the drop down menu also has a category "Other project types allowed by the MS4 Permit". Example for "Other" project types are agency CIP programs such as Green Streets, LID conversions (medians, parks), agency filter installation, etc.
P	Specific Project Type	-	List the subcategory of the project; for example, list Regional BMP type (i.e. infiltration basin, wetland, etc.).
Q	Potential Pollutant	-	Identify the potential pollutant(s) that can be treated by the proposed project.
R	Project Size & Parameters	Contributing Drainage Area (acres)	List the contributing drainage area to the project.
S	Project Size & Parameters	Parcel Size (acres)	List the size of the parcel the project is located on.
T	Project Size & Parameters	Project Footprint (acres)	List the size of the project footprint.
U	Project Size & Parameters	Parameters (with units as necessary)	Parameters needed to quantify benefits from the project; i.e. for an infiltration basin, list the water quality volume, long-term infiltration rate, depth of the basin, etc.
V	Regulatory Requirement	-	Indicate if the project is proposed to meet particular regulatory requirement such as TMDL, etc.
W	Project Timeline	-	Indicate if a project must be implemented by certain date to meet a grant deadline or other time commitment.
X	Other Notes	-	List any other relevant notes; for example, when retrofitting existing infrastructure project category is selected, input parameters needed to quantify benefits from existing infrastructure into this column as these will be needed to estimate additional benefits that can be used for alternative compliance. If N/A is selected in any dropdown menus, add additional explanation in here

## **4. Hydromodification Management Applicability/Exemptions**

Hydromodification, which is caused by both altered storm water flow and altered sediment flow regimes, is largely responsible for degradation of creeks, streams, and associated habitats in the San Diego Region. The purpose of the hydromodification management requirements in the Regional MS4 Permit is to maintain or restore more natural hydrologic flow regimes to prevent accelerated, unnatural erosion in downstream receiving waters.

In some cases, priority development projects may be exempt from hydromodification management requirements if the project site discharges runoff to receiving waters that are not susceptible to erosion (e.g., a lake, bay, or the Pacific Ocean) either directly or via hardened systems including concrete-lined channels or existing underground storm drain systems.

The March 2011 Final Hydromodification Management Plan (HMP) identified certain exemptions from hydromodification management requirements by presenting "HMP applicability criteria." The Regional MS4 Permit maintains some of these HMP applicability criteria. However, some of the applicability criteria are not included under the Regional MS4 Permit unless the area or receiving water is mapped in the WMAA. The intent of this Section is to provide mapping of areas exempt from hydromodification management requirements, and provide supporting technical analyses for exemptions that are recommended by the WMAA.

### **4.1. Additional Analysis for Hydromodification Management Exemptions**

This section documents additional analysis performed to further evaluate the following exemptions that were already approved by the San Diego Regional Board with the 2011 Final HMP. This study only provides additional analysis, data, and rationale for supporting or eliminating the following existing exemptions and does not propose or study any new exemptions.

- Exempt River Reaches
- Stabilized Conveyance Systems Draining to Exempt Water Bodies
- Highly Impervious Watersheds and Urban Infill and
- Tidally Influenced Lagoons

### 4.1.1. Exempt River Reaches

#### 4.1.1.1. History

The March 2011 Final HMP, approved by the SDRWQCB under the 2007 MS4 Permit, provides the following exemption from hydromodification management requirements under Section 6.1, HMP Applicability Requirements:

- *Figure 6-1, Node 5 – Potential exemptions may be granted for projects discharging runoff directly to an exempt receiving water, such as the Pacific Ocean, San Diego Bay, an exempt river system (detailed in Table 6-1), or an exempt reservoir system (detailed in Table 6-2).*

Exempt river system/reach from the 2011 Final HMP:

River	Downstream Limit	Upstream Limit
San Diego River	Outfall to Pacific Ocean	Confluence with San Vicente Creek

Exemptions related to runoff discharging directly to the above river reach was based on the flow duration analysis performed for the San Diego River in the Final HMP and the Technical Advisory Committee (formed to provide input on the development of the Final HMP) members' opinion (based on field observations and years of historical perspective) that the above river reach have very low gradients, were depositional (aggrading), have very wide floodplain areas when in the natural condition and that the effects of cumulative watershed impacts to this reach is minimal provided that properly sized energy dissipation is provided at outfalls to the river.

#### 4.1.1.2. Status under 2013 Regional MS4 Permit

Under the Regional MS4 Permit, exempt river reaches would not qualify for exemption from hydromodification management controls unless the optional WMAA is developed with additional rationale/analyses to support reinstating exemptions to these river reaches. Additional analysis performed as part of the WMAA to evaluate hydromodification management control exemptions to the previously exempt reaches is presented below.

#### 4.1.1.3. Research, Approach and Results

Hydromodification impacts can be caused due to increase in flows, changes in sediment transport capacity and changes in sediment supply to the streams (SCCWRP, 2012). In order to evaluate the cumulative impacts due to development and determine if hydromodification management exemption can be reinstated for the river reach that was exempt in the previous permit term erosion potential (Ep) analysis was used to evaluate the increase in flows and changes in sediment transport capacity. In addition, sediment supply potential (Sp) analysis was used to evaluate the changes in sediment supply in this study. In regards to Ep analysis SCCWRP Technical Report 667 "Hydromodification Assessment and Management in California" states:

*"The underlying premise of the erosion potential approach advances the concept of flow duration control by addressing in-stream processes related to sediment transport. An erosion potential calculation combines flow parameters with stream geometry to assess long term (decadal) changes in the sediment transport capacity. The cumulative distribution of shear stress, specific stream power and sediment transport capacity across*

*the entire range of relevant flows can be calculated and expressed using an erosion potential metric, Ep (e.g., Bledsoe, 2002)."*

The approach used in this study is explained in detail in Attachment B.1.1.1. The following WMA characterization maps developed in Section 2 were used to select inputs for the exempt river reach analysis:

- Planning land use layers from Section 2.3 were used to estimate the existing impervious area and identify the developable parcels in each watershed. A GIS exercise was performed to identify the developable parcels in each watershed that will be exempt from hydromodification management requirements if the exemption is granted.
- Stream type classification analysis from Section 2.2 was used to select a conservative cross section (segments that are assigned naturally constrained) to be used in analysis for each watershed
- GLU analysis and its associated quantitative analysis described in Section 2.4 were used to determine Sp metric for each watershed. In this study coarse sediment supply changes were limited to changes in hill slope erosion between existing condition and future condition (for parcels that are proposed to be exempt from hydromodification management) of the watershed. It was assumed that the changes in instream sediment supply between existing and future condition for these large depositional river systems are very minimal.

Selection of inputs for the analysis is explained in detail in Attachment B.1.1.2 and results from the analysis are presented in Attachment B.1.1.3 in tabular format. The Ep analysis performed in this study does not account for the following Regional MS4 permit requirements as a conservative assumption. If accounted for, it will result in a smaller Ep than what is currently reported in Attachment B.1.1.3:

- New development priority development projects including projects that are proposed to be exempt from hydromodification management requirements through this WMAA study must implement retention BMPs to the extent feasible if alternative compliance option is not selected or not available.
- Redevelopment priority development projects must mitigate to the pre-developed condition

**4.1.1.4. Recommendation**

Based on the results from this study reported in Attachment B.1.1.3, the flow duration analysis performed in the Final HMP, and the Technical Advisory Committee (TAC) recommendations provided during the Final HMP development, it is recommended that hydromodification management exemption be reinstated for projects discharging runoff directly to the following exempt river reach:

River	Downstream Limit	Upstream Limit
San Diego River	Outfall to Pacific Ocean	Confluence with San Vicente Creek

Each municipality must define/approve “direct discharge” based on the project site conditions. To qualify for the potential exemption, the outlet elevation must be between the river bottom elevation and the 100-year floodplain elevation and properly designed energy dissipation must be provided. Mapping of these exempt river reaches is presented in Attachment B.2.

#### ***4.1.1.5. Limitations***

The analysis and associated recommendations as presented above were based on instream erosion as the primary consideration to support reinstatement of exemptions from hydromodification management controls for discharges directly to these river reaches. While it is recognized that other factors contribute to adverse impacts (e.g., salinity imbalance, pollutants) to instream habitat and resulting biotic integrity, hydromodification management control has traditionally been considered an “umbrella process” that encompasses most of the highest risk stressors (percent sands and fines present, channel alteration, and riparian disturbance) to physical habitat. Beyond demonstrating that instream erosion is not anticipated as a result of reinstating hydromodification management control exemptions for discharges to these river reaches, a focused method for correlating physical and biotic integrity to modified hydrological conditions has not been performed in this analysis, as an assessment method has not yet been developed.

The current assessment methods may yield inconclusive results when attempting to identify causal relationships between degraded instream habitat solely due to increased flows and erosive force from hydromodification. A causal assessment recently conducted in the lower reaches of the San Diego River, conducted as a partnership between the Southern California Coastal Water Research Project (SCCWRP), the City of San Diego, the County of San Diego, and the San Diego RWQCB, focused on stressors potentially responsible for known biological impairment of the river. Once the data of the causal assessment become available, it may be useful in classifying the potential stressors such as altered physical habitat as likely, unlikely, or an uncertain cause to biological impairment.

With respect to adverse impacts to habitat as a result of pollutants entrained in storm water discharges, these areas will still be subject over time to the pollutant control requirements of the Regional MS4 Permit as areas develop or redevelop. The current requirements obligate development to maximize retention of the design storm volume which will mitigate a portion of the volume that would otherwise be controlled with hydromodification management BMPs. In some cases, this offsetting of volume reduction through pollutant control BMPs may exceed the HMP volumes. In addition, the development that occurs within the exempted watershed areas is still required to provide any applicable flood control measures. Risk of flooding as a result of exemption from hydromodification controls is unlikely as the control thresholds are significantly lower (order of magnitude) than flood control requirements implemented to protect life and property.

#### **4.1.2. Stabilized Conveyance Systems Draining to Exempt Water Bodies**

##### ***4.1.2.1. History***

The March 2011 Final HMP, approved by the SDRWQCB under the 2007 MS4 Permit, provides the following exemption from hydromodification management requirements under Section 6.1, HMP Applicability Requirements:

- "Figure 6-1, Nodes 7 and 8 – For projects discharging runoff directly to a hardened conveyance or rehabilitated stream system that extends to exempt receiving waters detailed in Node 5, potential exemptions from hydromodification criteria may be granted. Such hardened or rehabilitated systems could include existing storm drain systems, existing concrete channels, or stable engineered unlined channels. To qualify for this exemption, the existing hardened or rehabilitated conveyance system must continue uninterrupted to the exempt system. In other words, the hardened or rehabilitated conveyance system cannot discharge to an unlined, non-engineered channel segment prior to discharge to the exempt system. Additionally, the project proponent must demonstrate that the hardened or rehabilitated conveyance system has capacity to convey the 10-year ultimate condition flow through the conveyance system. The 10-year flow should be calculated based upon single-event hydrologic criteria as detailed in the San Diego County Hydrology Manual.

This exemption was consistent with 2007 MS4 Permit language allowing exemption for discharges into "channels that are concrete-lined or significantly hardened (e.g., with rip-rap, sackrete, etc.) downstream to their outfall in bays or the ocean." The HMP language also allowed for channels stabilized by soft methods such as turf reinforcement mat or vegetation to be considered for exemption. Under these criteria, an engineered channel that is stabilized with riprap, turf reinforcement mat, vegetation, or other materials other than concrete could be determined to be exempt from hydromodification management requirements, pending demonstrating that it has capacity to convey the 10-year ultimate condition flow.

##### ***4.1.2.2. Status under 2013 Regional MS4 Permit***

A significant change under the Regional MS4 Permit is the requirement that exempt systems draining to exempt water bodies either be "existing underground storm drain systems," or "conveyance channels whose bed and banks are concrete lined" all the way to exempt water bodies. The Regional MS4 Permit language does not include engineered channels that are stabilized with materials other than concrete, such as riprap, turf reinforcement mat, or vegetation. However, areas identified by Copermittees as appropriate for an exemption may be identified in the optional WMAA incorporated into the WQIP.

##### ***4.1.2.3. Research and Results***

To provide a process for engineered channels that are stabilized with materials other than concrete, such as riprap, turf reinforcement mat, or vegetation to be identified in the WMAAs, an example study was prepared for an existing engineered channel stabilized with vegetation. The study demonstrates that a channel stabilized with materials other than concrete can be stable or have minimal potential for erosion. In order to allow for other channels that are stabilized with materials other than concrete to be identified in each WMAA, criteria for defining what is "stable" or "minimal potential for erosion" was determined.

Forester Creek in the City of Santee was selected for the sample channel analysis. Forester Creek is stabilized with vegetation from its confluence with the San Diego River downstream to Prospect Avenue upstream. For the purpose of this discussion, the confluence is the location where the floodplain of Forester Creek meets the San Diego River floodplain, just west of Gorge Avenue and Willowgrove Avenue, at the eastern side of the Carlton Oaks Golf Course. Stabilization occurred in two separate projects. The reach from the San Diego River confluence downstream to Mission Gorge Road upstream was constructed in 1990. The reach from Mission Gorge Road downstream to Prospect Avenue upstream is known as the Forester Creek Improvement Project and was constructed in 2006-2007. Forester Creek includes energy dissipators stabilized with riprap, concrete, and articulated concrete block at Mission Gorge Road undercrossing and Prospect Avenue undercrossing. Other than at bridge crossings, the engineered un-lined reach of Forester Creek is stabilized with native vegetation. There is dense growth of trees in the channel.



**Vegetation in Forester Creek Downstream of Mission Gorge Road**



**Vegetation in Forester Creek Upstream of Mission Gorge Road between Mission Gorge Road and State Route 52**



### **Vegetation in Forester Creek between State Route 52 and Olive Lane**

Upstream of Prospect Avenue, Forester Creek is a concrete-lined channel serving an urban area that is almost fully built out and served by existing underground storm drain systems and concrete-lined channels. Because of the vegetated reaches of Forester Creek extending to the San Diego River, the concrete-lined portion of Forester Creek and tributary underground storm drain systems and concrete-lined channels are not exempt from hydromodification management requirements unless the vegetated reaches of Forester Creek are identified in the optional WMAA incorporated into the WQIP.

An erosion potential analysis was prepared for the vegetated reaches of Forester Creek. An erosion potential analysis compares cumulative excess shear stress over all flows capable of transporting the channel-bed material from post-development to pre-development condition. The analysis used the same methods for determining erosion potential as presented in Section 4.1.1 and Attachment B.1.1 for the major river reaches.

For the purpose of determining flow rates and durations (hydrologic analysis), a regional scaling procedure developed by Hawley & Bledsoe in 2011 was used, the same method as presented in Section 4.1.1 and Attachment B.1.1 for the major river reaches. The method uses Duration Density Functions (DDFs) presented in the 2011 paper, "How do flow peaks and durations change in suburbanizing semi-arid watersheds? A southern California case study, "to estimate cumulative durations for geomorphically-effective flows in a logarithmically-binned histogram format. Using these flows, long-term sediment transport can be subsequently estimated. The

analysis requires the following data, summarized below.

### Summary of Input Data for Hydrologic Calculations for Forester Creek Erosion Potential Analysis

Data	Units	Forester Creek Watershed Existing Condition	Forester Creek Watershed Future Condition
Tributary Area, A	square miles (mi <sup>2</sup> )	23.36	23.36
Mean Annual Precipitation, MAP	inches	14	14
Length of Daily Flow Record	Years	30	30
Minimum Flow Rate	cubic feet per second	0.01	0.01
Number of Flow Bins	--	25	25
Impervious Cover	mi <sup>2</sup> / mi <sup>2</sup>	0.4634	0.4792

Impervious cover for the Forester Creek watershed was determined by assigning land-use specific imperviousness values to the land use categories presented in the SanGIS land use data sets (existing land use in 2012 and planned land use, described in Chapter 2.3). The composite imperviousness of the watershed was then calculated based on the existing condition and future condition land use distribution within the watershed. The Forester Creek watershed is nearly fully built out therefore there is little change in imperviousness from existing to future condition. Impervious area calculations for the Forester Creek watershed are provided in Attachment B.1.2.

For the purpose of determining shear stress in the channel (hydraulic analysis), normal depth calculations for the binned flow rates determined from the DDF analysis were prepared for two channel cross sections. One cross section was taken in the reach constructed in 1990, and one cross section in the Forester Creek Improvement Project reach. For each reach, the cross section expected to experience the greatest shear stress was selected, based on channel width and slope. The analysis requires the following data, summarized below.

### Summary of Input Data for Hydraulic Calculations for Forester Creek Erosion Potential Analysis

Data	Units	Forester Creek Watershed Cross Section 1300	Forester Creek Watershed Cross Section 2475
Channel Bottom Width, b	feet	84	155
Channel Side Slopes, z1 and z2	Horizontal:Vertical	z1 = 1.5:1 z2 = 2:1	z1 = z2 = 2:1
Channel Slope	foot/foot	0.006	0.003
Channel Roughness (Manning's n)	--	0.100	0.100
Critical Shear Stress	pounds per square foot (lb/ft <sup>2</sup> )	2.1	2.1

Critical shear stress for the reaches was estimated to be greater than or equal to 2.1 pounds per square foot (lb/ft<sup>2</sup>), based on review of permissible shear stress values presented in "Stability Thresholds for Stream Restoration Materials" (Fischenich 2001) and "Streambank Soil Bioengineering Considerations for Semi-Arid Climates" (Hoag and Fripp 2005). Based on Fischenich 2001, permissible shear stress for "live willow stakes" is approximately 2.10 to 3.10 lb/ft<sup>2</sup>.

The analysis results, presented in Attachment B.1.2, show that for both the existing and future condition, the shear stress for all geomorphically-effective flows based on the DDF analysis is less than the estimated critical shear stress of 2.1 lb/ft<sup>2</sup>. This means that no excess shear stress or "work" occurs in the channel in either the existing or future condition. Therefore, there is no increase in the duration of "work" (cumulative work), in the future condition, and erosion potential is 1.0.

Note that while the flow rates are the same in both the existing and future condition analyses, the duration of each flow rate is increased in the future condition. The flow rates in the flow bins are based on the watershed area, mean annual precipitation, and length of the synthetic record. These do not change from existing to future condition. The duration for each flow bin is related to the watershed area, mean annual precipitation, length of the synthetic record, and the impervious area. The duration increases in the future condition based on the increased impervious area. The increase in duration would result in increased cumulative work in the future condition if any of the flow rates resulted in shear stress greater than the estimated critical shear stress (excess shear stress, or "work"), because cumulative work is the product of work times duration.

The scenario that occurred in the Forester Creek analysis, in which no work occurred in the expected range of geomorphically-effective flow rates, is a potential scenario for engineered channels because engineered conveyance systems are typically engineered for flood flows much greater and less frequent than the geomorphically-effective flows. For example, Forester Creek is engineered to convey a 100-year single-storm event flow rate of approximately 12,450 to 13,840 cubic feet per second (cfs) within the channel. The 10-year single-storm event flow rate for Forester Creek is approximately 6,000 to 6,800 cfs. The maximum geomorphically-effective flow rate for Forester Creek based on the DDF analysis is 836 cfs.

#### ***4.1.2.4. Recommendation***

Based on the study that was prepared under the Regional WMAA and described above, the vegetated reaches of Forester Creek from its confluence with the San Diego River downstream to Prospect Avenue upstream are recommended to be exempt from hydromodification management requirements. The analysis has shown that future increases in impervious area within the watershed are not expected to increase the erosion potential in Forester Creek. The concrete-lined portion of Forester Creek and existing storm drain systems draining directly to the concrete-lined portion of Forester Creek should also be exempt. Storm drain systems draining directly to the vegetated reaches of Forester Creek would also be exempt if there is no evidence of localized erosion issues at the storm drain outfall.

Because engineered conveyance systems are typically engineered to convey flood flows much greater than the geomorphically-effective flows typically determined using continuous simulation modeling or DDF analysis, some engineered conveyance systems may be capable of conveying all geomorphically-effective flows at very low depths with shear stress less than critical shear stress, as was the case for Forester Creek. Based on this, other engineered

conveyance systems that are stabilized with materials other than concrete, such as riprap, turf reinforcement mat, or vegetation, including rehabilitated stream systems, may be studied. Those systems that meet criteria presented in the Regional WMAA for stabilized conveyance systems draining to exempt water bodies may be recommended as exempt systems in the optional WMAA incorporated into the WQIP. However, any future proposed HMP exemptions would need to be approved through the WQIP Annual Update process (Regional MS4 Permit Section F.1.2.c.).

#### **4.1.3. Highly Impervious/Highly Urbanized Watersheds and Urban Infill**

Based on evaluation of the highly impervious/highly urbanized watershed and urban infill exemptions presented in the March 2011 Final HMP, and comparison with more recent research prepared for the Ventura County Hydromodification Control Plan (Ventura County HCP) (Final Draft dated September 2013), resurrection of these exemptions from the March 2011 Final HMP was not recommended by the Regional WMAA. The research prepared in support of the Ventura County HCP determined lower thresholds of additional impervious area (ranging from 0.44% to 1.65%) than the limit presented in the San Diego County Final HMP dated March 2011 (3%). No areas within the San Diego River WMA are currently recommended for highly impervious/highly urbanized watershed or urban infill exemption.

#### **4.1.4. Tidally Influenced Lagoons**

There are no tidally influenced lagoons recommended for exemption from hydromodification management requirements in the San Diego River WMA. Refer to the Regional WMAA for further information regarding this exemption.

