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The Beneficial Uses that are present in the Tijuana River WMA as defined by the Basin Plan are provided below:

- Agricultural Supply (AGR) includes uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
- Aquaculture (AQUA) includes the uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.
- Preservation of Biological Habitats (BIOL) includes uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.
- Cold Freshwater Habitat (COLD) includes uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.
- Commercial and Sport Fishing (COMM) includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
- Estuarine Habitat (EST) includes uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).
- Freshwater Replenishment (FRSH) includes uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).
- Industrial Service Supply (IND) includes uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.
- Marine Habitat (MAR) includes uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).
- Migration of Aquatic Organisms (MIGR) necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.
- Municipal and Domestic Supply (MUN) Includes uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
- Navigation (NAV) includes uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.
- Industrial Process Supply (PROC) includes uses of water for industrial activities that depend primarily on water quality.

- Rare, Threatened, or Endangered Species (RARE) includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.
- Contact Water Recreation (REC1) includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs.
- Non-contact Water Recreation (REC2) includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
- Shellfish Harvesting (SHELL) includes uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters and mussels) for human consumption, commercial, or sport purposes.
- Spawning, Reproduction, and/or Early Development (SPWN) includes uses of water that support high quality habitats suitable for reproduction, early development and sustenance of marine fish and/or cold freshwater fish.
- Warm Freshwater Habitat (WARM) – includes uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.
- Wildlife Habitat (WILD) includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

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**Tijuana River Watershed Management Area TJR-TWAS-2 Dry Long Term Effectiveness Assessment Table**

| Category Group | Analyte | Units | Water Quality Benchmarks | Benchmark References | Tijuana River TJR-TWAS-2 3/17/10 | Tijuana River TJR-TWAS-2 5/11/10 | 2009-2010 Exceedances | Historical Mean Ratio to Benchmark |
|---|---|---|---|---|---|---|---|---|
| **General/Physical/Organic** | | | | | | | | |
| NA | Electrical Conductivity | µmhos/cm | NA | 2. CCR, 5. Goldbook | 2,480 | 2,990 | - | - |
| CHEM-Conventional | Oil & Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL | 5.3 | <5 | 0% | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 8.02 | 8.1 | 0% | NA[1] |
| NA | Water Temperature | Celsius | NA | | 22.6 | 26.8 | - | - |
| **Bacteriological** | | | | | | | | |
| BACT-Enterococci | Enterococci | MPN/100 mL | 151 (a) | 1. Basin Plan | **500,000** | **1,300,000** | 100% | NA[1] |
| BACT-Fecal Coliform | Fecal Coliform | MPN/100 mL | 4,000 | 1. Basin Plan REC-1/REC-2 | **9,000,000** | **5,000,000** | 100% | NA[1] |
| BACT-Total Coliform | Total Coliform | MPN/100 mL | NA | 1. Basin Plan | 9,000,000 | 16,000,000 | - | - |
| **Wet Chemistry** | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (b) | 6. U.S. EPA Water Quality Criteria (Freshwater) | **16.4** | **20** | 100% | NA[1] |
| CHEM-Conventional | Biochemical Oxygen Demand | mg/L | 10 | 8. McNeeley (1979) | **44.3** | **41** | 100% | NA[1] |
| CHEM-Conventional | Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | **393** | **220** | 100% | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.05 | <0.15 | 0% | NA[1] |
| CHEM-Conventional | Surfacants (MBAS) | mg/L | 0.5 | 1. Basin Plan | **5.8** | **3.2** | 100% | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 58 | 14. NSQD, 1. Basin Plan | **2,150** | **710** | 100% | NA[1] |
| CHEM-Conventional | Turbidity | NTU | 20 | 1. Basin Plan | **1,137** | **140** | 100% | NA[1] |
| NA | Dissolved Organic Carbon | mg/L | NA | | 24.4 | 18 | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 21.1 | 25 | - | - |
| NA | Total Organic Carbon | mg/L | NA | | 36.7 | 20 | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | <0.05 | 0.064J | 0% | NA[1] |
| NUTR-Total Nitrogen | Total Nitrogen (calculated) | mg/L | 1 | 1. Basin Plan | **21.1** | **25.064** | 100% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Dissolved Phosphorus | mg/L | 0.1 | 1. Basin Plan | **4.001** | **1.7** | 100% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Total Phosphorus | mg/L | 0.1 | 1. Basin Plan | **14.619** | **9** | 100% | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids | mg/L | 2,100 (c) | 1. Basin Plan | 720 | 1,200 | 0% | NA[1] |
| **Pesticides** | | | | | | | | |
| CHEM-Pesticides | Chlorpyrifos | µg/L | 0.02 (acute) / 0.014 (chronic) | 12. CA Dept. of Fish & Game, 2000 | <0.002 | <0.01 | 0% | NA[1] |
| CHEM-Pesticides | Diazinon | µg/L | 0.08 (acute) / 0.05 (chronic) | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon | <0.004 | <0.01 | 0% | NA[1] |
| CHEM-Pesticides | Malathion | µg/L | 0.43 | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | <0.006 | <0.01 | 0% | NA[1] |
| **Hardness** | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 419.7 | 720 | - | - |
| **Total Metals** | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.0015 | 0.00093 | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.05 | 1. Basin Plan | 0.0266 | 0.018 | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | 0.005 | 1. Basin Plan | 0.0016 | 0.0005 | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | 0.05 | 1. Basin Plan | 0.0348 | 0.023 | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | 1 | 1. Basin Plan | 0.1292 | 0.061 | 0% | NA[1] |
| NA | Lead | mg/L | NA | | 0.1495 | 0.052 | - | - |
| CHEM-Metals | Nickel | mg/L | 0.1 | 1. Basin Plan | 0.0632 | 0.029 | 0% | NA[1] |
| CHEM-Metals | Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | 0.001 | 0.00065 | 0% | NA[1] |
| CHEM-Metals | Zinc | mg/L | 5 | 1. Basin Plan | 0.4531 | 0.16 | 0% | NA[1] |
| **Dissolved Metals** | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.0015 | 0.00097 | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.34 (acute) / 0.15 (chronic) | 16. 40 CFR 131.38 | 0.0138 | 0.0096 | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | <0.0004 | <0.0001 | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | (d) | 16. 40 CFR 131.38 | 0.0004J | 0.00028 | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | (d) | 16. 40 CFR 131.38 | <0.0008 | 0.003 | 0% | NA[1] |
| CHEM-Metals | Lead | mg/L | (d) | 16. 40 CFR 131.38 | 0.00013 | 0.00007J | 0% | NA[1] |
| CHEM-Metals | Selenium | mg/L | NA | 16. 40 CFR 131.38 | 0.00049 | 0.00036J | 0% | NA[1] |
| CHEM-Metals | Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.0095 | 0.0057 | 0% | NA[1] |

(a) Water Quality Benchmark for Enterococci are based on the maximum criteria for frequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan) 1994 (with amendments effective prior to April 25, 2007).

(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.

(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.

NA indicate no criteria or published value was available or applicable to the matrix or program. (-) Unable to calculate because there is no criteria or published value available for the analyte. NA[1]– Three or more years of data required to calculate the Historical Mean Ratio To Benchmark.

J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

Shaded text – exceeds water quality benchmarks.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

## Tijuana River Watershed Management Area TJR-TWAS-2 Wet Long Term Effectiveness Assessment Table

| Category Group | Analyte | Units | Water Quality Benchmarks | Benchmark References | Tijuana River | | 2009-2010 Exceedances | Historical Mean Ratio to Benchmark |
|---|---|---|---|---|---|---|---|---|
| | | | | | TJR-TWAS-2 | TJR-TWAS-2 | | |
| | | | | | 11/28/09 | 2/6/10 | | |
| **General/Physical/Organic** | | | | | | | | |
| NA | Electrical Conductivity | µmhos/cm | NA | 2. CCR, 5. Goldbook | 1,129 | 663 | - | - |
| CHEM-Conventional | Oil & Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000 | **18.8** | 9.9 | 50% | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.91 | 7.41 | 0% | NA[1] |
| NA | Water Temperature | Celcius | NA | | 13.8 | 16.6 | - | - |
| **Bacteriological** | | | | | | | | |
| BACT-Enterococcus | Enterococcus | MPN/100 mL | NA | 1. Basin Plan | 16,000,000 | 2,400,000 | - | - |
| BACT-Fecal Coliform | Fecal Coliform | MPN/100 mL | 4,000 | 1. Basin Plan REC-1/REC-2 | **5,000,000** | **5,000,000** | 100% | NA[1] |
| BACT-Total Coliform | Total Coliform | MPN/100 mL | NA | 1. Basin Plan | 9,000,000 | 16,000,000 | - | - |
| **Wet Chemistry** | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (a) | 6. U.S. EPA Water Quality Criteria (Freshwater) | 8.4 | 14.83 | 0% | NA[1] |
| CHEM-Conventional | Biochemical Oxygen Demand | mg/L | 30 | 4. MSGP 2000, 8. McNeeley (1979) | **76.2** | **66.6** | 100% | NA[1] |
| CHEM-Conventional | Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | 111 | **259** | 50% | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | 0.56 | <0.75 | 0% | NA[1] |
| CHEM-Conventional | Surfacants (MBAS) | mg/L | 0.5 | 1. Basin Plan | **4.051** | 0.026 | 50% | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 100 | 4. MSGP 2000, 1. Basin Plan | **5,717.5** | **2,630** | 100% | NA[1] |
| CHEM-Conventional | Turbidity | NTU | 20 | 1. Basin Plan | **2,910** | **1,446** | 100% | NA[1] |
| NA | Dissolved Organic Carbon | mg/L | NA | | 41.6 | 69.4 | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 35.76 | 21.1 | - | - |
| NA | Total Organic Carbon | mg/L | NA | | 48.2 | 66.6 | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | 3.52 | <0.11 | 0% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Dissolved Phosphorus | mg/L | 2 | 4. MSGP 2000 | 1.637 | **5.882** | 50% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Total Phosphorus | mg/L | 2 | 4. MSGP 2000 | **15.893** | **13.745** | 100% | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids | mg/L | 2,100 (b) | 1. Basin Plan | 560 | 1,770B | 0% | NA[1] |
| **Pesticides** | | | | | | | | |
| CHEM-Pesticides | Chlorpyrifos | µg/L | 0.2 (acute) / 0.014 (chronic) | 12. CA Dept. of Fish & Game, 2000 | <0.002 | <0.002 | 0% | NA[1] |
| CHEM-Pesticides | Diazinon | µg/L | 0.08 (acute) / 0.05 (chronic) | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon | <0.004 | <0.004 | 0% | NA[1] |
| CHEM-Pesticides | Malathion | µg/L | 0.43 | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | <0.006 | <0.006 | 0% | NA[1] |
| **Hardness** | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 174.9 | 658.1 | - | - |
| **Total Metals** | | | | | | | | |
| NA | Antimony | mg/L | NA | | 0.0044 | 0.0016 | - | - |
| NA | Arsenic | mg/L | NA | | 0.0394 | 0.0217 | - | - |
| NA | Cadmium | mg/L | NA | | 0.0025 | 0.0013 | - | - |
| NA | Chromium | mg/L | NA | | 0.0194 | 0.0291 | - | - |
| NA | Copper | mg/L | NA | | 0.2277 | 0.1351 | - | - |
| NA | Lead | mg/L | NA | | 0.15854 | 0.1512 | - | - |
| NA | Nickel | mg/L | NA | | 0.0643 | 0.0681 | - | - |
| CHEM-Metals | Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | 0.0004J | 0.0009 | 0% | NA[1] |
| NA | Zinc | mg/L | NA | | 1.038 | 0.4787 | - | - |
| **Dissolved Metals** | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.006 | 0.0016 | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.34 (c) | 16. 40 CFR 131.38 | 0.0124 | 0.0132 | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | <0.0004 | <0.0004 | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | (d) | 16. 40 CFR 131.38 | 0.0006 | 0.0004J | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | (d) | 16. 40 CFR 131.38 | 0.0029 | 0.0007J | 0% | NA[1] |
| CHEM-Metals | Lead | mg/L | (d) | 16. 40 CFR 131.38 | 0.00057 | 0.0001 | 0% | NA[1] |
| CHEM-Metals | Nickel | mg/L | (d) | 16. 40 CFR 131.38 | 0.012 | 0.0232 | 0% | NA[1] |
| NA | Selenium | mg/L | NA | | 0.0025 | 0.0009 | - | - |
| CHEM-Metals | Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.0083 | 0.0005 | 0% | NA[1] |
| **Pyrethroid** | | | | | | | | |
| NA | Allethrin | µg/L | NA | | <0.0005 | <0.0005 | - | - |
| CHEM-Pesticides | Bifenthrin | µg/L | 0.0093/0.0130* | Anderson et al., 2006 | **0.0178** | **0.0327B** | 100% | NA[1] |
| CHEM-Pesticides | Cyfluthrin | µg/L | 0.344 | Wheelock et al. 2004 | 0.0321 | <0.0005 | 0% | NA[1] |
| CHEM-Pesticides | Cypermethrin | µg/L | 0.683 | Wheelock et al. 2004 | 0.5917 | 0.2542 | 0% | NA[1] |
| NA | Danitol | µg/L | NA | | 0.0048 | 0.0082B | - | - |
| NA | Deltamethrin | µg/L | NA | | <0.0005 | <0.0005 | - | - |
| CHEM-Pesticides | Esfenvalerate | µg/L | 0.25 | Wheelock et al. 2004 | 0.0065 | 0.0127 | | |
| CHEM-Pesticides | L-Cyhalothrin | µg/L | 0.2 | Wheelock et al. 2004 | <0.0005 | 0.029 | 0% | NA[1] |
| CHEM-Pesticides | Permethrin | µg/L | 0.021/0.039/0.047* | Anderson et al., 2006/Wheelock et al., 2005 | **0.3612** | <0.005 | 0% | NA[1] |
| NA | Prallethrin | µg/L | NA | | <0.0005 | <0.0005 | 50% | NA[1] |

(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
*The lowest value presented in the range was used for conservative purposes.
NA indicate no criteria or published value was available or applicable to the matrix or program.
-Unable to calculate because there is no criteria or published value available for the analyte.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio To Benchmark and the Historical Frequency Above Benchmark.
B-Anayte was detected in the associated method blank.
H-Sample received and or/analyzed past the recommended holding time.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

Shaded text – exceeds water quality benchmark.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

## Tijuana River Watershed Management Area TJR-TWAS-1 Dry Long Term Effectiveness Assessment Table

| Category Group | Analyte | Units | Water Quality Benchmarks | Benchmark References | Tijuana River TJR-TWAS-1 3/17/10 | Tijuana River TJR-TWAS-1 5/11/10 | 2009-2010 Exceedances | Historical Mean Ratio to Benchmark |
|---|---|---|---|---|---|---|---|---|
| **General/Physical/Organic** | | | | | | | | |
| NA | Electrical Conductivity | µmhos/cm | NA | 2. CCR, 5. Goldbook | 1,877 | 1,634 | - | - |
| CHEM-Conventional | Oil & Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL | <5 | <5 | 0% | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.97 | 7.77 | 0% | NA[1] |
| NA | Water Temperature | Celsius | NA | | 11.9 | 14.9 | - | - |
| **Bacteriological** | | | | | | | | |
| BACT-Enterococci | Enterococci | MPN/100 mL | 151 (a) | 1. Basin Plan | <20 | 170 | 50% | NA[1] |
| BACT-Fecal Coliform | Fecal Coliform | MPN/100 mL | 400 | 1. Basin Plan REC-1/REC-2 | 20 | <20 | 0% | NA[1] |
| BACT-Total Coliform | Total Coliform | MPN/100 mL | NA | 1. Basin Plan | 1,300 | 5,000 | - | - |
| **Wet Chemistry** | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (b) | 6. U.S. EPA Water Quality Criteria (Freshwater) | <0.03 | 0.083J | 0% | NA[1] |
| CHEM-Conventional | Biochemical Oxygen Demand | mg/L | 10 | 8. McNeeley (1979) | <2 | 1.6J | 0% | NA[1] |
| CHEM-Conventional | Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | 13.4 | 20 | 0% | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.05 | <0.15 | 0% | NA[1] |
| CHEM-Conventional | Surfacants (MBAS) | mg/L | 0.5 | 1. Basin Plan | 0.037 | 0.03J | 0% | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 58 | 14. NSQD, 1. Basin Plan | 1.7J | <5 | 0% | NA[1] |
| CHEM-Conventional | Turbidity | NTU | 20 | 1. Basin Plan | 2.8 | 2.4 | 0% | NA[1] |
| NA | Dissolved Organic Carbon | mg/L | NA | | 7.5 | 7.3 | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | <1 | 0.46 | - | - |
| NA | Total Organic Carbon | mg/L | NA | | 7.6 | 7.5 | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | <0.05 | 0.11 | 0% | NA[1] |
| NUTR-Total Nitrogen | Total Nitrogen (calculated) | mg/L | 1 | 1. Basin Plan | <1 | 0.57 | 0% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Dissolved Phosphorus | mg/L | 0.1 | 1. Basin Plan | 0.071 | 0.049 | 0% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Total Phosphorus | mg/L | 0.1 | 1. Basin Plan | 0.074 | 0.1 | 0% | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids | mg/L | 500 (c) | 1. Basin Plan | 1,090 | 1,100 | 100% | NA[1] |
| **Pesticides** | | | | | | | | |
| CHEM-Pesticides | Chlorpyrifos | µg/L | 0.02 (acute) / 0.014 (chronic) | 12. CA Dept. of Fish & Game, 2000 | <0.002H | <0.01 | 0% | NA[1] |
| CHEM-Pesticides | Diazinon | µg/L | 0.08 (acute) / 0.05 (chronic) | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon | <0.004H | <0.01 | 0% | NA[1] |
| CHEM-Pesticides | Malathion | µg/L | 0.43 | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | <0.006H | <0.01 | 0% | NA[1] |
| **Hardness** | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 469 | 480 | - | - |
| **Total Metals** | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.0001J | 0.00008J | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.05 | 1. Basin Plan | 0.0048 | 0.0027 | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | 0.005 | 1. Basin Plan | <0.0004 | 0.0001 | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | 0.05 | 1. Basin Plan | 0.0001J | 0.00013J | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | 1 | 1. Basin Plan | 0.0008 | 0.00048J | 0% | NA[1] |
| NA | Lead | mg/L | NA | | 0.0003 | 0.00045 | - | - |
| CHEM-Metals | Nickel | mg/L | 0.1 | 1. Basin Plan | 0.001 | 0.0004J | 0% | NA[1] |
| CHEM-Metals | Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | 0.0003J | 0.00023J | 0% | NA[1] |
| CHEM-Metals | Zinc | mg/L | 5 | 1. Basin Plan | <0.0005 | 0.0012J | 0% | NA[1] |
| **Dissolved Metals** | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.0001J | 0.00008J | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.34 (acute) / 0.15 (chronic) | 16. 40 CFR 131.38 | 0.004 | 0.0024 | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | <0.0004 | 0.0001 | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | (d) | 16. 40 CFR 131.38 | <0.0005 | 0.00006J | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | (d) | 16. 40 CFR 131.38 | 0.0004J | 0.00043J | 0% | NA[1] |
| CHEM-Metals | Lead | mg/L | (d) | 16. 40 CFR 131.38 | <0.0001 | <0.0002 | 0% | NA[1] |
| CHEM-Metals | Selenium | mg/L | NA | 16. 40 CFR 131.38 | 0.0012 | 0.00027J | 0% | NA[1] |
| CHEM-Metals | Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.0095 | 0.0018J | 0% | NA[1] |

(a) Water Quality Benchmark for Enterococci are based on the maximum criteria for frequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan) 1994 (with amendments effective prior to April 25, ,2007).

(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.

(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.

NA indicate no criteria or published value was available or applicable to the matrix or program. (-) Unable to calculate because there is no criteria or published value available for the analyte. NA[1]– Three or more years of data required to calculate the Historical Mean Ratio To Benchmark.

J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

H-Sample received and/or analyzed past the recommended holding time.

Shaded text – exceeds water quality benchmarks.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River Watershed Management Area TJR-TWAS-1 Wet Long Term Effectiveness Assessment Table**

| Category Group | Analyte | Units | Water Quality Benchmarks | Benchmark References | Tijuana River TJR-TWAS-1 12/7/09 | Tijuana River TJR-TWAS-1 2/6/10 | 2009-2010 Exceedances | Historical Mean Ratio to Benchmark |
|---|---|---|---|---|---|---|---|---|
| **General/Physical/Organic** | | | | | | | | |
| NA | Electrical Conductivity | µmhos/cm | NA | 2. CCR, 5. Goldbook | 289 | 672 | - | - |
| CHEM-Conventional | Oil & Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000 | 2.6J | 1.5J | 0% | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.61 | 6.54 | 0% | NA[1] |
| NA | Water Temperature | Celcius | NA | | 9.3 | 11.5 | - | - |
| **Bacteriological** | | | | | | | | |
| BACT-Enterococcus | Enterococcus | MPN/100 mL | NA | 1. Basin Plan | 17,000 | 5,000 | - | - |
| BACT-Fecal Coliform | Fecal Coliform | MPN/100 mL | 4,000 | 1. Basin Plan REC-1/REC-2 | **8,000** | **6,000** | 100% | NA[1] |
| BACT-Total Coliform | Total Coliform | MPN/100 mL | NA | 1. Basin Plan | 23,000 | 220,000 | - | - |
| **Wet Chemistry** | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (a) | 6. U.S. EPA Water Quality Criteria (Freshwater) | 0.18 | 0.08 | 0% | NA[1] |
| CHEM-Conventional | Biochemical Oxygen Demand | mg/L | 30 | 4. MSGP 2000, 8. McNeeley (1979) | <2H | 3 | 0% | NA[1] |
| CHEM-Conventional | Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | 52.3 | 68.7 | 0% | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | 0.07 | <0.15 | 0% | NA[1] |
| CHEM-Conventional | Surfacants (MBAS) | mg/L | 0.5 | 1. Basin Plan | **0.76** | 0.039 | 50% | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 100 | 4. MSGP 2000, 1. Basin Plan | **413** | **241.3** | 100% | NA[1] |
| CHEM-Conventional | Turbidity | NTU | 20 | 1. Basin Plan | **306.5** | **275** | 100% | NA[1] |
| NA | Dissolved Organic Carbon | mg/L | NA | | 15.2 | 9.5 | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 1.78 | 1.148 | - | - |
| NA | Total Organic Carbon | mg/L | NA | | 14.8 | 9.3 | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | 0.86 | 0.31 | 0% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Dissolved Phosphorus | mg/L | 2 | 4. MSGP 2000 | 0.333 | 0.261 | 0% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Total Phosphorus | mg/L | 2 | 4. MSGP 2000 | 0.825 | 1.046 | 0% | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids | mg/L | 500 (b) | 1. Basin Plan | 286 | **668B** | 50% | NA[1] |
| **Pesticides** | | | | | | | | |
| CHEM-Pesticides | Chlorpyrifos | µg/L | 0.2 (acute) / 0.014 (chronic) | 12. CA Dept. of Fish & Game, 2000 | <0.002 | <0.002 | 0% | NA[1] |
| CHEM-Pesticides | Diazinon | µg/L | 0.08 (acute) / 0.05 (chronic) | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon | <0.004 | <0.004 | 0% | NA[1] |
| CHEM-Pesticides | Malathion | µg/L | 0.43 | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | <0.006 | <0.006 | 0% | NA[1] |
| **Hardness** | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 56.9 | 270.6 | - | - |
| **Total Metals** | | | | | | | | |
| NA | Antimony | mg/L | NA | | 0.0002J | 0.0003J | - | - |
| NA | Arsenic | mg/L | NA | | 0.0018 | 0.0033 | - | - |
| NA | Cadmium | mg/L | NA | | 0.0003J | 0.0003J | - | - |
| NA | Chromium | mg/L | NA | | 0.0018 | 0.0017 | - | - |
| NA | Copper | mg/L | NA | | 0.0111 | 0.0055 | - | - |
| NA | Lead | mg/L | NA | | 0.02199 | 0.0092 | - | - |
| NA | Nickel | mg/L | NA | | 0.0027 | 0.0016 | - | - |
| CHEM-Metals | Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | 0.0002J | 0.0006 | 0% | NA[1] |
| NA | Zinc | mg/L | NA | | 0.1257 | 0.0479 | - | - |
| **Dissolved Metals** | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.0002J | 0.0003J | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.34 (c) | 16. 40 CFR 131.38 | 0.0015 | 0.0025 | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | <0.0004 | <0.0004 | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | (d) | 16. 40 CFR 131.38 | 0.0004J | 0.0002J | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | (d) | 16. 40 CFR 131.38 | 0.0043 | 0.0018 | 0% | NA[1] |
| CHEM-Metals | Lead | mg/L | (d) | 16. 40 CFR 131.38 | 0.00168 | 0.00006J | 0% | NA[1] |
| CHEM-Metals | Nickel | mg/L | (d) | 16. 40 CFR 131.38 | 0.0007 | 0.0008 | 0% | NA[1] |
| NA | Selenium | mg/L | NA | | 0.0005 | 0.0006 | - | - |
| CHEM-Metals | Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.0178 | 0.0036 | 0% | NA[1] |
| **Pyrethroid** | | | | | | | | |
| NA | Allethrin | µg/L | NA | | <0.0005 | <0.0005 | - | - |
| CHEM-Pesticides | Bifenthrin | µg/L | 0.0093/0.0130* | Anderson et al., 2006 | 0.0058 | **0.0277B** | 50% | NA[1] |
| CHEM-Pesticides | Cyfluthrin | µg/L | 0.344 | Wheelock et al. 2004 | <0.0005 | <0.0005 | 0% | NA[1] |
| CHEM-Pesticides | Cypermethrin | µg/L | 0.683 | Wheelock et al. 2004 | <0.0005 | <0.0005 | 0% | NA[1] |
| NA | Danitol | µg/L | NA | | <0.0005 | 0.0042B | - | - |
| NA | Deltamethrin | µg/L | NA | | <0.0005 | <0.0005 | - | - |
| CHEM-Pesticides | Esfenvalerate | µg/L | 0.25 | Wheelock et al. 2004 | <0.0005 | 0.0026 | 0% | NA[1] |
| NA | Fenvalerate | µg/L | NA | | <0.0005 | 0.0081 | - | - |
| NA | Fluvalinate | µg/L | NA | | <0.0005 | <0.0005 | - | - |
| CHEM-Pesticides | L-Cyhalothrin | µg/L | 0.2 | Wheelock et al. 2004 | <0.0005 | 0.027 | 0% | NA[1] |
| CHEM-Pesticides | Permethrin | µg/L | 0.021/0.039/0.047* | Anderson et al., 2006/Wheelock et al., 2005 | <0.005 | <0.005 | 0% | NA[1] |
| NA | Prallethrin | µg/L | NA | | <0.0005 | <0.0005 | - | - |

(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
*The lowest value presented in the range was used for conservative purposes.
NA indicate no criteria or published value was available or applicable to the matrix or program.
-Unable to calculate because there is no criteria or published value available for the analyte.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio To Benchmark and the Historical Frequency Above Benchmark.
B-Anayte was detected in the associated method blank.
H-Sample received and/ or analyzed past the recommended holding time.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

Shaded text – exceeds water quality benchmark.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

## Tijuana River Watershed Management Area TJR-MLS Wet Long Term Effectiveness Assessment Table

| Analyte | Units | Water Quality Benchmarks | Benchmark References | 2005-2006 | | | 2006-2007 | | | 2007-2008 | 2008-2009 | 2009-2010 | | Frequency Above Benchmarks | Mean Ratio to Benchmarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 10/18/05 | 2/19/06 | 2/28/06 | 10/14/06 | 1/30/07 | 4/20/07 | - | 12/16/08 | 11/28/09 | 2/6/10 | | |
| **General / Physical / Organic** | | | | | | | | | | | | | | | |
| Electrical Conductivity | ~mhos/cm | NA | 2. CCR, 5. Goldbook | 1,715 | 1,806 | 752 | 702 | 1,460 | 991 | | 1,386 | 1,376 | 644 | | |
| Oil and Grease | mg/L | 10 | 1 Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000 | 2.5 | 1.32 | 2.9 | 38 | <5 | <5 | | <5 | 6.3 | 16.1 | 22% | 0.83 |
| pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.56 | 7.82 | 7.87 | 7.56 | 7.47 | 7.53 | | 7.65 | 7.47 | 7.26 | 0% | 0.00 |
| Water Temperature | Celcius | NA | | 17.60 | 13.60 | 15.50 | 16.80 | 11.90 | 15.50 | | 13.60 | 14.5 | 16.4 | | |
| **Bacteriological** | | | | | | | | | | | | | | | |
| Enterococci | MPN/100 mL | NA | 1. Basin Plan | 5,000,000 | 800,000 | 500,000 | 1,700,000 | 800,000 | 1,700,000 | | 800,000 | 9,000,000 | 3,000,000 | | |
| Fecal Coliform | MPN/100 mL | 4,000 | 1.Basin Plan REC-1/REC-2 | >16,000,000 | 9,000,000 | 500,000 | 16,000,000 | 2,200,000 | 1,700,000 | | 9,000,000 | 2,800,000 | 9,000,000 | 100% | 1838.89 |
| Total Coliform | MPN/100 mL | NA | 1. Basin Plan | >16,000,000 | 16,000,000 | 2,200,000 | 16,000,000 | 5,000,000 | 5,000,000 | | 16,000,000 | 16,000,000 | 16,000,000 | | |
| **Wet Chemistry** | | | | | | | | | | | | | | | |
| Ammonia as N | mg/L | (a) | 6. USEPA Water Quality Criteria (Freshwater) | 16 | 4.38 | 7.21 | 6.81 | 7.83 | 10.4 | | 0.41 | 7.35 | 7.11 | 0% | 0.43 |
| Biochemical Oxygen Demand | mg/L | 30 | 4. MSGP 2000, 8. McNeeley (1979) | 23.1 | 28 | 25 | 15.1 | 77.7 | 67.6 | | 82.2 | 74.1 | >77.8 | 56% | 1.74 |
| Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | 170 | 140 | 141 | 522 | 480 | 379 | | 81 | 123 | 74.6 | 78% | 1.95 |
| Dissolved Organic Carbon | mg/L | NA | | 30.2 | 37.9 | 82.4 | 65 | 47.6 | 42.5 | | 13.6 | 45.6 | 13.7 | | |
| Dissolved Phosphorus | mg/L | 2 | 4. MSGP 2000 | 1.23 | 1.76 | 1.72 | 1.91 | 1.88 | 2.36 | | 1.135 | 2.096 | 1.279 | 22% | 0.85 |
| Nitrate as N | mg/L | 10 | 1. Basin Plan | 3.54 | 2.65 | 1.45 | 7.62 | 2.34 | 2.36 | | 3.08 | 5.06 | 1.4 | 0% | 0.33 |
| Nitrite as N | mg/L | 1 | 1. Basin Plan | 0.81 | 0.66 | 0.29 | 0.43 | 0.66 | 0.33 | | 0.26 | 1.25 | 0.39 | 11% | 0.56 |
| Surfactants (MBAS) | mg/L | 0.5 | 1. Basin Plan | 0.5 | 0.6 | <0.5 | <0.5 | <0.5 | <0.5 | | 0.60 | 4.65H | <0.025 | 33% | 1.64 |
| Total Dissolved Solids | mg/L | 2,100 (b) | 1. Basin Plan | 1,290 | 532 | 720 | 460 | 796 | 424 | | 460 | 460 | 710B | 0% | 0.31 |
| Total Kjeldahl Nitrogen | mg/L | NA | | 16.3 | 14.7 | 7.5 | 9.7 | 21.6 | 11.4 | | 10 | 20.2 | 18.5 | | |
| Total Organic Carbon | mg/L | NA | | 69.7 | 51.7 | 136 | 130 | 60.4 | 76.8 | | 28.2 | 46.5 | 14 | | |
| Total Phosphorus | mg/L | 2 | 4. MSGP 2000 | 2.45 | 1.98 | 1.83 | 3 | 1.94 | 3.12 | | 3.40 | 5.867 | 6.452 | 67% | 1.67 |
| Total Suspended Solids | mg/L | 100 | 4. MSGP 2000, 1. Basin Plan | 764 | 8,140 | 7,780 | 1,560 | 692 | 1,080 | | 2,512 | 2,175 | 4,090 | 100% | 31.99 |
| Turbidity | NTU | 20 | 1. Basin Plan | 129 | 192 | 147 | 646 | 197 | 526 | | 1,482 | 1,152 | 2,400 | 100% | 38.17 |
| **Pesticides** | | | | | | | | | | | | | | | |
| Chlorpyrifos | ~g/L | 0.02 (acute) / 0.014 (chronic) | 12. CA Dept. of Fish & Game, 2000 | <0.01 | <0.02 | <0.02 | <0.002 | <0.002 | <0.002 | | <0.002 | <0.002 | <0.002 | 0% | 0.17 |
| Diazinon | ~g/L | 0.08 (acute) / 0.05 (chronic) | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon | 0.241 | 0.278 | 0.128 | 0.347 | 0.272 | 0.390 | No Samples Collected | 0.2094 | <0.004 | <0.004 | 78% | 2.60 |
| Malathion | ~g/L | 0.43 | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | 0.041 | <0.02 | <0.02 | 1.340 | <0.006 | 0.730 | | 0.113 | <0.006 | <0.006 | 33% | 0.89 |
| **Hardness** | | | | | | | | | | | | | | | |
| Total Hardness | mg $CaCO_3$/L | NA | | 544 | 706 | 496 | 379 | 348 | 263 | | 87.8 | 201.5 | 177.1 | | |
| **Total Metals** | | | | | | | | | | | | | | | |
| Antimony | mg/L | NA | | <0.005 | 0.005 | <0.005 | 0.004 | 0.008 | 0.004 | | 0.0009 | 0.0027 | 0.0023 | | |
| Arsenic | mg/L | NA | | 0.014 | 0.019 | 0.012 | 0.025 | 0.009 | 0.009 | | 0.0095 | 0.0206 | 0.0138 | | |
| Cadmium | mg/L | NA | | <0.001 | 0.006 | 0.001 | 0.006 | <0.001 | <0.001 | | 0.0009 | 0.0009 | 0.0013 | | |
| Chromium | mg/L | NA | | <0.005 | 0.006 | 0.006 | 0.05 | 0.031 | 0.024 | | 0.0093 | 0.0084 | 0.0094 | | |
| Copper | mg/L | NA | | 0.013 | 0.082 | 0.011 | 0.07 | 0.104 | 0.045 | | 0.0093 | 0.0004 | 0.0481 | | |
| Lead | mg/L | NA | | 0.009 | 0.089 | 0.008 | 0.102 | 0.078 | 0.047 | | 0.0594 | 0.0549L | 0.0731 | | |
| Nickel | mg/L | NA | | 0.025 | 0.050 | 0.017 | 0.037 | 0.032 | 0.023 | | 0.0265 | 0.0335 | 0.0288 | | |
| Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | <0.005 | <0.005 | <0.005 | <0.004 | <0.004 | <0.004 | | 0.00033 | 0.0006 | 0.0011 | 0% | 0.34 |
| Zinc | mg/L | NA | | 0.109 | 1.100 | 0.176 | 0.558 | 0.456 | 0.296 | | 0.3394 | 0.3608 | 0.3405 | | |
| **Dissolved Metals** | | | | | | | | | | | | | | | |
| Antimony | mg/L | 0.006 | 1. Basin Plan | <0.005 | <0.005 | <0.005 | 0.003 | 0.005 | 0.003 | | 0.0032 | 0.0054 | 0.0029 | 0% | 0.56 |
| Arsenic | mg/L | 0.34 (c) | 16. 40 CFR 131.38 | 0.007 | 0.003 | <0.001 | 0.004 | <0.001 | <0.001 | | 0.0073 | 0.014 | 0.008 | 0% | 0.01 |
| Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | <0.001 | 0.002 | <0.001 | <0.001 | <0.001 | <0.001 | | <0.0004 | <0.0004 | <0.0004 | 0% | 0.05 |
| Chromium | mg/L | (d) | 16. 40 CFR 131.38 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | 0.00031 | 0.0007 | 0.00031 | 0% | 0.09 |
| Copper | mg/L | (d) | 16. 40 CFR 131.38 | 0.008 | 0.012 | 0.009 | 0.01 | 0.01 | 0.008 | | 0.0019 | 0.0041 | 0.0024 | 0% | 0.21 |
| Lead | mg/L | (d) | 16. 40 CFR 131.38 | <0.002 | <0.002 | <0.002 | <0.001 | <0.001 | <0.001 | | 0.00015 | 0.0007 | 0.0005 | 0% | 0.04 |
| Nickel | mg/L | (d) | 16. 40 CFR 131.38 | 0.014 | 0.013 | 0.008 | 0.007 | 0.011 | 0.007 | | 0.0048 | 0.0153 | 0.0066 | 0% | 0.04 |
| Selenium | mg/L | NA | | <0.005 | <0.005 | <0.005 | <0.004 | <0.004 | <0.004 | | 0.00043 | 0.002 | 0.0008 | | |
| Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.033 | 0.031 | <0.020 | 0.021 | 0.02 | <0.02 | | 0.0034 | 0.0129 | 0.0058 | 0% | 0.85 |
| **Pyrethroid** | | | | | | | | | | | | | | | |
| Allethrin | ~g/L | NA | | NS | NS | NS | NS | NS | NS | | <0.002 | <0.0005 | <0.0005 | 0% | |
| Bifenthrin | ~g/L | 0.0093/0.013* | Anderson et al. in press/Weston | NS | NS | NS | NS | NS | NS | | 0.0316 | <0.0005 | 0.02658 | 50% | 1.733 |
| Cyfluthrin | ~g/L | 0.344 | San Diego Regional Monitoring Program | NS | NS | NS | NS | NS | NS | | <0.002 | 0.0403 | <0.0005 | 0% | 0.040 |
| Cypermethrin | ~g/L | 0.683 | San Diego Regional Monitoring Program | NS | NS | NS | NS | NS | NS | | 0.1878 | 0.2183 | 0.1015 | 0% | 0.248 |
| Danitol | ~g/L | NA | | NS | NS | NS | NS | NS | NS | | <0.002 | <0.0005 | 0.0029B | 0% | |
| Deltamethrin | ~g/L | NA | | NS | NS | NS | NS | NS | NS | | <0.002 | <0.0005 | <0.0005 | 0% | |
| Esfenvalerate | ~g/L | 0.25 | San Diego Regional Monitoring Program | NS | NS | NS | NS | NS | NS | | 0.0039 | 0.0036 | 0.0058 | 0% | 0.018 |
| L-Cyhalothrin | ~g/L | 0.2 | San Diego Regional Monitoring Program | NS | NS | NS | NS | NS | NS | | <0.002 | <0.0005 | 0.0295 | 0% | 0.513 |
| Permethrin | ~g/L | 0.021/0.039/0.047* | Anderson et al. in press/Wheelock et al. 2005 | NS | NS | NS | NS | NS | NS | | 0.2728 | <0.005 | <0.005 | 33% | 4.410 |
| Prallethrin | ~g/L | NA | | NS | NS | NS | NS | NS | NS | | <0.002 | <0.0005 | <0.0005 | 0% | |

(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
NA indicates no criteria or published value was available or applicable to the matrix or program.
* The lowest value presented in the range was used for conservative purposes.
B-Anayte was detected in the associated method blank.
H-Sample received and or/analyzed past the recommended holding time.
J flagged values indicate that the reported result is below the reporting limit, but above the method detection limit.

Shaded text – exceeds water quality benchmark and the **CMC** water quality benchmark for metals.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River Watershed Management Area TJR-MLS Dry Long Term Effectiveness Assessment Table**

| Category Group | Analyte | Units | Water Quality Benchmarks | Benchmark References | Tijuana River | | 2009-2010 Exceedances | Historical Mean Ratio to Benchmark |
|---|---|---|---|---|---|---|---|---|
| | | | | | TJR-MLS 3/17/10 | TJR-MLS 5/11/10 | | |
| **General/Physical/Organic** | | | | | | | | |
| NA | Electrical Conductivity | hmhos/cm | NA | 2. CCR, 5. Goldbook | 2,610 | 3,060 | - | - |
| CHEM-Conventional | Oil & Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL | 2.3J | <5 | 0% | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.81 | 7.89 | 0% | NA[1] |
| NA | Water Temperature | Celsius | NA | | 16.3 | 19.4 | - | - |
| **Bacteriological** | | | | | | | | |
| BACT-Enterococci | Enterococci | MPN/100 mL | 151 (a) | 1. Basin Plan | **500,000** | **50,000** | 100% | NA[1] |
| BACT-Fecal Coliform | Fecal Coliform | MPN/100 mL | 4,000 | 1. Basin Plan REC-1/REC-2 | **5,000,000** | **1,300,000** | 100% | NA[1] |
| BACT-Total Coliform | Total Coliform | MPN/100 mL | NA | 1. Basin Plan | 16,000,000 | 5,000,000 | - | - |
| **Wet Chemistry** | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (b) | 6. U.S. EPA Water Quality Criteria (Freshwater) | **11.4** | **13** | 100% | NA[1] |
| CHEM-Conventional | Biochemical Oxygen Demand | mg/L | 10 | 8. McNeeley (1979) | **40.8** | **13** | 100% | NA[1] |
| CHEM-Conventional | Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | **132** | 64 | 50% | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | 0.45 | 0.21 | 0% | NA[1] |
| CHEM-Conventional | Surfacants (MBAS) | mg/L | 0.5 | 1. Basin Plan | **4.8** | **4.5** | 100% | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 58 | 14. NSQD, 1. Basin Plan | 42.5 | 23 | 0% | NA[1] |
| CHEM-Conventional | Turbidity | NTU | 20 | 1. Basin Plan | **27.5** | 13 | 50% | NA[1] |
| NA | Dissolved Organic Carbon | mg/L | NA | | 20.9 | 19 | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 14.3 | 14 | - | - |
| NA | Total Organic Carbon | mg/L | NA | | 23.8 | 19 | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | 0.58 | 4.7 | 0% | NA[1] |
| NUTR-Total Nitrogen | Total Nitrogen (calculated) | mg/L | 1 | 1. Basin Plan | **15.33** | **18.91** | 100% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Dissolved Phosphorus | mg/L | 0.1 | 1. Basin Plan | **3.135** | **4.7** | 100% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Total Phosphorus | mg/L | 0.1 | 1. Basin Plan | **3.902** | **4.3** | 100% | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids | mg/L | 2,100 (c) | 1. Basin Plan | 1,344 | 1,600 | 0% | NA[1] |
| **Pesticides** | | | | | | | | |
| CHEM-Pesticides | Chlorpyrifos | −g/L | 0.2 (acute) / 0.014 (chronic) | 12. CA Dept. of Fish & Game, 2000 | <0.002 | <0.01 | 0% | NA[1] |
| CHEM-Pesticides | Diazinon | −g/L | 0.08 (acute) / 0.05 (chronic) | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. U.S. EPA, Aquatic Life Ambient Water Quality Criteria Diazinon | <0.004 | <0.01 | 0% | NA[1] |
| CHEM-Pesticides | Malathion | −g/L | 0.43 | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | <0.006 | <0.01 | 0% | NA[1] |
| **Hardness** | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 422.7 | 550 | - | - |
| **Total Metals** | | | | | | | | |
| NA | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.0008 | 0.00092 | 0% | NA[1] |
| NA | Arsenic | mg/L | 0.05 | 1. Basin Plan | 0.0067 | 0.0068 | 0% | NA[1] |
| NA | Cadmium | mg/L | 0.005 | 1. Basin Plan | <0.0004 | 0.00005J | 0% | NA[1] |
| NA | Chromium | mg/L | 0.05 | 1. Basin Plan | 0.0006 | 0.00066 | 0% | NA[1] |
| NA | Copper | mg/L | 1 | 1. Basin Plan | 0.0114 | 0.0096 | 0% | NA[1] |
| NA | Lead | mg/L | NA | | 0.00315 | 0.0008 | - | - |
| NA | Nickel | mg/L | 0.1 | 1. Basin Plan | 0.0086 | 0.02 | 0% | NA[1] |
| CHEM-Metals | Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | 0.0016 | 0.0011 | 0% | NA[1] |
| NA | Zinc | mg/L | 5 | 1. Basin Plan | 0.0205 | 0.021 | 0% | NA[1] |
| **Dissolved Metals** | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.0008 | 0.00088 | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.34 (acute) / 0.15 (chronic) | 16. 40 CFR 131.38 | 0.0074 | 0.0068 | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | <0.0004 | 0.00003J | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | (d) | 16. 40 CFR 131.38 | 0.0003J | 0.0003 | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | (d) | 16. 40 CFR 131.38 | 0.0041 | 0.0075 | 0% | NA[1] |
| CHEM-Metals | Lead | mg/L | (d) | 16. 40 CFR 131.38 | 0.00047 | 0.0002 | 0% | NA[1] |
| CHEM-Metals | Nickel | mg/L | (d) | 16. 40 CFR 131.38 | 0.0071 | 0.017 | 0% | NA[1] |
| CHEM-Metals | Selenium | mg/L | NA | | 0.001 | 0.001 | | |
| CHEM-Metals | Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.007 | 0.018 | 0% | NA[1] |

(a) Water Quality Benchmark for Enterococci are based on the maximum criteria for the frequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan) 1994 (with amendments effective prior to April 25, ,2007).

(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.

(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.

J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported Value is estimated.

NA indicate no criteria or published value was available or applicable to the matrix or program.

(-) Unable to calculate because there is no criteria or published value available for the analyte.

NA[1]- Three or more years of data required to calculate the Historical Mean Ratio To Benchmark.

Shaded text – exceeds water quality benchmarks.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River WMA 2010-2011 Dry Weather Assessment**
**Analytical Data for SMC05402**

| Category Group | Analyte | Units | Water Quality Benchmarks | HSA Benchmark References | Barrett Lake (911.30) SMC05402 7/28/2011 | 2010-2011 Exceedances | Historical Mean Ratio to Benchmarks | Historical Frequency Above Benchmarks |
|---|---|---|---|---|---|---|---|---|
| **Physical Chemistry** | | | | | | | | |
| NA | Alkalinity | mg/L | NA | | 160 | - | - | - |
| NA | Conductivity | −mhos/cm | NA | | 671 | - | - | - |
| CHEM-Conventional | Dissolved Oxygen | mg/L | <5 | 1. Basin Plan | 8.12 | 0% | NA[1] | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 8.3 | 0% | NA[1] | NA[1] |
| NA | Salinity | PPT | NA | | 0.33 | - | - | - |
| NA | Water Temperature | Celsius | NA | | 20.64 | - | - | - |
| **Periphyton** | | | | | | | | |
| NA | Ash-Free Dry Weight | g/m² | NA | | 68.01 | - | - | - |
| NA | Chlorophyll-a | mg/m² | NA | | 59.9 | - | - | - |
| **Wet Chemistry** | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (a) | 6. USEPA Water Quality Criteria (Freshwater) | <0.048 | 0% | NA[1] | NA[1] |
| CHEM-Conventional | Chloride | mg/L | 250 (b) | 1. Basin Plan | 53 | 0% | NA[1] | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.01 | 0% | NA[1] | NA[1] |
| CHEM-Conventional | Sulfate | mg/L | 250 (c) | 1. Basin Plan | 70 | 0% | NA[1] | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 58 | 14. NSQD, 1. Basin Plan | 2 | 0% | NA[1] | NA[1] |
| NA | Orthophosphate as P | mg/L | NA | | <0.00083 | - | - | - |
| NA | Silica | mg/L | NA | | 36 | - | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 0.12 | - | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | 1 | 0% | NA[1] | NA[1] |
| NUTR-Total Nitrogen | Total Nitrogen | mg/L | 1 | 1. Basin Plan | **1.2** | 100% | NA[1] | NA[1] |
| NUTR-Total Phosphorus | Total Phosphorus | mg/L | 0.1 | 1. Basin Plan | 0.02 | 0% | NA[1] | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids (calculated)[1] | mg/L | 500 (d) | 1. Basin Plan | 470 | 0% | NA[1] | NA[1] |
| **Hardness** | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 200 | - | - | - |
| **Total Metals** | | | | | | | | |
| CHEM-Metals | Arsenic | mg/L | 0.05 | 1. Basin Plan | 0.0011 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Cadmium | mg/L | 0.005 | 1. Basin Plan | <0.00002 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Chromium | mg/L | 0.05 | 1. Basin Plan | <0.000074 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Copper | mg/L | 1.0 | 1. Basin Plan | 0.00032J | 0% | NA[1] | NA[1] |
| NA | Lead | mg/L | NA | | 0.00004J | - | - | - |
| CHEM-Metals | Nickel | mg/L | 0.1 | 1. Basin Plan | 0.0006J | 0% | NA[1] | NA[1] |
| CHEM-Metals | Selenium | mg/L | 0.005 | 40 CFR 131.38 | 0.0014 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Zinc | mg/L | 5.0 | 1. Basin Plan | 0.0011J | 0% | NA[1] | NA[1] |
| **Dissolved Metals** | | | | | | | | |
| CHEM-Metals | Arsenic | mg/L | 0.34 acute / 0.15 chronic | 40 CFR 131.38 | 0.0011 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (e) | 40 CFR 131.38 | <0.00002 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Chromium | mg/L | (e) | 40 CFR 131.38 | <0.000074 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Copper | mg/L | (e) | 40 CFR 131.38 | 0.00029J | 0% | NA[1] | NA[1] |
| CHEM-Metals | Lead | mg/L | (e) | 40 CFR 131.38 | <0.000011 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Nickel | mg/L | (e) | 40 CFR 131.38 | 0.00058J | 0% | NA[1] | NA[1] |
| NA | Selenium | mg/L | NA | | 0.0013 | - | - | - |
| CHEM-Metals | Zinc | mg/L | (e) | 40 CFR 131.38 | 0.0016J | 0% | NA[1] | NA[1] |
| **Pyrethroids** | | | | | | | | |
| NA | Allethrin | −g/L | NA | | <0.00085 | - | - | - |
| CHEM-Pesticides | Bifenthrin | −g/L | 0.0093 | 15. Anderson et al., 2006 | <0.00079 | 0% | NA[1] | NA[1] |
| CHEM-Pesticides | Cyfluthrin | −g/L | 0.344 | 17. Wheelock et al., 2004 | <0.00083 | 0% | NA[1] | NA[1] |
| CHEM-Pesticides | Cypermethrin | −g/L | 0.683 | 17. Wheelock et al., 2004 | <0.00066 | 0% | NA[1] | NA[1] |
| NA | Deltamethrin | −g/L | NA | | <0.0019 | - | - | - |
| CHEM-Pesticides | Esfenvalerate | −g/L | 0.25 | 17. Wheelock et al., 2004 | <0.00098 | 0% | NA[1] | NA[1] |
| NA | Fenvalerate | −g/L | NA | | <0.00098 | 0% | - | - |
| CHEM-Pesticides | L-Cyhalothrin | −g/L | 0.2 | 17. Wheelock et al., 2004 | <0.0012 | 0% | NA[1] | NA[1] |
| CHEM-Pesticides | Permethrin | −g/L | 0.021 | 15. Anderson et al., 2006 | <0.005 | 0% | NA[1] | NA[1] |
| NA | Prallethrin | −g/L | NA | | <0.00092 | - | - | - |

<-Results less than the method detection limit.
NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for chloride is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for sulfate is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for total dissolved solids is based on the San Diego Reginal Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007).
(e) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, may 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
[1] Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio To Benchmarks and Historical Frequency Above Benchmarks .
(-) Unable to calculate because there is no criteria or published value available for the analyte.