## 5. Conclusions

### 5.1. Watershed Management Area Characterization

The WMA Characterization data was developed using available regional data to further understand the macro-scale watershed characteristics and processes in the San Diego River WMA. The Regional MS4 Permit allows for flexibility in complying with land development requirements when using the information developed in the WMAA to improve water quality planning and implementation associated with land development. This dataset will assist with identifying the opportunities and constraints for projects and management decisions based on a watershed-scale (rather than piecemeal project identification without context within the watershed) and provides Copermittees the ability to exercise the option to create an alternative compliance program that offers the opportunity to develop watershed-specific alternatives to universal onsite structural BMP implementation. The characterization data includes:

Characterization Data	Utilization Potential
<p>Dominant Hydrologic Process:</p> <ul style="list-style-type: none"> <li>• Overland flow</li> <li>• Infiltration</li> <li>• Interflow</li> </ul>	<ul style="list-style-type: none"> <li>• Identify areas for enhanced infiltration or collection of storm water for treatment</li> <li>• Implement management measures that correspond to pre-development conditions – promotes long-term channel stability and health</li> <li>• Increases understanding of the natural functioning of the watershed and what has been (or is at risk of being) altered by urbanization.</li> </ul>
<p>Stream Characterization:</p> <ul style="list-style-type: none"> <li>• Reach type</li> <li>• Bed material</li> <li>• Bank material</li> <li>• Hydrographic category</li> <li>• Channel infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Preliminary dataset that can be used to conduct stream power evaluations</li> <li>• Identify channel systems for preservation or restoration</li> <li>• Identification of appropriate space for channel processes to occur (e.g., flood plain connectivity)</li> <li>• Insight to sensitivity of receiving stream reach</li> <li>• Indicates the features within channels that affect water and sediment movement through the watershed</li> </ul>

Characterization Data	Utilization Potential
Land Use: <ul style="list-style-type: none"> <li>• Existing</li> <li>• Future</li> </ul>	<ul style="list-style-type: none"> <li>• Foresight (identifies relative risks, opportunities, or constraints) in comparing future to existing land uses, i.e., areas that may be more/less vulnerable to adverse impacts to changes in storm water runoff associated with development</li> <li>• Encourage infill development</li> </ul>
Potential Critical Coarse Sediment Yield Areas	<ul style="list-style-type: none"> <li>• Preservation of areas or function that contributes critical sediment within the watershed to stream armoring/stability</li> <li>• Assist with identifying potentially susceptible stream reaches that require uninterrupted coarse sediment supplies to remain stable</li> <li>• Dual goal of open space conservation</li> </ul>

Regarding the identification of the potential critical coarse sediment yield areas in the WMAA using readily available regional datasets, it is anticipated that when more precise estimates for potential critical coarse sediment yield areas are required for a particular site or subarea that this regional study will be augmented with site-specific analysis. Development projects must avoid critical sediment yield areas or implement measures that allow critical coarse sediment to be discharged to receiving waters, such that there is no net impact to the receiving water to meet the requirements of the Regional MS4 permit. As such, projects should consult the Model BMP Design Manual and/or jurisdiction specific BMP Design manual for options to meet the Regional MS4 permit requirements. It is anticipated that the data will not be static but will be enhanced over time through future studies or field assessments that will refine what is currently a macro-level data set.

## 5.2. Template for Candidate Project List

It is anticipated the Copermittees that elect to develop alternative compliance programs will conduct a separate exercise to nominate potential candidate projects for inclusion into the WQIPs using the template developed for this project.

## 5.3. Hydromodification Management Exemptions

Attachment B.2 presents hydromodification management applicability/exemption mapping for the San Diego River WMA. The mapping includes receiving waters that are exempt based on the Regional MS4 Permit or recommended exempt based on studies.

Receiving waters that are **exempt** based on the Regional MS4 Permit include:

- The Pacific Ocean
- Lakes and Reservoirs
- Existing underground storm drains or concrete-lined channels draining directly to the ocean

Receiving waters or conveyance systems that are **recommended exempt** in the San Diego River WMA based on studies that were prepared as part of the Regional WMAA include:

- San Diego River from Pacific Ocean to confluence with San Vicente Creek
- Forester Creek stabilized reach from the confluence with the San Diego River to Prospect Avenue
- Existing underground storm drains or concrete-lined channels discharging directly to the above receiving waters. These systems were identified based on MS4 data provided by the Copermittees via the data call. These systems may not represent all discharges to the above receiving waters. Additional systems may be considered exempt if there is no evidence of erosion at the outfall of the conveyance system, and any other criteria determined by the local jurisdiction.

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# San Diego River Watershed Management Area Analysis ATTACHMENTS



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*October 3, 2014*

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**ATTACHMENT A**  
**WATERSHED MANAGEMENT AREA**  
**CHARACTERIZATION**

**ATTACHMENT A.1**  
**DOMINANT HYDROLOGICAL PROCESS**

## A.1 Dominant Hydrological Process

**Table A.1.1: Runoff Coefficients versus Land Use, Hydrologic Soil Group (A, B, C, D), and Slope Range**

Land Use	A			B			C			D		
	0-2%	2-6%	6% <sup>a</sup>	0-2%	2-6%	6% <sup>a</sup>	0-2%	2-6%	6% <sup>a</sup>	0-2%	2-6%	6% <sup>a</sup>
Cultivated land	0.08 <sup>a</sup>	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	0.14 <sup>b</sup>	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Meadow	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
	0.14	0.22	0.30	0.20	0.28	0.37	0.26	0.35	0.44	0.30	0.40	0.50
Forest	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Residential lot size 1/8 acre	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Residential lot size 1/4 acre	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
	0.30	0.34	0.37	0.33	0.37	0.42	0.36	0.40	0.47	0.38	0.42	0.52
Residential lot size 1/3 acre	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
	0.28	0.32	0.35	0.30	0.35	0.39	0.33	0.38	0.45	0.36	0.40	0.50
Residential lot size 1/2 acre	0.16	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
	0.25	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.48
Residential lot size 1 acre	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Industrial	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
Streets	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	0.76	0.77	0.79	0.80	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.15	0.21	0.28
	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

<sup>a</sup> Runoff coefficients for storm recurrence intervals less than 25 years.

<sup>b</sup> Runoff coefficients for storm recurrence intervals of 25 years or longer.

Source: Table 7-9 in *Hydrologic Analysis and Design* (McCuen, 2005)

**Table A.1.2: Land Cover Grouping**

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
1	42000 Valley and Foothill Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
2	42100 Native Grassland		Agricultural/Grass
3	42110 Valley Needlegrass Grassland		Agricultural/Grass
4	42120 Valley Sacaton Grassland		Agricultural/Grass

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Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping	
5	42200 Non-Native Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass	
6	42300 Wildflower Field		Agriculture/Grass	
7	42400 Foothill/Mountain Perennial Grassland		Agriculture/Grass	
8	42470 Transmontane Dropseed Grassland		Agriculture/Grass	
9	45000 Meadow and Seep		Agriculture/Grass	
10	45100 Montane Meadow		Agriculture/Grass	
11	45110 Wet Montane Meadow		Agriculture/Grass	
12	45120 Dry Montane Meadows		Agriculture/Grass	
13	45300 Alkali Meadows and Seeps		Agriculture/Grass	
14	45320 Alkali Seep		Agriculture/Grass	
15	45400 Freshwater Seep		Agriculture/Grass	
16	46000 Alkali Playa Community		Agriculture/Grass	
17	46100 Badlands/Mudhill Forbs		Agriculture/Grass	
18	Non-Native Grassland		Agriculture/Grass	
19	18000 General Agriculture		Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Agriculture/Grass
20	18100 Orchards and Vineyards			Agriculture/Grass
21	18200 Intensive Agriculture			Agriculture/Grass
22	18200 Intensive Agriculture - Dairies, Nurseries, Chicken Ranches			Agriculture/Grass
23	18300 Extensive Agriculture - Field/Pasture, Row Crops	Agriculture/Grass		
24	18310 Field/Pasture	Agriculture/Grass		
25	18310 Pasture	Agriculture/Grass		
26	18320 Row Crops	Agriculture/Grass		
27	12000 Urban/Developed	Developed		
28	12000 Urban/Develpoed	Developed		
29	81100 Mixed Evergreen Forest	Forest	Forest	
30	81300 Oak Forest		Forest	
31	81310 Coast Live Oak Forest		Forest	
32	81320 Canyon Live Oak Forest		Forest	
33	81340 Black Oak Forest		Forest	
34	83140 Torrey Pine Forest		Forest	
35	83230 Southern Interior Cypress Forest		Forest	
36	84000 Lower Montane Coniferous Forest		Forest	
37	84100 Coast Range, Klamath and Peninsular Coniferous Forest		Forest	

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Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
38	84140 Coulter Pine Forest	Forest	Forest
39	84150 Bigcone Spruce (Bigcone Douglas Fir)-Canyon Oak Forest		Forest
40	84230 Sierran Mixed Coniferous Forest		Forest
41	84500 Mixed Oak/Coniferous/Bigcone/Coulter		Forest
42	85100 Jeffrey Pine Forest		Forest
43	11100 Eucalyptus Woodland	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Forest
44	60000 RIPARIAN AND BOTTOMLAND HABITAT	Riparian and Bottomland Habitat	Forest
45	61000 Riparian Forests		Forest
46	61300 Southern Riparian Forest		Forest
47	61310 Southern Coast Live Oak Riparian Forest		Forest
48	61320 Southern Arroyo Willow Riparian Forest		Forest
49	61330 Southern Cottonwood-willow Riparian Forest		Forest
50	61510 White Alder Riparian Forest		Forest
51	61810 Sonoran Cottonwood-willow Riparian Forest		Forest
52	61820 Mesquite Bosque		Forest
53	62000 Riparian Woodlands		Forest
54	62200 Desert Dry Wash Woodland		Forest
55	62300 Desert Fan Palm Oasis Woodland		Forest
56	62400 Southern Sycamore-alder Riparian Woodland		Forest
57	70000 WOODLAND	Woodland	Forest
58	71000 Cismontane Woodland		Forest
59	71100 Oak Woodland		Forest
60	71120 Black Oak Woodland		Forest
61	71160 Coast Live Oak Woodland		Forest
62	71161 Open Coast Live Oak Woodland		Forest
63	71162 Dense Coast Live Oak Woodland		Forest
64	71162 Dense Coast Love Oak Woodland		Forest

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Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping	
65	71180 Engelmann Oak Woodland	Woodland	Forest	
66	71181 Open Engelmann Oak Woodland		Forest	
67	71182 Dense Engelmann Oak Woodland		Forest	
68	72300 Peninsular Pinon and Juniper Woodlands		Forest	
69	72310 Peninsular Pinon Woodland		Forest	
70	72320 Peninsular Juniper Woodland and Scrub		Forest	
71	75100 Elephant Tree Woodland		Forest	
72	77000 Mixed Oak Woodland		Forest	
73	78000 Undifferentiated Open Woodland		Forest	
74	79000 Undifferentiated Dense Woodland		Forest	
75	Engelmann Oak Woodland		Forest	
76	52120 Southern Coastal Salt Marsh		Bog and Marsh	Other
77	52300 Alkali Marsh			Other
78	52310 Cismontane Alkali Marsh			Other
79	52400 Freshwater Marsh	Other		
80	52410 Coastal and Valley Freshwater Marsh	Other		
81	52420 Transmontane Freshwater Marsh	Other		
82	52440 Emergent Wetland	Other		
83	44000 Vernal Pool	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Other	
84	44320 San Diego Mesa Vernal Pool		Other	
85	44322 San Diego Mesa Claypan Vernal Pool (southern mesas)		Other	
86	13100 Open Water	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other	
87	13110 Marine		Other	
88	13111 Subtidal		Other	
89	13112 Intertidal		Other	
90	13121 Deep Bay		Other	
91	13122 Intermediate Bay		Other	
92	13123 Shallow Bay		Other	
93	13130 Estuarine		Other	
94	13131 Subtidal		Other	
95	13133 Brackishwater		Other	

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Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
96	13140 Freshwater	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other
97	13200 Non-Vegetated Channel, Floodway, Lakeshore Fringe		Other
98	13300 Saltpan/Mudflats		Other
99	13400 Beach		Other
100	21230 Southern Foredunes	Dune Community	Scrub/Shrub
101	22100 Active Desert Dunes		Scrub/Shrub
102	22300 Stabilized and Partially-Stabilized Desert Sand Field		Scrub/Shrub
103	24000 Stabilized Alkaline Dunes		Scrub/Shrub
104	29000 ACACIA SCRUB		Scrub/Shrub
105	63000 Riparian Scrubs	Riparian and Bottomland Habitat	Scrub/Shrub
106	63300 Southern Riparian Scrub		Scrub/Shrub
107	63310 Mule Fat Scrub		Scrub/Shrub
108	63310 Mulefat Scrub		Scrub/Shrub
109	63320 Southern Willow Scrub		Scrub/Shrub
110	63321 Arundo donax Dominant/Southern Willow Scrub		Scrub/Shrub
111	63330 Southern Riparian Scrub		Scrub/Shrub
112	63400 Great Valley Scrub		Scrub/Shrub
113	63410 Great Valley Willow Scrub		Scrub/Shrub
114	63800 Colorado Riparian Scrub		Scrub/Shrub
115	63810 Tamarisk Scrub		Scrub/Shrub
116	63820 Arrowweed Scrub		Scrub/Shrub
117	31200 Southern Coastal Bluff Scrub	Scrub and Chaparral	Scrub/Shrub
118	32000 Coastal Scrub		Scrub/Shrub
119	32400 Maritime Succulent Scrub		Scrub/Shrub
120	32500 Diegan Coastal Sage Scrub		Scrub/Shrub
121	32510 Coastal form		Scrub/Shrub
122	32520 Inland form (> 1,000 ft. elevation)		Scrub/Shrub
123	32700 Riversidian Sage Scrub		Scrub/Shrub
124	32710 Riversidian Upland Sage Scrub		Scrub/Shrub
125	32720 Alluvial Fan Scrub		Scrub/Shrub
126	33000 Sonoran Desert Scrub		Scrub/Shrub
127	33100 Sonoran Creosote Bush Scrub		Scrub/Shrub
128	33200 Sonoran Desert Mixed Scrub		Scrub/Shrub
129	33210 Sonoran Mixed Woody Scrub		Scrub/Shrub

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Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
130	33220 Sonoran Mixed Woody and Succulent Scrub	Scrub and Chaparral	Scrub/Shrub
131	33230 Sonoran Wash Scrub		Scrub/Shrub
132	33300 Colorado Desert Wash Scrub		Scrub/Shrub
133	33600 Encelia Scrub		Scrub/Shrub
134	34000 Mojavean Desert Scrub		Scrub/Shrub
135	34300 Blackbush Scrub		Scrub/Shrub
136	35000 Great Basin Scrub		Scrub/Shrub
137	35200 Sagebrush Scrub		Scrub/Shrub
138	35210 Big Sagebrush Scrub		Scrub/Shrub
139	35210 Sagebrush Scrub		Scrub/Shrub
140	36110 Desert Saltbush Scrub		Scrub/Shrub
141	36120 Desert Sink Scrub		Scrub/Shrub
142	37000 Chaparral		Scrub/Shrub
143	37120 Southern Mixed Chaparral		Scrub/Shrub
144	37120 Southern Mixed Chapparal		Scrub/Shrub
145	37121 Granitic Southern Mixed Chaparral		Scrub/Shrub
146	37121 Southern Mixed Chaparral		Scrub/Shrub
147	37122 Mafic Southern Mixed Chaparral		Scrub/Shrub
148	37130 Northern Mixed Chaparral		Scrub/Shrub
149	37131 Granitic Northern Mixed Chaparral		Scrub/Shrub
150	37132 Mafic Northern Mixed Chaparral		Scrub/Shrub
151	37200 Chamise Chaparral		Scrub/Shrub
152	37210 Granitic Chamise Chaparral		Scrub/Shrub
153	37220 Mafic Chamise Chaparral		Scrub/Shrub
154	37300 Red Shank Chaparral		Scrub/Shrub
155	37400 Semi-Desert Chaparral		Scrub/Shrub
156	37500 Montane Chaparral		Scrub/Shrub
157	37510 Mixed Montane Chaparral		Scrub/Shrub
158	37520 Montane Manzanita Chaparral		Scrub/Shrub
159	37530 Montane Ceanothus Chaparral		Scrub/Shrub
160	37540 Montane Scrub Oak Chaparral		Scrub/Shrub
161	37800 Upper Sonoran Ceanothus Chaparral		Scrub/Shrub
162	37830 Ceanothus crassifolius Chaparral		Scrub/Shrub
163	37900 Scrub Oak Chaparral		Scrub/Shrub
164	37A00 Interior Live Oak Chaparral	Scrub/Shrub	

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
165	37C30 Southern Maritime Chaparral	Scrub and Chaparral	Scrub/Shrub
166	37G00 Coastal Sage-Chaparral Scrub		Scrub/Shrub
167	37K00 Flat-topped Buckwheat		Scrub/Shrub
168	39000 Upper Sonoran Subshrub Scrub		Scrub/Shrub
169	Diegan Coastal Sage Scrub		Scrub/Shrub
170	Granitic Northern Mixed Chaparral		Scrub/Shrub
171	Southern Mixed Chaparral		Scrub/Shrub
172	11000 Non-Native Vegetation	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Unknown
173	11000 Non-Native VegetationVegetation		Unknown
174	11200 Disturbed Wetland		Unknown
175	11300 Disturbed Habitat		Unknown
176	13000 Unvegetated Habitat		Unknown
177	Disturbed Habitat		Unknown

**Table A.1.3: Related Land Cover and Land Use Categories**

Land Cover per San Diego County	Land Use per Table A.1.1
Agriculture/Grass	Meadow
Forest	Forest
Scrub/Shrub	Average (Meadow, Forest)
Unknown/Other	Meadow

**Table A.1.4: Applicable Hydrologic Response Unit Calculations**

Land Cover	Soil	Gradient	Runoff Coeff.	ET Coeff.	Infiltration Coeff.	Runoff/Infiltration Ratio	Hydrologic Process Designation
Agriculture/Grass	A	0-2%	0.10	0.60	0.30	0.33	I
Agriculture/Grass	A	2-6%	0.16	0.60	0.24	0.67	U
Agriculture/Grass	A	6-10%	0.25	0.60	0.15	1.67	O
Agriculture/Grass	B	0-2%	0.14	0.60	0.26	0.54	I
Agriculture/Grass	B	2-6%	0.22	0.60	0.18	1.22	U
Agriculture/Grass	B	6-10%	0.30	0.60	0.10	3.00	O
Agriculture/Grass	C	0-2%	0.20	0.60	0.20	1.00	U
Agriculture/Grass	C	2-6%	0.28	0.60	0.12	2.33	O
Agriculture/Grass	C	6-10%	0.36	0.60	0.04	9.00	O
Agriculture/Grass	D	0-2%	0.24	0.60	0.16	1.50	U
Agriculture/Grass	D	2-6%	0.30	0.60	0.10	3.00	O
Agriculture/Grass	D	6-10%	0.40	0.60	0.00	infinite	O

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Land Cover	Soil	Gradient	Runoff Coeff.	ET Coeff.	Infiltration Coeff.	Runoff/Infiltration Ratio	Hydrologic Process Designation
Forest	A	0-2%	0.05	0.80	0.15	0.33	I
Forest	A	2-6%	0.08	0.80	0.12	0.67	U
Forest	A	6-10%	0.11	0.80	0.09	1.22	U
Forest	B	0-2%	0.08	0.80	0.12	0.67	U
Forest	B	2-6%	0.11	0.80	0.09	1.22	U
Forest	B	6-10%	0.14	0.80	0.06	2.33	O
Forest	C	0-2%	0.10	0.80	0.10	1.00	U
Forest	C	2-6%	0.13	0.80	0.07	1.86	O
Forest	C	6-10%	0.16	0.80	0.04	4.00	O
Forest	D	0-2%	0.12	0.80	0.08	1.50	U
Forest	D	2-6%	0.16	0.80	0.04	4.00	O
Forest	D	6-10%	0.20	0.80	0.00	infinite	O
Scrub/Shrub	A	0-2%	0.08	0.70	0.23	0.33	I
Scrub/Shrub	A	2-6%	0.12	0.70	0.18	0.67	U
Scrub/Shrub	A	6-10%	0.18	0.70	0.12	1.50	U
Scrub/Shrub	B	0-2%	0.11	0.70	0.19	0.58	I
Scrub/Shrub	B	2-6%	0.17	0.70	0.14	1.22	U
Scrub/Shrub	B	6-10%	0.22	0.70	0.08	2.75	O
Scrub/Shrub	C	0-2%	0.15	0.70	0.15	1.00	U
Scrub/Shrub	C	2-6%	0.21	0.70	0.10	2.16	O
Scrub/Shrub	C	6-10%	0.26	0.70	0.04	6.50	O
Scrub/Shrub	D	0-2%	0.19	0.70	0.12	1.50	U
Scrub/Shrub	D	2-6%	0.23	0.70	0.07	3.29	O
Scrub/Shrub	D	6-10%	0.30	0.70	0.00	infinite	O

Hydrologic Process Designation: I = Interflow; O = Overland Flow; U = Uncertain

**Table A.1.5: Hydrologic Response Unit Designations**

Land Cover	Slope	Soil Type				
		A	B	C	D	Other (fill/water)
Agriculture/ Grass/Unknown/ Other	0-2%	I	I	U	U	U
	2-6%	U	U	O	O	U
	6-10%	O	O	O	O	O
	>10%	O	O	O	O	O
Developed	0-2%	O	O	O	O	O
	2-6%	O	O	O	O	O
	6-10%	O	O	O	O	O
	>10%	O	O	O	O	O
Forest	0-2%	I	U	U	U	U
	2-6%	U	U	O	O	U
	6-10%	U	O	O	O	U
	>10%	O	O	O	O	O
Scrub/Shrub	0-2%	I	I	U	U	U
	2-6%	U	U	O	O	U
	6-10%	U	O	O	O	U
	>10%	O	O	O	O	O

Hydrologic Process Designation: I = Interflow; O = Overland Flow; U = Uncertain



**ATTACHMENT A.2**  
**STREAM CHARACTERIZATION**

Legend

- Watershed Boundaries
- Municipal Boundaries
- Rivers & Streams
- Regional WMAA Streams



Miles 0 25 50 100 150

# Watershed Management Area Streams

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

Aerial Imagery Source: DigitalGlobe, 09/2012

Legend

- Watershed Boundaries
- Municipal Boundaries
- Rivers & Streams

Hydrographic Category

- Intermittent
- Perennial



# Watershed Management Area Streams by Hydrographic Category

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

Aerial Imagery Source: DigitalGlobe, 09/2012

**Legend**

- Watershed Boundaries
- Municipal Boundaries
- Rivers & Streams
- Regional WMAA Streams within Federal/State/Indian Lands (not characterized, displayed for continuity)