Shaded text – exceeds water quality benchmarks.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River WMA 2010-2011 Dry Weather Assessment**
**Analytical Data for SMC03510**

| Category Group | Analyte | Units | Water Quality Benchmarks | HSA Benchmark References | Marron (911.21) SMC03510 7/21/2011 | 2010-2011 Exceedances | Historical Mean Ratio to Benchmarks | Historical Frequency Above Benchmarks |
|---|---|---|---|---|---|---|---|---|
| **Physical Chemistry** | | | | | | | | |
| NA | Alkalinity | mg/L | NA | | 408 | - | - | - |
| NA | Conductivity | −mhos/cm | NA | | 2,458 | - | - | - |
| CHEM-Conventional | Dissolved Oxygen | mg/L | <5 | 1. Basin Plan | 11.24 | 0% | NA[1] | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 8.2 | 0% | NA[1] | NA[1] |
| NA | Salinity | PPT | NA | | 1.27 | - | - | - |
| NA | Water Temperature | Celsius | NA | | 23.12 | - | - | - |
| **Periphyton** | | | | | | | | |
| NA | Ash-Free Dry Weight | g/m² | NA | | 52.99 | - | - | - |
| NA | Chlorophyll-a | mg/m² | NA | | 169.9 | - | - | - |
| **Wet Chemistry** | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (a) | 6. USEPA Water Quality Criteria (Freshwater) | 0.24 | 0% | NA[1] | NA[1] |
| CHEM-Conventional | Chloride | mg/L | 250 (b) | 1. Basin Plan | 280 | 100% | NA[1] | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | 0.15 | 0% | NA[1] | NA[1] |
| CHEM-Conventional | Sulfate | mg/L | 250(c) | 1. Basin Plan | 320 | 100% | NA[1] | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 58 | 14. NSQD, 1. Basin Plan | 5 | 0% | NA[1] | NA[1] |
| NA | Orthophosphate as P | mg/L | NA | | 3.1 | - | - | - |
| NA | Silica | mg/L | NA | | 34 | - | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 1.5 | - | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | 5.45 | 0% | NA[1] | NA[1] |
| NUTR-Total Nitrogen | Total Nitrogen | mg/L | 1 | 1. Basin Plan | 7 | 100% | NA[1] | NA[1] |
| NUTR-Total Phosphorus | Total Phosphorus | mg/L | 0.1 | 1. Basin Plan | 4.5 | 100% | NA[1] | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids (calculated)[1] | mg/L | 500 (d) | 1. Basin Plan | 1,721 | 100% | NA[1] | NA[1] |
| **Hardness** | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 440 | - | - | - |
| **Total Metals** | | | | | | | | |
| CHEM-Metals | Arsenic | mg/L | 0.05 | 1. Basin Plan | 0.0037 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Cadmium | mg/L | 0.005 | 1. Basin Plan | 0.00003J | 0% | NA[1] | NA[1] |
| CHEM-Metals | Chromium | mg/L | 0.05 | 1. Basin Plan | 0.0005 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Copper | mg/L | 1.0 | 1. Basin Plan | 0.0012 | 0% | NA[1] | NA[1] |
| NA | Lead | mg/L | NA | | 0.0001J | - | - | - |
| CHEM-Metals | Nickel | mg/L | 0.1 | 1. Basin Plan | 0.012 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Selenium | mg/L | 0.005 | 40 CFR 131.38 | 0.00048 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Zinc | mg/L | 5.0 | 1. Basin Plan | 0.0044J | 0% | NA[1] | NA[1] |
| **Dissolved Metals** | | | | | | | | |
| CHEM-Metals | Arsenic | mg/L | 0.34 acute / 0.15 chronic | 40 CFR 131.38 | 0.0035 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (e) | 40 CFR 131.38 | 0.00003J | 0% | NA[1] | NA[1] |
| CHEM-Metals | Chromium | mg/L | (e) | 40 CFR 131.38 | 0.00029 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Copper | mg/L | (e) | 40 CFR 131.38 | 0.0012 | 0% | NA[1] | NA[1] |
| CHEM-Metals | Lead | mg/L | (e) | 40 CFR 131.38 | 0.00003J | 0% | NA[1] | NA[1] |
| CHEM-Metals | Nickel | mg/L | (e) | 40 CFR 131.38 | 0.012 | 0% | NA[1] | NA[1] |
| NA | Selenium | mg/L | NA | | 0.00047 | - | - | - |
| CHEM-Metals | Zinc | mg/L | (e) | 40 CFR 131.38 | 0.005 | 0% | NA[1] | NA[1] |
| **Pyrethroids** | | | | | | | | |
| NA | Allethrin | −g/L | NA | | <0.00085 | - | - | - |
| CHEM-Pesticides | Bifenthrin | −g/L | 0.0093 | 15. Anderson et al., 2006 | <0.00079 | 0% | NA[1] | NA[1] |
| CHEM-Pesticides | Cyfluthrin | −g/L | 0.344 | 17. Wheelock et al., 2004 | <0.00083 | 0% | NA[1] | NA[1] |
| CHEM-Pesticides | Cypermethrin | −g/L | 0.683 | 17. Wheelock et al., 2004 | <0.00066 | 0% | NA[1] | NA[1] |
| NA | Deltamethrin | −g/L | NA | | <0.0019 | - | - | - |
| CHEM-Pesticides | Esfenvalerate | −g/L | 0.25 | 17. Wheelock et al., 2004 | <0.00098 | 0% | NA[1] | NA[1] |
| NA | Fenvalerate | −g/L | NA | | <0.00098 | 0% | - | - |
| CHEM-Pesticides | L-Cyhalothrin | −g/L | 0.2 | 17. Wheelock et al., 2004 | <0.0012 | 0% | NA[1] | NA[1] |
| CHEM-Pesticides | Permethrin | −g/L | 0.021 | 15. Anderson et al., 2006 | <0.005 | 0% | NA[1] | NA[1] |
| NA | Prallethrin | −g/L | NA | | <0.00092 | - | - | - |

<-Results less than the method detection limit.
NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for chloride is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for sulfate is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for total dissolved solids is based on the San Diego Reginal Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007).
(e) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, may 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
[1] Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio To Benchmarks and Historical Frequency Above Benchmarks .
(-) Unable to calculate because there is no criteria or published value available for the analyte.

Shaded text – exceeds water quality benchmarks.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River WMA 2011-2012 Wet Weather Assessment**
**Analytical Data for TJR-MLS**

| Category Group | Analyte | Units | Water Quality Benchmarks | Benchmark References | TJR-MLS | | 2011-2012 Exceedances | Historical Frequency Above Benchmarks | Historical Mean Ratio to Benchmarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10/06/11 | 02/07/12 | | | |
| **General/Physical/Organic** | | | | | | | | | |
| NA | Electrical Conductivity | µmhos/cm | NA | | 1,199 | 1,084 | - | - | - |
| CHEM-Conventional | Oil and Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000 | 2.2J | 6.3 | 0% | 10% | 0.60 |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.57 | 4.76# | 0% | 0% | 0.00 |
| NA | Water Temperature | Celcius | NA | | 18.1 | 16.7 | - | - | - |
| **Bacteriological** | | | | | | | | | |
| BACT-Enterococcus | Enterococcus | MPN/100 mL | NA | | 9,000,000 | 1,300,000 | - | - | - |
| BACT-Fecal Coliform | Fecal Coliform | MPN/100 mL | 4,000 | 1.Basin Plan REC-1/REC-2 | 16,000,000 | 5,000,000 | 100% | 100% | 1214.29 |
| BACT-Total Coliform | Total Coliform | MPN/100 mL | NA | | >16,000,000 | 16,000,000 | - | - | - |
| **Wet Chemistry** | | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (a) | 6. USEPA Water Quality Criteria (Freshwater) | 8.9 | 8.5† | 0% | 10% | 0.53 |
| CHEM-Conventional | Biochemical Oxygen Demand | mg/L | 30 | 4. MSGP 2000, 8. McNeeley (1979) | 45 | 96† | 100% | 57% | 1.67 |
| CHEM-Conventional | Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | 210 | 410 | 100% | 71% | 1.93 |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | 1.2 | 0.64 | 50% | 10% | 0.51 |
| CHEM-Conventional | Surfactants (MBAS) | mg/L | 0.5 | 1. Basin Plan | 0.54 | 0.44 | 50% | 38% | 1.68 |
| CHEM-Conventional | Total Suspended Solids | mg/L | 100 | 4. MSGP 2000, 1. Basin Plan | 420 | 1,300 | 100% | 90% | 20.31 |
| CHEM-Conventional | Turbidity | NTU | 20 | 1. Basin Plan | 220 | 580 | 100% | 95% | 40.69 |
| NA | Dissolved Organic Carbon | mg/L | NA | | 23 | 16 | - | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 14 | 23 | - | - | - |
| NA | Total Organic Carbon | mg/L | NA | | 32 | 18 | - | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | 2.9 | 1.9 | 0% | 0% | 0.27 |
| NUTR-Total/Dissolved Phosphorus | Dissolved Phosphorus | mg/L | 2 | 4. MSGP 2000 | 2.3 | 3.9 | 100% | 29% | 0.93 |
| NUTR-Total/Dissolved Phosphorus | Total Phosphorus | mg/L | 2 | 4. MSGP 2000 | 4.1 | 7.2 | 100% | 71% | 1.47 |
| TDS-Total Dissolved Solids | Total Dissolved Solids | mg/L | 2,100 (b) | 1. Basin Plan | 790 | 650 | 0% | 0% | 0.34 |
| **Pesticides** | | | | | | | | | |
| CHEM-Pesticides | Chlorpyrifos | −g/L | 0.02 acute / 0.014 chronic | 12. CA Dept. of Fish & Game, 2000 | <0.01 | <0.01 | 0% | 26% | 1.42 |
| CHEM-Pesticides | Diazinon | −g/L | 0.08 acute / 0.05 chronic | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon | 0.15 | 0.09 | 100% | 86% | 4.32 |
| CHEM-Pesticides | Malathion | −g/L | 0.43 | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | 0.35H* | 0.23 | 0% | 44% | 1.12 |
| **Hardness** | | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 350 | 420 | - | - | - |
| **Total Metals** | | | | | | | | | |
| NA | Antimony | mg/L | NA | | 0.002 | 0.0016 | - | - | - |
| NA | Arsenic | mg/L | NA | | 0.012 | 0.01 | - | - | - |
| NA | Cadmium | mg/L | NA | | 0.00062 | 0.00075 | - | - | - |
| NA | Chromium | mg/L | NA | | 0.016 | 0.021 | - | - | - |
| NA | Copper | mg/L | NA | | 0.074 | 0.088 | - | - | - |
| NA | Lead | mg/L | NA | | 0.055 | 0.061 | - | - | - |
| NA | Nickel | mg/L | NA | | 0.027 | 0.028 | - | - | - |
| CHEM-Metals | Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | 0.001 | 0.0011 | 0% | 5% | 0.47 |
| NA | Zinc | mg/L | NA | | 0.24 | 0.27 | - | - | - |
| **Dissolved Metals** | | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.0039 | 0.0029 | 0% | 0% | 0.48 |
| CHEM-Metals | Arsenic | mg/L | 0.34 (c) | 16. 40 CFR 131.38 | 0.0079 | 0.0058 | 0% | 0% | 0.01 |
| CHEM-Metals | Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | 0.00003J | 0.00003J | 0% | 0% | 0.03 |
| CHEM-Metals | Chromium | mg/L | (d) | 16. 40 CFR 131.38 | 0.00061 | 0.00052 | 0% | 0% | 0.00 |
| CHEM-Metals | Copper | mg/L | (d) | 16. 40 CFR 131.38 | 0.0027 | 0.0024 | 0% | 5% | 0.22 |
| CHEM-Metals | Lead | mg/L | (d) | 16. 40 CFR 131.38 | 0.00041 | 0.00037 | 0% | 0% | 0.00 |
| CHEM-Metals | Nickel | mg/L | (d) | 16. 40 CFR 131.38 | 0.011 | 0.0071 | 0% | 0% | 0.01 |
| NA | Selenium | mg/L | NA | | 0.00069 | 0.00076 | - | - | - |
| CHEM-Metals | Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.011 | 0.0083 | 0% | 0% | 0.08 |
| **Pyrethroid** | | | | | | | | | |
| NA | Allethrin | −g/L | NA | | <0.002 | <0.002 | - | - | - |
| CHEM-Pesticides | Bifenthrin | −g/L | 0.0093 | 15. Anderson et al., 2006 | 0.0209 | 0.0253 | 100% | 67% | NA[1] |
| CHEM-Pesticides | Cyfluthrin | −g/L | 0.344 | 17. Wheelock et al., 2004 | <0.002 | 0.025 | 0% | 0% | NA[1] |
| CHEM-Pesticides | Cypermethrin | −g/L | 0.683 | 17. Wheelock et al., 2004 | 0.1322 | 0.3644 | 0% | 0% | NA[1] |
| NA | Danitol | −g/L | NA | | <0.002 | <0.002 | - | - | - |
| NA | Deltamethrin | −g/L | NA | | <0.002 | <0.002 | - | - | - |
| CHEM-Pesticides | Esfenvalerate | −g/L | 0.25 | 17. Wheelock et al., 2004 | <0.002 | <0.002 | 0% | 0% | NA[1] |
| CHEM-Pesticides | L-Cyhalothrin | −g/L | 0.2 | 17. Wheelock et al., 2004 | <0.002 | 0.0123 | 0% | 0% | NA[1] |
| CHEM-Pesticides | Permethrin | −g/L | 0.021 | 15. Anderson et al., 2006 | 1.6028 | 1.2961 | 100% | 33% | NA[1] |
| NA | Prallethrin | −g/L | NA | | <0.002 | <0.002 | - | - | - |

NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
#Result was not compared to the water quality benchmark for pH due to equipment malfunction. Ammonia water quality benchmark could not be calculated for the assessement.
† Result was from composite sample. The grab sample was analyzed outside of the holding time.
H*-Original result was outside of calibration range. Analysis was re-run outside of recommended holding time.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio to Benchmarks.
(-) Unable to calculate because there is no criteria or published value available for analyte.

Shaded text – exceeds water quality benchmark.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River WMA 2011-2012 Dry Weather Assessment**
**Analytical Data for TJR-MLS**

| Category Group | Analyte | Units | Water Quality Benchmarks | Benchmark References | TJR-MLS 12/06/11-12/07/11 | TJR-MLS 05/08/12-05/09/12 | 2011-2012 Exceedances | Historical Frequency Above Benchmarks | Historical Mean Ratio to Benchmarks |
|---|---|---|---|---|---|---|---|---|---|
| **General/Physical/Organic** | | | | | | | | | |
| NA | Electrical Conductivity | ħmhos/cm | NA | | 3,040 | 2,410 | - | - | - |
| CHEM-Conventional | Oil and Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL | <5 | <5 | 0% | 0% | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.48 | 7.66 | 0% | 0% | NA[1] |
| NA | Water Temperature | Celcius | NA | | 12.3 | 19.6 | - | - | - |
| **Bacteriological** | | | | | | | | | |
| BACT-Enterococcus | Enterococcus | MPN/100 mL | 151 (a) | 1. Basin Plan | **3,000** | **8,000** | 100% | 100% | NA[1] |
| BACT-Fecal Coliform | Fecal Coliform | MPN/100 mL | 4,000 | 1.Basin Plan REC-1/REC-2 | 1,300 | 1,700 | 0% | 100% | NA[1] |
| BACT-Total Coliform | Total Coliform | MPN/100 mL | NA | | 230,000 | 70,000 | - | - | - |
| **Wet Chemistry** | | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (b) | 6. USEPA Water Quality Criteria (Freshwater) | **7** | **6.6** | 100% | 100% | NA[1] |
| CHEM-Conventional | Biochemical Oxygen Demand | mg/L | 10 | 8. McNeeley (1979) | 6 | 5.5 | 0% | 100% | NA[1] |
| CHEM-Conventional | Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | 58 | 68 | 0% | 50% | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | 0.018J | 0.084J | 0% | 0% | NA[1] |
| CHEM-Conventional | Surfactants (MBAS) | mg/L | 0.5 | 1. Basin Plan | **1.6** | 0.088 | 50% | 100% | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 58 | 14. NSQD, 1. Basin Plan | **64** | 24 | 50% | 0% | NA[1] |
| CHEM-Conventional | Turbidity | NTU | 20 | 1. Basin Plan | **24** | **33** | 100% | 50% | NA[1] |
| NA | Dissolved Organic Carbon | mg/L | NA | | 18 | 17 | - | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 8.6 | 7.9 | - | - | - |
| NA | Total Organic Carbon | mg/L | NA | | 18 | 16 | - | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | <0.1 | 0.077J | 0% | 0% | NA[1] |
| NUTR-Total Nitrogen | Total Nitrogen (calculated) | mg/L | 1 | 1. Basin Plan | **8.618** | **8.061** | 100% | 100% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Dissolved Phosphorus | mg/L | 0.1 | 1. Basin Plan | **1.8** | **4.1** | 100% | 100% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Total Phosphorus | mg/L | 0.1 | 1. Basin Plan | **2.6** | **4.7** | 100% | 100% | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids | mg/L | 2,100 (c) | 1. Basin Plan | 1,500 | 2000 | 0% | 0% | NA[1] |
| **Pesticides** | | | | | | | | | |
| CHEM-Pesticides | Chlorpyrifos | −g/L | 0.02 acute / 0.014 chronic | 12. CA Dept. of Fish & Game, 2000 | <0.01 | <0.01 | 0% | 0% | NA[1] |
| CHEM-Pesticides | Diazinon | −g/L | 0.08 acute / 0.05 chronic | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon | <0.01 | 0.0065J | 0% | 0% | NA[1] |
| CHEM-Pesticides | Malathion | −g/L | 0.43 acute / 0.1 chronic | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | <0.01 | <0.01 | 0% | 0% | NA[1] |
| **Hardness** | | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 760 | 680 | - | - | - |
| **Total Metals** | | | | | | | | | |
| NA | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.00028J | 0.00042J | 0% | 0% | NA[1] |
| NA | Arsenic | mg/L | 0.05 | 1. Basin Plan | 0.0036 | 0.0043 | 0% | 0% | NA[1] |
| NA | Cadmium | mg/L | 0.005 | 1. Basin Plan | 0.00002J | 0.00003J | 0% | 0% | NA[1] |
| NA | Chromium | mg/L | 0.05 | 1. Basin Plan | 0.00064 | 0.00086 | 0% | 0% | NA[1] |
| NA | Copper | mg/L | 1 | 1. Basin Plan | 0.0013 | 0.0014 | 0% | 0% | NA[1] |
| NA | Lead | mg/L | NA | | 0.00078 | 0.0013 | - | - | - |
| NA | Nickel | mg/L | 0.1 | 1. Basin Plan | 0.0081 | 0.0089 | 0% | 0% | NA[1] |
| CHEM-Metals | Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | 0.00034J | 0.00039J | 0% | 0% | NA[1] |
| NA | Zinc | mg/L | 5.0 | 1. Basin Plan | 0.0042J | 0.0069 | 0% | 0% | NA[1] |
| **Dissolved Metals** | | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.00026J | 0.0004J | 0% | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.34 acute / 0.15 chronic | 16. 40 CFR 131.38 | 0.0033 | 0.0041 | 0% | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | <0.0001 | <0.0001 | 0% | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | (d) | 16. 40 CFR 131.38 | 0.00017J | 0.0002 | 0% | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | (d) | 16. 40 CFR 131.38 | <0.0005 | 0.00059 | 0% | 0% | NA[1] |
| CHEM-Metals | Lead | mg/L | (d) | 16. 40 CFR 131.38 | 0.00003J | 0.00002J | 0% | 0% | NA[1] |
| CHEM-Metals | Nickel | mg/L | (d) | 16. 40 CFR 131.38 | 0.0079 | 0.0086 | 0% | 0% | NA[1] |
| NA | Selenium | mg/L | NA | | 0.00032J | 0.00037J | - | - | - |
| CHEM-Metals | Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.0016J | 0.0027J | 0% | 0% | NA[1] |

NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark for Enterococcus is based on the maximum criteria for infrequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio to Benchmarks.
(-) Unable to calculate because there is no criteria or published value available for the analyte.

Shaded text-exceeds water quality benchmarks and the **CCC** water quality benchmark for Ammonia.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River WMA 2011-2012 Wet Weather Assessment**
**Analytical Data for TJR-TWAS-1**

| Category Group | Analyte | Units | Water Quality Benchmarks | Benchmark References | TJR-TWAS-1 | | 2011-2012 Exceedances | Historical Frequency Above Benchmarks | Historical Mean Ratio to Benchmarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10/05/11-10/06/11 | 02/07/12 | | | |
| **General/Physical/Organic** | | | | | | | | | |
| NA | Electrical Conductivity | ÞmhoS/cm | NA | | 1,884 | 1,123 | - | - | - |
| CHEM-Conventional | Oil and Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000 | <5 | 1.4J | 0% | 0% | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.84 | 7.18 | 0% | 0% | NA[1] |
| NA | Water Temperature | Celcius | NA | | 13.2 | 9.6 | - | - | - |
| **Bacteriological** | | | | | | | | | |
| BACT-Enterococcus | Enterococcus | MPN/100 mL | NA | | 7,000 | 1,300 | - | - | - |
| BACT-Fecal Coliform | Fecal Coliform | MPN/100 mL | 400 | 1. Basin Plan REC-1/REC-2 | 1,100 | <20 | 50% | 100% | NA[1] |
| BACT-Total Coliform | Total Coliform | MPN/100 mL | NA | | 9,149E | 11,000 | - | - | - |
| **Wet Chemistry** | | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (a) | 6. U.S. EPA Water Quality Criteria (Freshwater) | 0.13 | <0.1 | 0% | 0% | NA[1] |
| CHEM-Conventional | Biochemical Oxygen Demand | mg/L | 30 | 4. MSGP 2000, 8. McNeeley (1979) | 3.6 | 2.8[†] | 0% | 0% | NA[1] |
| CHEM-Conventional | Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | 45 | 34 | 0% | 0% | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | 0.016J | 0.011J | 0% | 0% | NA[1] |
| CHEM-Conventional | Surfactants (MBAS) | mg/L | 0.5 | 1. Basin Plan | 0.094 | 0.11 | 0% | 50% | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 100 | 4. MSGP 2000, 1. Basin Plan | 24 | 15 | 0% | 100% | NA[1] |
| CHEM-Conventional | Turbidity | NTU | 20 | 1. Basin Plan | 14 | 22 | 50% | 100% | NA[1] |
| NA | Dissolved Organic Carbon | mg/L | NA | | 13 | 6.4 | - | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 0.95 | 0.77 | - | - | - |
| NA | Total Organic Carbon | mg/L | NA | | 14 | 7.4 | - | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | 0.53 | 0.2 | 0% | 0% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Dissolved Phosphorus | mg/L | 2 | 4. MSGP 2000 | 0.23 | 0.11 | 0% | 0% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Total Phosphorus | mg/L | 2 | 4. MSGP 2000 | 0.41 | 0.22 | 0% | 0% | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids | mg/L | 500 (b) | 1. Basin Plan | 980 | 680 | 100% | 50% | NA[1] |
| **Pesticides** | | | | | | | | | |
| CHEM-Pesticides | Chlorpyrifos | −g/L | 0.02 acute / 0.014 chronic | 12. CA Dept. of Fish & Game, 2000 | <0.01 | <0.01 | 0% | 0% | NA[1] |
| CHEM-Pesticides | Diazinon | −g/L | 0.08 acute / 0.05 chronic | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon | <0.01 | <0.01 | 0% | 0% | NA[1] |
| CHEM-Pesticides | Malathion | −g/L | 0.43 | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | <0.01 | <0.01 | 0% | 0% | NA[1] |
| **Hardness** | | | | | | | | | |
| NA | Hardness | mg $CaCO_3$/L | NA | | 440 | 370 | - | - | - |
| **Total Metals** | | | | | | | | | |
| NA | Antimony | mg/L | NA | | 0.00016J | 0.00011J | - | - | - |
| NA | Arsenic | mg/L | NA | | 0.0037 | 0.0032 | - | - | - |
| NA | Cadmium | mg/L | NA | | 0.000091J | 0.000058J | - | - | - |
| NA | Chromium | mg/L | NA | | 0.00064 | 0.00043 | - | - | - |
| NA | Copper | mg/L | NA | | 0.0026 | 0.0014 | - | - | - |
| NA | Lead | mg/L | NA | | 0.0016 | 0.0012 | - | - | - |
| NA | Nickel | mg/L | NA | | 0.0018 | 0.0012 | - | - | - |
| CHEM-Metals | Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | <0.0004 | 0.00028J | 0% | 0% | NA[1] |
| NA | Zinc | mg/L | NA | | 0.013 | 0.0082 | - | - | - |
| **Dissolved Metals** | | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.00015J | 0.000096J | 0% | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.34 (c) | 16. 40 CFR 131.38 | 0.0026 | 0.0021 | 0% | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | 0.00006J | 0.00004J | 0% | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | (d) | 16. 40 CFR 131.38 | 0.00013J | 0.000084J | 0% | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | (d) | 16. 40 CFR 131.38 | 0.0017 | 0.00089 | 0% | 0% | NA[1] |
| CHEM-Metals | Lead | mg/L | (d) | 16. 40 CFR 131.38 | 0.000091J | 0.000059J | 0% | 0% | NA[1] |
| CHEM-Metals | Nickel | mg/L | (d) | 16. 40 CFR 131.38 | 0.0015 | 0.0011 | 0% | 0% | NA[1] |
| NA | Selenium | mg/L | NA | | <0.0004 | <0.0004 | - | - | - |
| CHEM-Metals | Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.0051 | 0.0027J | 0% | 0% | NA[1] |
| **Pyrethroid** | | | | | | | | | |
| NA | Allethrin | −g/L | NA | | <0.002 | <0.002 | - | - | - |
| CHEM-Pesticides | Bifenthrin | −g/L | 0.0093 | 15. Anderson et al., 2006 | <0.002 | <0.002 | 0% | 50% | NA[1] |
| CHEM-Pesticides | Cyfluthrin | −g/L | 0.344 | 17. Wheelock et al., 2004 | <0.002 | <0.002 | 0% | 0% | NA[1] |
| CHEM-Pesticides | Cypermethrin | −g/L | 0.683 | 17. Wheelock et al., 2004 | <0.002 | <0.002 | 0% | 0% | NA[1] |
| NA | Danitol | −g/L | NA | | <0.002 | <0.002 | - | - | - |
| NA | Deltamethrin | −g/L | NA | | <0.002 | <0.002 | - | - | - |
| CHEM-Pesticides | Esfenvalerate | −g/L | 0.25 | 17. Wheelock et al., 2004 | <0.002 | <0.002 | 0% | 0% | NA[1] |
| CHEM-Pesticides | L-Cyhalothrin | −g/L | 0.20 | 17. Wheelock et al., 2004 | <0.002 | <0.002 | 0% | 0% | NA[1] |
| CHEM-Pesticides | Permethrin | −g/L | 0.021 | 15. Anderson et al., 2006 | <0.025[††] | <0.025[††] | 0% | 0% | NA[1] |
| NA | Prallethrin | −g/L | NA | | <0.002 | <0.002 | - | - | - |

NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(c) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.
[†] Result was from composite sample. The grab sample was analyzed outside of the holding time
[††] Permethrin was non-detect at the method detection limit of 0.005 −g/L..
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio to Benchmarks.
(-) Unable to calculate because there is no criteria or published value available for analyte.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River WMA 2011-2012 Dry Weather Assessment**
**Analytical Data for TJR-TWAS-1**

| Category Group | Analyte | Units | Water Quality Benchmarks | Benchmark References | TJR-TWAS-1 09/12/11-09/13/11 | TJR-TWAS-1 05/08/12-05/09/12 | 2011-2012 Exceedances | Historical Frequency Above Benchmarks | Historical Mean Ratio to Benchmarks |
|---|---|---|---|---|---|---|---|---|---|
| **General/Physical/Organic** | | | | | | | | | |
| NA | Electrical Conductivity | −mhos/cm | NA | | 1,545 | 1,579 | - | - | - |
| CHEM-Conventional | Oil and Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL | <5 | 1.3J | 0% | 0% | NA[1] |
| CHEM-Conventional | pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.87 | 7.82 | 0% | 0% | NA[1] |
| NA | Water Temperature | Celcius | NA | | 16.50 | 12.50 | - | - | - |
| **Bacteriological** | | | | | | | | | |
| BACT-Enterococcus | Enterococcus | MPN/100 mL | 151 (a) | 1. Basin Plan | **500** | **270** | 100% | 50% | NA[1] |
| BACT-Fecal Coliform | Fecal Coliform | MPN/100 mL | 400 | 1.Basin Plan REC-1/REC-2 | 110 | **500** | 50% | 0% | NA[1] |
| BACT-Total Coliform | Total Coliform | MPN/100 mL | NA | | 8,000 | 1,300 | - | - | - |
| **Wet Chemistry** | | | | | | | | | |
| CHEM-Conventional | Ammonia as N | mg/L | (b) | 6. USEPA Water Quality Criteria (Freshwater) | 0.076J | 0.054J | 0% | 0% | NA[1] |
| CHEM-Conventional | Biochemical Oxygen Demand | mg/L | 10 | 8. McNeeley (1979) | 1.3J | 0.64J | 0% | 0% | NA[1] |
| CHEM-Conventional | Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | 21 | 11 | 0% | 0% | NA[1] |
| CHEM-Conventional | Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.1 | <0.1 | 0% | 0% | NA[1] |
| CHEM-Conventional | Surfactants (MBAS) | mg/L | 0.5 | 1. Basin Plan | 0.049J | 0.032J | 0% | 0% | NA[1] |
| CHEM-Conventional | Total Suspended Solids | mg/L | 58 | 14. NSQD, 1. Basin Plan | 4 | 5 | 0% | 0% | NA[1] |
| CHEM-Conventional | Turbidity | NTU | 20 | 1. Basin Plan | 4.3 | 4.4 | 0% | 0% | NA[1] |
| NA | Dissolved Organic Carbon | mg/L | NA | | 8.1 | 5.1 | - | - | - |
| NA | Total Kjeldahl Nitrogen | mg/L | NA | | 0.43 | 0.28 | - | - | - |
| NA | Total Organic Carbon | mg/L | NA | | 7.5 | 4.9 | - | - | - |
| NUTR-Nitrate as N | Nitrate as N | mg/L | 10 | 1. Basin Plan | 0.067J | <0.1 | 0% | 0% | NA[1] |
| NUTR-Total Nitrogen | Total Nitrogen (calculated) | mg/L | 1 | 1. Basin Plan | 0.497 | 0.28 | 0% | 0% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Dissolved Phosphorus | mg/L | 0.1 | 1. Basin Plan | **0.18** | **0.13** | 100% | 0% | NA[1] |
| NUTR-Total/Dissolved Phosphorus | Total Phosphorus | mg/L | 0.1 | 1. Basin Plan | **0.25** | **0.15** | 100% | 0% | NA[1] |
| TDS-Total Dissolved Solids | Total Dissolved Solids | mg/L | 500 (c) | 1. Basin Plan | **1,000** | **940** | 100% | 100% | NA[1] |
| **Pesticides** | | | | | | | | | |
| CHEM-Pesticides | Chlorpyrifos | −g/L | 0.02 acute / 0.014 chronic | 12. CA Dept. of Fish & Game, 2000 | <0.01 | <0.01 | 0% | 0% | NA[1] |
| CHEM-Pesticides | Diazinon | −g/L | 0.08 acute / 0.05 chronic | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon | <0.01 | <0.01 | 0% | 0% | NA[1] |
| CHEM-Pesticides | Malathion | −g/L | 0.43 acute / 0.1 chronic | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | <0.01 | <0.01 | 0% | 0% | NA[1] |
| **Hardness** | | | | | | | | | |
| NA | Total Hardness | mg $CaCO_3$/L | NA | | 470 | 420 | - | - | - |
| **Total Metals** | | | | | | | | | |
| NA | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.00007J | 0.00005J | 0% | 0% | NA[1] |
| NA | Arsenic | mg/L | 0.05 | 1. Basin Plan | 0.0027 | 0.0031 | 0% | 0% | NA[1] |
| NA | Cadmium | mg/L | 0.005 | 1. Basin Plan | 0.00004J | 0.00005J | 0% | 0% | NA[1] |
| NA | Chromium | mg/L | 0.05 | 1. Basin Plan | 0.00009J | 0.00009J | 0% | 0% | NA[1] |
| NA | Copper | mg/L | 1 | 1. Basin Plan | 0.00045J | <0.0005 | 0% | 0% | NA[1] |
| NA | Lead | mg/L | NA | | 0.00039 | 0.00017J | - | - | - |
| NA | Nickel | mg/L | 0.1 | 1. Basin Plan | 0.00033J | 0.0003J | 0% | 0% | NA[1] |
| CHEM-Metals | Selenium | mg/L | 0.005 | 16. 40 CFR 131.38 | <0.0004 | <0.0004 | 0% | 0% | NA[1] |
| NA | Zinc | mg/L | 5.0 | 1. Basin Plan | 0.0013J | 0.0014J | 0% | 0% | NA[1] |
| **Dissolved Metals** | | | | | | | | | |
| CHEM-Metals | Antimony | mg/L | 0.006 | 1. Basin Plan | 0.00008J | 0.00006J | 0% | 0% | NA[1] |
| CHEM-Metals | Arsenic | mg/L | 0.34 acute / 0.15 chronic | 16. 40 CFR 131.38 | 0.0023 | 0.0026 | 0% | 0% | NA[1] |
| CHEM-Metals | Cadmium | mg/L | (d) | 16. 40 CFR 131.38 | 0.00004J | 0.00005J | 0% | 0% | NA[1] |
| CHEM-Metals | Chromium | mg/L | (d) | 16. 40 CFR 131.38 | 0.00015J | <0.0002 | 0% | 0% | NA[1] |
| CHEM-Metals | Copper | mg/L | (d) | 16. 40 CFR 131.38 | 0.00048J | <0.0005 | 0% | 0% | NA[1] |
| CHEM-Metals | Lead | mg/L | (d) | 16. 40 CFR 131.38 | 0.00003J | <0.0002 | 0% | 0% | NA[1] |
| CHEM-Metals | Nickel | mg/L | (d) | 16. 40 CFR 131.38 | 0.00031J | 0.00023J | 0% | 0% | NA[1] |
| NA | Selenium | mg/L | NA | | <0.0004 | <0.0004 | - | - | - |
| CHEM-Metals | Zinc | mg/L | (d) | 16. 40 CFR 131.38 | 0.0021J | 0.0014J | 0% | 0% | NA[1] |

NA indicate no criteria or published value was available or applicable to the matrix or program.
(a) Water Quality Benchmark for Enterococcus is based on the maximum criteria for infrequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(b) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.
(c) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).
(d) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.
J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.
NA[1] Three or more years of data required to calculate the Historical Mean Ratio to Benchmarks.
(-) Unable to calculate because there is no criteria or published value available for the analyte.

Shaded text – exceeds water quality benchmarks.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

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**Table C-6-1**
**Receiving Water Conditions in the Tijuana River WMA**

| Hydrologic Area | Receiving Water | Condition | Temporal Extent | | Basis |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| **Lower Watershed** | | | | | |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline at 3/4 mile North of Tijuana River | Impairment of REC-1 due to Total Coliform, Fecal Coliform, and Enterococcus. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline at end of Seacoast Drive | Impairment of REC-1 due to Total Coliform, Fecal Coliform, and Enterococcus | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at Monument Road | Impairment of REC-1 due to Total Coliform and Fecal Coliform | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at the US Border | Impairment of REC-1 due to Total Coliform, Fecal Coliform, and Enterococcus | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth | Impairment of REC-1 due to Total Coliform, Fecal Coliform, and Enterococcus | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth | Possible presence of pathogens including viruses and specifically Hepatitis A. | | x | Public workshop testimony. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of REC-1 due to Indicator Bacteria. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River | Elevated Fecal Coliforms and Enterococcus at NPDES monitoring location. | x | x | Sampling results at MLS reported in LTEA and Weston Reports. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Solids. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Sedimentation/Siltation. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River | Poor to fair stream substrate of mostly silt and consolidated clay. | | x | Assessment at MLS station reported in LTEA and 2011-12 Weston Report. |

| Hydrologic Area | Receiving Water | Condition | Temporal Extent | | Basis |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Tijuana Valley (911.1) | Tijuana River | Poor stream substrate with stream bed and banks of unconsolidated sand and silt and riparian buffer lacking canopy. | | x | Assessment at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Elevated TSS at NPDES sampling location. | x | x | Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Elevated Turbidity at NPDES sampling location. | x | x | Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of REC-2 due to Trash. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River | Presence of trash at assessment site in 911.12 HSA. | | x | Assessment at trash assessment site reported in 2010-11 Weston Report. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Total Nitrogen as N. | x | x | 2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Elevated Ammonia as N at NPDES sampling location. | x | x | Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Elevated Nitrite as N at NPDES sampling location. | x | | Sampling results at MLS reported in Weston Report. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Phosphorus. | x | x | 2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |

| Hydrologic Area | Receiving Water | Condition | Temporal Extent | | Basis |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Eutrophic conditions. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River | Benthic algae at NPDES sampling location. | | x | Sampling results at MLS reported in LTEA and at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Low Dissolved Oxygen. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River | Elevated BOD and COD at NPDES sampling location. | x | x | Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Pesticides. | x | x | 2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of REC-1 due to Surfactants (MBAS). | x | x | 2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Selenium. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Trace Elements. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River | Impairment of MUN due to Synthetic Organics. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Toxicity. | x | x | 2010 303(d) List Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |

| Hydrologic Area | Receiving Water | Condition | Temporal Extent | | Basis |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Tijuana Valley (911.1) | Tijuana River | Benthic Alterations (poor to very poor IBI scores) at NPDES monitoring location. | x | x | Sampling results at MLS reported in LTEA and Weston Report and at TWAS-2 station reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Elevated oil and grease | x | | Sampling results at TWAS-2 reported in LTEA. |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of REC-1 due to Indicator Bacteria. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of MAR due to Turbidity. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of REC-2 due to Trash. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of EST due to Eutrophic Conditions. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of MAR due to Low Dissolved Oxygen. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of EST due to Pesticides. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of EST due to Lead. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of EST due to Nickel. | x | x | 2010 303(d) List |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of COMM due to Thallium. | x | x | 2010 303(d) List |

| Hydrologic Area | Receiving Water | Condition | Temporal Extent | | Basis |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| **Upper Watershed** | | | | | |
| Potrero (911.2) | Tecate Creek | Impairment of WARM due to Selenium. | x | x | 2010 303(d) List |
| Potrero (911.2) | Tecate Creek | Elevated chloride at SMC Station. | | x | Sampling results at SMC03510 station reported in Weston Report |
| Potrero (911.2) | Tecate Creek | Elevated sulfate at SMC Station. | | x | Sampling results at SMC03510 station reported in Weston Report. |
| Potrero (911.2) | Tecate Creek | Benthic Alterations (poor to very poor IBI scores) at SMC Station. | | x | Sampling results at SMC03510 station reported in Weston Report. |
| Potrero (911.2) | Tecate Creek | Elevated Total Nitrogen as N at SMC Station. | | x | Sampling results at SMC03510 station reported in Weston Report. |
| Potrero (911.2) | Tecate Creek | Elevated Phosphorus at SMC Station. | | x | Sampling results at SMC03510 station reported in Weston Report. |
| Potrero (911.2) | Tecate Creek | Elevated TDS at SMC Station. | | x | Sampling results at SMC03510 station reported in Weston Report. |
| Potrero (911.2) | Tecate Creek | Presence of trash. | | x | Upper Watershed Trash Assessment reported in WURMP annual reports. |
| Barrett Lake (911.3) | Barrett Lake | Impairment of WARM due to Total Nitrogen as N. | x | x | 2010 303(d) List |
| Barrett Lake (911.3) | Barrett Lake | Impairment of MUN due to Manganese. | x | x | 2010 303(d) List |
| Barrett Lake (911.3) | Barrett Lake | Impairment of MUN due to Perchlorate. | x | x | 2010 303(d) List |
| Barrett Lake (911.3) | Barrett Lake | Impairment of MUN due to Color. | x | x | 2010 303(d) List |
| Barrett Lake (911.3) | Barrett Lake | Impairment of MUN due to pH. | x | x | 2010 303(d) List |

| Hydrologic Area | Receiving Water | Condition | Temporal Extent | | Basis |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Monument (911.4) | Pine Valley Creek (Upper) | Impairment of MUN due to Turbidity. | x | x | 2010 303(d) List |
| Morena (911.5) | Morena Reservoir | Impairment of MUN due to Ammonia as N. | x | x | 2010 303(d) List |
| Morena (911.5) | Morena Reservoir | Impairment of WARM due to Phosphorus. | x | x | 2010 303(d) List |
| Morena (911.5) | Morena Reservoir | Impairment of MUN due to Manganese. | x | x | 2010 303(d) List |
| Morena (911.5) | Morena Reservoir | Impairment of MUN due to Color. | x | x | 2010 303(d) List |
| Morena (911.5) | Morena Reservoir | Impairment of MUN due to pH. | x | x | 2010 303(d) List |
| Cottonwood (911.6) | Cottonwood Creek (Tijuana River watershed) | Impairment of WARM due to Selenium. | x | x | 2010 303(d) List |
| Campo (911.8) | Campo Creek | Benthic Alterations (poor to very poor IBI scores) at NPDES monitoring location. | x | x | Sampling results at TWAS-1 reported in LTEA and Weston Report. |
| Campo (911.8) | Campo Creek | Benthic algae at NPDES sampling location. | | x | Sampling results at TWAS-1 reported in LTEA. |
| Campo (911.8) | Campo Creek | Elevated fecal coliforms at NPDES monitoring location. | x | x | Sampling results at TWAS-1 reported in LTEA and Weston Report. |
| Campo (911.8) | Campo Creek | Elevated *Enterococcus* at NPDES monitoring location. | | x | Sampling results at TWAS-1 reported in LTEA and Weston Report. |
| Campo (911.8) | Campo Creek | Elevated TSS at NPDES sampling location. | x | | Sampling results at TWAS-1 reported in LTEA. |
| Campo (911.8) | Campo Creek | Elevated Turbidity at NPDES sampling location. | x | | Sampling results at TWAS-1 reported in LTEA and Weston Report. |
| Campo (911.8) | Campo Creek | Elevated Surfactants (MBAS) at NPDES sampling location. | x | | Sampling results at TWAS-1 reported in LTEA. |
| Campo (911.8) | Campo Creek | Elevated Pesticides at NPDES sampling location. | x | | Sampling results at TWAS-1 reported in LTEA. |

| Hydrologic Area | Receiving Water | Condition | Temporal Extent | | Basis |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Campo (911.8) | Campo Creek | Elevated TDS at NPDES sampling location. | x | x | Sampling results at TWAS-1 reported in LTEA and Weston Report. |
| Campo (911.8) | Campo Creek | Elevated Phosphorus at NPDES sampling location. | | x | Sampling results at TWAS-1 reported in Weston Report. |
| Campo (911.8) | Campo Creek | Toxicity | | x | Sampling results at TWAS-1 reported in LTEA and Weston Report. |
| Campo (911.8) | Campo Creek | Presence of trash. | | x | Upper Watershed Trash Assessment reported in WURMP annual reports. |

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# Long Term Effectiveness Assessment MS4 Tables

## Tijuana River Watershed Management Area MS4 Random Dry Weather 2009-2010

| Analyte | Units | Water Quality Benchmarks | Benchmark References | MS4D-TJR-07 E-1B 6/1/2010 |
|---|---|---|---|---|
| **Physical Chemistry** | | | | |
| Conductivity | −S/cm | NA | NA | 1,054 |
| pH | pH Units | 6.5-9.0 | 1. Basin Plan | 8.07 |
| Water Temperature | Celcius | NA | NA | 20.9 |
| **General Chemistry** | | | | |
| Nitrate as N | mg/L | 10 | 1. Basin Plan | 4.27 |
| Nitrate/Nitrite as N | mg/L | 10 | 1. Basin Plan | 4.28 |
| Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.007 |
| Phosphorus, Total* | mg/L | 0.1 | 1. Basin Plan | 0.43 |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | 1.7 |
| Total Nitrogen* | mg/L | 1 | 1. Basin Plan | 6 |
| Total Dissolved Solids (calculated)[1] | mg/L | 2100 (a) | 1. Basin Plan | 738 |
| Total Suspended Solids | mg/L | 58 | 14. NSQD | <1 |
| **Bacteriological** | | | | |
| Enterococcus | MPN/100 mL | 151 | 1. Basin Plan | 170 |
| Fecal Coliforms | MPN/100 mL | 4,000 | 1. Basin Plan | <20 |
| Total Coliforms | MPN/100 mL | NA | 1. Basin Plan | 800 |

<-Results less than the method detection limit.
NA indicate no criteria or published value was available or applicable to the matrix or program.
*Total Nitrogen and Total Phosphorus are narrative standards in the Basin Plan based on biostimulatory responses to nutrients.
[1] Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.
(a) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River Watershed Management Area MS4 Targeted Dry Weather (2009-2010)**

| Analyte | Unit | WQB CMC | WQB CCC | 911.1 | 911.1 | 911.1 | 911.12 | 911.12 | 911.3 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | E1B | DW227 | DW322 | DW304 | DW304 | TIJ02 |
| | | | | 6/3/2010 | 7/13/2010 | 7/13/2010 | 6/14/2010 | 7/13/2010 | 6/22/2010 |
| Conductivity | −S/cm | NA | NA | 1,200 | NS | NS | NS | NS | NS |
| pH | pH Units | NA | NA | 8.6 | NS | NS | NS | NS | NS |
| Temperature | Celcius | NA | NA | 19.2 | NS | NS | NS | NS | NS |
| Ammonia as N | mg/L | NA | NA | 0.65 | NS | NS | NS | NS | <0.1 |
| Nitrate as N | mg/L | 10 | NA | 1.26 | NS | NS | NS | NS | 0.75 |
| Nitrite as N | mg/L | 1 | NA | NS | NS | NS | NS | NS | <0.05 |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | NS | NS | NS | NS | NS | <0.5 |
| Total Nitrogen (calculated) | mg/L | 1.0 | NA | NS | <0.3 | 5.6 | 2.1 | NS | 0.8 |
| Orthophosphate as P | mg/L | NA | NA | 0.41 | NS | NS | NS | NS | 0.16 |
| Total Phosphorus | mg/L | 0.10 | NA | NS | 0.14 | 0.80 | 0.52 | NS | 0.38 |
| Total Suspended Solids | mg/L | 58 | NA | NS | <10 | 13 | 30 | NS | <20 |
| Total Dissolved Solids | mg/L | 500 (b) | NA | 840 | NS | NS | NS | NS | NS |
| Turbidity | NTU | 20 | NA | 5.66 | NS | NS | NS | NS | NS |
| MBAS | mg/L | 0.5 | NA | 1.75 | NS | NS | NS | NS | NS |
| Dissolved Oxygen | mg/L | 5 | NA | NS | 4.80 | <1 | 2.00 | NS | NS |
| Oil & Grease | mg/L | 10 | NA | <5 | NS | NS | NS | NS | NS |
| Enterococcus | MPN/100 mL | 151 | NA | 1,300 | 80 | 18,000 | 320 | NS | 230 |
| Fecal Coliform | MPN/100 mL | 400 | NA | 5,000 | 78 | 3,300 | 68 | NS | 170 |
| Total Coliform | MPN/100 mL | NA | NA | 170,000 | 4,900 | 130,000 | 2,300 | NS | 1,700 |
| Chlorpyrifos | −g/L | 0.02 | 0.014 | <0.05 | <0.97 | <0.96 | <1 | NS | NS |
| Diazinon | −g/L | 0.08 | 0.05 | <0.05 | <0.97 | <0.96 | <1 | NS | NS |
| Malathion | −g/L | 0.43 | NA | <0.05 | NS | NS | NS | NS | NS |
| Total Hardness | mg $CaCO_3$/L | NA | NA | 307.00 | 290.00 | 340.00 | 290.00 | NS | NS |
| Cadmium, Dissolved | −g/L | (e) | NA | <10 | <5 | <5 | <5 | NS | NS |
| Copper, Dissolved | −g/L | (e) | NA | 61.00 | <10 | <10 | <10 | NS | NS |
| Lead, Dissolved | −g/L | (e) | NA | <50 | <5 | <5 | <5 | NS | NS |
| Nickel, Dissolved | mg/L | (e) | NA | NS | <0.01 | <0.01 | NS | <0.01 | NS |
| Thallium, Dissolved | −g/L | (e) | NA | NS | <10 | <10 | <10 | NS | NS |
| Zinc, Dissolved | −g/L | (e) | NA | 147.00 | <20 | 36.00 | 42.00 | NS | NS |

<-Results less than the reporting limit.

NA indicates no criteria or published value was available or applicable to the matrix or program.

NS indicates no sample taken.

(b) Water Quality Benchmark for Total Dissolved Solids is based on then San Diego Regional Water Quality Control Plan by watershed for the San Diego region (Basin Plan), 1994 (w/ amendments affective prior to April 25, 2007).

(e) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, Mat 18, 2000. The Criteria Maximum Concentration (CMC) was used.