**Bed Material**

- Concrete
- Earth
- Pipe / Culvert
- Riprap



# Watershed Management Area Streams by Bed Material

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

**Legend**

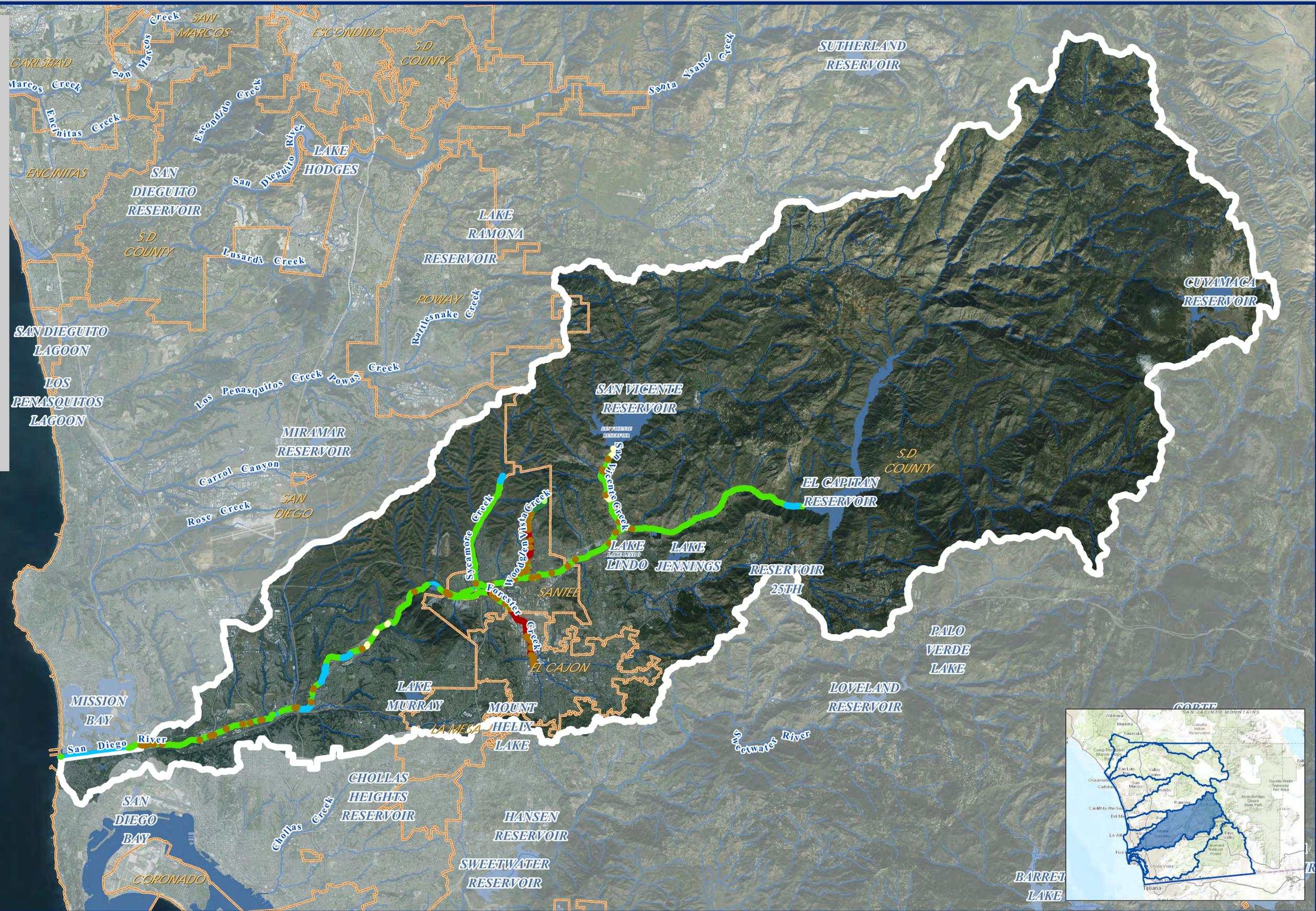
- Watershed Boundaries
- Municipal Boundaries
- Rivers & Streams
- Regional WMAA Streams within Federal/State/Indian Lands (not characterized, displayed for continuity)

**Other Streams (Non-Earthen)**

- Pipe / Culvert
- Concrete
- Riprap

**Geologic Group of Earthen Streams**

- Coarse Bedrock
- Coarse Sedimentary Impermeable
- Coarse Sedimentary Permeable
- Fine Bedrock
- Fine Sedimentary Impermeable
- Fine Sedimentary Permeable



# Watershed Management Area Streams by Geologic Group

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

**Legend**

- Watershed Boundaries
- Municipal Boundaries
- Rivers & Streams
- Regional WMAA Streams within Federal/State/Indian Lands (not characterized, displayed for continuity)

**Reach Type**

- Engineered Constrained
- Engineered Un-constrained
- Natural Constrained
- Natural Un-constrained



Aerial Imagery Source: DigitalGlobe, 09/2012



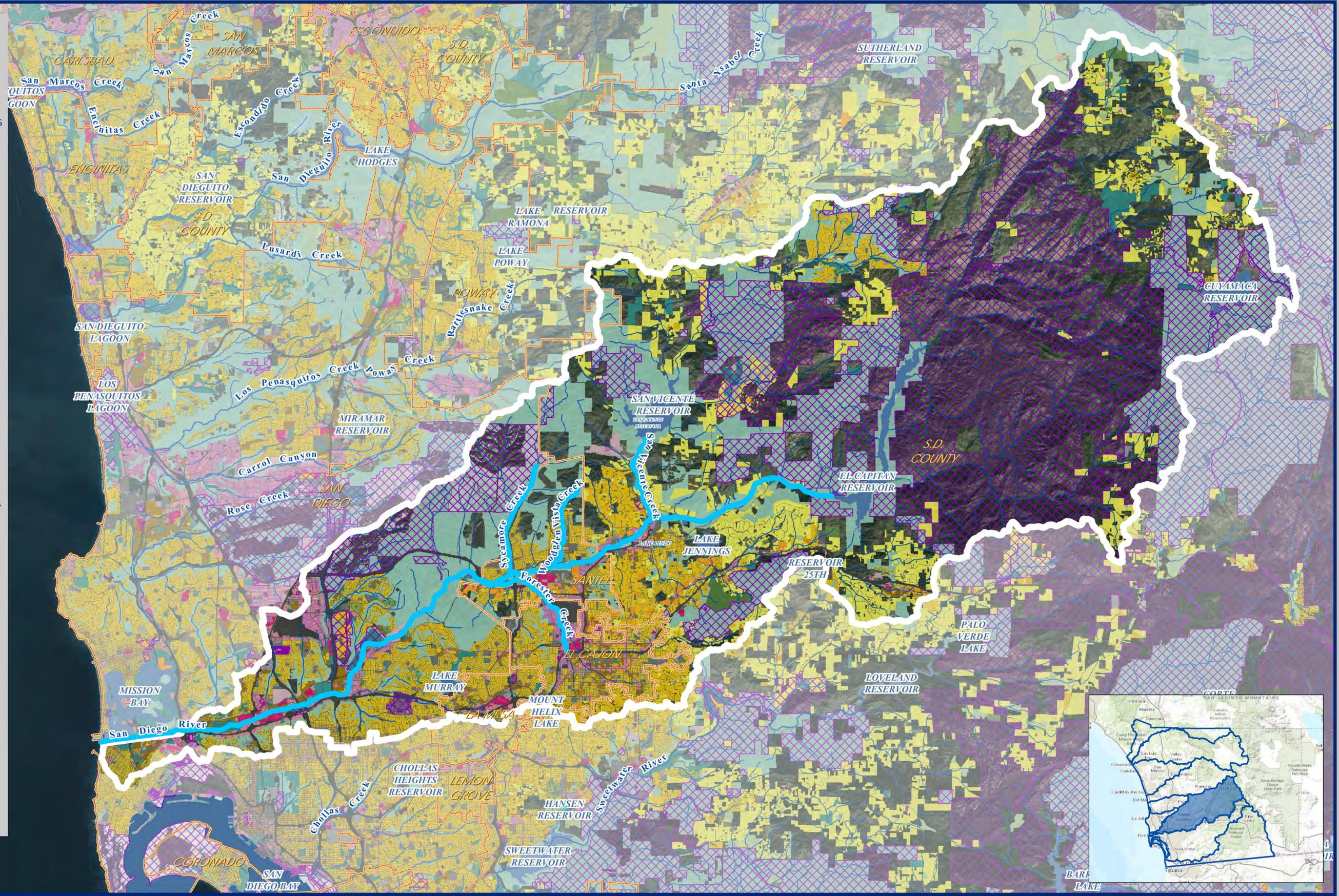
# Watershed Management Area Streams by Reach Type

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014

**ATTACHMENT A.3**  
**LAND USES**

- Legend
- Regional WMAA Streams
  - Watershed Boundaries
  - Municipal Boundaries
  - Federal/State/Indian Lands
  - Rivers & Streams
- Existing Land Use
- Residential**
- Spaced Rural Residential
  - Single Family Residential
  - Mobile Homes
  - Multi-Family Residential
  - Mixed Use
- Commercial and Office**
- Shopping Centers
  - Commercial and Office
- Industrial**
- Heavy Industry
  - Light Industry
  - Extractive Industry
- Public Facilities and Utilities**
- Transport., Comm., Utilities
  - Education
  - Institutions
  - Military
- Parks and Recreation**
- Recreation
  - Open Space Parks
- Agriculture**
- Intensive Agriculture
  - Extensive Agriculture
- Other**
- Indian Reservations
  - Water
  - Road Rights of Way
  - Railroad Rights of Way



Miles 0 25 50 100 150

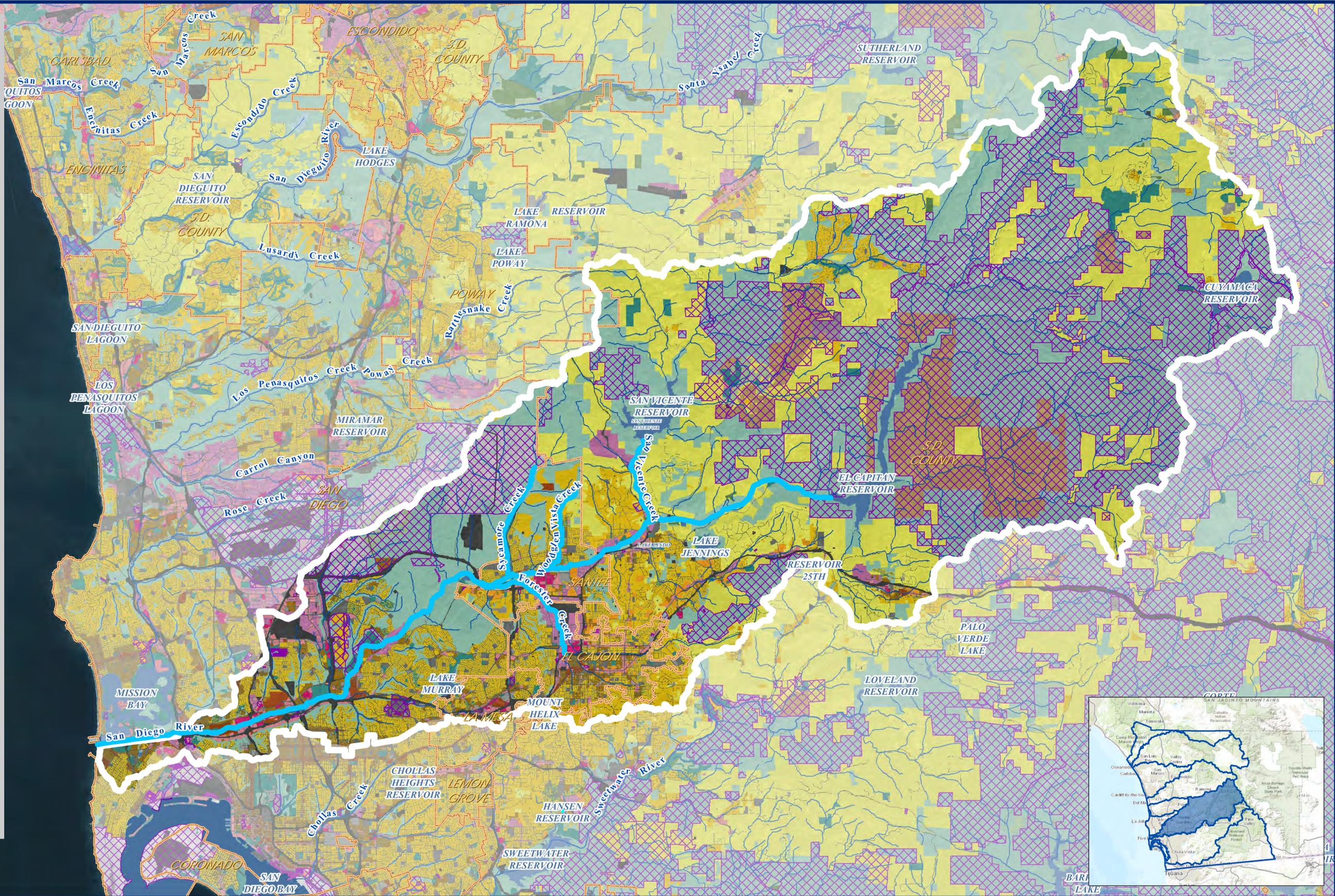
# Existing Land Use

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014



- Legend**
- Regional WMAA Streams
  - Watershed Boundaries
  - Municipal Boundaries
  - Federal/State/Indian Lands
  - Rivers & Streams
- Planned Land Use**
- Residential**
- Spaced Rural Residential
  - Single Family Residential
  - Mobile Homes
  - Multi-Family Residential
  - Mixed Use
- Commercial and Office**
- Shopping Centers
  - Commercial and Office
- Industrial**
- Heavy Industry
  - Light Industry
  - Extractive Industry
- Public Facilities and Utilities**
- Transport., Comm., Utilities
  - Education
  - Institutions
  - Military
- Parks and Recreation**
- Recreation
  - Open Space Parks
- Agriculture**
- Intensive Agriculture
  - Extensive Agriculture
- Other**
- Indian Reservations
  - Water
  - Road Rights of Way
  - Railroad Rights of Way

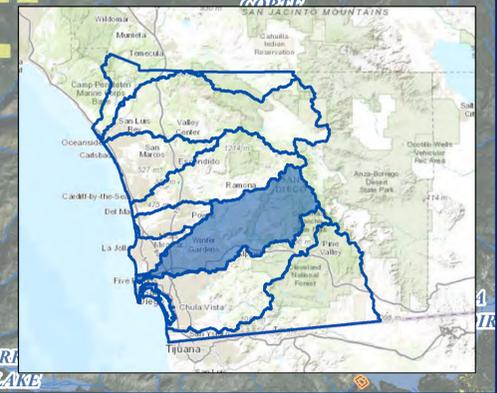
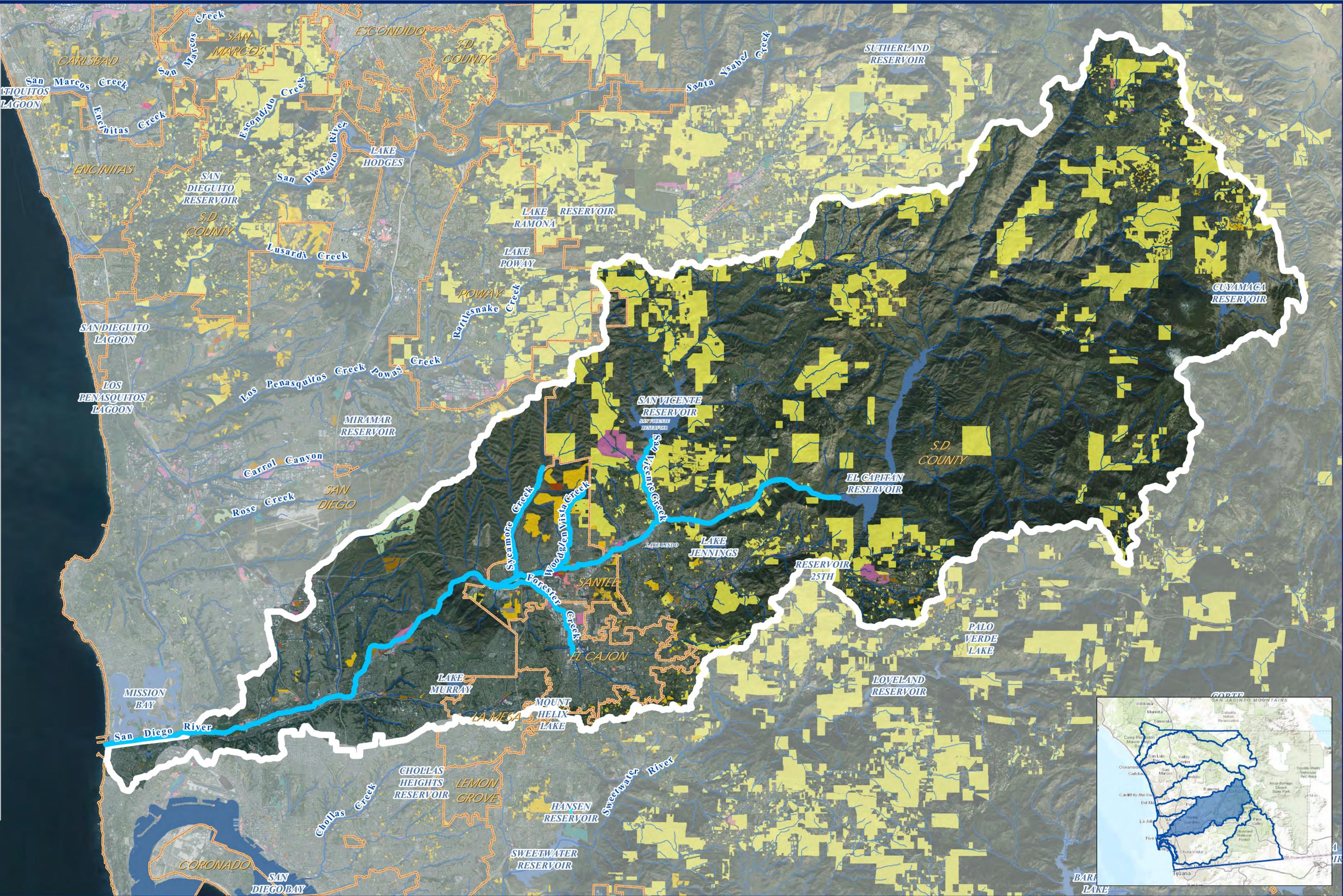


**Planned Land Use**  
 San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014



- Legend
-  Regional WMAA Streams
  -  Watershed Boundaries
  -  Municipal Boundaries
  -  Rivers & Streams
- Developable Land
- Residential
-  Spaced Rural Residential
  -  Single Family Residential
  -  Mobile Homes
  -  Multi-Family Residential
  -  Mixed Use
- Commercial and Office
-  Shopping Centers
  -  Commercial and Office
- Industrial
-  Heavy Industry
  -  Light Industry
  -  Extractive Industry
- Public Facilities and Utilities
-  Transport., Comm., Utilities
  -  Education
  -  Institutions
  -  Military
- Parks and Recreation
-  Recreation
  -  Open Space Parks
- Agriculture
-  Intensive Agriculture
  -  Extensive Agriculture
- Other
-  Indian Reservations
  -  Water
  -  Road Rights of Way
  -  Railroad Rights of Way



Miles 0 25 50 100 150

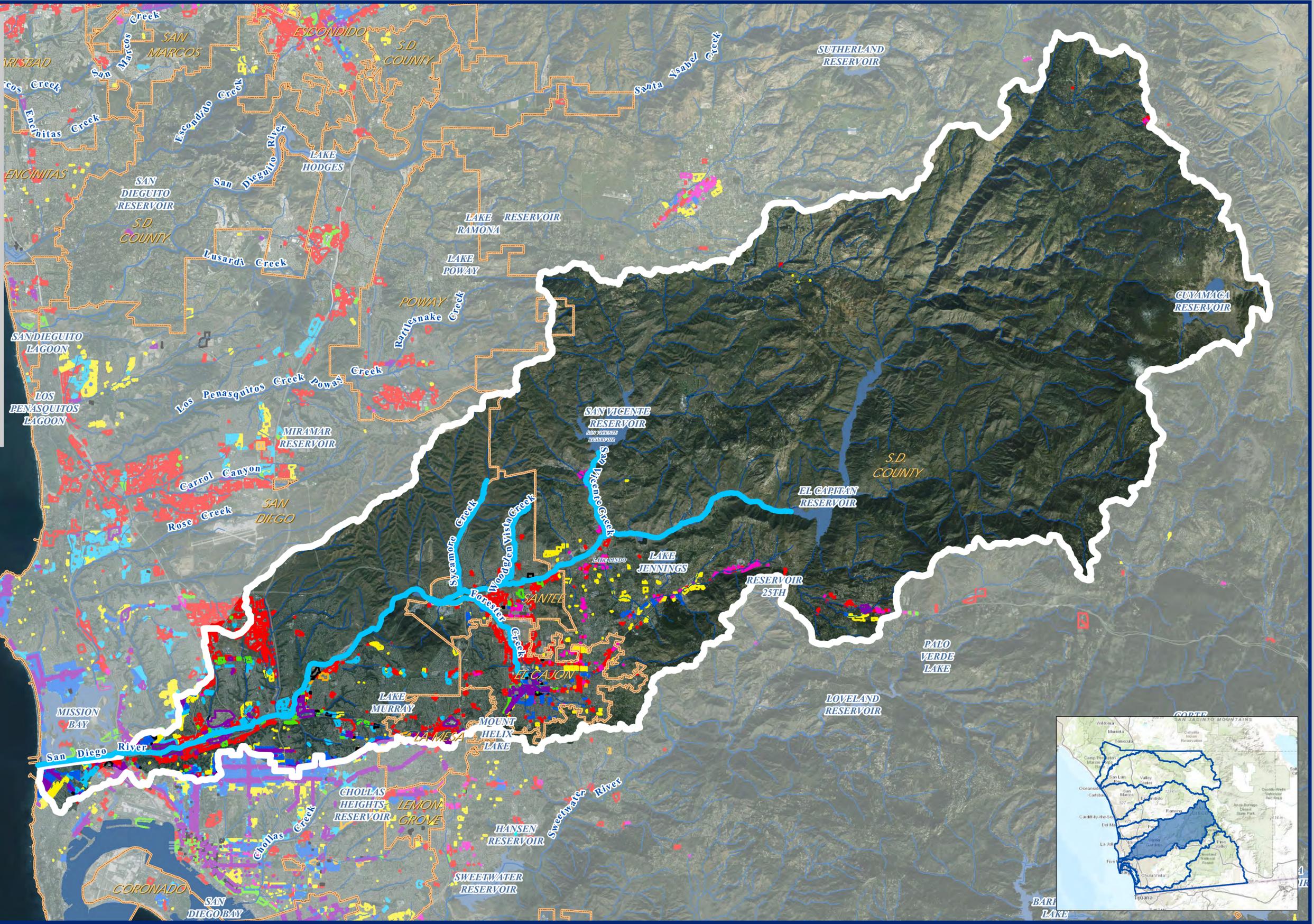
# Developable Land

## San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014



- Legend
- Regional WMAA Streams
  - Watershed Boundaries
  - Municipal Boundaries
  - Rivers & Streams
- Infill
- Employment
  - Single Family
  - Multi-Family
- Redevelopment
- Residential to Employment
  - Single Family to Multi-Family
  - Mobile Home to Other
  - Employment to Residential
  - Employment to Employment
  - Residential to Road or Freeway
  - Employment to Road or Freeway
  - Employment/Residential to Mixed Use



# Redevelopment and Infill Areas

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Miles 0 25 50 100 150

Exhibit Date: Sept. 8, 2014



**ATTACHMENT A.4**  
**POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS**

### A.4.1 Geology Grouping

Geologic grouping was based on the mapped geologic unit as determined by published geologic mapping information. The following describes the methodology utilized to determine bedrock or sedimentary characteristics, anticipated grain size, and suitability for infiltration. A complete list of the various geologic maps used in this evaluation is listed in Chapter 6.