## Tijuana River Watershed Management Area MS4 Outfall Random Dry Weather 2008-2009

| Group | Analytes | Units | Benchmarks | Source | MS4D-TJR-04 | MS4D-TJR-08 | MS4D-TJR-09 |
|---|---|---|---|---|---|---|---|
| | | | | | 80028762 | E-1B | 80028768 |
| | | | | | 6/10/2009 | 6/10/2009 | 6/10/2009 |
| **Flow** | Flow | GPM | NA | NA | Ponded | Ponded | Ponded |
| **Physical Chemistry** | Conductivity | ħS/cm | NA | NA | 1,225 | 1,999 | 922 |
| | pH | pH units | 6.5-9.0 | 1. Basin Plan | 8.74 | 7.26 | 9.34 |
| | Temperature | °C | NA | NA | 20.9 | 22.3 | 19.6 |
| **General Chemistry** | Nitrate as N | mg/L | 10 | 1. Basin Plan | <0.009 | 0.140 | 0.110 |
| | Nitrate/Nitrite as N | mg/L | 10 | 1. Basin Plan | <0.009 | 0.170 | 0.130 |
| | Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.007 | <0.007 | <0.007 |
| | Phosphorus, Total* | mg/L | 0.1 | 1. Basin Plan | 0.09 | 0.60 | 0.52 |
| | Total Kjeldahl Nitrogen | mg/L | NA | NA | 1.8 | 1.8 | 3.0 |
| | Total Nitrogen* | mg/L | 1 | 1. Basin Plan | 1.8 | 2.0 | 3.1 |
| | Total Suspended Solids | mg/L | 58 | 14. NSQD | <1.0 | 103 | 183 |
| **Bacteria** | Enterococci | MPN/100 mL | 151 | 1. Basin Plan | 1,400 | 8,000 | 260 |
| | Fecal Coliform | MPN/100 mL | 400 | 1. Basin Plan | 80 | 130,000 | 80 |
| | Total Coliform | MPN/100 mL | NA | 1. Basin Plan | 300 | 1,600,000E | 3,500 |

NA indicate no criteria or published value was available or applicable to the matrix or program.

< = Results less than the method detection limit

E = Result is an estimate

*Total N and Total P are narrative standards in the Basin Plan based on biostimulatory responses to nutrients

Source

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

**Tijuana River Watershed Management Area Long Term Effectiveness Assessment Targeted MS4 Data Table (2008-2009)**

| Analyte | Unit | Benchmark | Source | CT-TIJ02 | SD-DW227 | SD-DW227 | SD-DW303 | SD-DW304 | SD-DW322 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 05/21/2009 | 06/15/2009 | 06/29/2009 | 06/09/2009 | 06/09/2009 | 07/06/2009 |
| **Flow** | | | | | | | | | |
| Flow | GPM | NA | NA | 405.27 | Ponded | Ponded | Ponded | Ponded | Ponded |
| **General Cheimistry** | | | | | | | | | |
| pH | pH Units | 6.5-9.0 | 1. Basin Plan | NS | NS | NS | NS | NS | 7.34 |
| **Wet Chemistry** | | | | | | | | | |
| Ammonia | mg/L | NA | NA | 0.06 | NS | NS | NS | NS | NS |
| Dissolved Oxygen | mg/L | NA | NA | NS | 1.2 | NS | 8.3 | 4.7 | 1.1 |
| Nitrate as N | mg/L | 10 | 1. Basin Plan | 0.52 | NS | NS | NS | NS | NS |
| Nitrite as N | mg/L | NA | NA | < 0.01 | NS | NS | NS | NS | NS |
| Organic Nitrogen | mg/L | NA | NA | 0.44 | NS | NS | NS | NS | NS |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | 0.5 | NS | NS | NS | NS | NS |
| Total Nitrogen | mg/L | 1 | 1. Basin Plan | 1.03 | 2.93 | NS | 6.98 | 2.565 | 3.73 |
| Orthophosphate as P | mg/L | NA | NA | 0.01 | NS | NS | NS | NS | NS |
| Total Phosphorus | mg/L | 0.1 | 1. Basin Plan | 0.01 | 0.34 | NS | 0.5 | 0.18 | 0.8 |
| Total Suspended Solids | mg/L | 58 | NA | 1 | 13 | NS | 42 | < 10** | 24 |
| Total Hardness | mg/L | NA | NA | NS | 320 | 270 | 330 | 290 | 380 |
| **Dissolved Metals** | | | | | | | | | |
| Cadmium, Dissolved | mg/L | (a) | 40 CFR 131.38 | NS | < 0.005 | NS | < 0.005 | < 0.005 | < 0.005 |
| Copper, Dissolved | mg/L | (a) | 40 CFR 131.38 | NS | < 0.01 | NS | < 0.01 | < 0.01 | < 0.01 |
| Lead, Dissolved | mg/L | (a) | 40 CFR 131.38 | NS | < 0.005 | NS | < 0.005 | < 0.005 | < 0.005 |
| Nickel, Dissolved | mg/L | (a) | 40 CFR 131.38 | NS | NS | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Thallium, Dissolved | mg/L | NA | NA | NS | < 0.01 | NS | < 0.01 | < 0.01 | 0.015 |
| Zinc, Dissolved | mg/L | (a) | 40 CFR 131.38 | NS | < 0.02 | NS | < 0.02 | 0.069 | < 0.02 |
| **Pesticides** | | | | | | | | | |
| Chlorpyrifos | ħg/L | 0.02 | CA Dept of Fish Game 1998 | NS | < 0.962** | NS | < 0.971** | < 0.98** | < 0.962** |
| Diazinon | ħg/L | 0.08 | CA Dept of Fish Game 2000 | NS | < 0.962** | NS | < 0.971** | < 0.98** | < 0.962** |
| **Bacteria** | | | | | | | | | |
| Enterococci | MPN/100 mL | 151 | 1. Basin Plan | 130 | 80 E | 520 | 9,000 | 1,200 | 84,000 |
| Fecal Coliform | MPN/100 mL | 400 | 1. Basin Plan REC-1/REC-2 | < 20 | 3,300 | 490 | 460 | 78 | 3,100 |
| Total Coliform | MPN/100 mL | NA | NA | 40 | 79,000 | 3,300 | 79,000 | 23,000 | 240,000 |
| **CMC Benchmarks for Dissolved Metals** | | | | | | | | | |
| Cadmium, Dissolved | mg/L | | | NS | 0.015 | NS | 0.016 | 0.014 | 0.018 |
| Copper, Dissolved | mg/L | | | NS | 0.040 | NS | 0.041 | 0.037 | 0.047 |
| Lead, Dissolved | mg/L | | | NS | 0.223 | NS | 0.230 | 0.201 | 0.266 |
| Nickel, Dissolved | mg/L | | | NS | NS | 1.085 | 1.286 | 1.153 | 1.449 |
| Zinc, Dissolved | mg/L | | | NS | 0.314 | NS | 0.322 | 0.289 | 0.363 |

E = Estimated

NA indicate no criteria or published value was available or applicable to the matrix or program.

NS=Not Sampled

< = results less than the reporting limit.

** Benchmark was below detection limit, and so detection level exceedance cannot be determined.

a) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

## Long Term Effectiveness Assessment Targeted Dry MS4 Table (2007-2008)

| Tijuana River (TIJ02) | | | |
|---|---|---|---|
| **Group** | **Analyte** | **Units** | **7/30/2008** |
| General Chemistry | Total Nitrogen-N | mg/L | 1.36 |
| | Total Phosphate-P | mg/L | 0.013 |
| | Total Suspended Solids | mg/L | 0.5 |
| | Phosphorus, Total | mg/L | 0.026 |
| | Turbidity | NTU | NS |
| Bacteria | Enterococci | MPN/100mL | 500 |
| | Fecal Coliform | MPN/100mL | 20 |
| | Total Coliform | MPN/100mL | 300 |

NS=Not Sampled

# Long Term Effectiveness Assessment MS4 Tables

## Tijuana River Watershed Management Area MS4 Random Wet Weather 2009-2010

| Analyte | Units | Water Quality Benchmarks | Benchmark References | MS4W-TJR-05 | MS4W-TJR-05 | MS4W-TJR-07 | MS4W-TJR-07 | MS4W-TJR-08 | MS4W-TJR-08 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 80028768 | 80028768 | E-1B-02 | E-1B-02 | 15836 | 15836 |
| | | | | 12/7/2009 | 2/27/2010 | 2/5/2010 | 2/27/2010 | 1/18/2010 | 3/7/2010 |
| **Physical Chemistry** | | | | | | | | | |
| Conductivity | −S/cm | NA | NA | 151 | 183.8 | 180.2 | 122.9 | 50.3 | 237 |
| pH | pH Units | 6.5-9.0 | 1. Basin Plan | 8.75 | 8.46 | 7.56 | 7.88 | 7.83 | 7.03 |
| Water Temperature | Celcius | NA | NA | 12.7 | 18.2 | 15.8 | 18.7 | 14.5 | 13.9 |
| **General Chemistry** | | | | | | | | | |
| Nitrate as N | mg/L | 10 | 1. Basin Plan | 0.7 | 0.5 | 0.63 | 0.43 | 0.19 | 0.19 |
| Nitrate/Nitrite as N | mg/L | 10 | 1. Basin Plan | 0.84 | 0.56 | 0.68 | 0.46 | 0.24 | 0.25 |
| Nitrite as N | mg/L | 1 | 1. Basin Plan | 0.13 | 0.05 | 0.05 | <0.007 | <0.007 | 0.06 |
| Phosphorus, Total | mg/L | 2 | 1. Basin Plan | 0.97 | 0.99 | 0.28 | 0.22 | 0.14 | 0.08 |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | 1.3 | 1.5 | 1.6 | 0.6 | <0.3 | 0.8 |
| Total Nitrogen | mg/L | NA | NA | 2.1 | 2.1 | 2.3 | 1.1 | <0.5 | 1.1 |
| Total Suspended Solids | mg/L | 100 | 4. MSGP 2000 | 1,950 | 764 | 27 | 23 | 22 | <1 |
| Total Dissolved Solids (calculated)[1] | mg/L | 2,100* | 1. Basin Plan | 106 | 129 | 126 | 86 | 35 | 166 |
| **Bacterialogical** | | | | | | | | | |
| Enterococcus | MPN/100 mL | NA | NA | 50,000 | 50,000 | 24,000 | 50,000 | 1,300 | 5,000 |
| Fecal Coliforms | MPN/100 mL | 400-4,000 | 1. Basin Plan | 50,000 | 5,000 | 8,000 | 2,300 | 70 | 20 |
| Total Coliforms | MPN/100 mL | NA | NA | 140,000 | 130,000 | 60,000 | 80,000 | 3,000 | 2,800 |

<-Results less than the method detection limit
NA indicate no criteria or published value was available or applicable to the matrix or program.
*applies to hydrologic areas 911.12
[1] Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.7 (TDS=Conductivity x 0.7) per SM1030F.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

## Tijuana River Watershed Management Area MS4 Outfall Random Wet Weather 2008-2009

| Group | Analyte | Units | Benchmarks | Source | MS4W-TJR-01 | MS4W-TJR-02 | MS4W-TJR-03 | MS4W-TJR-08 |
|---|---|---|---|---|---|---|---|---|
| | | | | | 80028745 | 15836 | 80028739 | E-1B |
| | | | | | 12/15/2008 | 12/15/2008 | 2/5/2009 | 2/13/2009 |
| **Physical Chemistry** | Conductivity | −S/cm | NA | NA | 103.0 | 162.3 | 318.0 | 201.0 |
| | pH | pH units | 6.5-9.0 | 1. Basin Plan | 6.07 | 6.77 | 7.55 | 7.37 |
| | Temperature | °C | NA | NA | 14.4 | 13.7 | 14.3 | 14.0 |
| **General Chemistry** | Nitrate as N | mg/L | 10 | 1. Basin Plan | - | - | 1.00 | 0.69 |
| | Nitrate/Nitrite as N | mg/L | 10 | 1. Basin Plan | 0.48 | 1.01 | 1.20 | 0.72 |
| | Nitrite as N | mg/L | 1 | 1. Basin Plan | - | - | 0.190 | <0.007 |
| | Phosphorus, Total | mg/L | 0.1 | 1. Basin Plan | 0.7 | 0.36 | 0.39 | 0.49 |
| | Total Kjeldahl Nitrogen | mg/L | NA | NA | 1.8 | 1.6 | 4.4 | 3.4 |
| | Total Nitrogen | mg/L | 1 | 1. Basin Plan | 2.3 | 2.6 | 5.6 | 4.1 |
| | Total Suspended Solids | mg/L | 100 | 4. MSGP 2000 | <1 | <1 | 122 | 33 |
| **Bacteria** | Enterococci | MPN/100mL | NA | NA | 110,000 | 50,000 | 5,000 | 8,000 |
| | Fecal Coliform | MPN/100mL | 400 | 1. Basin Plan | 8,000 | 130 | 300 | 500 |
| | Total Coliform | MPN/100mL | NA | NA | 300,000 | 140,000 | 5,000 | 17,000 |

NA indicate no criteria or published value was available or applicable to the matrix or program.
< = Results less than the method detection limit

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

## Tijuana River WMA 2010-2011 MS4 Random Dry Weather

| Analyte | Units | Water Quality Benchmarks | Benchmark References | MS4D-TJR-13<br>6176<br>5/16/2011 |
|---|---|---|---|---|
| **Physical Chemistry** | | | | |
| Conductivity | −mhos/cm | NA | NA | 381 |
| pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.11 |
| Temperature | Celsius | NA | NA | 11.2 |
| **General Chemistry** | | | | |
| Nitrate as N | mg/L | 10 | 1. Basin Plan | <0.05 |
| Nitrate/Nitrite as N | mg/L | 10 | 1. Basin Plan | <0.05 |
| Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.05 |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | 2.4 |
| Total Nitrogen* | mg/L | 1 | 1. Basin Plan | **2.4** |
| Total Phosphorus* | mg/L | 0.1 | 4. MSGP 2000 | <0.05 |
| Total Dissolved Solids (calculated)[1] | mg/L | 500 (a) | 1. Basin Plan | 267 |
| Total Suspended Solids | mg/L | 58 | 4. MSGP 2000 | <20 |
| **Bacteriological** | | | | |
| Enterococcus | MPN/100 mL | 151 | NA | **300** |
| Fecal Coliform | MPN/100 mL | 400 | 1. Basin Plan (REC1) | 40 |
| Total Coliform | MPN/100 mL | NA | NA | 800 |

< - results are less than the reporting limit.

*Total Nitrogen and Total Phosphorus are narrative standards in the Basin Plan based on biostimulatory response to nutrients.

[1]Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F.

(a) Water Quality Benchmark for total dissolved solids is based on the San digeo Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to

NA - No criteria or published value was available or applicable to the matrix or program.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

## Tijuana River WMA 2010-2011 MS4 Targeted Dry Weather

| Analyte | Units | WQB CMC | WQB CCC | 911.11<br>E-1B<br>8/15/2011 | 911.3<br>TIJ02<br>7/12/2011 |
|---|---|---|---|---|---|
| Electrical Conductivity | ħS/cm | NA | NA | 12,030 | NS |
| pH | pH units | NA | NA | 8.06 | NS |
| Water Temperature | Celsius | NA | NA | 21.7 | NS |
| Ammonia as N | mg/L | (a) | (a) | 0.782 | 0.1 |
| Nitrate as N | mg/L | 10 | NA | 1.319 | 5.46 |
| Nitrite as N | mg/L | 1 | NA | NS | 0.009E |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | NS | 1.2 |
| Total Nitrogen (calculated) | mg/L | 1 | NA | NS | **6.7** |
| Dissolved Phosphorus | mg/L | 0.1 | NA | NS | **0.27** |
| Orthophosphate as P | mg/L | | NA | 0.638 | NS |
| Total Phosphorus | mg/L | 0.1 | NA | NS | **0.34** |
| Total Suspended Solids | mg/L | 58 | NA | NS | 1E |
| Total Dissolved Solids | mg/L | 2,100 (b) | NA | **8,421** | NS |
| Turbidity | NTU | 20 | NA | 3.05 | 1 |
| Surfactants (MBAS) | mg/L | 0.5 | NA | 0.5 | NS |
| Oil and Grease | mg/L | 10 | NA | <5 | NS |
| Enterococcus | MPN/100 mL | 151 | NA | **300** | 130 |
| Fecal Coliform | MPN/100 mL | 400/4,000 | NA | 2E | 130 |
| Total Coliform | MPN/100 mL | NA | NA | 22,000 | 800 |
| Chlorpyrifos | ħg/L | 0.02 | 0.014 | <0.05 | NS |
| Diazinon | ħg/L | 0.08 | 0.05 | <0.05 | NS |
| Total Hardness | mg $CaCO_3$/L | NA | NA | 300 | NS |
| Cadmium, Dissolved | mg/L | (e) | (e) | <0.01 | NS |
| Copper, Dissolved | mg/L | (e) | (e) | **0.041E** | NS |
| Lead, Dissolved | mg/L | (e) | (e) | <0.05 | NS |
| Zinc, Dissolved | mg/L | (e) | (e) | 0.131 | NS |

<-Results less than the reporting limit.

NA indicates no criteria or published value was available or applicable to the matrix or program.

NS indicates no sample taken.

E indicates estimated result.

(a) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.

(b) Water Quality Benchmark for Total Dissolved Solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego region (Basin Plan), 1994 (with amendments affective prior to April 25, 2007).

(e) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, Mat 18, 2000. The Criteria Maximum Concentration (CMC) was used.

## Tijuana River WMA 2010-2011 MS4 Random Wet Weather

| Analyte | Units | Water Quality Benchmarks | Benchmark References | MS4W-TJR-01 | MS4W-TJR-09 | MS4W-TJR-13 | MS4W-TJR-16 | MS4W-TJR-18 | MS4W-TJR-19 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 6379 | 3920 | 6176 | 4173 | 4319 | 3357 |
| | | | | 10/19/2010 | 2/18/2011 | 10/19/2010 | 2/18/2011 | 3/20/2011 | 3/21/2011 |
| **Physical Chemistry** | | | | | | | | | |
| Conductivity | −mhos/cm | NA | NA | 28.3 | 245 | 35.6 | 19.4 | 44.6 | 76.9 |
| pH | pH units | 6.5-9.0 | 1. Basin Plan | 6.53 | 8.22 | 6.82 | 8.84 | 7.62 | 7.61 |
| Water Temperature | Celsius | NA | NA | 15.4 | 10.3 | 9.6 | 9.6 | 7.3 | 7.6 |
| **General Chemistry** | | | | | | | | | |
| Nitrate as N | mg/L | 10 | 1. Basin Plan | 0.26 | <0.05 | 0.48 | 0.16 | 0.07 | 0.11 |
| Nitrate/Nitrite as N | mg/L | 10 | 1. Basin Plan | 0.29 | 0.07 | 0.48 | 0.19 | 0.12 | 0.14 |
| Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.05 | <0.05 | <0.05 | <0.05 | 0.05 | <0.05 |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | 1.5 | 2.1 | 1.2 | 1.7 | 1.6 | 2.1 |
| Total Nitrogen | mg/L | NA | NA | 1.8 | 2.2 | 1.7 | 1.9 | 1.7 | 2.2 |
| Total Phosphorus | mg/L | 2 | 4. MSGP 2000 | <0.05 | 0.24 | 0.64 | 0.93 | 0.71 | 0.19 |
| Total Dissolved Solids (calculated)[1] | mg/L | 500 (a) | 1. Basin Plan | 20 | 172 | 25 | 14 | 31 | 54 |
| Total Suspended Solids | mg/L | 100 | 4. MSGP 2000 | 28 | **121** | **2730** | **568** | **734** | 99 |
| **Bacteriological** | | | | | | | | | |
| Enterococcus | MPN/100 mL | NA | NA | TE | 5,000 | TE | 23,000 | 300 | 80,000 |
| Fecal Coliform | MPN/100 mL | 400/4000 | 1. Basin Plan (REC-1/REC-2) | 170 | 80 | **13,000** | <20 | <20 | 20 |
| Total Coliform | MPN/100 mL | NA | NA | 50,000 | 1,700 | 23,000 | 23,000 | 230 | 3,000 |

< - results are less than the reporting limit.

[1]Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F.

(a) Water Quality Benchmark for total dissolved solids is based on the San digeo Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007).

NA - No criteria or published value was available or applicable to the matrix or program.

TE - Tecnician error.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

## Tijuana River WMA 2011-2012 MS4 Random Dry Weather

| Analyte | Units | Water Quality Benchmarks | Benchmark References | 911.60<br>MS4D-TJR-02<br>4177<br>5/24/2012 |
|---|---|---|---|---|
| **Physical Chemistry** | | | | |
| Conductivity | −mhos/cm | NA | NA | 738 |
| pH | pH units | 6.5-9.0 | 1. Basin Plan | 8.09 |
| Temperature | Celsius | NA | NA | 17.0 |
| **General Chemistry** | | | | |
| Nitrate as N | mg/L | 10 | 1. Basin Plan | <0.05 |
| Nitrate/Nitrite as N | mg/L | 10 | 1. Basin Plan | <0.05 |
| Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.05 |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | 1.1 |
| Total Nitrogen* | mg/L | 1 | 1. Basin Plan | **1** |
| Total Phosphorus* | mg/L | 0.1 | 4. MSGP 2000 | <0.05 |
| Total Dissolved Solids (calculated)[1] | mg/L | 500 (a) | 1. Basin Plan | **517** |
| Total Suspended Solids | mg/L | 58 | 4. MSGP 2000 | <20 |
| **Bacteriological** | | | | |
| Enterococcus | MPN/100 mL | 151 | NA | **1,100** |
| Fecal Coliform | MPN/100 mL | 400 | 1. Basin Plan (REC1) | 20 |
| Total Coliform | MPN/100 mL | NA | NA | 230 |

< - results are less than the reporting limit.
NA indicate no criteria or published value was available or applicable to the matrix or program.
*Total Nitrogen and Total Phosphorus are narrative standards in the Basin Plan based on biostimulatory response to nutrients.
[1]Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F.

(a) Water Quality Benchmark for total dissolved solids is based on the San digeo Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007).

Highlighted text – exceeds water quality benchmark.

Sources
Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

## Tijuana River WMA 2011-2012 MS4 Targeted Dry Weather

| Analyte | Units | WQB CMC | WQB CCC | 911.11 DW322 6/19/2012 | 911.11 E1B 5/24/2012 | 911.11 E1B 7/16/2012 | 911.82 TIJ13 6/22/2012 |
|---|---|---|---|---|---|---|---|
| pH | pH units | NA | NA | 7.48 | NS | NS | NS |
| Ammonia as N | mg/L | (a) | (a) | NS | NS | NS | 0.06E |
| Nitrate as N | mg/L | 10 | NA | NS | NS | NS | <0.05 |
| Nitrate/Nitrite as N | mg/L | 10 | NA | NS | NS | NS | <0.05 |
| Nitrite as N | mg/L | 1 | NA | NS | NS | NS | <0.05 |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | NS | NS | NS | 0.9 |
| Total Nitrogen (calculated) | mg/L | 1 | NA | **2.5** | NS | NS | 0.9 |
| Dissolved Phosphorus | mg/L | 0.1 | NA | NS | NS | NS | **0.5** |
| Total Phosphorus | mg/L | 0.1 | NA | **0.68** | NS | NS | **0.52** |
| Total Suspended Solids | mg/L | 58 | NA | 44 | NS | NS | 4E |
| Total Dissolved Solids | mg/L | 500 (b) | NA | NS | NS | NS | **682** |
| Dissolved Oxygen | mg/L | 5 | NA | **4.4** | NS | NS | NS |
| Oil and Grease | mg/L | 10 | NA | NS | <1 | <5 | NS |
| Enterococcus | MPN/100 mL | 151 (e) | NA | **18,000E** | **700** | 36 | **2,100** |
| Fecal Coliform | MPN/100 mL | 400 | NA | NS | NS | NS | 130 |
| Fecal Coliform | MPN/100 mL | 4000 | NA | 3,300 | 30 | 700 | NS |
| Total Coliform | MPN/100 mL | NA | NA | 920,000 | 30,000 | 2,800 | 2,800 |
| Chlorpyrifos | −g/L | 0.02 | 0.014 | <0.96 | <0.05 | <0.05 | NS |
| Diazinon | −g/L | 0.08 | 0.05 | <0.96 | <0.05 | <0.05 | NS |
| Malathion | −g/L | 0.43 | 0.1 | NS | <0.05 | <0.05 | NS |
| Total Hardness | mg $CaCO_3$/L | NA | NA | 320 | 325 | 256 | NS |
| Cadmium, Dissolved | mg/L | (f) | (f) | <0.005 | <0.001 | <0.001 | NS |
| Copper, Dissolved | mg/L | (f) | (f) | 0.023 | 0.022 | 0.014 | NS |
| Lead, Dissolved | mg/L | (f) | (f) | <0.005 | <0.005 | <0.005 | NS |
| Nickel, Dissolved | mg/L | (f) | (f) | 0.01 | NS | NS | NS |
| Thallium, Dissolved | mg/L | NA | NA | <0.01 | NS | NS | NS |
| Zinc, Dissolved | mg/L | (f) | (f) | 0.028 | 0.06 | 0.056 | NS |

<-Results less than the reporting limit.

NA indicate no criteria or published value was available or applicable to the matrix or program.

E-Reported value is estimated.

NS-Not sampled.

(a) Water Quality Benchmark is based on CMC (salmonids absent) and CCC (early life stages present) using water temperature and pH described in the U.S. EPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.

(b) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(e) Water Quality Benchmark for Enterococcus is based on the maximum criteria for infrequently used freshwater area by the San Diego Regional Water Quality Control Plan for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(f) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) and Continuous Criteria Concentration (CCC) were used.

Highlighted text – exceeds water quality benchmark.

## Tijuana River WMA 2011-2012 MS4 Random Wet Weather

| Analyte | Units | Water Quality Benchmarks | Benchmark References | 911.60 | 911.12 | 911.30 | 911.41 | 911.41 | 911.41 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | MS4W-TJR-02 | MS4W-TJR-03 | MS4W-TJR-05 | MS4W-TJR-06 | MS4W-TJR-21 | MS4W-TJR-45 |
| | | | | 4177 | 15836 | 3008 | 6354 | 6400 | 6413 |
| | | | | 12/12/2011 | 10/5/2011 | 11/4/2011 | 11/12/2011 | 3/17/2012 | 3/17/2012 |
| **Physical Chemistry** | | | | | | | | | |
| Conductivity | −mhos/cm | NA | NA | 535 | 177 | 60.5 | 79.5 | 40.3 | 21 |
| pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.79 | 7.65 | 7.81 | 7.61 | 7.35 | 7.31 |
| Water Temperature | Celsius | NA | NA | 9.00 | 18.20 | 10.40 | 11.60 | 11.40 | 9.80 |
| **General Chemistry** | | | | | | | | | |
| Nitrate as N | mg/L | 10 | 1. Basin Plan | <0.05 | 1.21 | 0.7 | 0.24 | 0.23 | 0.3 |
| Nitrate/Nitrite as N | mg/L | 10 | 1. Basin Plan | <0.05 | 1.37 | 0.76 | 0.38 | 0.28 | 0.34 |
| Nitrite as N | mg/L | 1 | 1. Basin Plan | <0.05 | 0.16 | 0.06 | 0.14 | <0.05 | 0.05 |
| Total Kjeldahl Nitrogen | mg/L | NA | NA | 1.7 | 6.2 | 1.2 | 1.8 | <0.5 | <0.5 |
| Total Nitrogen | mg/L | NA | NA | 1.7 | 7.6 | 2 | 2.2 | <0.5 | <0.5 |
| Total Phosphorus | mg/L | 2 | 4. MSGP 2000 | <0.05 | 0.21 | 0.06 | 0.21 | 0.22 | 0.53 |
| Total Dissolved Solids (calculated)[1] | mg/L | 500 (a) | 1. Basin Plan | 374.5 | 123.9 | 42.4 | 55.7 | 28.2 | 14.7 |
| Total Suspended Solids | mg/L | 100 | 4. MSGP 2000 | <20 | <20 | 31 | **272** | 55 | **220** |
| **Bacteriological** | | | | | | | | | |
| Enterococcus | MPN/100 mL | NA | NA | 500 | 3,000 | 5,000 | 3,000 | 2,200 | 17,000 |
| Fecal Coliform | MPN/100 mL | 400/4000 | 1. Basin Plan (REC-1/REC-2) | 20 | 70 | **1,400** | **500** | 110 | 40 |
| Total Coliform | MPN/100 mL | NA | NA | 1,300 | 6,000 | 240,000 | 50,000 | 1,400 | 5,000 |

< - results are less than the reporting limit.

NA indicate no criteria or published value was available or applicable to the matrix or program.

[1]Total dissolved solids was calculated by multiplying the conductivity by a factor of 0.4 (TDS=Conductivity x 0.7) per SM1030F

(a) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with ammendments effective prior to April 25, 2007). Benchmark does not apply to 911.1.

Highlighted text – exceeds water quality benchmark.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations

## Tijuana River WMA 2011-2012 MS4 Targeted Wet Weather

| Analyte | Units | Water Quality Benchmarks | Benchmark References | 911.12 | | | |
|---|---|---|---|---|---|---|---|
| | | | | MS4T-TJR-RISE | MS4T-TJR-PEAK | MS4T-TJR-FALL | MS4-TJR |
| | | | | 11/4/2011 | 11/4/2011 | 11/4/2011 | EMC |
| **Physical Chemistry** | | | | | | | |
| Electrical Conductivity | −mhos/cm | NA | | 141.3 | 76 | 68.7 | 101.6 |
| pH | pH units | 6.5-9.0 | 1. Basin Plan | 7.45 | 7.68 | 6.61 | 7.45 |
| Water Temperature | Celsius | NA | | 15.8 | 14 | 13.1 | 14.6 |
| **Bacteriological** | | | | | | | |
| Enterococcus | MPN/100 mL | NA | | 70,000 | 14,000 | 8,000 | 36,030 |
| Fecal Coliform | MPN/100 mL | 4,000 | 1.Basin Plan REC-1/REC-2 | 700 | 230 | 300 | 430 |
| Total Coliform | MPN/100 mL | NA | | 7,000 | 5,000 | 8,000 | 6,203 |
| **General Chemistry** | | | | | | | |
| Ammonia as N | mg/L | (a) | 6. USEPA Water Quality Criteria (Freshwater) | 0.32 | 0.24 | 0.15 | 0.26 |
| Biochemical Oxygen Demand | mg/L | 30 | 4. MSGP 2000, 8. McNeeley (1979) | 11 | 3.5 | 3.3 | 6.5 |
| Chemical Oxygen Demand | mg/L | 120 | 4. MSGP 2000 | **130** | 83 | 24 | 94 |
| Chloride | mg/L | NA (b) | 1. Basin Plan | 10 | 2.8 | 2.9 | 5.9 |
| Dissolved Phosphorus | mg/L | 2 | 4. MSGP 2000 | 0.09 | 0.055 | 0.048 | 0.069 |
| Nitrate as N | mg/L | 10 | 1. Basin Plan | 1.1 | 0.2 | 0.18 | 0.59 |
| Nitrate/Nitrite as N | mg/L | 10 | 1. Basin Plan | 1.1 | 0.24 | 0.21 | 0.61 |
| Nitrite as N | mg/L | 1 | 1. Basin Plan | 0.068J | 0.037J | 0.032J | 0.050 |
| Oil and Grease | mg/L | 10 | 1. Basin Plan, 3. Anacostia River TMDL, 4. MSGP 2000 | 1.6J | <1.3 | 1.7J | 1.2 |
| Sulfate | mg/L | NA (c) | 1. Basin Plan | 8.8 | 3.1 | 2.5 | 5.5 |
| Surfactants (MBAS) | mg/L | 0.5 | 1. Basin Plan | **0.6** | 0.036J | 0.05 | 0.282 |
| Total Dissolved Solids | mg/L | NA (d) | 1. Basin Plan | 80 | 46 | 40 | 60 |
| Total Hardness | mg $CaCO_3$/L | NA | | 62 | 52 | 25 | 52 |
| Total Kjeldahl Nitrogen | mg/L | NA | | 2.7 | 1.4 | 0.57 | 1.84 |
| Total Nitrogen | mg/L | NA | | 3.8 | 1.6 | 0.79 | 2.43 |
| Total Phosphorus | mg/L | 2 | 4. MSGP 2000 | 0.37 | 0.33 | 0.1 | 0.31 |
| Total Suspended Solids | mg/L | 100 | 4. MSGP 2000, 1. Basin Plan | **390** | **350** | 32 | **319** |
| Turbidity | NTU | 20 | 1. Basin Plan | **52** | **47** | **24** | **46** |
| **Organophosphorus Pesticides** | | | | | | | |
| Chlorpyrifos | −g/L | 0.02 acute / 0.014 chronic | 12. CA Dept. of Fish & Game, 2000 | <0.014 | <0.014 | <0.0069 | 0.0065 |
| Diazinon | −g/L | 0.08 acute / 0.05 chronic | 12. CA Dept. of Fish & Game, 2000, 11. Chollas Creek TMDL for Diazinon, 10. USEPA, Aquatic Life Ambient Water Quality Criteria Diazinon | <0.01 | <0.01 | <0.0052 | 0.0046 |
| Malathion | −g/L | 0.43 | 13. CA Dept. of Fish & Game, 1998, 5. Goldbook | <0.015 | <0.015 | <0.0076 | 0.0069 |
| **Total Metals** | | | | | | | |
| Antimony, Total | mg/L | NA | | 0.0019 | 0.0014 | 0.00063 | 0.00150 |
| Arsenic, Total | mg/L | NA | | 0.0022 | 0.0019 | 0.001 | 0.0019 |
| Cadmium, Total | mg/L | NA | | 0.00057 | 0.00046 | 0.00018 | 0.00046 |
| Chromium, Total | mg/L | NA | | 0.0094 | 0.008 | 0.0023 | 0.0077 |
| Copper, Total | mg/L | NA | | 0.037 | 0.026 | 0.01 | 0.028 |
| Lead, Total | mg/L | NA | | 0.057 | 0.044 | 0.007 | 0.0440 |
| Manganese, Total | mg/L | NA | | 0.17 | 0.15 | 0.033 | 0.141 |
| Nickel, Total | mg/L | NA | | 0.01 | 0.0073 | 0.0023 | 0.0077 |
| Selenium, Total | mg/L | 0.005 | 16. 40 CFR 131.38 | 0.00035J | <0.00028 | <0.00028 | 0.00023 |
| Zinc, Total | mg/L | NA | | 0.44 | 0.27 | 0.081 | 0.315 |
| **Dissolved Metals** | | | | | | | |
| Antimony, Dissolved | mg/L | 0.006 | 1. Basin Plan | 0.0011 | 0.00056 | 0.00035J | 0.00076 |
| Arsenic, Dissolved | mg/L | 0.34 (e) | 16. 40 CFR 131.38 | 0.00097 | 0.00083 | 0.00081 | 0.00089 |
| Cadmium, Dissolved | mg/L | (f) | 16. 40 CFR 131.38 | 0.000098J | 0.00003J | 0.000054J | 0.000063 |
| Chromium, Dissolved | mg/L | (f) | 16. 40 CFR 131.38 | 0.00071 | 0.00042 | 0.00033 | 0.00053 |
| Copper, Dissolved | mg/L | (f) | 16. 40 CFR 131.38 | **0.012** | 0.0049 | **0.0046** | **0.0079** |
| Lead, Dissolved | mg/L | (f) | 16. 40 CFR 131.38 | 0.00083 | 0.00029 | 0.00028 | 0.00052 |
| Nickel, Dissolved | mg/L | (f) | 16. 40 CFR 131.38 | 0.0032 | 0.00075J | 0.00084 | 0.00182 |
| Selenium, Dissolved | mg/L | NA | | 0.00039J | <0.00028 | <0.00028 | 0.00025 |
| Zinc, Dissolved | mg/L | (f) | 16. 40 CFR 131.38 | 0.065 | 0.0096 | 0.021 | 0.0353 |

<-Results less than the method detection limit.

NA indicate no criteria or published value was available or applicable to the matrix or program.

(a) Water Quality Benchmark is based on CMC (salmonids absent) using pH described in the USEPA, 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA-822-R-99-014, December 1999.

(b) Water Quality Benchmark for chloride is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(c) Water Quality Benchmark for sulfate is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(d) Water Quality Benchmark for total dissolved solids is based on the San Diego Regional Water Quality Control Plan by watershed for the San Diego Region (Basin Plan), 1994 (with amendments effective prior to April 25, 2007).

(e) Water Quality Benchmark for dissolved metal fractions are based on a default water effects ratios (WER) value of 1 and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000.

(f) Water Quality Benchmark for dissolved metal fractions are based on total hardness and are calculated as described by the USEPA Federal Register Doc. 40 CFR Part 131, May 18, 2000. The Criteria Maximum Concentration (CMC) was used.

H-Samples analyzed/and or received past recommended holding time.

J-Analyte was detected at a concentration below the reporting limit and above the method detection limit. Reported value is estimated.

Shaded text – exceeds water quality benchmark.

Sources

Please refer to the San Diego County Copermittee Regional Monitoring Program Benchmark Sources for benchmark source citations.

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**Table F-1**
**Receiving Water Conditions Potentially Attributed in Part to MS4 Discharges (Priority Water Quality Conditions)**

| Hydrologic Area | Receiving Water | Condition (indicated with "x" in next column) | Temporal Extent[1] | | Data or Information Attributing MS4 Discharge (indicated with shading in previous column) |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River | Impairment of REC-1 due to Total Coliform. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River | Impairment of REC-1 due to Fecal Coliform. | x | x | Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River | Impairment of REC-1 due to *Enterococcus*. | x | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive | Impairment of REC-1 due to Total Coliform. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive | Impairment of REC-1 due to Fecal Coliform. | x | x | Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive | Impairment of REC-1 due to *Enterococcus*. | x | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at Monument Road | Impairment of REC-1 due to Total Coliform. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |

| Hydrologic Area | Receiving Water | Condition (indicated with "x" in next column) | Temporal Extent[1] | | Data or Information Attributing MS4 Discharge (indicated with shading in previous column) |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at Monument Road | Impairment of REC-1 due to Fecal Coliform. | x | x | Wet: MS4 sampling results presented in LTEA. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at the US Border | Impairment of REC-1 due to Total Coliform. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at the US Border | Impairment of REC-1 due to Fecal Coliform. | x | x | Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at the US Border | Impairment of REC-1 due to *Enterococcus*. | x | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth | Impairment of REC-1 due to Total Coliform. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth | Impairment of REC-1 due to Fecal Coliform. | x | x | Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth | Impairment of REC-1 due to *Enterococcus*. | x | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of REC-1 due to Indicator Bacteria. | x | x | Wet: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |

| Hydrologic Area | Receiving Water | Condition (indicated with "x" in next column) | Temporal Extent[1] | | Data or Information Attributing MS4 Discharge (indicated with shading in previous column) |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Tijuana Valley (911.1) | Tijuana River | Elevated fecal coliforms at NPDES monitoring location. | x | x | Wet: MS4 sampling results presented in LTEA. Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. |
| Tijuana Valley (911.1) | Tijuana River | Elevated *Enterococcus* at NPDES monitoring location. | | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Solids. | x | x | Wet: MS4 sampling results presented in LTEA and the 2011-12 Weston Report. Dry: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Sedimentation/Siltation. | x | x | Wet: MS4 sampling results presented in LTEA and the 2011-12 Weston Report. |
| Tijuana Valley (911.1) | Tijuana River | Elevated TSS at NPDES sampling location. | x | x | Wet: MS4 sampling results presented in LTEA and the 2011-12 Weston Report. Dry: MS4 sampling results presented in LTEA. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Tijuana River | Elevated Turbidity at NPDES sampling location. | x | x | Wet: MS4 sampling results presented in LTEA and the 2011-12 Weston Report. Dry: MS4 sampling results presented in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of REC-2 due to Trash. | x | x | Tijuana River Watershed Technical Support Document includes storm water runoff and dry weather runoff as sources of trash in the Tijuana River and Estuary. |

| Hydrologic Area | Receiving Water | Condition (indicated with "x" in next column) | Temporal Extent[1] | | Data or Information Attributing MS4 Discharge (indicated with shading in previous column) |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Total Nitrogen as N. | x | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Phosphorus. | x | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Eutrophic conditions. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Low Dissolved Oxygen. | x | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Tijuana River | Elevated BOD and COD at NPDES sampling location. | x | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Pesticides. | x | | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of REC-1 due to Surfactants (MBAS). | x | x | Dry: MS4 sampling results presented in LTEA. |
| Tijuana Valley (911.1) | Tijuana River | Impairment of MUN due to Synthetic Organics. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |

| Hydrologic Area | Receiving Water | Condition (indicated with "x" in next column) | Temporal Extent[1] | | Data or Information Attributing MS4 Discharge (indicated with shading in previous column) |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Tijuana Valley (911.1) | Tijuana River | Impairment of WARM due to Toxicity. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of MAR due to Turbidity. | x | x | Wet and Dry: Tijuana River Bacterial Source Identification – Final Report |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of RECT-1 due to Indicator Bacteria. | x | x | Wet and Dry: Tijuana River Bacterial Source Identification – Final Report |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of REC-2 due to Trash. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as Potential Source. Tijuana River Watershed Technical Support Document includes storm water runoff and dry weather runoff as sources of trash in the Tijuana River and Estuary. |
| Tijuana Valley (911.1) | Tijuana River Estuary | Impairment of MAR due to Low Dissolved Oxygen. | x | x | Dry: MS4 sampling results presented in LTEA and the 2010-11 and 2011-12 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Barrett Lake (911.3) | Barrett Lake | Impairment of WARM due to Total Nitrogen as N. | x | x | Dry: MS4 sample results presented in LTEA and 2010-11 Weston Report. 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Monument (911.4) | Pine Valley Creek (Upper) | Impairment of MUN due to Turbidity. | x | x | Wet: MS4 sample results presented in 2011-12 Weston Report. |

| Hydrologic Area | Receiving Water | Condition (indicated with "x" in next column) | Temporal Extent[1] | | Data or Information Attributing MS4 Discharge (indicated with shading in previous column) |
|---|---|---|---|---|---|
| | | | Wet | Dry | |
| Morena (911.5) | Morena Reservoir | Impairment of WARM due to Phosphorus. | x | x | 303(d) List includes "Urban Runoff/Storm Sewers" as potential source. |
| Campo (911.8) | Campo Creek | Elevated *Enterococcus* at NPDES sampling location. | | x | Dry: MS4 sample results presented in 2011-12 Weston Report. |
| Campo (911.8) | Campo Creek | Elevated Phosphorus at NPDES sampling location. | | x | Dry: MS4 sample results presented in 2011-12 Weston Report. |
| Campo (911.8) | Campo Creek | Elevated TDS at NPDES sampling location. | x | x | Dry: MS4 sample results presented in 2011-12 Weston Report. |

Notes:

"X" indicates temporal extent of receiving water condition.

Shading indicates temporal extent of MS4 outfall monitoring data.

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**Calculations for 911.1**

| | Total Acres | Relative Magnitude of Pollutant Load | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sedimentation/Siltation/ Solids/TSS | Turbidity | Indicator Bacteria | Low DO | Nutrients | Surfactants (MBAS) | TDS | Trash | Pesticides | Synthetic Organics | Toxicity |
| Commercial | 460 | 2 | 2 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| Industrial | 1053 | 3 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 1 | 3 | 3 |
| Transportation | 2291 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 3 |
| Low Density Residential | 1373 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 |
| High Density Residential | 577 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 |
| | **Average Pollutant Load Magnitude Weighted by Land Area Acreages** | 2.6 | 2.6 | 1.6 | 1.7 | 1.4 | 1.7 | 1.8 | 2.0 | 1.4 | 2.2 | 2.2 |
| | **Percentage of Land Area Scored "High"** | 58% | 58% | 18% | 34% | 0% | 8% | 18% | 26% | 0% | 58% | 58% |

**Calculations for 911.3**

| | Total Acres | Relative Magnitude of Pollutant Load | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sedimentation/Siltation/ Solids/TSS | Turbidity | Indicator Bacteria | Low DO | Nutrients | Surfactants (MBAS) | TDS | Trash | Pesticides | Synthetic Organics | Toxicity |
| Commercial | 0 | 2 | 2 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| Industrial | 0 | 3 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 1 | 3 | 3 |
| Transportation | 116 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 3 |
| Low Density Residential | 1224 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 |
| High Density Residential | 18 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 |
| | **Average Pollutant Load Magnitude Weighted by Land Area Acreages** | 2.1 | 2.1 | 1.9 | 2.8 | 1.9 | 1.9 | 1.1 | 1.1 | 1.9 | 1.2 | 1.2 |
| | **Percentage of Land Area Scored "High"** | 9% | 9% | 1% | 91% | 0% | 0% | 0% | 0% | 0% | 9% | 9% |

Note: Municipal and institutional land uses are included with commercial in this analysis.

**Calculations for 911.5**

| | Total Acres | Relative Magnitude of Pollutant Load | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sedimentation/Siltation/ Solids/TSS | Turbidity | Indicator Bacteria | Low DO | Nutrients | Surfactants (MBAS) | TDS | Trash | Pesticides | Synthetic Organics | Toxicity |
| Commercial | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| Industrial | 0 | 3 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 1 | 3 | 3 |
| Transportation | 48 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 3 |
| Low Density Residential | 779 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 |
| High Density Residential | 72 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 |
| | **Average Pollutant Load Magnitude Weighted by Land Area Acreages** | 2.1 | 2.1 | 2.0 | 2.9 | 1.9 | 1.9 | 1.1 | 1.1 | 1.9 | 1.1 | 1.1 |
| | **Percentage of Land Area Scored "High"** | 5% | 5% | 8% | 94% | 0% | 0% | 0% | 0% | 0% | 5% | 5% |

**Calculations for 911.8**

| | Total Acres | Relative Magnitude of Pollutant Load | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sedimentation/Siltation/ Solids/TSS | Turbidity | Indicator Bacteria | Low DO | Nutrients | Surfactants (MBAS) | TDS | Trash | Pesticides | Synthetic Organics | Toxicity |
| Commercial | 105 | 2 | 2 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| Industrial | 69 | 3 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 1 | 3 | 3 |
| Transportation | 1204 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 3 |
| Low Density Residential | 11804 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 |
| High Density Residential | 77 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 |
| | **Average Pollutant Load Magnitude Weighted by Land Area Acreages** | 2.1 | 2.1 | 1.9 | 2.8 | 1.9 | 1.9 | 1.1 | 1.1 | 1.9 | 1.2 | 1.2 |
| | **Percentage of Land Area Scored "High"** | 10% | 10% | 1% | 90% | 0% | 1% | 1% | 1% | 0% | 10% | 10% |

Note: Municipal and institutional land uses are included with commercial in this analysis.