Due to the various mapped scales of the published data and differing mapped unit names, the geologic units were initially compiled into similar categories where possible. For example, the Lindavista Formation is mapped as unit Ql on geologic maps at a scale of 1:24,000 but correlates to the same unit Qvop8 on geologic maps at a scale of 1:100,000. Following the compilation of geologic unit names, the units were differentiated between crystalline bedrock and sedimentary formations based on geologic characterization and material behavior. The Point Loma Formation for example, is a Cretaceous-age sandstone, but it was classified as a “coarse bedrock” unit due to its indurated and resistant nature.

For each site location, the predominant geologic units were then described as “coarse” or “fine” based on typical weathering characteristics of the bedrock units, or primary grain size of the sedimentary units. For example, granodiorite or tonalite crystalline rock typically weathers to a coarse material such as a silty sand and therefore was classified as “coarse,” compared to a gabbro which generally weathers to a sandy clay and was characterized as “fine.” Sedimentary formations can be more variable, such as the Mission Valley Formation. In this case, the Mission Valley Formation was characterized as “coarse” since the unit is predominantly comprised of sandstone even if it does contain localities of siltstone and claystone within the unit.

To further characterize the sedimentary formations, these units were evaluated for suitability of infiltration. Since no field investigations were performed for this evaluation to determine permeability, the differentiation between impermeable and permeable were based on the age of the geologic unit with the assumption that relatively younger sedimentary units of Pleistocene-age or younger (<1.6 mya) would be more susceptible to surface water infiltration. Geology grouping of different map units is presented in Table A.4.1

**Table A.4.1 Geologic grouping for different map units**

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
gr-m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
grMz	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Jcr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jhc	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jsp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ka	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kdl	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgbf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgdf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgh	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm1	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm2	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm3	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm4	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgu	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Khg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ki	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kis	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kjd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJem	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJld	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kjv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB

San Diego River WMAA Attachments

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Klb	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klh	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Km	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmgp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpa	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kqbd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kt	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ktr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kvc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwsr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Mzd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzq	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzs	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
sch	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Kp	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ql	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
QTf	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ec	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
K	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
Kccg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Kcs	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Kl	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ku	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI

San Diego River WMAA Attachments

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qvof	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tp	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tpm	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tscu	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsd	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdcg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsm	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tso	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tst	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tt	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tta	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmv	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsi	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa11	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa12	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa13	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoc	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop1	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop10	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop10a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop11	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI

San Diego River WMAA Attachments

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qvop11a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop12	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop13	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop2	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop3	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop4	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop5	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop6	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsa	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qof	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Q	Jennings; CA	Coarse	Sedimentary	Permeable	CSP
Qa	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qd	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qmb	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qw	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qt	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa1-2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa2-6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa5	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa7	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP

San Diego River WMAA Attachments

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qoc	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qc	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qu	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop2-4	San Diego 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop3	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop4	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop6	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qya	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyc	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Mzu	San Diego & Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
gb	Jennings; CA	Fine	Bedrock	Impermeable	FB
JTRm	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kat	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kc	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgb	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
KJvs	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kmv	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Ksp	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kvsp	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kwmt	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Qv	Jennings; CA	Fine	Bedrock	Impermeable	FB
Tba	San Diego 30' x 60'	Fine	Bedrock	Impermeable	FB
Tda	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tv	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tvsr	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgdfg	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Ta	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tcs	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Td	San Diego & Oceanside	Fine	Sedimentary	Impermeable	FSI

San Diego River WMAA Attachments

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
	30' x 60'				
Td+Tf	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qls	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tm	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tf	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tfr	El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
To	San Diego & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qpe	San Diego & Oceanside 30' x 60'	Fine	Sedimentary	Permeable	FSP
Mexico	San Diego 30' x 60'	NA	NA	Permeable	Other
Kuo	San Diego 30' x 60'	NA (Offshore)	NA	Permeable	Other
Teo	San Diego & Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Tmo	Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Qmo	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
QTso	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
af	San Diego & Oceanside 30' x 60'	Variable, dependent on source material	Sedimentary		Other

### A.4.2 Quantitative Analysis

Soil loss estimates for each Geomorphic Landscape Unit were estimated using the Revised Universal Soil Loss Equation (RUSLE; Renard et al. 1997) listed below:

$$A = R \times K \times LS \times C \times P$$

Where

A = estimated average soil loss in tons/acre/year

R = rainfall-runoff erosivity factor

K = soil erodibility factor

LS = slope length and steepness factor

C = cover-management factor

P = support practice factor; assumed 1 for this analysis

Regional datasets used to estimate the inputs required to estimate the soil loss from each GLU are listed in table below:

Dataset	Source	Download year	Description
RUSLE – R Factor	SWRCB	2014	Regional R factor map was downloaded from <a href="ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_R_Factor/">ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_R_Factor/</a>
RUSLE – K Factor	SWRCB	2014	Regional K factor map was downloaded from <a href="ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_K_Factor/">ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_K_Factor/</a>
RUSLE – LS Factor	SWRCB	2014	Regional LS factor map was downloaded from <a href="ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_LS_Factor/">ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_LS_Factor/</a>
RUSLE – C Factor	USEPA	2014	Regional C factor map was downloaded from <a href="http://www.epa.gov/esd/land-sci/emap_west_browser/pages/wemap_mm_sl_rusle_c_qt.htm#mapnav">http://www.epa.gov/esd/land-sci/emap_west_browser/pages/wemap_mm_sl_rusle_c_qt.htm#mapnav</a>

GIS analysis was used to calculate the area weighted estimate of R, K, LS and C factors using the regional datasets listed in the table above. For the developed land cover the C factor was then adjusted to 0 from the regional estimate to account for management actions implemented on developed sites (e.g. impervious surfaces). Soil loss estimates ranged from 0 to 15.2 tons/acre/year.

For evaluating the degree of relative risk to a stream solely arising from changes in sediment and/or water delivery SCCWRP Technical Report 605, 2010 states:

*“The challenge in implementing this step is that presently we have insufficient basis to defensibly identify either low-risk or high-risk conditions using these metrics. For example, channels that are close to a threshold for geomorphic change may display significant morphological changes under nothing more than natural year-to-year variability in flow or sediment load.*

- *Acknowledging this caveat, we nonetheless anticipate that changes of less than 10% in either driver are unlikely to instigate, on their own, significant channel changes. This value is a conservative estimate of the year-to-year variability in either discharge or sediment flux that can be accommodated by a channel system in a state of dynamic equilibrium. It does not “guarantee,” however, that channel change may not occur—either in response to yet modest alterations in water or sediment delivery, or because of other urbanization impacts (e.g., point discharge of runoff or the trapping of the upstream sediment flux; see Booth 1990) that are not represented with this analysis.*
- *In contrast, recognizing a condition of undisputed “high risk” must await broader collection of regionally relevant data. We note that >60% reductions in predicted sediment production have resulted in both minimal (McGonigle) and dramatic (Agua Hedionda) channel changes, indicating that “more data” may never provide absolute guidance. At present, we suggest using predicted watershed changes of 50% or more in either runoff (as indexed by change in impervious area) or sediment production as provisional criteria for requiring a more detailed evaluation of both the drivers and the resisting factors for channel change, regardless of other screening-level assessments. Clearly, however, only more experience with the application of such “thresholds,” and the actual channel conditions that accompany them, will provide a defensible basis for setting numeric standards.”*

The following criterion was developed using the suggestions listed above and then used to assign relative sediment production rating to each GLU:

- Low: Soil Loss < 5.6 tons/acre/year [GLUs that have a soil loss of 0 to 5.6 tons/acre/year produces around 10% of the total coarse sediment soil loss from the study area]
- Medium: 5.6 tons/acre/year < Soil Loss < 8.4 tons/acre/year
- High: > 8.4 tons/acre/year [GLUs that have a soil loss greater than 8.4 tons/acre/year produces around 42% of the total coarse sediment soil loss from the study area]

Results from the quantitative analysis are summarized in Table A.4.2.

**Table A.4.2 Relative Sediment Production for different Geomorphic Landscape Units**

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CB-Agricultural/Grass-1	52883	0.20	4.67	0.14	50	6.5	Medium	No
CB-Agricultural/Grass-2	40633	0.21	5.19	0.14	56	8.3	Medium	No
CB-Agricultural/Grass-3	32617	0.22	6.04	0.14	57	10.6	High	Yes
CB-Agricultural/Grass-4	11066	0.23	7.38	0.14	57	13.5	High	Yes
CB-Developed-1	39746	0.22	3.77	0	49	0	Low	No
CB-Developed-2	32614	0.22	4.28	0	50	0	Low	No
CB-Developed-3	15841	0.22	4.86	0	49	0	Low	No
CB-Developed-4	1805	0.22	5.63	0	48	0	Low	No
CB-Forest-1	32231	0.20	6.38	0.14	39	6.8	Medium	No
CB-Forest-2	38507	0.20	7.20	0.13	45	8.8	High	Yes
CB-Forest-3	55303	0.20	8.14	0.13	48	10.6	High	Yes
CB-Forest-4	38217	0.20	9.95	0.14	50	13.6	High	Yes
CB-Other-1	1036	0.20	5.52	0.13	45	6.5	Medium	No
CB-Other-2	317	0.20	6.46	0.13	45	7.9	Medium	No
CB-Other-3	296	0.20	6.96	0.14	43	8.3	Medium	No
CB-Other-4	111	0.21	6.84	0.14	41	8.2	Medium	No
CB-Scrub/Shrub-1	88135	0.20	5.66	0.14	33	5.3	Low	No
CB-Scrub/Shrub-2	143694	0.20	6.51	0.14	37	6.8	Medium	No
CB-Scrub/Shrub-3	246703	0.21	7.33	0.14	41	8.4	Medium	No
CB-Scrub/Shrub-4	191150	0.21	8.28	0.14	42	9.8	High	No
CB-Unknown-1	1727	0.21	5.32	0.13	44	6.3	Medium	No
CB-Unknown-2	1935	0.21	5.95	0.13	44	7.1	Medium	No

San Diego River WMAA Attachments

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CB-Unknown-3	1539	0.22	6.21	0.13	44	7.7	Medium	No
CB-Unknown-4	278	0.22	6.61	0.13	44	8.4	High	Yes
CSI-Agricultural/Grass-1	14609	0.34	2.72	0.14	39	4.8	Low	No
CSI-Agricultural/Grass-2	9059	0.37	3.61	0.14	47	8.7	High	Yes
CSI-Agricultural/Grass-3	10096	0.38	3.99	0.14	47	9.8	High	Yes
CSI-Agricultural/Grass-4	2498	0.37	4.33	0.14	47	10.5	High	Yes
CSI-Developed-1	82371	0.28	2.51	0	39	0	Low	No
CSI-Developed-2	22570	0.30	2.66	0	41	0	Low	No
CSI-Developed-3	13675	0.30	2.89	0	40	0	Low	No
CSI-Developed-4	3064	0.27	3.20	0	39	0	Low	No
CSI-Forest-1	449	0.27	4.26	0.13	43	6.6	Medium	No
CSI-Forest-2	611	0.25	5.11	0.13	44	7.5	Medium	No
CSI-Forest-3	716	0.29	4.43	0.13	44	7.4	Medium	No
CSI-Forest-4	348	0.30	4.49	0.13	43	7.6	Medium	No
CSI-Other-1	319	0.31	2.50	0.13	32	3.2	Low	No
CSI-Other-2	83	0.27	3.01	0.13	39	4.3	Low	No
CSI-Other-3	45	0.28	3.03	0.13	39	4.5	Low	No
CSI-Other-4	13	0.24	4.01	0.14	39	5.2	Low	No
CSI-Scrub/Shrub-1	9051	0.26	3.53	0.13	39	4.7	Low	No
CSI-Scrub/Shrub-2	10802	0.27	4.36	0.13	41	6.3	Medium	No
CSI-Scrub/Shrub-3	28220	0.26	4.82	0.13	41	6.7	Medium	No
CSI-Scrub/Shrub-4	20510	0.26	5.52	0.13	41	7.8	Medium	No
CSI-Unknown-1	5292	0.28	2.38	0.13	36	3.1	Low	No

San Diego River WMAA Attachments

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CSI-Unknown-2	2074	0.29	2.98	0.13	40	4.5	Low	No
CSI-Unknown-3	2171	0.27	3.04	0.13	39	4.2	Low	No
CSI-Unknown-4	676	0.26	3.04	0.13	38	3.8	Low	No
CSP-Agricultural/Grass-1	59327	0.22	3.01	0.14	44	4.0	Low	No
CSP-Agricultural/Grass-2	8426	0.23	3.81	0.14	42	5.2	Low	No
CSP-Agricultural/Grass-3	2377	0.24	4.05	0.14	41	5.6	Low	No
CSP-Agricultural/Grass-4	291	0.22	6.28	0.14	52	10.1	High	Yes
CSP-Developed-1	85283	0.27	2.10	0	42	0	Low	No
CSP-Developed-2	7513	0.26	2.77	0	42	0	Low	No
CSP-Developed-3	2317	0.27	2.70	0	40	0	Low	No
CSP-Developed-4	272	0.27	2.76	0	38	0	Low	No
CSP-Forest-1	14738	0.22	4.52	0.14	44	6.0	Medium	No
CSP-Forest-2	3737	0.22	5.99	0.14	45	8.2	Medium	No
CSP-Forest-3	1858	0.21	6.42	0.14	45	8.5	High	Yes
CSP-Forest-4	484	0.21	7.62	0.14	48	10.2	High	Yes
CSP-Other-1	7404	0.23	2.61	0.14	39	3.2	Low	No
CSP-Other-2	343	0.24	3.68	0.13	40	4.8	Low	No
CSP-Other-3	126	0.24	3.76	0.13	40	4.9	Low	No
CSP-Other-4	17	0.24	4.19	0.13	39	5.3	Low	No
CSP-Scrub/Shrub-1	22583	0.23	3.75	0.14	41	4.8	Low	No
CSP-Scrub/Shrub-2	8938	0.24	5.63	0.14	40	7.1	Medium	No
CSP-Scrub/Shrub-3	7186	0.23	6.15	0.13	39	7.5	Medium	No
CSP-Scrub/Shrub-4	2609	0.22	7.16	0.14	43	9.3	High	Yes

San Diego River WMAA Attachments

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
CSP-Unknown-1	6186	0.25	2.63	0.13	40	3.4	Low	No
CSP-Unknown-2	744	0.27	3.49	0.13	39	4.8	Low	No
CSP-Unknown-3	350	0.28	3.32	0.13	38	4.5	Low	No
CSP-Unknown-4	78	0.28	3.26	0.13	40	4.5	Low	No
FB-Agricultural/Grass-1	6103	0.25	5.49	0.14	49	9.2	High	No
FB-Agricultural/Grass-2	7205	0.25	5.87	0.14	51	10.1	High	No
FB-Agricultural/Grass-3	6730	0.24	6.43	0.14	53	11.3	High	No
FB-Agricultural/Grass-4	2586	0.22	8.62	0.14	57	15.2	High	No
FB-Developed-1	10116	0.28	3.94	0	46	0	Low	No
FB-Developed-2	9075	0.28	4.41	0	45	0	Low	No
FB-Developed-3	5499	0.27	4.72	0	44	0	Low	No
FB-Developed-4	785	0.27	5.08	0	43	0	Low	No
FB-Forest-1	3780	0.21	7.24	0.13	39	8.0	Medium	No
FB-Forest-2	7059	0.21	7.53	0.13	43	8.8	High	No
FB-Forest-3	13753	0.22	8.02	0.13	43	9.7	High	No
FB-Forest-4	8899	0.26	9.63	0.13	35	11.5	High	No
FB-Other-1	172	0.26	5.72	0.13	44	8.6	High	No
FB-Other-2	75	0.26	5.97	0.13	38	7.7	Medium	No
FB-Other-3	76	0.28	6.27	0.13	34	7.6	Medium	No
FB-Other-4	36	0.31	6.70	0.13	33	8.6	High	No
FB-Scrub/Shrub-1	10297	0.24	6.94	0.14	36	8.3	Medium	No
FB-Scrub/Shrub-2	25150	0.25	7.24	0.14	38	9.0	High	No
FB-Scrub/Shrub-3	70895	0.25	7.89	0.13	38	10.0	High	No

San Diego River WMAA Attachments

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
FB-Scrub/Shrub-4	70679	0.26	9.05	0.14	39	12.1	High	No
FB-Unknown-1	654	0.30	5.33	0.13	37	7.6	Medium	No
FB-Unknown-2	829	0.29	5.26	0.13	40	7.9	Medium	No
FB-Unknown-3	1062	0.29	5.54	0.13	39	8.2	Medium	No
FB-Unknown-4	299	0.28	6.02	0.13	38	8.4	High	No
FSI-Agricultural/Grass-1	8462	0.32	3.91	0.13	24	3.9	Low	No
FSI-Agricultural/Grass-2	4979	0.33	4.29	0.13	31	5.7	Medium	No
FSI-Agricultural/Grass-3	4808	0.34	4.26	0.13	34	6.3	Medium	No
FSI-Agricultural/Grass-4	1055	0.35	4.11	0.13	36	6.7	Medium	No
FSI-Developed-1	9953	0.29	3.09	0	34	0	Low	No
FSI-Developed-2	4972	0.31	3.22	0	37	0	Low	No
FSI-Developed-3	3350	0.29	3.30	0	36	0	Low	No
FSI-Developed-4	763	0.28	3.31	0	37	0	Low	No
FSI-Forest-1	186	0.33	4.62	0.13	37	7.2	Medium	No
FSI-Forest-2	217	0.35	4.47	0.13	39	7.9	Medium	No
FSI-Forest-3	262	0.37	4.71	0.13	40	9.2	High	No
FSI-Forest-4	111	0.36	4.73	0.13	40	9.2	High	No
FSI-Other-1	266	0.31	3.11	0.13	24	2.9	Low	No
FSI-Other-2	81	0.30	3.29	0.13	25	3.1	Low	No
FSI-Other-3	56	0.31	3.04	0.13	27	3.2	Low	No
FSI-Other-4	15	0.29	3.57	0.13	33	4.4	Low	No
FSI-Scrub/Shrub-1	2241	0.27	4.46	0.13	29	4.5	Low	No
FSI-Scrub/Shrub-2	3911	0.28	4.96	0.13	31	5.7	Medium	No

San Diego River WMAA Attachments

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
FSI-Scrub/Shrub-3	7590	0.29	5.05	0.13	34	6.3	Medium	No
FSI-Scrub/Shrub-4	3502	0.30	5.14	0.13	37	7.5	Medium	No
FSI-Unknown-1	1117	0.29	2.83	0.13	27	3.0	Low	No
FSI-Unknown-2	780	0.30	3.44	0.13	32	4.3	Low	No
FSI-Unknown-3	855	0.29	3.41	0.13	31	4.0	Low	No
FSI-Unknown-4	285	0.28	3.21	0.13	32	3.7	Low	No
FSP-Agricultural/Grass-1	13	0.22	2.22	0.13	40	2.5	Low	No
FSP-Agricultural/Grass-2	3	0.22	2.59	0.13	40	3.0	Low	No
FSP-Agricultural/Grass-3	2	0.22	2.69	0.13	40	3.2	Low	No
FSP-Agricultural/Grass-4	0	0.20	2.94	0.12	40	2.9	Low	No
FSP-Developed-1	180	0.26	2.85	0	40	0	Low	No
FSP-Developed-2	13	0.25	2.69	0	40	0	Low	No
FSP-Developed-3	8	0.21	2.25	0	40	0	Low	No
FSP-Developed-4	0	0.21	2.29	0	40	0	Low	No
FSP-Forest-1	8	0.22	2.29	0.14	40	2.9	Low	No
FSP-Forest-2	5	0.20	2.22	0.14	40	2.5	Low	No
FSP-Forest-3	0	0.20	2.22	0.14	40	2.5	Low	No
FSP-Other-1	1307	0.20	2.38	0.14	40	2.7	Low	No
FSP-Other-2	34	0.21	2.36	0.14	40	2.7	Low	No
FSP-Other-3	8	0.22	2.56	0.13	40	3.0	Low	No
FSP-Other-4	0	0.43	4.35	0.12	40	9.3	High	No
FSP-Scrub/Shrub-1	147	0.23	2.68	0.14	40	3.3	Low	No
FSP-Scrub/Shrub-2	18	0.23	2.55	0.14	40	3.3	Low	No

San Diego River WMAA Attachments

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
FSP-Scrub/Shrub-3	4	0.20	2.23	0.14	40	2.6	Low	No
FSP-Scrub/Shrub-4	0	0.20	1.70	0.12	40	1.7	Low	No
FSP-Unknown-1	40	0.20	1.87	0.13	40	1.9	Low	No
FSP-Unknown-2	5	0.20	1.99	0.12	40	2.0	Low	No
FSP-Unknown-3	1	0.20	2.39	0.12	40	2.4	Low	No
O-Agricultural/Grass-1	2433	0.20	2.93	0.14	34	2.8	Low	No
O-Agricultural/Grass-2	112	0.21	3.44	0.14	32	3.2	Low	No
O-Agricultural/Grass-3	30	0.23	3.89	0.13	32	3.8	Low	No
O-Agricultural/Grass-4	1	0.26	6.47	0.13	37	7.9	Medium	No
O-Developed-1	8327	0.27	1.37	0	39	0	Low	No
O-Developed-2	474	0.25	2.12	0	40	0	Low	No
O-Developed-3	157	0.26	3.07	0	41	0	Low	No
O-Developed-4	26	0.24	3.89	0	41	0	Low	No
O-Forest-1	235	0.22	6.15	0.13	43	7.6	Medium	No
O-Forest-2	67	0.21	5.07	0.13	45	6.6	Medium	No
O-Forest-3	45	0.21	5.43	0.13	47	7.3	Medium	No
O-Forest-4	20	0.20	5.95	0.13	59	9.0	High	No
O-Other-1	9362	0.25	3.86	0.13	36	4.3	Low	No
O-Other-2	344	0.24	3.32	0.13	35	3.5	Low	No
O-Other-3	120	0.23	4.86	0.13	35	5.0	Low	No
O-Other-4	37	0.22	5.64	0.13	39	6.6	Medium	No
O-Scrub/Shrub-1	688	0.22	4.83	0.13	40	5.7	Medium	No
O-Scrub/Shrub-2	224	0.22	5.80	0.13	36	6.3	Medium	No

San Diego River WMAA Attachments

Geomorphic Landscape Unit (GLU)	Area (acres)	K	LS	C	R	A	Relative Sediment Production	Critical Coarse Sediment
O-Scrub/Shrub-3	209	0.22	6.47	0.13	41	7.5	Medium	No
O-Scrub/Shrub-4	96	0.22	6.62	0.13	44	8.2	Medium	No
O-Unknown-1	1236	0.28	1.60	0.12	26	1.5	Low	No
O-Unknown-2	62	0.27	1.48	0.13	36	1.8	Low	No
O-Unknown-3	15	0.29	3.52	0.13	38	4.9	Low	No
O-Unknown-4	7	0.34	3.87	0.12	40	6.6	Medium	No

**GLU Nomenclature:** Geology – Land Cover – Slope Category

**Geology Categories:**

- CB Coarse Bedrock
- CSI Coarse Sedimentary Impermeable
- CSP Coarse Sedimentary Permeable
- FB Fine Bedrock
- FSI Fine Sedimentary Impermeable
- FSP Fine Sedimentary Permeable
- O Other

**Slope Categories:**

- 1 0%-10%
- 2 10% - 20%
- 3 20% - 40%
- 4 > 40%

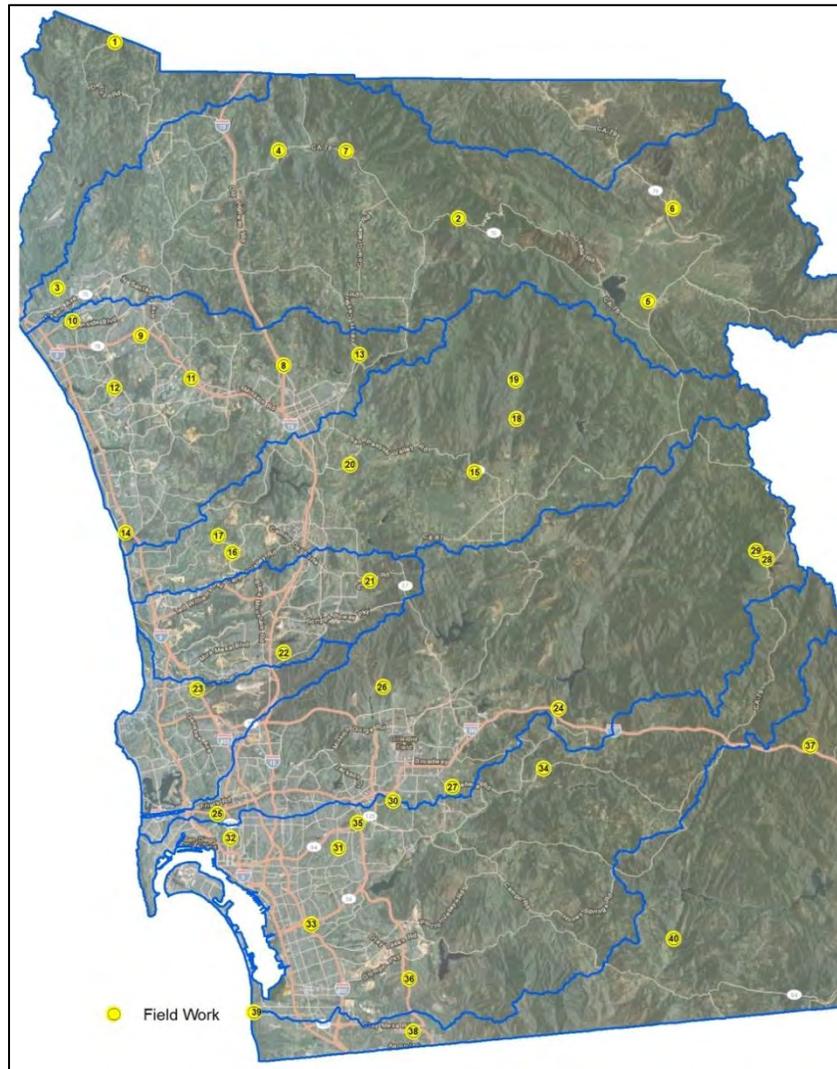
### A4.3 Field Assessment

#### Site Selection:

Forty locations were selected from the study region for field assessment. Sites were selected such that they are accessible by existing road network based on review of satellite imagery and are uniformly distributed considering the following criteria:

- Geologic grouping
- Land cover
- Slope category
- WMA
- Jurisdiction

Yellow circles in the figure below shows the 40 locations for which field assessment was performed.



### **Pre-Field Activities**

Prior to conducting field activities, the consultant team reviewed available published geologic information at each site location and prepared satellite imagery of each site using Google Earth™. Pre-field activities consisted of evaluating site access at each location using aerial imagery and logistics were coordinated based on regional site location to maximize field efficiency.

### **Site Reconnaissance**

Site reconnaissance was performed at forty locations between 22 January and 7 February 2014 by a team of geologists. The reconnaissance consisted of:

- Visual soil classification,
- Assessing existing vegetative cover (0-100%),
- Qualitative assignment of existing sediment production (low, medium, and high) [based on existing vegetative cover],
- Qualitative assignment of potential sediment production (low, medium, and high)[assuming there is 0% vegetative cover], and
- Identifying existing erosional features.

Descriptions and visual classifications of the surficial materials were based on the Unified Soil Classification System (USCS). Underlying geologic units were confirmed where exposed formations were observed within the individual site limits.

### **SITE AND GEOLOGIC CONDITIONS**

Our knowledge of the site conditions has been developed from a review of available geologic literature, previous geologic and geotechnical investigations by the consultant team in the study region, professional experience, site reconnaissance, and field investigations performed for this study.

#### **Surface Conditions**

Site locations were sited in open space with the exception of sites ID-27, -30, and -31 which were situated within developed areas with paved streets and sidewalks. The surface conditions at the site locations were characterized by sloping terrain varying from relatively flat (< 5%) to very steep slopes (> 40%). At the time of our reconnaissance the natural hillsides along the areas of interest were covered by varying degrees of moderate to dense growth scrub brush, low grasses, and scattered trees.

Existing erosional and geomorphic features at each site location were identified where possible. The observed erosional features included notable drainages, rilling, scour, and sediment accumulation. Observed geomorphic features included areas of minor slope instability and surficial slumping. Several sources of ground disturbance were identified during the site reconnaissance included active grading operations and bioturbation.

An evaluation of the existing and potential sediment production for each site was determined based on surface conditions. Sediment production was assigned as “high, medium, or low” based on the existing conditions and consultant team’s professional experience.

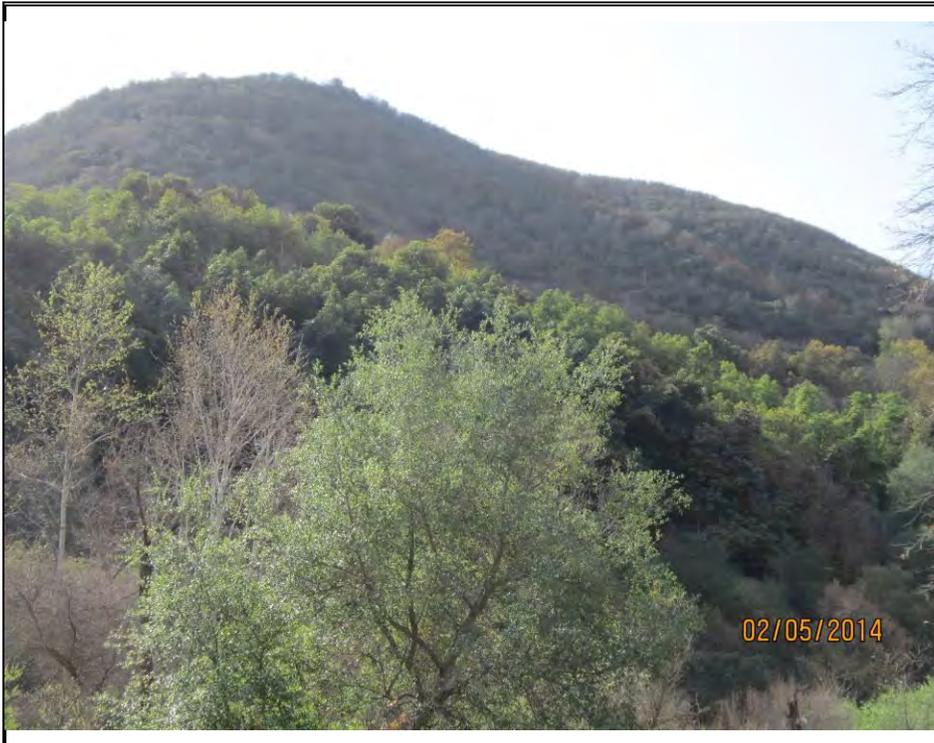
**Surficial Deposits**

Surficial deposits, including topsoil, alluvium, colluvium, slopewash, and residual soils are present in portions of the study area within the natural drainages and mantling the slope areas. The composition and grain size of these materials are variable depending on the age, parent sources, and mode of deposition.

**Geologic Conditions**

Our knowledge of the subsurface conditions at the site locations is based on a review of available published geologic information, professional experience, site reconnaissance, previous explorations and geotechnical investigations performed by the consultant team in the study region.

**Field Assessment Photo Log**



**Field Visit ID-1**  
**GLU: CB-Scrub/Shrub-4**

View: Looking southwest

Existing sediment  
production: Med

Potential sediment  
production: High

Existing veg. cover: 90%



**Field Visit ID-2**  
**GLU: CB-Forest-4**

View: Looking north

Existing sediment  
production: Med

Potential sediment  
production: High

Existing veg. cover: 95%



**Field Visit ID-3**

**GLU: CSI-Agricultural/  
Grass-3**

View: Looking southwest

Existing sediment  
production: Low to Med

Potential sediment  
production:  
Med to High

Existing veg. cover:  
95-100%



**Field Visit ID-4**

**GLU: CSI-Scrub/Shrub-2**

View: Looking north

Existing sediment  
production: Med

Potential sediment  
production: High

Existing veg. cover: 70%



**Field Visit ID-5**

**GLU: CSP-Agricultural/  
Grass-1**

View: Looking southwest

Existing sediment  
production: Low to Med

Potential sediment  
production: Med

Existing veg. cover: 90%



**Field Visit ID-6**

**GLU: CSP-Agricultural/  
Grass-3**

View: Looking east

Existing sediment  
production: Low to Med

Potential sediment  
production:  
Low to Med

Existing veg. cover:  
Southeast slope ~50%  
Northeast slope ~70%



**Field Visit ID-7**

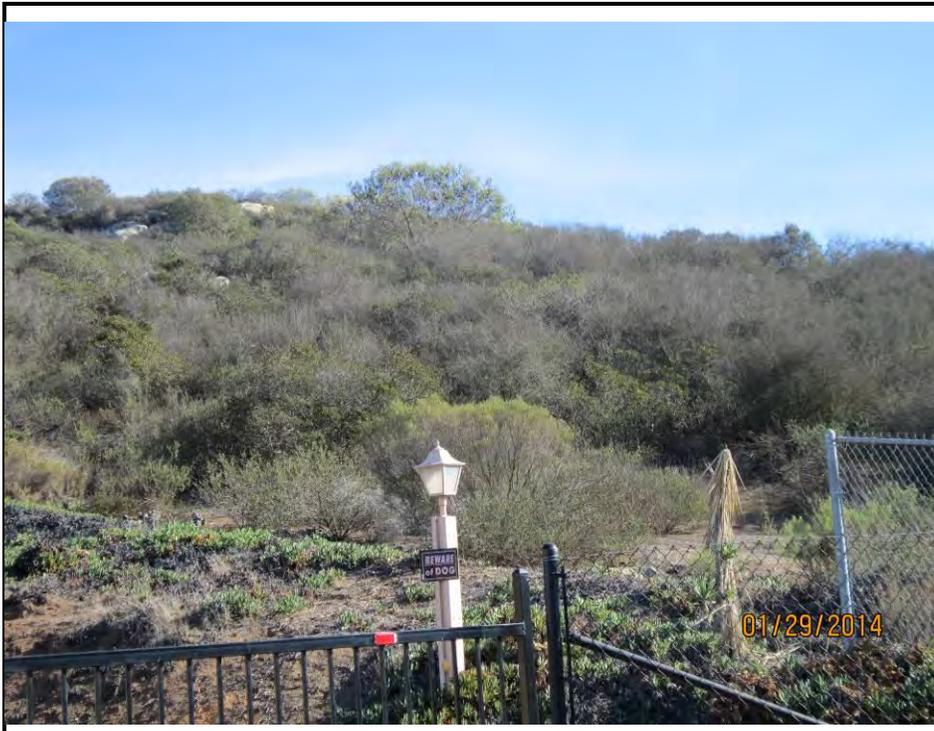
**GLU: CSP-Forest-3**

View: Looking east

Existing sediment  
production: Med to High

Potential sediment  
production: High

Existing veg. cover: 75-80%



**Field Visit ID-8**

**GLU: CB-Scrub/Shrub-3**

View: Looking southeast

Existing sediment  
production: Low to Med

Potential sediment  
production:  
Med to High

Existing veg. cover: 90-95%



**Field Visit ID-9**

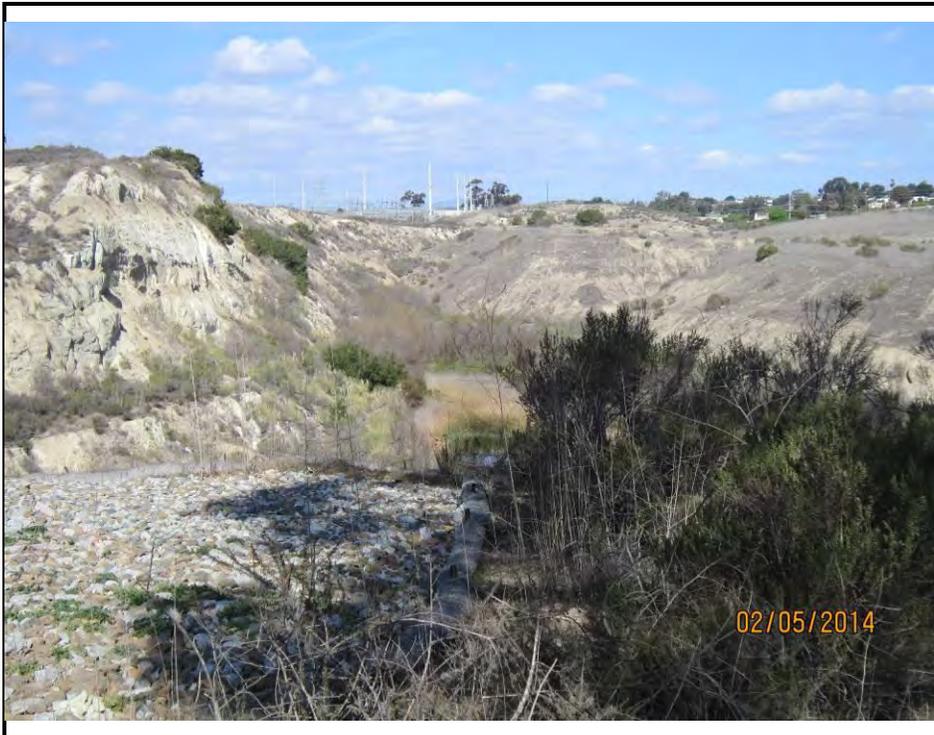
**GLU: CB-Agricultural/  
Grass-2**

View: Looking northwest

Existing sediment  
production: Low to Med

Potential sediment  
production: Med

Existing veg. cover: 70%



**Field Visit ID-10**

**GLU: CSI-Unknown-2**

View: Looking north

Existing sediment  
production: Med to High

Potential sediment  
production: High

Existing veg. cover: 75%



**Field Visit ID-11**

**GLU: CSI-Agricultural/  
Grass-2**

View: Looking east

Existing sediment  
production: Low

Potential sediment  
production: Med

Existing veg. cover: 85%



**Field Visit ID-12**

**GLU: CSP-Unknown-2**

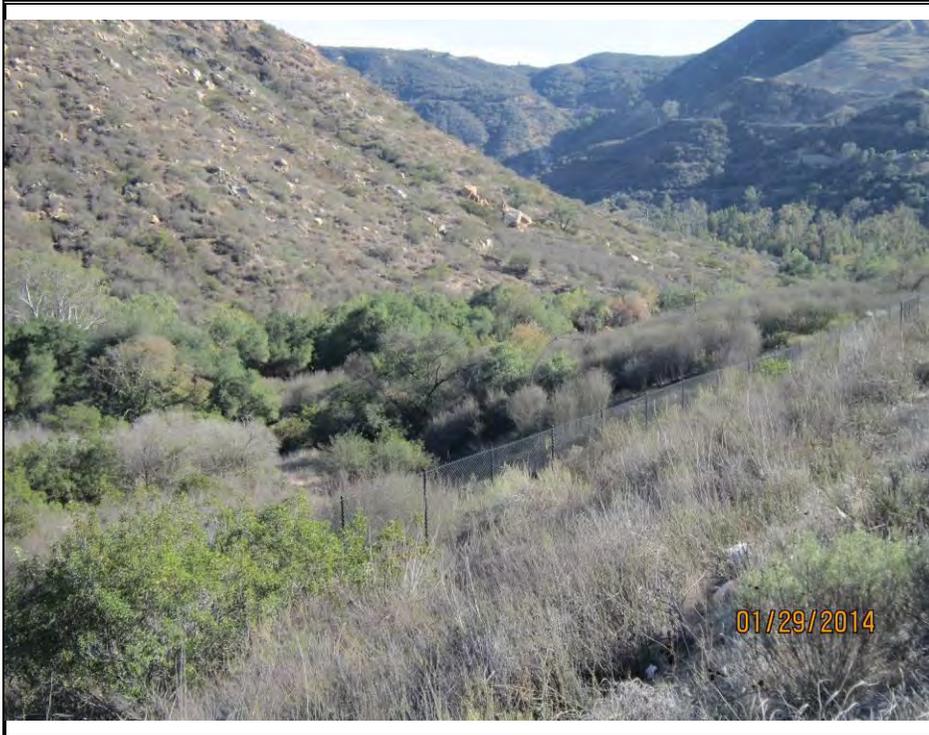
View: Looking southwest

Existing sediment  
production: Low

Potential sediment  
production:

Low to Med

Existing veg. cover: 50%



**Field Visit ID-13**

**GLU: CSP-Scrub/Shrub-2**

View: Looking southeast

Existing sediment  
production: Med

Potential sediment  
production:  
Med to High

Existing veg. cover: 80-85%



**Field Visit ID-14**

**GLU: FSP-Scrub/Shrub-1**

View: Looking northeast

Existing sediment  
production: Low

Potential sediment  
production:  
Low to Med

Existing veg. cover:  
95-100%



**Field Visit ID-15**

**GLU: CB-Agricultural/  
Grass-4**

View: Looking west

Existing sediment  
production: Med

Potential sediment  
production: High

Existing veg. cover: 95%



**Field Visit ID-16**

**GLU: CB-Agricultural/  
Grass-3**

View: Looking south

Existing sediment  
production: High\*

Potential sediment  
production: High

Existing veg. cover: 90-95%

\* Area was burned in 2014  
fires after the field  
assessment so existing  
sediment production was  
adjusted to High (based on  
potential sediment  
production) from Medium