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**Conditions**

- Viruses: Hep A – River Mouth
- Pathogens

**Sources**

- Military Operations – NOLF
- Agriculture/Ranches
- Unpaved alleys
- Bare/Un-vegetated yards
- Oils on surfaces
- Illegal dumping
- Aerial deposition – Border crossing (Prevailing winds: West and East)
- Encampments
- Agricultural debris/Residuals
- Food vendors/Stands

**Strategies**

- Focus on culture – Not just translate
- Targeted trash campaign at Border Xing Increase trash receptacles, public areas, (Disneyland study " 26 steps" )
- Discarding packaging
- Street sweeping efficiency studies
- Cleanup events
- Bioremediation – Metals, bacteria
- Limit home oil/Fluid changes
- Residential Rain Harvesting
- Recycling/Disposal events
- More coordination – Navy, Border Patrol
- Recycling plastics
- Non – native invasive removal / wetland restoration
- Cultural trash ethics – Education
- Communication strategy
- Junkyards – E. San Ysidro
- Cigarette butt collection/Receptacles

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Appendix H.1 City of Imperial Beach Strategies and Schedules

Appendix H.2 City of San Diego Strategies and Schedules

Appendix H.3 County of San Diego Strategies and Schedules

# Appendix H.1 City of Imperial Beach Strategies and Schedules

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Jurisdictional Strategies** | | | | | | | | | | | |
| ***Development Planning*** | | | | | | | | | | | |
| ***All Development Projects*** | | | | | | | | | | | |
| 1 | For all development projects, administer a program to ensure implementation of source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area, where applicable and feasible. | Refer to JRMP | TBD | TBD | TBD | City-wide | FY16 | Ongoing | Development Permit Fee and General Fund | Community Development and Public Works | |
| 2 | Update municipal code and ordinances to facilitate and encourage LID and source control BMPs. | Refer IBMC and BMP Design Manuel | TBD | TBD | TBD | City-wide | FY16 | As needed | General Fund | Env Division and City Attorney | |
| 3 | Development and redevelopment projects (all projects) with greater than $50,000 of improvements get reviewed by the Public Works department for public improvement conditions which include enhanced storm water conditions. | Require source control and LID BMPs as conditions on standard development projects greater than $50,0000 | TBD | TBD | TBD | City-wide | FY15 | Ongoing | Development Permit Fee and General Fund | Public Works | Develop list of standard conditions for project review in JRMP |
| 4 | Develop standard project review conditions for non-priority development projects for storm water. | Refer to JRMP | TBD | TBD | TBD | City-wide | FY17 | As needed | Env Division Budget | Env Division | Plan to develop standards during this permit cycle |
| 5 | Provide education opportunities to developers and project applicants on storm water requirements. | See education component | TBD | TBD | TBD | City-wide | FY15 | Ongoing | Env Division Budget | Env Division | |
| 6 | Update education materials for developers (brochures, forms, website…) | See education component | TBD | TBD | TBD | City-wide | FY17 | As needed | Env Division Budget | Env Division | Update at least once per permit cycle |
| 7 | Train staff on LID regulatory changes, BMP Design Manual, and MS4 Permit elements. | See education component | TBD | TBD | TBD | City-wide | FY15 | Ongoing | Env Division Budget | Public Works | |
| 8 | Provide storm water conditions on Encroachment Permits. | Reinforce construction BMPs through encroachment permit process | TBD | TBD | TBD | City-wide | FY16 | Ongoing | General Fund | Public Works | Encroachment permits get routed through PW |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | Develop GIS inventory of storm water BMPs required for conditions of approval on PDP and standard development projects. | Need to evaluate feasibility | Optional | TBD | TBD | City-wide | FY18 | As needed | General Fund | Community Development, Public Works, and GIS | Will be challenging |
| ***Priority Development Projects (PDPs)*** | | | | | | | | | | | |
| 10 | For PDPs, administer a program requiring implementation of structural BMPs to control pollutants and manage hydromodification. Includes confirmation of design, construction, and maintenance of PDP structural BMPs. | Refer to JRMP | TBD | TBD | TBD | City-wide | FY16 | Ongoing | Development Permit Fee and General Fund | Community Development and Public Works | |
| 11 | Maintain watershed database of PDP and BMPs and link to GIS | Need to evaluate feasibility | TBD | TBD | TBD | City-wide | FY18 | As needed | General Fund | Env Division and GIS | Link PDP to watersheds and GIS during this permit cycle may be challenging |
| 12 | Update IBMC and BMP Design Manual procedures to determine nature and extent of storm water requirements applicable to development projects and to identify conditions of concern for selecting, designing, and maintaining appropriate structural BMPs. | Refer IBMC and BMP Design Manuel | TBD | TBD | TBD | City-wide | FY16 | Ongoing | General Fund | Env Division and Community Development | Continue to work with Community Development |
| 13 | Review and update post construction BMP maintenance agreement for PDPs and review administrative process. | Provide a comprehensive review of BMP Maintenance agreement and aim for simplification. | Optional | TBD | TBD | City-wide | FY18 | As needed | General Fund | Env Division, City Attorney, and Department Directors | Review and update post construction BMP maintenance during permit cycle |
| 14 | Collaborate with regional Copermittees on implementation of WMAAs and alternative compliance program. | Participate in regional groups on WMAA implementation and assessment and consider possible implementation in IB. | TBD | TBD | TBD | Regional | FY16 | Ongoing | Env Division Budget | Env Division | Complicated |
| ***Green Streets*** | | | | | | | | | | | |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | Integrate LID and green street designs into CIP projects where applicable and feasible. | Integrate LIDs and green street concepts into CIPs and long term planning vision. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund and CIPs | Community Development and Public Works | Consider applicability of LID BMPs in the design of CIPs |
| ***Construction Management*** | | | | | | | | | | | |
| 16 | Administer a program to oversee implementation of BMPs during the construction phase of land development. Includes inspections at an appropriate frequency and enforcement of requirements. | Inspect before rain events and during any permit inspection | TBD | TBD | TBD | City-wide | FY 15 | Ongoing | Development Permit Fee and General Fund | Public Works and Community Development | All construction projects are considered priorities |
| 17 | Maintain and update a quarterly watershed based inventory of active construction projects. | Construction inventory. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | Development Permit Fee and General Fund | Public Works and Community Development | |
| 18 | Maintain a watershed based inventory of construction inspections. | Construction inspections by Community Development for private projects and Public Works for public projects. | TBD | TBD | TBD | City-wide | FY 15 | Ongoing | Development Permit Fee and General Fund | Public Works and Community Development | |
| 19 | Require the implementation of minimum BMPs at construction sites. | Refer to JRMP and IBMC | TBD | TBD | TBD | City-wide | FY 15 | Ongoing | Development Permit Fee and General Fund | Public Works and Community Development | |
| ***Existing Development*** | | | | | | | | | | | |
| ***Commercial, Industrial, Municipal, and Residential Facilities and Areas*** | | | | | | | | | | | |
| 20 | Administer a program to require implementation of minimum BMPs for existing development (commercial, industrial, municipal, and residential) that are specific to the facility, area types, and PGAs, as appropriate. Includes inspection of existing development at appropriate frequencies and using appropriate methods. | Provide onsite inspections at least once per permit cycle | TBD | TBD | TBD | City-wide | FY 15 | Ongoing | General Fund | Public Works | |
| 21 | Maintain a watershed based inventory of existing development in GIS. | Develop inventory in Access and GIS | TBD | TBD | TBD | City-wide | FY 15 | Ongoing | General Fund | Env Division and GIS | |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | Target residential inspections for sediment and irrigation runoff | Target residential inspections on a specific issue. | TBD | TBD | TBD | City-wide | FY17 | As needed | Env Division Budget | Env Division | |
| 23 | Target commercial inspections for trash storage areas and FOG management | Target commercial inspections on specific BMPs. | TBD | TBD | TBD | City-wide | FY17 | As needed | Env Division Budget | Env Division | |
| 24 | Target Municipal inspections on landscaping and maintenance of LID areas and existing BMPs. | Target municipal inspections for specific pollutant. | TBD | TBD | TBD | City-wide | FY17 | As needed | Env Division Budget | Env Division and Parks and Facilities | |
| 25 | Update minimum BMPs for existing residential, commercial, and municipal facilities. | JRMP and IBMC | TBD | TBD | TBD | City-wide | FY16 | As needed | Env Division Budget | Env Division and City Attorney | |
| 26 | Implement pet waste program. Includes the installation and maintenance of pet waste bag dispensers and trash bins, signage and education, physical removal of pet waste at parks, and enforcement. | Maintain pet waste bag program. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Env Division and Parks and Facilities | |
| 27 | Review and update City GIS database related to storm water. | Significant redevelopment over the past permit cycle requires an update to the City GIS database. | TBD | TBD | TBD | City-wide | FY19 | As needed | General Fund | Env Division and GIS | |
| ***MS4 Infrastructure*** | | | | | | | | | | | |
| 28 | Implementation of operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, detention basins, etc.) for water quality improvement. | Annually inspect and clean all MS4 catch basins and lines that have visual impairments of trash or debris. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Env Division and Sewer Division | Automation of data entry |
| 29 | Clean and maintain MS4 outfall locations (September-October) | Due to wildlife nesting concerns the City of IB coordinates its cleaning and maintenance of MS4 outfall locations with the FWS along SD Bay and Tijuana River National Estuarine Research Reserve along TJ River. Annual maintenance is provided for vegetation and debris removal. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Public Works | |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | Ensure operation and maintenance of Navy outfalls. | In the SD Bay watershed a portion of the City's MS4 drains to a detention basin on Navy property. Within the TJ watershed a portion of the City's MS4 drains to a Navy outfall. The City coordinates annual inspections of these locations and works with the Navy to ensure adequate operation and maintenance of these areas. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Env Division and Public Works | |
| 31 | Provide operation and maintenance of the 10th Street and IB Blvd CDS unit. | Inspect quarterly | TBD | TBD | TBD | Tijuana River | FY15 | Ongoing | General Fund | Env Division and Sewer Division | |
| 32 | Provide operation and maintenance cleaning of MS4 catch basin filters. | Quarterly clean and inspect MS4 catch basin filters. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Env Division and Sewer Division | |
| 33 | Provide operation and maintenance of low flow and first flush storm drain divers at Palm Ave and Date Ave. | Inspect weekly | TBD | TBD | TBD | San Diego Bay | FY15 | Ongoing | General Fund | Env Division and Sewer Division | |
| 34 | Provide operation and maintenance of LID infiltration areas. | Maintenance requirements vary but at a minimum each infiltration area receives maintenance annually. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Env Division, Streets Division, Parks and Facilities | |
| 35 | Provide operation of maintenance of wash out diverters at PW, Lifeguards, and fire station. | Inspect annually | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Sewer Division and Tidelands | |
| ***Roads, Streets, and Parking Lots*** | | | | | | | | | | | |
| 36 | Implement operation and maintenance activities for public streets, unpaved roads, paved roads, and paved highways | Refer to JRMP | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Public Works | |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 37 | Provide street sweeping of residential areas, commercial areas, paved alleys, medians, and parking lots. | Weekly sweeping: Commercial areas including open stripped and raised curb medians; and municipal parking areas.<br>Two times per month sweeping: Beachfront area (Seacoast residential area)<br>Monthly sweeping: Residential areas including stripped and raised curb medians, and paved alleys. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Env Division and EDCO | |
| 38 | Evaluate street sweeping effectiveness for opportunities of enhancement. | Hold community meetings, present options to council, and evaluate options with street sweeping contract. | Optional | TBD | TBD | City-wide | FY18 | As needed | General Fund | Env Division and EDCO | |
| 39 | Develop plan for unimproved alleys. | Develop plans with the community on how best to address unimproved alleys in the City. Any improvements will require community support and be conformant to EPA green streets standards. | Optional | TBD | TBD | City-wide | FY15 | Ongoing | General Fund and CIP | Public Works and Community Development | |
| 40 | Daily Tidelands maintenance of beachfront property. | Tidelands division provides daily trash collection, sweeping, and maintenance of the beachfront and Seacoast Dr. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Tidelands | |
| 41 | Provide weekly bulky item pickup from alleys of illegally dumped material. | Illegally dumped materials in City alleys are cleaned up every week. Items get reported to PW and EDCO performs the cleanup every week. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Env Division and EDCO | |
| ***Pesticides, Herbicides, and Fertilizer BMP Program*** | | | | | | | | | | | |
| 42 | Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications. | Integrated pest management | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Parks and Facilities | |
| ***Retrofit and Rehabilitation in Areas of Existing Development*** | | | | | | | | | | | |
| 43 | Consider the integration of LID retrofits where feasible as part of street CIP rehabilitation projects. | Make green streets a standard for future CIP projects | TBD | TBD | TBD | City-wide | FY18 | As needed | General Fund | Public Works and Community Development | |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | Elimination of residential and commercial curb cuts | Non-permitted curb cuts are eliminated as the City implements street rehabilitation projects. | TBD | TBD | TBD | City-wide | FY15 | Ongoing | General Fund | Streets Division and CIP | |
| 45 | Include storm water BMPs, LID, EPA green streets and other applicable storm water treatment systems into the long range planning and design of City projects. | Make green streets a standard for future CIP projects | TBD | TBD | TBD | City-wide | FY18 | As needed | General Fund | Public Works and Community Development | |
| 46 | Continue to work with the FWS for rehabilitation and restoration projects along the SD Bay watershed and with the Tijuana National Estuarine Research Reserve for project in the TJ Watershed. | Actively participate and partner with multiple agencies in the restoration of South San Diego Bay and Tijuana River Estuary | TBD | TBD | TBD | City-wide | FY16 | Ongoing | General Fund | Public Works and Community Development | |
| ***Illicit Discharge, Detection, and Elimination (IDDE) Program*** | | | | | | | | | | | |
| 47 | Implement Illicit Discharge, Detection, and Elimination (IDDE) Program per the JRMP. Requirements include: maintaining an MS4 map, using municipal personnel and contractors to identify and report illicit discharges, maintaining a hotline for public reporting of illicit discharges, monitoring MS4 outfalls, and investigating and addressing any illicit discharges. | Refer to JRMP | TBD | TBD | TBD | City-wide | FY16 | Ongoing | General Fund | Public Works and Community Development | |
| 48 | Implement proactive enforcement of storm water violations. | All City employees in City vehicles are expected to report storm water violations to the Environmental Division. All Public Works employees are in constant communication through radio phones. | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |
| 49 | Conduct frequent visual outfall monitoring to identify and eliminate illicit discharges. | Frequency? Vary by area or by sub watershed? | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |
| ***Public Education and Participation*** | | | | | | | | | | | |
| 50 | Implement a public education and participation program to promote and encourage development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water prioritized by high-risk behaviors, pollutants of concern, and target audiences. | TBD | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | Provide education opportunities to commercial businesses | Education to businesses provided through storm water brochure provided during business license application and renewal. Education is also provided through inspections and enforcement actions. | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |
| 52 | Provide education opportunities to development community | Contractors and developers are trained through face-to-face meetings with the Community Development Department and the Publics Works Department during the permitting process, through inspections, and trough investigations of illegal discharges. Educational brochures are used as part of the permitting process and web resources are available. | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |
| 53 | Provide education to municipal departments and personnel | Multiple training opportunities provided to municipal staff. Annual training is provided to PW department. Monthly code enforcement working group, weekly Community Development department, and weekly staff meetings provide opportunities to discuss storm water issues. City also provides a weekly FYI that gets emailed to all City staff and City council. | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |
| 54 | Provide education to residents, general public, and school children | The general public receives educational information in the City's website, quarterly EDCO newsletter, printed materials at offices, through community presentations, ILACSD school presentations, community events, regional events, and various other methods. | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 55 | Provide education to underserved community. | Education materials are provided in both English and Spanish. The environmental division incorporates the underserved community in most education activities, which is particularly important to IB due to the large Spanish speaking community. | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |
| 56 | Review printed storm water educational materials | Review printed materials such as brochures at least once per permit cycle. | TBD | TBD | TBD | TBD | FY17 | Ongoing | Env Division Budget | Env Division | |
| 57 | Update electronic website information | Annually update storm water information on the City's website. | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |
| 58 | Encourage public participation in community events. | The City provides or supports multiple community clean up and awareness events throughout the year. Examples include: Creek to Bay, Tijuana River Action Month, Homefront Cleanup, Citywide Garage Sale, Fiesta del Rio, Sun and Sea Festival… | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | |
| 59 | Collaborate with regional education and outreach efforts. | Continue in regional education efforts in the San Diego region | TBD | TBD | TBD | TBD | FY16 | Ongoing | Env Division Budget | Env Division | TBD |
| 60 | Provide targeted education specific to each WQIP | Provide targeted education in collaboration with WMA partners and to address specific issues raised in the WQIP | TBD | TBD | TBD | TBD | FY18 | Ongoing | Env Division Budget | Env Division | |
| ***Enforcement Response Plan*** | | | | | | | | | | | |
| 61 | Implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Enforcement Response Plan. | Refer to JRMP | TBD | TBD | TBD | TBD | FY16 | As needed | Env Division Budget | Env Division | |
| ***Additional Nonstructural Strategies*** | | | | | | | | | | | |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 62 | Address and clean up pollutants from homeless encampments | Continue to collaborate with FWS to cut back vegetation to discourage homeless encampments. Participate in regional actions to address the social issues related to homelessness | TBD | TBD | TBD | TBD | FY19 | As needed | General Fund | Public Works | |
| 63 | Support source reduction initiatives. | Continue to provide support for source reduction, product stewardship, and extended producer responsibility initiatives. The City participates with the Regional Solid Waste TAC | TBD | TBD | TBD | TBD | FY19 | As needed | General Fund | Env Division | |
| 64 | Conduct special studies for each WMA as needed to address storm water issues | Identify studies and develop plan. | TBD | TBD | TBD | TBD | FY18 | As needed | General Fund | Env Division | |
| 65 | Participate in regional partnerships to address water quality issues outside the scope of the MS4 Permit. | Continue participation in the following: Tijuana River Recovery Team, Tijuana National Estuarine Research Reserve Advisory Council, IBWC Citizen's Forum, and EPA Border 2020 Program | TBD | TBD | TBD | TBD | FY15 | Ongoing | General Fund | Env Division | |
| 66 | Collaborate/partner with school districts in City (South Bay Union and Sweetwater) on storm water. | Develop partnerships with schools and identify storm water opportunities for partnership. | TBD | TBD | TBD | TBD | FY15 | Ongoing | General Fund | Env Division | |
| 67 | Collaborate/partner with Caltrans on storm water issues. | Develop partnerships with Caltrans and identify storm water opportunities for partnership along HWY 75. | TBD | TBD | TBD | TBD | FY15 | Ongoing | General Fund | Env Division | |
| 68 | Collaborate/partner with Navy on storm water issues. | Develop partnerships with Navy and identify storm water opportunities for partnership. | TBD | TBD | TBD | TBD | FY15 | Ongoing | General Fund | Env Division | |
| 69 | Collaborate/partner with Scripps Institute of Oceanography on coastal monitoring projects. | Continue working with SIO to support research activities and grant applications for work along the Imperial Beach shoreline | TBD | TBD | TBD | TBD | FY15 | Ongoing | Env Division Budget | Env Division | |
| 70 | Collaborate/partner with NGOs on storm water issues. | Continue working with NGOs on for Tijuana River Actions Month, Creek to Bay, and School presentations | TBD | TBD | TBD | TBD | FY15 | Ongoing | Env Division Budget | Env Division | |

| ID | Strategy | Implementation Approach | Jurisdictional or Optional | Priority | Sources | Geographic Focus* (Location) | Timing | Frequency | Cost or Funding Strategy | Responsible Party and Other Collaborators | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 71 | Collaborate/partner with on the City of San Diego Pure Water program | Support the development of a new local water supply for the region. | TBD | TBD | TBD | TBD | Fy15 | Ongoing | General Fund | Env Division | |
| 72 | If a regional social services effort is established, support workgroup to provide sanitation and trash management for person experiencing homelessness and determine if the program is suitable and appropriate for jurisdictional needs to meet goals. | Support regional effort. | Optional | TBD | TBD | TBD | FY19 | As needed | General Fund | Public Works | |
| ***Additional Structural Strategies*** | | | | | | | | | | | |
| 73 | Develop a program to address and capture trash and debris. | Study best option for trash capture devices in the City that does not contribute to flooding issues. | Optional | TBD | TBD | TBD | FY19 | As needed | General Fund and Grants | Public Works | |
| 74 | Study options to capture trash and treat runoff for the E outfalls that drain primarily Mar Vista HS and Sports Park. | Study best option for BMP for 5th and Grove | Optional | TBD | TBD | TBD | FY19 | As needed | General Fund and Grants | Public Works | |
| 75 | Work with FWS to continue evaluation of daylighting K outfall. | Work with FWS to prioritize projects and assist in grants. | Optional | TBD | TBD | TBD | FY19 | As needed | General Fund and Grants | Public Works | |
| 76 | Study options to capture trash and treat runoff from the H-outfall. | Study best option for BMP for H-outfall | Optional | TBD | TBD | TBD | FY19 | As needed | General Fund and Grants | Public Works | |
| 77 | Study trash capture options for retrofit of MS4 catch basins. | Study best option for trash capture devices in the City that does not contribute to flooding issues. | Optional | TBD | TBD | TBD | FY19 | As needed | General Fund and Grants | Public Works | |