**Field Visit ID-17**

**GLU: CSI-Scrub/Shrub-4**

View: Looking west

Existing sediment  
production: Med

Potential sediment  
production: High

Existing veg. cover: 95%



**Field Visit ID-18**

**GLU: CSP-Forest-1**

View: Looking southwest

Existing sediment  
production: Low to Med

Potential sediment  
production: Med

Existing veg. cover: 80%



**Field Visit ID-19**

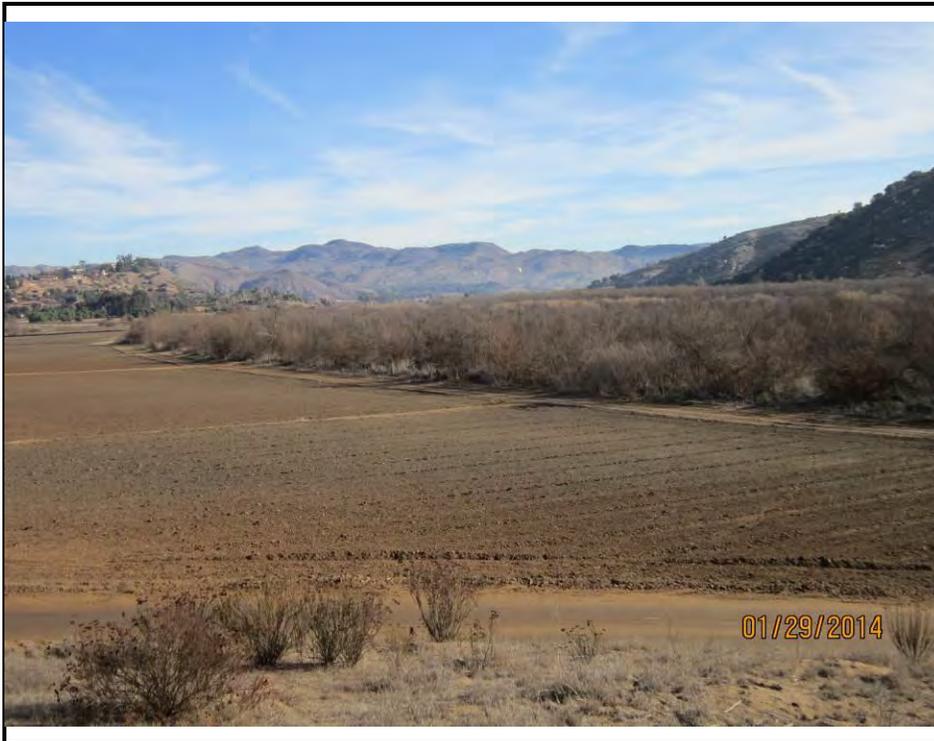
**GLU: CSP-Scrub/Shrub-3**

View: Looking southwest

Existing sediment  
production: Low to Med

Potential sediment  
production:  
Med to High

Existing veg. cover: 60%



**Field Visit ID-20**

**GLU: CSP-Unknown-1**

View: Looking southeast

Existing sediment  
production: Low

Potential sediment  
production: Med

Existing veg. cover: 95%



**Field Visit ID-21**

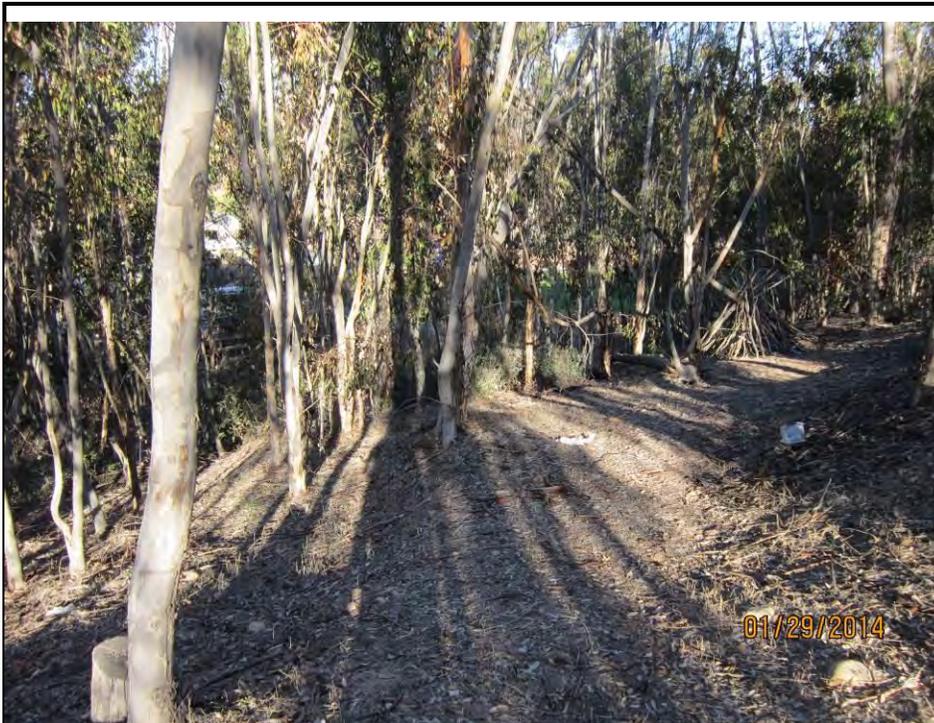
**GLU: CB-Unknown-3**

View: Looking northwest

Existing sediment  
production: Low to Med

Potential sediment  
production:  
Med to High

Existing veg. cover: 50-60%



**Field Visit ID-22**

**GLU: CSI-Forest-3**

View: Looking east

Existing sediment  
production: Low

Potential sediment  
production: Med

Existing veg. cover: 60%



**Field Visit ID-23**

**GLU: CSI-Scrub/Shrub-1**

View: Looking north

Existing sediment  
production: Low

Potential sediment  
production: Low

Existing veg. cover: 80%



**Field Visit ID-24**

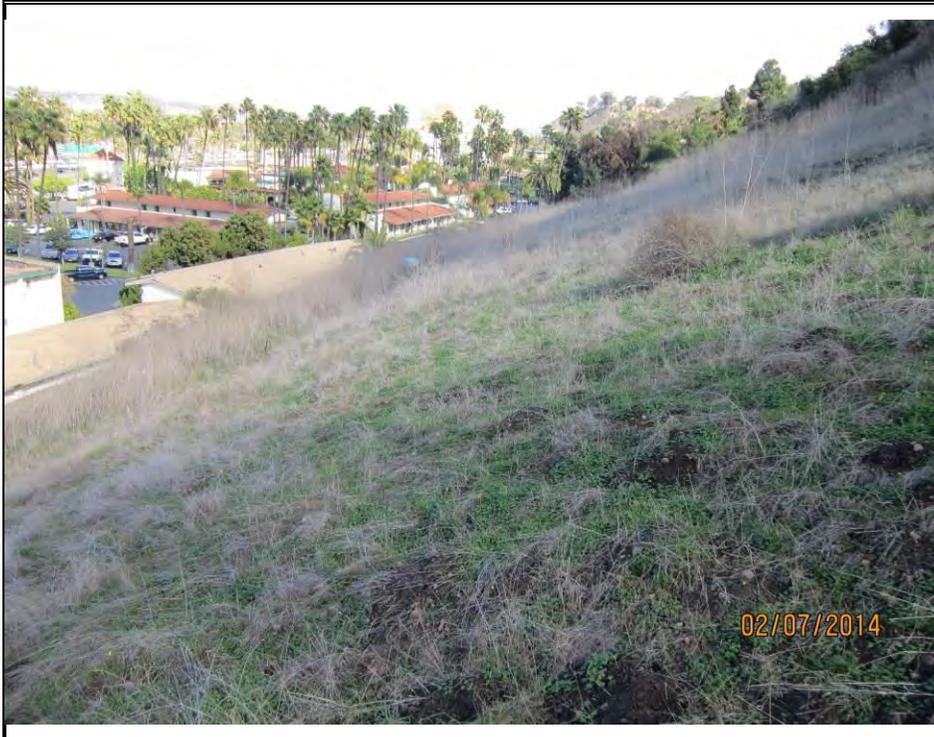
**GLU: CB-Unknown-4**

View: Looking northeast

Existing sediment  
production: Low to Med

Potential sediment  
production: High

Existing veg. cover: 80%



**Field Visit ID-25**

**GLU: CSI-Agricultural/  
Grass-4**

View: Looking east

Existing sediment  
production: Low

Potential sediment  
production: Med-High

Existing veg. cover: 95%



**Field Visit ID-26**

**GLU: CSI-Scrub/Shrub-3**

View: Looking east

Existing sediment  
production: Low

Potential sediment  
production: Med

Existing veg. cover: 100%



**Field Visit ID-27**

**GLU: CSP-Developed-2**

View: Looking north

Existing sediment  
production: Low

Potential sediment  
production: Low

Existing veg. cover: 30-35%



**Field Visit ID-28**

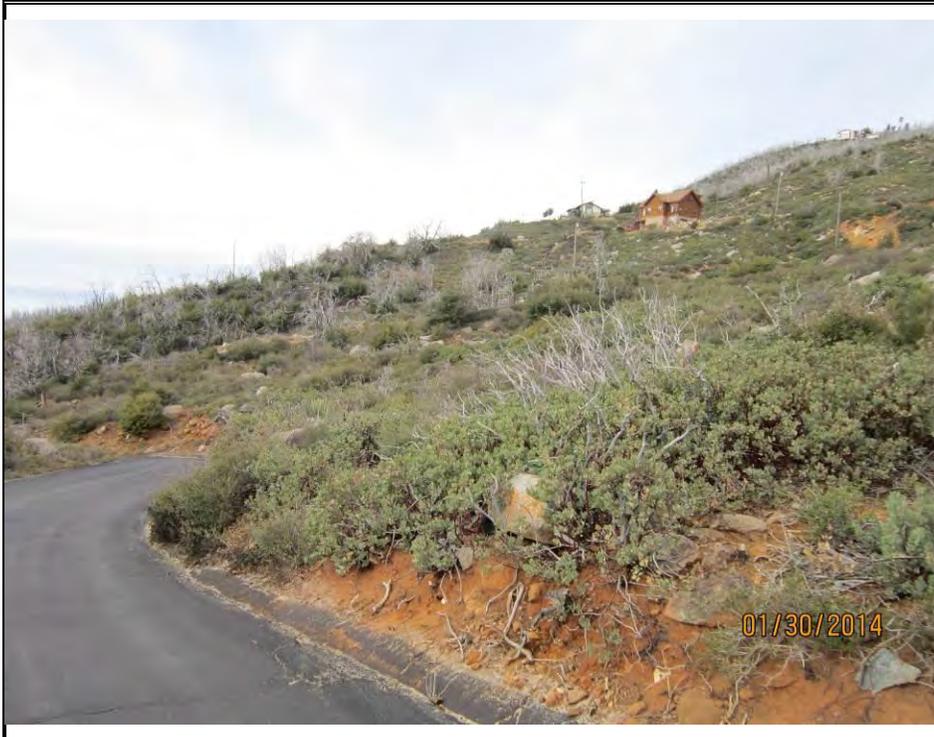
**GLU: CSP-Agricultural/  
Grass-2**

View: Looking north

Existing sediment  
production: Low

Potential sediment  
production: Med

Existing veg. cover: 90-95%



**Field Visit ID-29**

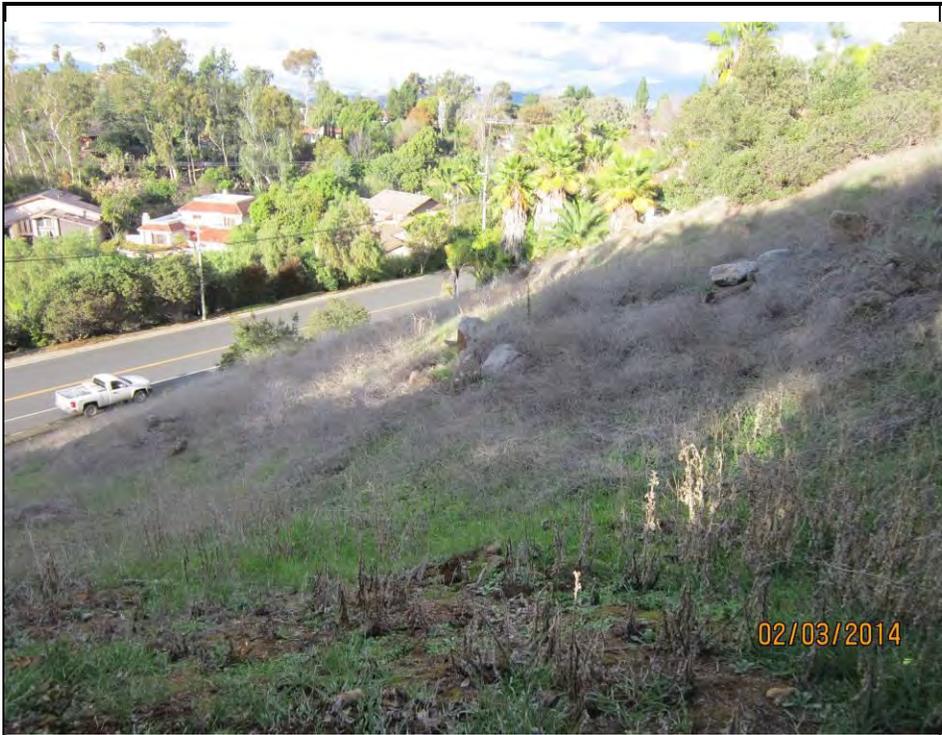
**GLU: FB-Forest-3**

View: Looking northwest

Existing sediment  
production: Med

Potential sediment  
production: High

Existing veg. cover: 80-85%



**Field Visit ID-30**

**GLU: CB-Developed-4**

View: Looking northeast

Existing sediment  
production: Low

Potential sediment  
production: Med

Existing veg. cover: 70%



**Field Visit ID-31**

**GLU: CSI-Developed-3**

View: Looking north

Existing sediment  
production: Low

Potential sediment  
production: Low

Existing veg. cover: 30-35%



**Field Visit ID-32**

**GLU: CSI-Unknown-3**

View: Looking west

Existing sediment  
production: Low to Med

Potential sediment  
production: Med

Existing veg. cover: 70-75%



**Field Visit ID-33**  
**GLU: CSP-Scrub/Shrub-1**

View: Looking northeast

Existing sediment  
production: Low to Med

Potential sediment  
production:  
Med to High

Existing veg. cover: 70%



**Field Visit ID-34**  
**GLU: CSP-Developed-2**

View: Looking south

Existing sediment  
production: Low

Potential sediment  
production: Low

Existing veg. cover: 95%



**Field Visit ID-35**

**GLU: FB-Scrub/Shrub-3**

View: Looking northeast

Existing sediment  
production: Low

Potential sediment  
production: Med

Existing veg. cover: 90-95%



**Field Visit ID-36**

**GLU: FSI-Agricultural/  
Grass-2**

View: Looking northeast

Existing sediment  
production: Low

Potential sediment  
production: Med

Existing veg. cover: 95%



**Field Visit ID-37**

**GLU: CB-Forest-3**

View: Looking southeast

Existing sediment  
production: Med-High

Potential sediment  
production: High

Existing veg. cover: 75-80%



**Field Visit ID-38**

**GLU: CSI-Agricultural/  
Grass-1**

View: Looking northeast

Existing sediment  
production: Low

Potential sediment  
production: Med

Existing veg. cover: 85%



**Field Visit ID-39**

**GLU: CSP-Developed-1**

View: Looking west

Existing sediment  
production: Low

Potential sediment  
production: Low

Existing veg. cover: 30-35%



**Field Visit ID-40**

**GLU: CSP-Scrub/Shrub-4**

View: Looking south

Existing sediment  
production: Med

Potential sediment  
production: High

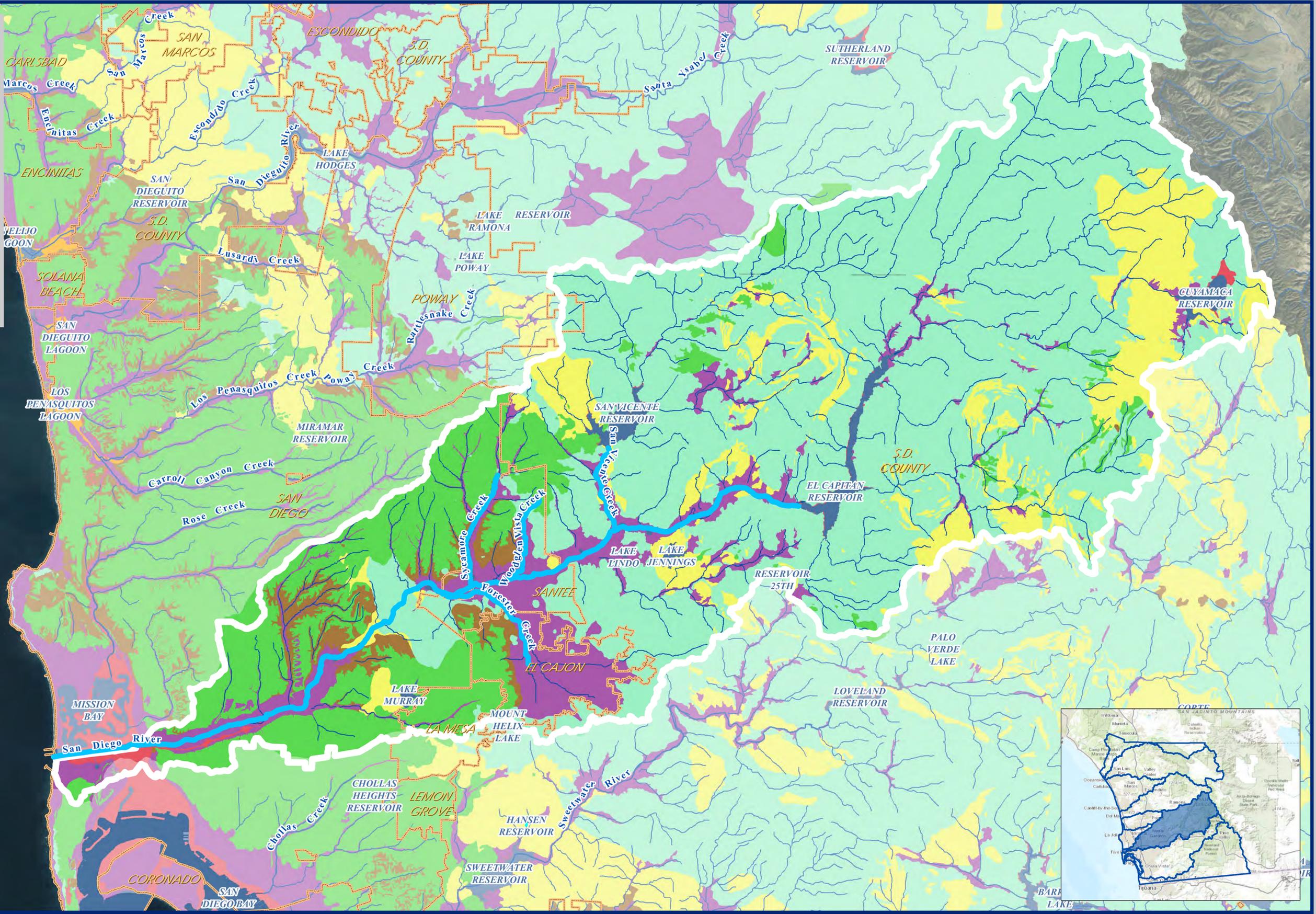
Existing veg. cover: 90-95%

Legend

- Regional WMAA Streams
- Watershed Boundaries
- Municipal Boundaries
- Rivers & Streams

Geologic Group

- Coarse Bedrock
- Coarse Sedimentary Impermeable
- Coarse Sedimentary Permeable
- Fine Bedrock
- Fine Sedimentary Impermeable
- Fine Sedimentary Permeable
- Other



Miles 0 25 50 100 150

# Geologic Group

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

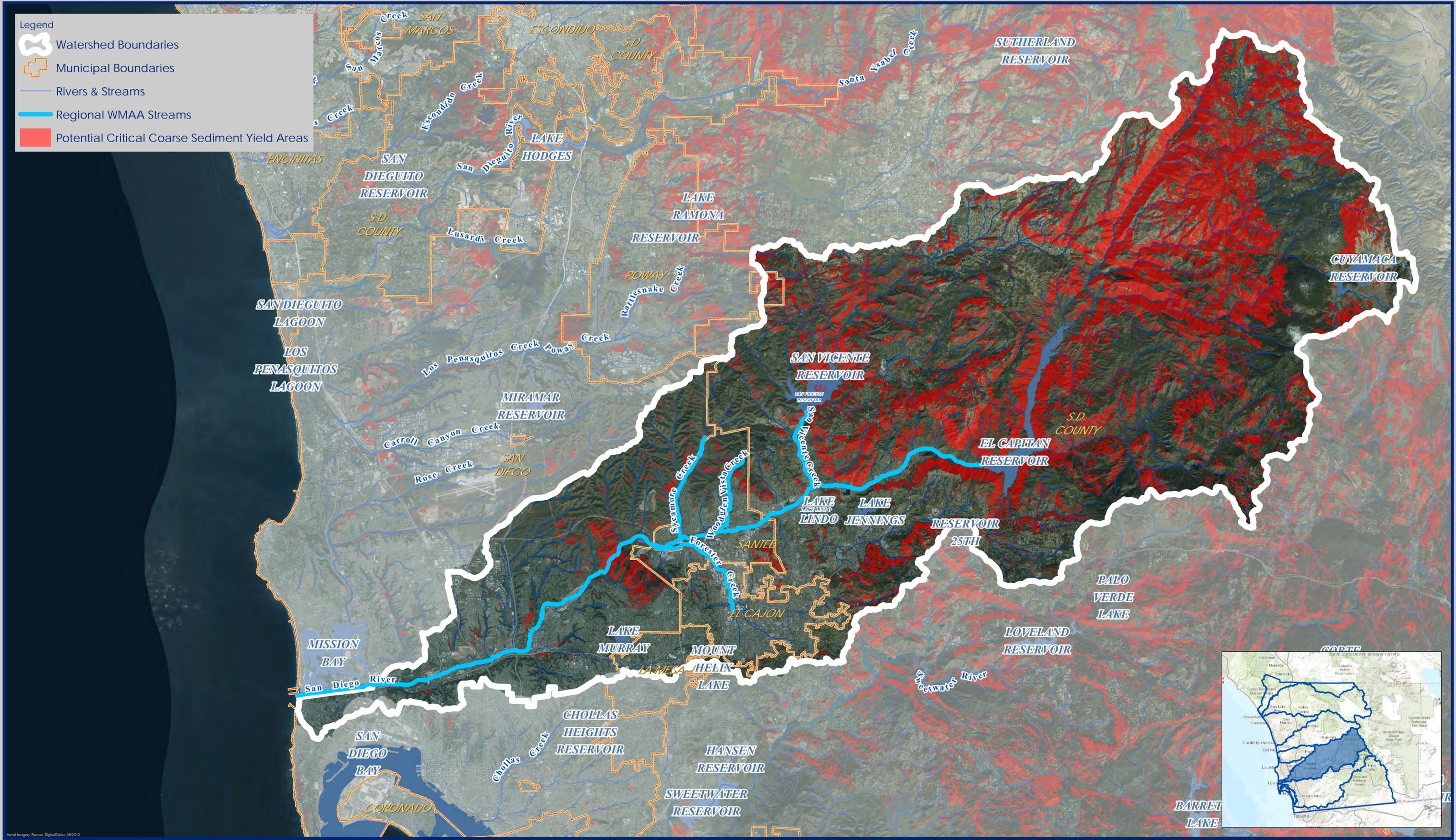
Exhibit Date: Sept. 8, 2014

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Legend

- Watershed Boundaries
- Municipal Boundaries
- Rivers & Streams
- Regional WMAA Streams
- Potential Critical Coarse Sediment Yield Areas



Miles 0 25 50 100 150

# Potential Critical Coarse Sediment Yield Areas

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014

**ATTACHMENT A.5**  
**PHYSICAL STRUCTURES**

## A.5 Physical Structures

The desktop-level analysis to identify existing physical structures within the nine watershed management areas within the San Diego region utilized the following GIS data sources:

- ESRI ArcMap, Google Earth, and Google Maps products
- Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) Flood Profiles and FEMA Flood Insurance Rate Map (FIRM)
- National Flood Hazard Layer (NFHL)
- Municipal master drainage plans (as provided)
- San Diego Geographic Information Source (SanGIS) Municipal Boundaries and Hydrologic Basins
- United States Geological Survey (USGS) National Hydrography Dataset (NHD) California data
- Stream data generated as indicated in Section 2.2

The following documents the process used to identify the physical structures along the reaches and the resulting GIS data:

- The process began by importing the data sources indicated above into a single ArcMap document that served as a master map file from which all further analysis proceeded.
- The data were screened and selected for inclusion as appropriate to the project scope.
- Point features were placed along river reach line segments to coincide with visually identified structures, utilizing different feature symbols according to the type of infrastructure.
- In the case of levees, the point was placed at the downstream-most end of the FEMA NFHL Shapefile. All point features generated in this task appear in the GIS shapefile.
- Municipal boundaries intersecting river reaches were identified to identify the applicable municipal drainage plan data.
- Point feature attributes and associated information for Physical Structures GIS shapefile is indicated in Table A.5.1 below.

**Table A.5.1: Structure Identification Point Feature Attribute Development and Information**

Attribute	Description
Struct_ID	The Structure ID field provides a six-digit identification number based upon the structure's specific location within a watershed. The first three digits in the code reflect the structure's Hydrologic Unit (HU) Basin number (ranging between 902-911 for Region 9, as defined in the Water Quality Control Plan for the San Diego Basin). The subsequent three digits reflect the structure's location along the reach, ascending along the channel from the headwaters to tailwaters (ranging between 001-999, beginning at the confluence and increasing in the upstream direction).

San Diego River WMAA Attachments

Attribute	Description
WMA	The Watershed Management Area field provides the name of the watershed in which the structure exists. The WMA corresponds with the HU identified in the first three digits in the Struct_ID (e.g., 911, Tijuana Watershed).
Channel_ID	The Channel ID field provides the name of the channel in which the structure exists.
Struct_Typ	The Structure Type field classifies known structures as one of the following types: Bridge, Culvert, Dam, Energy Dissipater, Flood Management Basin, Flood Wall, Grade Control, Levee, Pipeline, Weir.
Struct_Dtl	The Structure Detail field provides known quantitative information for multi-section culverts.
Struct_Mtl	The Structure Material field provides known qualitative information for structure material composition.
Struct_Shp	The Structure Shape field provides known geometric information for culvert shapes, and is classified as one of the following types: Arch, Box, Pipe.
Jurisd_ID	The Jurisdiction ID field, when applicable, provides the known separate structure identification number developed and utilized by the jurisdiction or entity responsible for creating and distributing the coinciding structure Shapefile data used for this analysis. This number was copied from the coinciding external Shapefile data attribute field best representing a unique jurisdiction or entity-based identification number (external Shapefile data received from regional WMAA data call; for jurisdictional information, see "Other" attribute field). Coinciding external Shapefile data was used to determine various structure attributes.
Plan_ID	The Plan ID field, when applicable, provides the known structure plan number corresponding with the Jurisdiction ID. This number was copied from the coinciding external Shapefile data attribute field best representing a unique plan number received from the regional WMAA data call (external Shapefile data received from regional WMAA data call; for jurisdictional information, see "Other" field). Coinciding external Shapefile data was used to determine various structure attributes.
Diameter	The Diameter field, when applicable, provides the known diameter (in US feet) for culverts.
Length	The Length field, when applicable, provides the known length (in US feet) for select structure types. When lengths were determined using FEMA FIS Flood Profiles, the scaled horizontal distances along the indicated roadway or channel slope were used.
Width	The Width field, when applicable, provides the known width (in US feet) for select structure types.
Height	The Height field, when applicable, provides the known height (in US feet) for select structure types. When heights were determined using FEMA FIS Flood Profiles, the scaled vertical distances from channel bed to indicated roadway bottom were used.
US_Invert	The Upstream Invert field, when applicable, provides the known upstream invert elevation (in US feet) for select structure types.
DS_Invert	The Downstream Invert field, when applicable, provides the known downstream invert elevation (in US feet) for select structure types.

Attribute	Description
RD_EL_NAVD	The Roadway Elevation (NAVD) field, when applicable, provides the known roadway elevation (in US feet, NAVD) for select structure types. When roadway elevations were determined using FEMA FIS Flood Profiles, the horizontal projection onto the vertical grid scales were used.
Loc_Descr	The Location Description field, when applicable, provides information for structures crossing a known roadway. In nearly all cases, Google Earth imagery was used to determine the roadway name.
Other	The Other field is used to convey any information not present within the preceding fields. Typically, "other" information includes jurisdictional, plan, and supplemental dimensions for a given structure.

### Example Structure Identification

The following example demonstrates the structure identification process for a discrete structure (ID 907029) along the San Diego River. The San Diego River is located in the San Diego River watershed (WMA 907). Scanning the river from lower to higher reached, a new point feature was placed at the road crossing over the San Diego River as indicated in Figure A.5.1. Select attributes of this particular structure were available from the FEMA NFHL as displayed in the highlighted boxes in Figure A.5.1. Additional attributes such as the culvert height, length, roadway elevation, and name were also determined from the FIS Flood Profile as indicated in Figure A.5.2. Satellite imagery (e.g., Google) was used to verify the existence of structure. In this case, the most current Google Map data indicated that the culvert still exists and that the roadway name has been changed to Qualcomm Way. When structures could not be verified with satellite imagery, the structure identification was based solely upon the information provided or readily available and was not physically verified in the field. Figure A.5.3 displays an example of imagery used to identify structures.

Figure A.5.1: Typical ArcMap Window

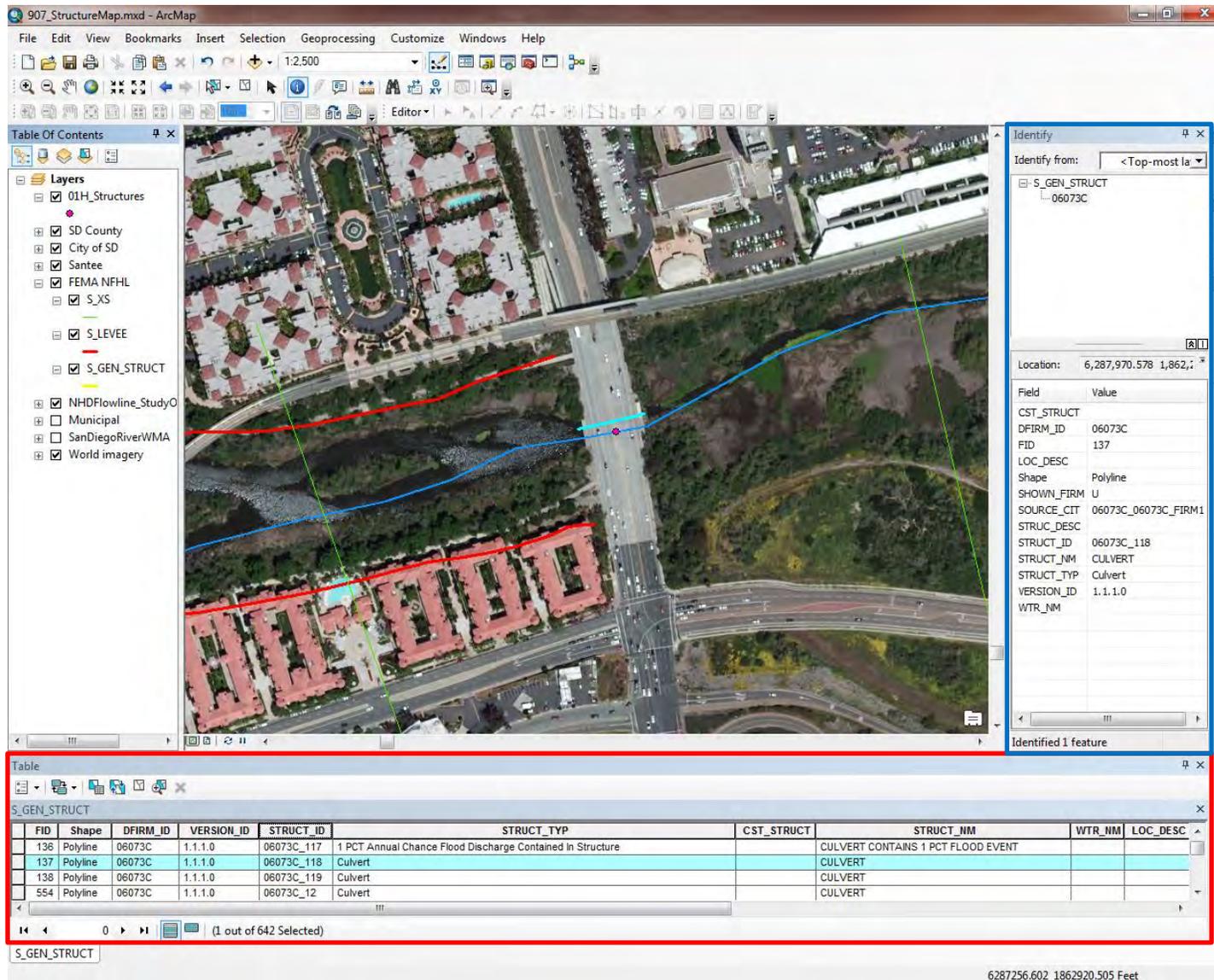
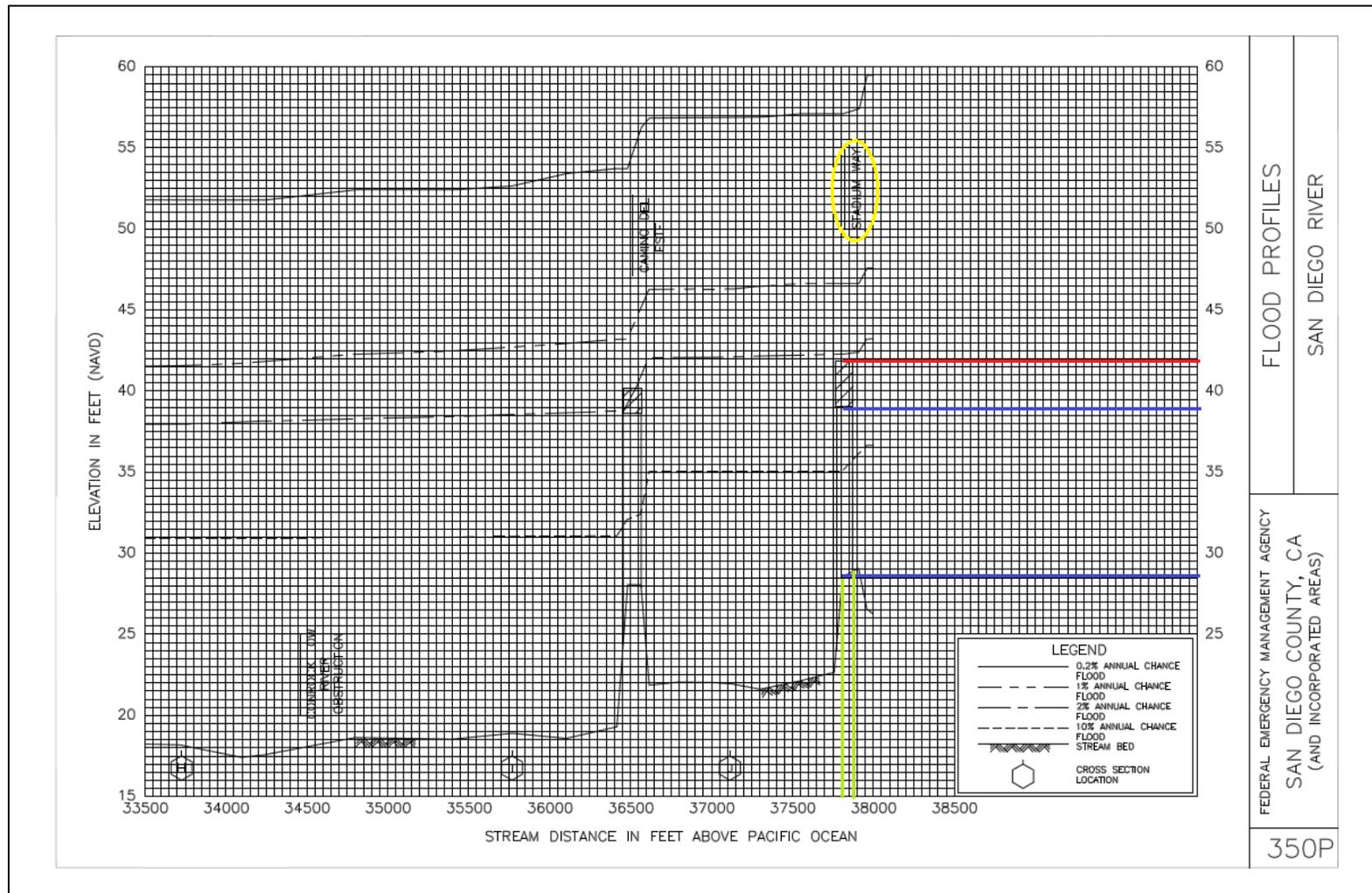


Figure A.5.2: Typical FEMA FIS Flood Profile



Legend: roadway elevation (red), roadway name (yellow), culvert height (blue), culvert width (green)

Figure A.5.3: Google Map Imagery for Structure Identification



The following bridge structure dimensional attributes were included in the point feature attributes:

- length 110 feet
- height 10 feet
- roadway elevation 41.9 feet

The attribute table associated with the identified structure included in the GIS shapefile is indicated in Table A.5.2.

**Table A.5.2: Structure 907029 Attribute Table**

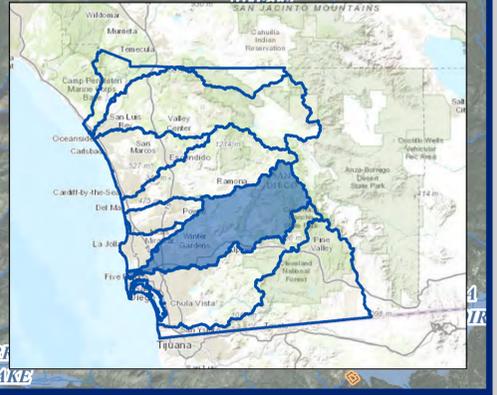
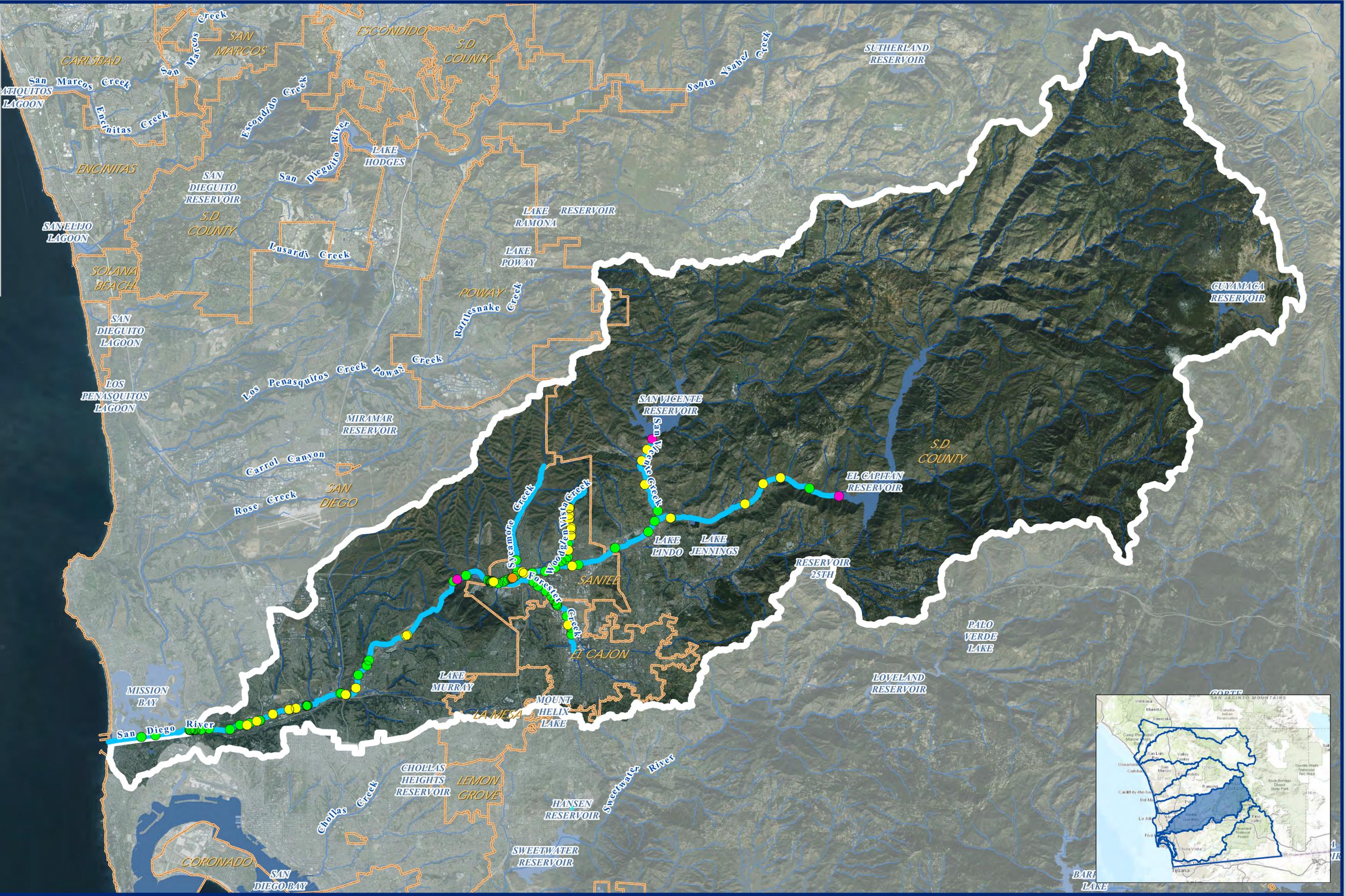
Attribute	Description
Struct_ID	907029
WMA	San Diego
Channel_ID	San Diego River
Struct_Typ	Culvert
Struct_Dtl	
Struct_Mtl	
Struct_Shp	
Jurisd_ID	06073C_118
Plan_ID	06073C_06073C_FIRM1
Diameter	0
Length	110
Width	0
Height	10
US_Invert	0
DS_Invert	0
RD_EL_NAVD	41.9
Loc_Descr	Qualcomm Way
Other	Info from FEMA NFHL shapefile data/FIS FP V.9-350P

Legend

**Channel Structure Type**

- Bridge
- Culvert
- Dam
- Energy Dissipator
- Pipeline
- Unknown

- Regional WMAA Streams
- Watershed Boundaries
- Municipal Boundaries
- Rivers & Streams



Miles 0 25 50 100 150

# Watershed Management Area Streams with Channel Structures

San Diego River Watershed - HU 907.00, 436 mi<sup>2</sup>

Exhibit Date: Sept. 8, 2014

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**ATTACHMENT B**  
**HYDROMODIFICATION MANAGEMENT**  
**APPLICABILITY/EXEMPTIONS**

**ATTACHMENT B.1**  
**EXEMPT RIVER REACH**

## B.1.1 Exempt River Reaches

### B.1.1.1 Approach for Exempt River Reach Analysis

The approach selected in this cumulative hydromodification impacts study accounts for: (1) hydrology, (2) channel geometry, (3) bed and bank material, and (4) sediment supply. The selected approach compares long-term changes in sediment transport capacity, or in-stream work, and sediment supply for the existing and future development conditions. The ratio of future/existing condition transport capacity, or work, is termed Erosion Potential (Ep). The ratio of future/existing condition bed sediment supply is termed Sediment Supply Potential (Sp). To calculate Ep, the hydrology, channel geometry, and bed/bank materials are characterized for the existing and future conditions. To calculate Sp, the sediment supply factor is characterized for the existing and future conditions.

The findings in this study propose exemption for a given river reach if the analysis satisfies the following criteria:

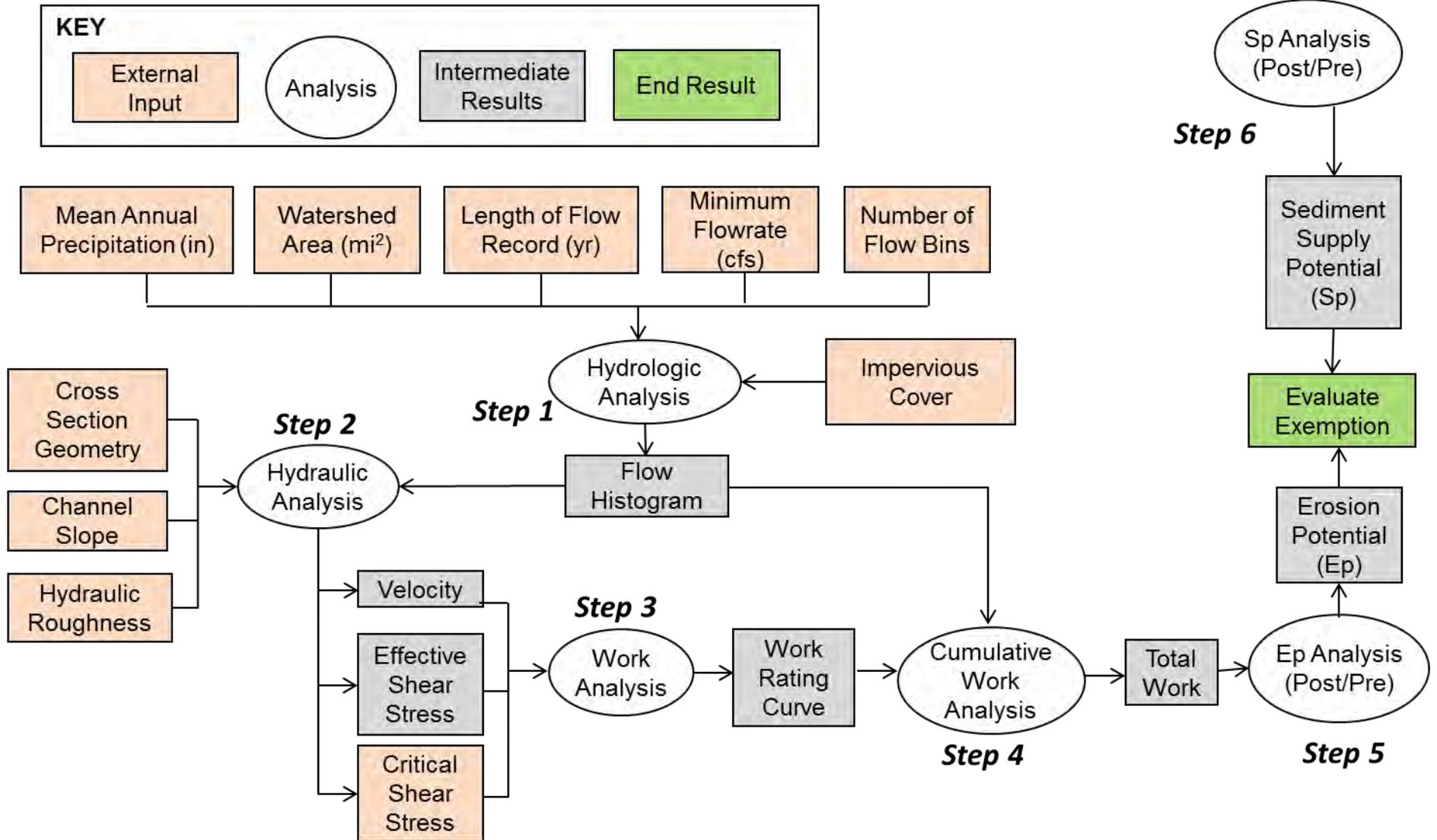
- $Ep < 1.05$  when  $d_{50} < 16$  mm or  $Ep < 1.20$  when  $d_{50} > 16$  mm, and;
- $Sp > 0.90$

The following bullet points provide basis for the criteria listed above:

- For Ep
  - According to the Journal of Hydrology article titled Channel Enlargement in Semiarid Suburbanizing Watersheds: A Southern California Case Study (Hawley and Bledsoe, 2013): “*The threshold corresponding to the presence/absence of headcutting varied based on substrate type, and was roughly quantified as a sediment-transport ratio greater than ~1.20 in systems with a median grain size > 16mm, and [Ep] ~ 1.05 when  $d_{50} < 16$  mm*”
- For Sp
  - Soar and Thorne (2001) indicate that a greater than 10% reduction in sediment supply can have potentially significant effects on stream stability.
  - SCCWRP Technical Report 605, 2010 states that changes of less than 10% in either driver (Water delivery and sediment are the drivers in this report) are unlikely to instigate, on their own, significant channel changes.

The flow chart summarizing the analysis procedure is presented below.

# Flowchart for Exempt River Reach Analysis



### B.1.1.2 Selection of Inputs for Exempt River Reach Analysis

The following steps were implemented for each river reach:

- Step 1 – Hydrologic Analysis:
  - Due to limited flow data, a flow duration equation developed for Southern California (Hawley and Bledsoe, 2011) was used to estimate existing and future flow histograms for each watershed.
  - The change in impervious cover between existing and future development conditions was estimated using the developable land use layer from Section 2.3.
  - A desktop-level GIS exercise was performed to manually assign land use classifications if the parcel in the developable land use layer directly discharges into the analyzed reach. Results are summarized in Section B.1.13.
  - Assumptions for percent imperviousness for each land use type were based on the information provided in the San Diego County Imperviousness Study (County of San Diego, 2010).
  - The table below presents the input parameters used to construct flow histograms, as well as the estimated channel slope at the critical cross section.

Exempt River Reach	Area (sq. miles)	Mean Annual Precipitation (in)	Length of Daily Flow Record (Years)	Channel Slope (ft/ft)
San Diego River	173	14.5	30	0.0012

- Step 2 – Hydraulic Analysis: The reach type classification from Section 2.2 was used to identify the critical cross section along the reach for Ep analysis. A critical flow rate of  $0.5Q_2$  was assigned to estimate the critical shear stress for the analyzed cross section. Flow rates below  $0.5Q_2$  were assumed to perform no work on the reach.
- Step 3 – Work Analysis: The simplified effective work equation shown below is used to calculate the work done for each flow bin.

$$W = (\tau - \tau_c)^{1.5}V$$

Where

- W = Work (dimensionless)
- $\tau$  = effective Shear Stress [lb/ft<sup>2</sup>]
- $\tau_c$  = Critical Shear Stress [lb/ft<sup>2</sup>]
- V = Flow Velocity [ft/s]

- Step 4 – Cumulative Work Analysis: Cumulative work is a measure of the long-term total work or sediment transport capacity performed at a given stream location. Cumulative work incorporates both discharge magnitude and flow duration distributions for the full range of simulated flow rates. Cumulative work is calculated by multiplying work and duration for each bin. Total work is calculated through summation of work from all flow bins.
- Step 5 – Ep Analysis: Ep is calculated by dividing the total work of the future condition by that of the existing condition. The existing river reaches analyzed appear relatively stable and have not experienced excessive geomorphic instability due to the alteration of

the drainage areas. Given the stable condition of the existing channels, the existing condition was used as the baseline condition instead of natural. Results from the Ep analysis are presented in Section B.1.1.3.

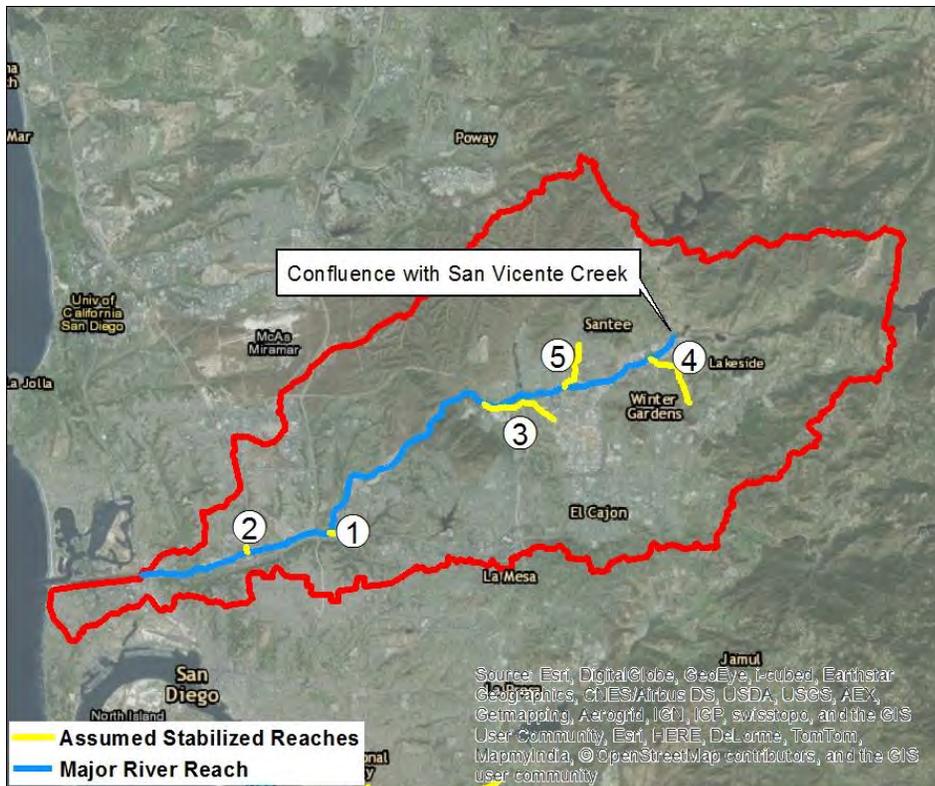
- Step 6 – Sp Analysis: Coarse Sediment Supply Potential for each watershed was estimated using the quantitative results from Section 2.4. First, the watershed coarse sediment soil loss was estimated for all GLUs producing coarse sediment. Then, the future-condition coarse sediment soil loss was estimated by subtracting the approximate exempt parcel soil loss from the existing soil loss. Sp is ultimately calculated by dividing the future coarse sediment soil loss by the existing coarse sediment soil loss. Results from Sp analysis are presented in Section B.1.1.3.

Steps 1 to 5 were performed in Excel and Steps 1 and 6 were executed in GIS. Ep estimates for the exempt river reaches are included in this attachment.

Exempt river reach extents are shown in the figure below. Figure also indicate the tributaries assumed to be stable for performing the erosion potential analysis as a conservative approach to approximate potential HMP exempt flows that may enter the river reach being analyzed.

For a PDP draining to one of the assumed stable tributaries shown in the following exempt reach figure, the PDP applicant shall verify and document that the assumed stable tributary is a stabilized conveyance system by using the methodology presented in section 4.1.2 prior to claiming exemption from hydromodification management requirements.

For a PDP draining to a tributary not shown in the figure below to be considered for exemption, a stability analysis using the section 4.1.2 methodology is to be conducted for the given tributary. If the stability analysis determines the tributary is stable, then the exempt river reach analysis indicated in section 4.1.1 shall be performed by adding the additional stabilized tributary to the current list of tributaries shown in the figure below to confirm that the reach satisfies the Ep and Sp criteria.



Extents of San Diego River and extents of assumed Stabilized Reaches: 1) Alvarado Creek; 2) Civita Channel; 3) Forester Creek; 4) Los Coches Creek and 5) Woodglen Vista Creek

The table below presents the summary of the developable land in each of the five watersheds with the exempt river reach and the estimated developable area that will be exempted from hydromodification management area requirements if the exempt river reach exemption is reinstated. This area will still be subject to the pollutant control requirements from the regional MS4 permit.

Exempt River Reach	Developable Land		
	Total (acres)	Area exempt (acres)	Exempt (%)
San Diego River	13,667	1,196	9%

### B.1.1.3 Results from Exempt River Reach Analysis

Results from Erosion potential analysis are presented below:

Exempt River Reach	Area (acres)	Impervious Area (acres) [%]			Ep (Post/Pre) [Criteria<1.05]
		Pre	Post	Increase	
San Diego River	111,006	32,106[28.9]	32,777[29.5]	671 [0.6]	1.03

Results from coarse sediment supply potential analysis are presented below:

Exempt River Reach	Soil Loss (tons/yr.)			Sp (Post/Pre) [Criteria>0.90]
	Pre	Exempt Parcels	Post [Pre – Exempt Parcels]	
San Diego River	354,619	2,575	352,044	0.99

Based on the results from the analysis it is recommended that exemption be reinstated for San Diego River.

Erosion Potential Analysis for San Diego River

Erosion Potential (Ep) **1.03**

<b>Channel Slope</b>	<b>0.0012</b>	ft/ft
<b>Estimated Q<sub>2</sub></b>	436	cfs
<b>0.5Q<sub>2</sub></b>	218	cfs
<b>Critical Shear</b>	<b>0.109</b>	lb/sq. ft
<b>γ</b>	62.4	lb/ft <sup>3</sup>

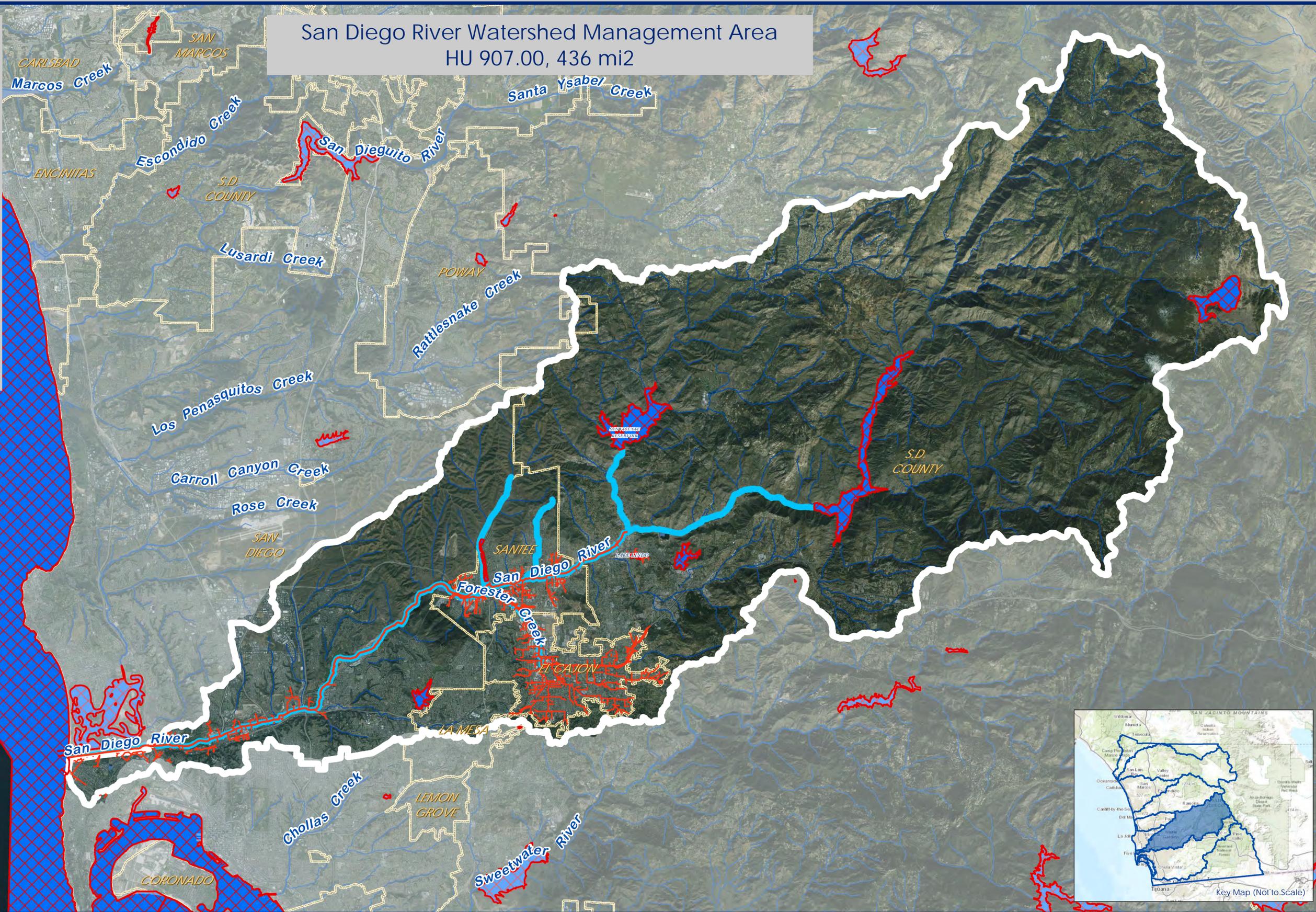
			Existing Condition	Future Condition
Tributary Area	A	sq mi	173	173
Mean Annual Precip	MAP	in/yr	14.5	14.5
Length of Daily Flow Record	Yr	yr	30	30
Imperviousness	Impav	mi <sup>2</sup> /mi <sup>2</sup>	0.2892	0.2953
Maximum Flow of Record	Q <sub>max</sub>	cfs	6336.8	6336.8
Minimum Flow of Record	Q <sub>min</sub>	cfs	0.01	0.01
10-year peak flow	Q <sub>10</sub>	cfs	12411.4	12411.4
Coefficient of DDF	day1	days & cfs	48535.40	52754.33
Exponent of DDF	day2	days & cfs	-0.88	-0.88
Number of Bins	N <sub>B</sub>	--	25	25
Bin Size	H <sub>B-log</sub>	--	0.557	0.557

Bin Number	Lower Bound of Bin Number	Upper Bound of Bin Number	Flow	Hydraulic Radius	Flow Velocity	Shear Stress	Work	Duration	Cumulative Work	Duration	Cumulative Work
<i>B</i>	<i>B<sub>lwr-log (cfs)</sub></i>	<i>B<sub>upr-log (cfs)</sub></i>	<i>Q (cfs)</i>	<i>R (ft)</i>	<i>v (ft/s)</i>	<i>τ (psf)</i>	<i>W</i>		<i>W*duration</i>		<i>W*duration</i>
1	0.006	0.010	0.01	0.00	0.02	0.000	0.000	3404271	0.00	3830691	0.00
2	0.010	0.017	0.01	0.00	0.02	0.000	0.000	2089074	0.00	2341409	0.00
3	0.017	0.030	0.02	0.00	0.03	0.000	0.000	1281986	0.00	1431125	0.00
4	0.030	0.053	0.04	0.01	0.04	0.001	0.000	786707	0.00	874737	0.00
5	0.053	0.093	0.07	0.01	0.05	0.001	0.000	482773	0.00	534660	0.00
6	0.093	0.162	0.13	0.01	0.07	0.001	0.000	296259	0.00	326797	0.00
7	0.162	0.282	0.22	0.02	0.08	0.001	0.000	181803	0.00	199746	0.00
8	0.282	0.492	0.39	0.02	0.10	0.001	0.000	111566	0.00	122090	0.00
9	0.492	0.859	0.68	0.03	0.13	0.002	0.000	68464	0.00	74624	0.00
10	0.859	1.499	1.18	0.04	0.16	0.003	0.000	42014	0.00	45612	0.00
11	1.499	2.615	2.06	0.06	0.20	0.004	0.000	25782	0.00	27879	0.00
12	2.615	4.562	3.59	0.09	0.25	0.007	0.000	15822	0.00	17040	0.00
13	4.562	7.960	6.26	0.12	0.31	0.009	0.000	9709	0.00	10415	0.00
14	7.960	13.889	10.92	0.17	0.39	0.013	0.000	5958	0.00	6366	0.00
15	13.889	24.234	19.06	0.23	0.49	0.017	0.000	3656	0.00	3891	0.00
16	24.234	42.283	33.26	0.33	0.61	0.025	0.000	2244	0.00	2378	0.00
17	42.283	73.776	58.03	0.45	0.76	0.034	0.000	1377	0.00	1454	0.00
18	73.776	128.724	101.25	0.63	0.94	0.047	0.000	845	0.00	889	0.00
19	128.724	224.597	176.66	0.87	1.17	0.065	0.000	519	0.00	543	0.00
20	224.597	391.875	308.24	1.20	1.45	0.090	0.000	318	0.00	332	0.00
21	391.875	683.742	537.81	1.65	1.80	0.124	0.003	195	0.60	203	0.62
22	683.742	1192.991	938.37	2.25	2.21	0.168	0.032	120	3.81	124	3.94
23	1192.991	2081.525	1637.26	3.00	2.68	0.225	0.105	74	7.72	76	7.96
24	2081.525	3631.836	2856.68	3.80	3.13	0.285	0.230	45	10.36	46	10.64
25	3631.836	6336.812	4984.32	4.06	3.28	0.304	0.282	28	7.80	28	7.98

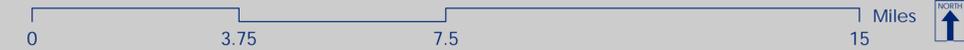
**ATTACHMENT B.2**  
**HYDROMODIFICATION MANAGEMENT EXEMPTION**  
**MAPPING**

# San Diego River Watershed Management Area HU 907.00, 436 mi2

- Legend**
-  Watershed Boundaries
  -  Municipal Boundaries
  -  Regional WMAA Streams
  -  Exempt Bodies:  
Water Storage Reservoirs, Lakes,  
Enclosed Embayments, Pacific  
Ocean, Buena Vista Lagoon
  -  Exempt River Reaches:  
Reaches of San Luis Rey River, San  
Dieguito River, San Diego River,  
Forester Creek, Sweetwater River,  
Otay River
  -  Exempt Conveyance Systems:  
Existing underground storm drains or  
conveyance channels whose bed  
and bank are concrete-lined,  
discharging directly to exempt water  
bodies, exempt rivers, or localized  
areas of Agua Hedionda Lagoon and  
Batiqitos Lagoon



Aerial Imagery Source: DigitalGlobe, 09/2012



## Receiving Waters and Conveyance Systems Exempt from Hydromodification Management Requirements

Exhibit Date: Sept. 8, 2014



**ATTACHMENT C**  
**ELECTRONIC FILES**

## Electronic Folder titled “San Diego River\_WMAA\_Attachment C Electronic\_Data.zip” Contents:

1. ArcMap 10.0 and 10.1 map files created for purpose of viewing Regional WMAA data
  - WMAA\_07\_SanDiegoRiver\_Data\_2014\_0908\_v10 .mxd
  - WMAA\_07\_SanDiegoRiver\_Data\_2014\_0908\_v101.mxd
2. ESRI Geodatabase titled "WMAA\_07\_SanDiegoRiver\_Data\_2014\_0908\_v10.gdb" containing the following data:
  - WatershedBoundaries
    - Watershed\_Boundaries
  - HydrologicProcesses
    - HRUAnalysis
  - Streams – description of existing streams in the watershed
    - SD\_Regional\_WMAA\_Streams (streams selected for detailed analysis)
    - SD\_NHD\_Streams (portion of NHD dataset included for reference)
  - LandUsePlanning
    - SanGIS\_ExistingLandUse
    - SanGIS\_PlannedLandUse
    - SanGIS\_DevelopableLands
    - SanGIS\_RedevelopmentandInfill
    - SanGIS\_MunicipalBoundaries
    - Federal\_State\_Indian\_Lands
    - SanGIS\_MHPA\_SD
    - SanGIS\_MSCP\_CN
    - SanGIS\_MSCP\_EAST\_DRAFT\_CN
    - SanGIS\_Draft\_North\_County\_MSCP\_Version\_8\_Categories
  - PotentialCoarseSedimentYield
    - GLUAnalysis
    - PotentialCoarseSedimentYieldAreas
    - MacroLevelPotentialCriticalAreas
    - PotentialCriticalCoarseSedimentYieldAreas
  - ChannelStructures
    - ChannelStructures
  - HydromodExemptions
    - Exempt\_Systems
    - Exempt\_Bodies
  - Floodplains: included for reference
    - FEMA\_NFHL
  - Baselayers: included for reference
    - SanGIS\_Lakes
    - link to ESRI World Imagery (internet connection is required to access ESRI World Imagery basemap)

## Electronic Folder titled “San Diego River\_WMAA\_Attachment C Electronic\_Data.zip” Contents, continued:

3. Google Earth – KMZ file titled:  
“WMAA\_07\_SanDiegoRiver\_Data\_2014\_0908\_GoogleEarth”, containing the following data:
  - WatershedBoundaries
  - Streams
    - SD Regional WMAA Streams (streams selected for detailed analysis)
    - SD NHD Streams (portion of NHD dataset included for reference)
  - LandUsePlanning
    - Municipal Boundaries
    - Federal/State/Indian Lands
  - ChannelStructures
  - HydromodExemptions
    - Exempt\_Systems
    - Exempt\_Bodies
  - Floodplains: included for reference
    - FEMA Floodplain
  - Dominant Hydrologic Processes
  - Potential Critical Coarse Sediment Yield Areas

### Notes:

- Open a map file (with extension .mxd) using ArcMap to view the data.
- All data contained in the geodatabase is loaded into the map.

**ATTACHMENT D**  
**REGIONAL MS4 PERMIT CROSSWALK**

Table below provides a linkage between the Regional MS4 Permit requirements for WMAA and this report.

Regional MS4 Permit Provision	Regional WMAA Report
B.3.b.(4)(a)	Chapter 2; Section 5.1; Attachment A and Attachment C
B.3.b.(4)(a)(i)	Section 2.1; Attachment A.1 and Attachment C
B.3.b.(4)(a)(ii)	Section 2.2; Attachment A.2 and Attachment C
B.3.b.(4)(a)(iii)	Section 2.3; Attachment A.3 and Attachment C
B.3.b.(4)(a)(iv)	Section 2.4; Attachment A.4 and Attachment C
B.3.b.(4)(a)(v)	Section 2.5; Attachment A.5 and Attachment C
B.3.b.(4)(b)	Chapter 3 and Section 5.2
B.3.b.(4)(c)	Chapter 4; Section 5.3; Attachment B and Attachment C