# Appendix H.2 City of San Diego Strategies and Schedules

**Table 1. City of San Diego Jurisdictional Strategies**

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
|---|---|---|---|---|---|---|
| **Jurisdictional Strategies** | | | | | | |
| ***Development Planning*** | | | | | | |
| ***All Development Projects*** | | | | | | |
| CSD-1 | Establish guidelines and standards for all development projects; provide technical support related to implementation of source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area or implement easements to protect water quality, where applicable and feasible. Includes internal coordination and collaboration between City departments (DSD, PWD, and Engineering) to improve success and long-term benefits of BMPs. | Refer to JRMP (currently under development). | City-wide | Prior to FY16 | Ongoing | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-1.1 | Investigation and research of emerging technology. | Annually the Construction & Development Standards Group identifies new tasks to conduct literature review, communication with researchers outside of the City, physical testing and experimentation of new or emerging technologies, and other research with the goal of updating tools available for reducing pollutant loads from development and redevelopment sites. | City-wide | Prior to FY16 | As needed | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-1.2 | Approve and implement a green infrastructure policy. | The City will begin developing a policy in FY16 that will increase the green infrastructure requirements for City CIP projects. This policy will be coordinated with ongoing efforts to update City design manuals and LID design standards for public LID BMPs. | City-wide on public parcels | FY16 (Begin) | As needed | T&SW with DSD and PWD |
| CSD-1.3 | Develop Design Standards for Public LID BMPs. | Improve quality of design to ensure efficiency and reliability in public designs. | City-wide | FY14-FY15 | As needed | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-1.4 | Outreach to impacted industry regarding minimum BMP requirement updates. | Affects commercial, industrial, and residential development. | City-wide | FY15 | As needed | TBD |
| CSD-2 | Train staff on LID regulatory changes and LID practices. | Formal training is required for all staff involved in development plan review to increase knowledge of LID BMPs. Goal of training associated with LID practices and regulations is to promote LID implementation and to avoid adverse conditions such as trees planted within swales, or planned drainage patterns which obstruct or inhibit LID performance. | City-wide | FY16 | As needed | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-3 | Amend municipal code and ordinances, including zoning ordinances, to facilitate and encourage LID opportunities to support compliance with the MS4 Permit and TMDLs in a reasonable manner. Ensure consistency with the City of San Diego's BMP Design Manual. Update the Storm Water Standards Manual accordingly. | Municipal codes and ordinances will be brought to City Council for consideration to encourage LID implementation (e.g., runoff detention and filtration using natural filters and stormwater retention for reuse). LID stormwater management will be encouraged in proposed codes and ordinances associated with development and redevelopment projects, which are brought to City Council for consideration. | City-wide | FY15 | As needed | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
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| CSD-4 | Create a manual that outlines right-of-way design standards. | Create a manual that includes flood control performance standards, permanent BMP elements design standards, design standards for green streets and other BMPs, and maintenance access. Provides drainage and streets design standards. Opportunity to merge various existing manuals and provide consistency. | City-wide | FY15 | One time | T&SW with DSD and PWD |
| CSD-5 | Provide technical education and outreach to the development community on the design and implementation requirements of the MS4 Permit and Water Quality Improvement Plan requirements. | Technical education and outreach to the development community includes outreach on design standards, City design manuals, and the WMAA. | City-wide | Prior to FY16 | Ongoing | T&SW with DSD |
| ***Priority Development Projects (PDPs)*** | | | | | | |
| CSD-6 | For PDPs, provide technical support to other City departments to ensure implementation of on-site structural BMPs to control pollutants and manage hydromodification by developing City wide storm water development standards and design guidelines. | Coordinate with other City departments to promote and confirm a thorough understanding of requirements for implementing structural BMPs that control pollutants and manage hydromodification. Included in that understanding are requirements to confirm proper design and construction through processes controlled by other City departments. | City-wide | FY16 | Ongoing | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-6.1 | Institute a program to verify and enforce maintenance and performance of treatment control BMPs. | Refer to JRMP (currently under development). | City-wide | FY16 | Ongoing | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-7 | Update BMP Design Manual procedures to determine nature and extent of storm water requirements applicable to development projects and to identify conditions of concern for selecting, designing, and maintaining appropriate structural BMPs. | Refer to JRMP (currently under development). | City-wide | FY15 | Every 5 years/ permit cycle | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-7.1 | Amend BMP Design Manual for trash areas. Require full four-sided enclosure, siting away from storm drains and cover. Consider the retrofit requirement. | Amend BMP Design Manual and zoning standards/requirements which address reduction of pollutants for common areas of trash build-up (e.g. restaurants, supermarkets, "big box" retail stores with food, pet stores). Most effective method for source control of bacteria and trash is to employ four-sized trash enclosures with a cover over trash areas. | City-wide | FY15 | One time | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-7.2 | Amend BMP Design Manual for animal-related facilities, such as such as animal shelters, "doggie day care" facilities, veterinary clinics, breeding, boarding and training facilities, groomers, and pet care stores. | Amend BMP Design Manual and zoning requirements (including retrofits) to provide supplemental standards for animal facilities (including animal shelters, dog daycares, veterinary clinics, groomers, pet car stores, and breeding, boarding, and training facilities). Supplemental standards may include requiring covered trash enclosures, identification of landscaped relief areas on site plans, ensuring drainage connections and treatment swales for areas that will not drain to the sanitary sewer, as well as inspection of grading, drainage, and landscaping for outdoor exercise areas. | City-wide | FY15 | One time | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-7.3 | Amend BMP Design Manual for nurseries and garden centers. | Amend BMP Design Manual to provide supplemental standards for plant nurseries and garden centers. Standards will focus on reducing irrigation runoff, and loading of sediment, pesticides, and nutrients. Measures may include: covered outdoor storage, green waste management BMPs, improved irrigation efficiency to reduce dry-weather runoff, and containment of runoff from impervious areas where plants and materials are stored. | City-wide | FY15 | One time | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
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| CSD-7.4 | Amend BMP Design Manual for auto-related uses. | Amend BMP Design Manual to provide supplemental standards for automotive-related uses to reduce loading of metals, oils, grease, and trash. Measures may include: four-sized covered trash enclosures, and careful review of auto-related usage areas (e.g. garage bays at repair shops) for grading, drainage, and drain connections to sanitary sewer systems. | City-wide | FY15 | One time | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-8 | Develop and administer an alternative compliance program for on-site structural BMP implementation (includes identifying Watershed Management Area Analysis [WMAA] candidate projects). Refer to Section 4.2.5. | Refer to JRMP (currently under development). | City-wide | FY15 | Ongoing | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-8.1 | Create a fund that allows habitat acquisition, protection enhancement, and restoration in conjunction with other cooperating entities including community groups, academic institutions, state county, and federal agencies, etc. | This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, 3) staff resources are identified and secured, 4) partners have been identified and formal MOUs have been developed, and 5) consensus and community support has been achieved. | City-wide | Optional | TBD | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| ***Construction Management*** | | | | | | |
| CSD-9 | Coordinate with other City departments to promote and confirm a thorough understanding of requirements for implementing temporary BMPs that control sediment and other pollutants during the construction phase of projects. Included in that understanding are requirements to inspect at appropriate frequencies and effectively enforce requirements through process controlled by other City departments. | Refer to JRMP (currently under development). | City-wide | FY16 | Ongoing | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| **Existing Development** | | | | | | |
| ***Commercial, Industrial, Municipal, and Residential Facilities and Areas*** | | | | | | |
| CSD-10 | Administer a program to require implementation of minimum BMPs for existing development (commercial, industrial, municipal, and residential) that are specific to the facility, area types, and PGAs, as appropriate. Includes inspection of existing development at appropriate frequencies and using appropriate methods. | Refer to JRMP (currently under development). | City-wide | FY16 | Ongoing | T&SW with DSD, PUD, & PWD |
| CSD-10.1 | Update minimum BMPs for existing residential, commercial, and industrial development. Specific updates to BMPs include required street sweeping, catch basin cleaning, and maintenance of private roads and parking lots in targeted areas. | Refer to JRMP (currently under development). | City-wide | FY15 | Every 5 years | T&SW |
| CSD-10.2 | Outreach to property managers and trash haulers to elevate the emphasis of power washing as a pollutant source. | Emphasis will be placed on non-compliant washing as an enforceable violation. | City-wide Residential, commercial and industrial areas | FY15 | Ongoing | T&SW |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
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| CSD-10.3 | Implement property based inspections. | Property-based inspections increase awareness and responsibility for individual properties to tackle issues associated with trash, landscapes, and parking areas. Expanding beyond the business-level inspections will achieve different and more effective opportunities for education, outreach, inspection, and enforcement to encourage water conservation strategies. | City-wide | Prior to FY16 | Ongoing | T&SW |
| CSD-10.4 | Review policies and procedures to ensure discharges from swimming pools meet permit requirements. | Verify and bring to City Council for consideration an update (as needed) for the City's Municipal Code (43.0301) to meet new permit requirements for swimming pool discharges. | City-wide | FY15 | As needed | T&SW,<br>City Attorney (Civil & Criminal) |
| CSD-11 | Promote and encourage implementation of designated BMPs for residential and non-residential areas. | Landscape-based rebates are a "gateway" for adoption of other beneficial practices and are one of the nonstructural methods which address impacts from single-family residential areas (City of San Diego 2011 program development background study). Residential incentives can include: education and training (neighborhood watershed field days), and aggressive subsidies or rebates for grass replacement and rainwater harvesting. Existing programs will be expanded overall, and also have targeted expansion within specific subwatershed, particularly with highest water quality priority conditions. | City-wide Residential and Commercial Areas | Prior to FY16 | Ongoing | T&SW with DSD, PUD, PWD, MWD, CWA & local water agencies |
| CSD-11.1 | Residential and Commercial BMP: Rain Barrel | The existing PUD rebate program will continue for residential properties and expand for commercial properties for water collection, conservation, and reuse with rain barrels. | City-wide Residential Areas | Prior to FY16 | Ongoing | T&SW with DSD, PUD, PWD, & local water agencies |
| CSD-11.2 | Residential and Commercial BMP: Grass Replacement | The existing PUD grass replacement cash rebate program will continue and expand for residential and commercial properties. Program encourages a reduction in water use through the conversion of non-artificial grass to water wise plant material, while maintaining a high level of living landscape to benefit the environment. | City-wide Residential and Commercial Areas | Prior to FY16 | Ongoing | T&SW with DSD, PUD, PWD, & local water agencies |
| CSD-11.3 | Residential and Commercial BMP: Downspout Disconnect | Disconnecting downspouts provide alternate runoff pathways from rooftops, sidewalks, driveways, and roads. Disconnecting downspouts from residential areas to pervious land can allow for depression storage and infiltration. | City-wide Residential and Commercial Areas | FY16 | Ongoing | T&SW with DSD, PUD, PWD, & local water agencies |
| CSD-11.4 | Residential and Commercial BMP: Microirrigation | The existing PUD micro-irrigation rebate program will continue and increase for residential and commercial properties. Application of microirrigation aims to improve the efficiency of landscape irrigation through the precise application of water. | City-wide Residential Areas | Prior to FY16 | Ongoing | T&SW with DSD, PUD, PWD, & local water agencies |
| CSD-11.5 | Provide Onsite Water Conservation Surveys. | Provide free onsite water conservation surveys to commercial and residential customers to reduce overirrigation and to encourage water conservation. | City-wide Residential and Commercial Areas | Prior to FY16 | Ongoing | T&SW with DSD, PUD, PWD, & local water agencies |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
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| ***MS4 Infrastructure*** | | | | | | |
| CSD-12 | Implementation of operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, channels as allowed by resource agencies, detention basins, etc.) for water quality improvement and for flood control risk management. | Refer to JRMP (currently under development). | City-wide | FY16 | Ongoing | T&SW |
| CSD-12.1 | Enhanced catch basin cleaning to increase pollutant removal (between 2-4 times per year in medium priority areas in the rainy season). | To increase pollutant load removal, catch basins will be cleaned between 2-4 times per year in medium priority areas in the rainy season. The City of San Diego's pilot study found that major pollutants may vary from neighborhood to neighborhood (yard waste versus trash and sediment). Implementation may be adapted based on catch basin record keeping and cleaning optimization. Increase in frequency will be phased over 4 Fiscal Years. | Tijuana River WMA: Medium priority areas identified in pilot study | FY16 | Ongoing | T&SW |
| CSD-12.2 | Increased frequency of catch basin inspection and as-needed cleaning. | For every segment of channel that is cleared, the City will conduct an inspection and as-needed cleaning of every catch basin within 100 feet of the cleared segment of channel. Additional inspection and as-needed cleaning will occur every three months for one year after the segment of channel is cleared. | Tijuana River WMA (15 open channel segments) | FY13 | 5 years (ends FY18) | T&SW |
| CSD-12.3 | Proactively repair and replace MS4 components to provide source control from MS4 infrastructure. | In order to limit inflow of pollutants and reduce pollutant loads, proactive measures will be taken to improve, repair, and replace MS4 components. The City of San Diego will start a multi-year program of repairing and replacing storm drain pipes to reduce sediment loading to the MS4. Development of an assessment management program and bond issues will be addressed. Exploration of daylighting pipes will take place where feasible and appropriate. | City-wide | FY16 | Ongoing | T&SW |
| CSD-13 | Coordinate with other City departments (PUD) to implement controls to prevent infiltration of sewage into the MS4 from leaking sanitary sewers. | Refer to JRMP (currently under development). | City-wide | FY16 | Ongoing | T&SW with PUD |
| CSD-13.1 | Identify sewer leaks and areas for sewer pipe replacement prioritization. | Risk assessment to include identifying targeted areas (age, location, proximity to MS4), coming up with methodology, pilot, desktop exercise/analysis. | City-wide | FY16 | As needed | T&SW with PUD |
| ***Roads, Street, and Parking Lots*** | | | | | | |
| CSD-14 | Implement operation and maintenance activities for public streets, unpaved roads, paved roads, and paved highways. | Refer to JRMP (currently under development). | City-wide | FY16 | Ongoing | T&SW |
| CSD-14.1 | Initiate sweeping of medians on high-volume arterial roadways. | Medians of roadways are also a potential source of pollutants. Consider implementing or increasing sweeping of medians. Consider mechanical and hand sweeping techniques. | City-wide | FY17 | Ongoing | T&SW |
| CSD-14.2 | Implement additional street sweeping (Settlement Agreement). | City shall increase street sweeping frequency by prioritizing high traffic commercial routes adjacent to maintained channel with vacuum-assisted sweeper for every 400 linear feet of vegetation that is removed (except for removal of invasive species, e.g., Arundo) within a drainage area. Sweeping shall be conducted in median areas that are not subject to regular sweeping routes, and shall occur at a frequency of at least once per quarter for one calendar year after maintenance. | Tijuana River WMA | FY13 | 5 years (ends FY18) | T&SW |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
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| ***Pesticide, Herbicides, and Fertilizer BMP Program*** | | | | | | |
| CSD-15 | Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications. | Refer to JRMP (currently under development). | City-wide | FY16 | Ongoing | T&SW with Parks and Rec |
| ***Retrofit and Rehabilitation in Areas of Existing Development*** | | | | | | |
| CSD-16 | Develop and implement a strategy to identify candidate areas of existing development appropriate for retrofitting projects and facilitate the implementation of such projects. | Refer to JRMP (currently under development). The Offsite Alternative Compliance Program will include methods for identifying and assessing potential retrofit projects in existing development areas. Retrofit project selection will be based upon a variety of factors including proximity to high priority water quality conditions, potential pollutant load removal effectiveness, and feasibility of implementation. The program will include protocols related to funding mechanisms for project construction and long-term maintenance, payment and credit structures, and water quality equivalency standards. | City-wide | TBD | Ongoing | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-17 | Develop and implement a strategy to identify candidate areas of existing development for stream, channel, or habitat rehabilitation projects and facilitate implementation of such projects. | Refer to JRMP (currently under development). The Offsite Alternative Compliance Program (Appendix I) will include methods for identifying and assessing potential stream, channel, or habitat rehabilitation projects in existing development areas. Rehabilitation project selection will be based upon a variety of factors including existing stream or habitat degradation, potential future cumulative stream or habitat impacts, and feasibility of implementation. The program will include protocols related to funding mechanisms for project construction and long-term maintenance, payment and credit structures, and water quality equivalency standards. | City-wide | TBD | Ongoing | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| ***Illicit Discharge, Detection, and Elimination (IDDE) Program*** | | | | | | |
| CSD-18 | Implement Illicit Discharge, Detection, and Elimination (IDDE) Program per the JRMP. Requirements include: maintaining an MS4 map, using municipal personnel and contractors to identify and report illicit discharges, maintaining a hotline for public reporting of illicit discharges, monitoring MS4 outfalls, and investigating and addressing any illicit discharges. | Refer to JRMP (currently under development). | City-wide | Prior to FY16 | Ongoing | T&SW |
| ***Public Education and Participation*** | | | | | | |
| CSD-19 | Implement a public education and participation program to promote and encourage development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water prioritized by high-risk behaviors, pollutants of concern, and target audiences. | Refer to JRMP (currently under development). | City-wide | Prior to FY16 | Ongoing | T&SW |
| CSD-19.1 | Continue implementation of a Pet Waste Program. | Pet Waste Program includes outreach on "Scoop the poop", installation of posts for dispensers, distribution of lawn signs, and attendance at dog-related community activities. | City-wide | Prior to FY16 | Ongoing | T&SW with Parks and Rec |
| CSD-19.2 | Promote and encourage implementation of designated BMPs in commercial and industrial areas. | Provide education and outreach on BMPs for commercial businesses and industrial facilities. | City-wide Non-residential Areas | Prior to FY16 | Ongoing | T&SW with PUD; Funding: Prop 84 and water districts (MWD) |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
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| CSD-19.3 | Expand outreach to homeowners' association (HOA) common lands and HOA incentives. | Approaches to consider include: offering incentives to HOAs and maintenance districts to adopt water-conserving/efficiency and stormwater-reduction changes to their landscapes, irrigation, and maintenance; conducting workshops with property managers; providing supplemental standards, inspection, or enforcement for HOA-managed properties. | City-wide | FY16 | Ongoing | T&SW |
| CSD-19.4 | Develop an outreach and training program for property managers responsible for HOAs and maintenance districts. | Approaches to engage HOAs and property managers include: conducting workshops with property managers, providing supplemental standards, inspections or enforcement around HOA properties, and offering incentives to HOAs and maintenance districts to adopt changes to landscapes, irrigation, or maintenance which promote water conservation or stormwater reduction. Property managers are also a target for enhanced outreach. | City-wide | FY16 | Ongoing | T&SW |
| CSD-19.5 | Enhance and expand trash cleanups through community-based organizations involving target audiences. | Increase effectiveness and reach of trash/beach cleanups and community based efforts by engaging community groups to self-define and carry-out trash clean-ups. Longstanding partnerships and sponsorships with I Love A Clean San Diego and others are recommended to be continued and enhanced. To effectively target stream clean-up efforts, focus on partnerships with community organizations which provide strong engagement with target audiences and communities. | City-wide | FY16 | Ongoing | T&SW and Parks and Rec |
| CSD-19.6 | Improve consistency and content of websites to highlight enforceable conditions and reporting methods. | Websites will be updated to provide a user-friendly format and clarity for stormwater violations, conditions which citizens can and should report, and how to make such reports. Examples of reports for common incidents will be developed and posted which may vary locally and regionally. Photographs of allowable practices as well as illegal practices should be shown for utmost clarity. Displaying hotline numbers prominently on the website and near the photographs of illegal practices will ensure that those seeking to report will be able to do so easily. Also ensure hotline number and website are searchable and can be retrieved by simple internet searches. | City-wide | Prior to FY16 | Ongoing | T&SW |
| CSD-19.7 | Develop a targeted education and outreach program for homeowners with orchards or other agricultural land uses on their property. | Educate residents on practices of small-scale or on-site composting to protect local water quality. May include targeted education of owners of chickens. Outreach can be coordinated through the San Diego County Agriculture, Weights, and Measures division. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, and 3) staff resources are identified and secured. | Tijuana River WMA | Optional | TBD | T&SW with County of San Diego Ag, Weights, and Measures |
| CSD-19.8 | Enhance school and recreation-based education and outreach. | Develop curriculum and establish distribution in public schools. Includes education on water conservation. | City-wide | FY15 | Ongoing | T&SW, PUD with community-based organization |
| CSD-19.9 | Develop education and outreach to reduce irrigation runoff. | Example approaches to reduce or eliminate irrigation runoff may include: education and outreach, prohibition, enhanced enforcement of existing prohibitions, and pilot projects such as the City of Del Mar's pilot door hanger project. | City-wide | Prior to FY16 | Ongoing | T&SW with PUD |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
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| CSD-19.10 | Develop regional training for water-using mobile businesses. | Consider development of supplemental standards for mobile businesses including: covered trash enclosures, careful review of washing areas (grading, drainage, landscaping, sanitary sewer system connectivity), and appropriate signage (either through zoning for retrofits or "best fix" approaches, or through BMP Design Manual standards). Businesses may include carpet cleaners, tile installers, plumbers, etc. | City-wide | FY16 | Ongoing | T&SW |
| CSD-19.11 | Enhance education and outreach based on results of effectiveness survey and changing regulatory requirements. | Use effectiveness surveys to enhance existing education and outreach programs while proactively keeping up with and incorporating changing regulatory requirements. | City-wide | FY16 | Ongoing | T&SW |
| CSD-19.12 | Continue to promote and encourage implementation of Integrated Pest Management (IPM) for residents and businesses. | The City will continue to provide education on IPM techniques during presentations and on the City's Think Blue website. | City-wide | Prior to FY16 | Ongoing | T&SW |
| ***Enforcement Response Plan*** | | | | | | |
| CSD-20 | Continue to implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Storm Water Code Enforcement Unit's Standard Operating Procedures (SOPs) - Enforcement Response Plan. | Refer to JRMP (currently under development). | City-wide | Prior to FY16 | Ongoing | T&SW with PUD, other City enforcement compliance programs |
| CSD-20.1 | Increase enforcement of irrigation runoff. | Increased enforcement policies against irrigation runoff will be established in tandem with the education and outreach programs on how these actions lead to pollutant loading. By shifting to property-based inspections irrigation runoff can be handled as enforceable violations once the public is well-informed. | City-wide | FY16 | Ongoing | T&SW |
| CSD-20.2 | Increase enforcement of water-using mobile businesses. | In addition to education, pollution associated with mobile business sources can be handled through policy, code development, inspections of business practices, and enforcement. | City-wide | FY16 | Ongoing | T&SW |
| CSD-21 | Increase enforcement of all minimum BMPs for existing residential, commercial, and industrial development. | Increased enforcement of existing development minimum BMPs. | City-wide | FY16 | As needed | T&SW |
| CSD-22 | Increase enforcement associated with property-based inspections. | Shifting inspections from businesses-specific to property-based will increase effectiveness and sense of responsibility and ownership. Education and outreach must be followed up with inspection and enforcement of regulations to encourage proper landscape and water conservation strategies. | City-wide | FY16 | Ongoing | T&SW |
| CSD-23 | Increase enforcement of sweeping and maintenance of private roads and parking lots in targeted areas. | Refer to Minimum BMPs in JRMP. | City-wide | FY16 | Ongoing | T&SW |
| CSD-24 | Increase identification and enforcement of actionable erosion and slope stabilization issues on private property and require stabilization and repair. | Eroding and unstable slope areas on private property (excluding construction sites) will be identified as potential sediment loading sources and subject to enforcement. In the short term, this will target enhanced inspection and enforcement programs to ensure inspectors address erosion and slope instability for the purpose of education. | City-wide | FY16 | Ongoing | T&SW |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
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| ***Additional Nonstructural Strategies*** | | | | | | |
| CSD-25 | Conduct a Comprehensive Benefits Analysis to identify benefits other than water quality that are applicable to each of the specific WQIP strategies. | The analysis identifies which other benefits apply to each strategy, and documents the assumptions making those linkages. The delineation of other benefits to strategies includes a general description of each benefit, and a listing of the assumptions that were made to link those benefits to strategies. In addition, the other benefits are characterized with respect to who is directly affected: the city, local residents, local businesses, or visitors. This analysis may be used as part of the adaptive management process to modify future strategies. | City-wide | FY15 | One time | T&SW |
| CSD-26 | Address and clean up trash from transient encampments with collaboration from the Homeless Outreach Team. | Coordinate with the Homeless Outreach Team to respond to transient encampment trash complaints. | City-wide | FY16 | Ongoing | T&SW with Police, ESD, Urban Corps, Alpha Project |
| CSD-27 | Continue participating in source reduction initiatives. | Source reduction initiatives are ultimately the most effective measure to remove pollutants from surface waters, where feasible. Bans or progressive phase-outs that may be considered include: leaf blowers, plastic bags, architectural copper (generally a legacy issue), as well as prohibiting or more aggressively regulating vehicle washing. Additional source reduction initiatives to consider include pesticide sales at hardware stores and irrigation supply stores. | City-wide | Prior to FY16 | Ongoing | T&SW |
| CSD-27.1 | Coordinate with Fleet Services to replace City-owned vehicle brake pads with copper-free brake pads as they become commercially available. | Consider legislative mandate and cooperative implementation of copper-free brake pads on city-owned vehicle to reduce pollutant deposition. | City-wide | FY18 | Ongoing | T&SW, ESD with PWD (Fleet Services) |
| CSD-28 | Proactively monitor for erosion, and complete minor repair and slope stabilization on municipal property. | Actively identify and repair eroding slopes that may be contributing to sediment loading. Prepare an inventory and assessment of eroding areas and their risk to surface waters. Follow assessment with a schedule for ongoing inspection and stabilization (potentially based on a number or percentage of sites annually). Consider Caltrans program as a template. | City-wide | FY16 | Ongoing | T&SW |
| CSD-29 | Lower Tijuana River WMA Sediment Source Characterization Study | The study will provide an inventory and descriptions of sediment sources in the lower Tijuana River Watershed Management Area. The study will utilize a combination of pre-and post-storm visual observations and sediment load measurements. The study will focus on municipal properties; unmaintained yards; dirt roads, trails, and unpaved alleys; large commercial areas; and other significant developed or impervious areas. The study will build upon the findings of the Tijuana River Watershed Technical Support Document for Solids, Turbidity and Trash TMDLs (2010). | Tijuana River WMA | FY16 | One time | T&SW, TJ WMA Copermittees |
| CSD-29.1 | Participate in Reference Watershed Study. | The San Diego Regional Reference Stream Study (currently being conducted by the Southern California Coastal Water Research Project). The study will develop numeric targets that account for "natural sources" to establish the concentrations or loads from streams in a minimally disturbed or "reference" condition. Refer to Section 5.1 for further details. | Region-wide | Prior to FY16 | One time | T&SW, SCCWRP, Regional copermittees |
| CSD-29.2 | Conduct a Cost of Service Study. | Conduct a Cost of Service Study that will examine the full cost of flood control and storm water strategies needed to comply with storm water regulations for the City of San Diego. The City of San Diego's Watershed Asset Management Plan will be used as the basis for the study. | City-wide | FY16 | One time | TBD |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
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| CSD-30 | Conduct Sustainable Return on Investment (SROI) analysis to estimate strategies' co-benefits and impacts to the public and the private sector on a common scale. | SROI is an economics-based framework for evaluating quantitative and qualitative performance metrics and monetizing them, if possible, along a triple bottom line (i.e. financial, societal, and environmental). This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, 3) staff resources are identified and secured, 4) partners have been identified and formal MOUs have been developed, and 5) consensus and community support has been achieved. | City-wide | Optional | TBD | T&SW and public participation |
| CSD-31 | Collaborate with the County, if a County-led regional social services effort is established, to provide sanitation and trash management for individuals experiencing homelessness and determine if the program is suitable and appropriate for jurisdictional needs to meet goals. | Support a non-profit or consortium to provide sanitation services associated with hygiene as well as trash management for persons experiencing homelessness. Rented or purchased shower/sanitary trailers providing mobile showers may be organized at specifically scheduled locations and times. This provision has been proposed as a method for preventing surface water usage for sanitation and bathing, as well as opportunity for outreach and referral by social service agencies. The trash management services will include providing trash bags, trash collection areas, and shower/sanitary facilities at centers which provide daytime shelter to their clients, or on a mobile-basis for known transit camps. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, 3) staff resources are identified and secured, 4) partners have been identified and formal MOUs have been developed, and 5) consensus and community support has been achieved. | City-wide | Optional | TBD | T&SW |
| CSD-32 | Identify strategy, resources, and funding to support mapping and assessment of agricultural operations. | Prepare and maintain an inventory of the locations of agricultural operations. Identify agricultural land close to receiving waters and/or MS4 system and conducting a site reconnaissance to assess if discharges are likely to occur and develop a series of follow-up actions specific to those risks. Coordinate with other City of San Diego departments that own and lease land for agricultural uses. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, and 3) staff resources are identified and secured. | Tijuana River WMA | Optional | TBD | PUD with T&SW |
| CSD-33 | Participate in an assessment to determine if implementation of an urban tree canopy (UTC) program would benefit water quality and other City goals, where feasible. | Perform a feasibility study to determine if implementing an UTC program would be beneficial to the City's goals. UTC intercepts rainfall through increased coverage of leaves, branches, and stems and reduces runoff from the storm drainage system. Benefits associated with enhancing an UTC include reducing heat island effects and air pollution in addition to aesthetics and community benefits. Where feasible, native trees will be utilized to prevent invasive trees from migrating to open spaces and to conserve water. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, and 3) staff resources are identified and secured. | City-wide | Optional | TBD | Planning Dept. with T&SW, SANDAG, and Nature Conservancy |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
|---|---|---|---|---|---|---|
| CSD-34 | Conduct a feasibility study to test Permeable Friction Course (PFC), a porous asphalt that overlays impermeable asphalt. | Perform an assessment to determine the feasibility of implementing PFC on City streets. PFC, an overlay of porous asphalt, is an innovative roadway material that improves driving conditions in wet weather and water quality. Placed in a layer 25-50mm thick on top of regular impermeable pavement, PFC allows rainfall to drain within the porous layer rather than on top of the pavement. PFC has also been shown to reduce concentrations of pollutants commonly observed in highway runoff. PFC incorporates stormwater treatment into the roadway surface and does not require additional right-of-way. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, and 3) staff resources are identified and secured. | City-wide | Optional | One time | T&SW with DSD, PWD, BIA, NGOs, Copermittees, and Engineering Community |
| CSD-35 | As opportunities arise and funding sources are identified, protect areas that are functioning naturally by avoiding impervious development and degradation on unpaved open space areas, creating permanent open space protections on undeveloped city-owned land, and accepting privately-owned undeveloped open areas. | This strategy may be implemented if there is interest in participation by the public or private entity with current control of the land. Conditions to be met also include 1) identification of partners, if needed (public, private, non-profit), 2) identification of costs and potential sources of funding, 3) final agreement by public or private entity with current control of the land, 4) final agreement by all other participating partners including acceptance by intended land- or asset-owning City department, 5) funding in place, and 6) if it can be determined that the benefit of preventing increased pollutant loads and minimizing impacts of future growth through land conservation is a more cost effective strategy to meet interim and final numeric goals than other recommended strategies included in this plan (Chesapeake Bay Commission, 2013). | City-wide | Optional | TBD | TBD |
| CSD-36 | Participate in a watershed council or group if one is established. | This strategy may be triggered as 1) partners have been identified and formal MOUs have been developed and 2) consensus and community support has been achieved. | City-wide | Optional | TBD | TBD |
| CSD-37 | Prohibit introduction of invasive plants in new development and redevelopment projects. | Coordinate with the City's Development Services Department to continue to prohibit introduction of invasive species such as Arundo donax and Cortaderia selloana for new development or redevelopment projects as specified in the City's municipal code for landscape. | City-wide | Prior to FY16 | Ongoing | T&SW with DSD |
| ***Green Infrastructure*** | | | | | | |
| CSD-38 | If interim load reduction goals are not met and green infrastructure is required, publicly-owned parcels will be identified as potential opportunities for green infrastructure implementation. | Construction, operation, and maintenance of bioretention and permeable pavement. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, and 3) staff resources are identified and secured. | Prioritized public parcels in Tijuana WMA | Optional | TBD | T&SW with PWD; Potential to collaborate with transit agencies, public school districts, and state and federal agencies |
| ***Green Streets*** | | | | | | |
| CSD-39 | If interim load reduction goals are not met and green infrastructure is required, the additional acreage of bioretention and permeable pavement may be implemented through green streets if potential opportunities for green infrastructure implementation on public parcels are not available. | This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, and 3) staff resources are identified and secured. | Tijuana River WMA | Optional | TBD | T&SW with PWD |
| **Multiuse Treatment Areas** | | | | | | |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
|---|---|---|---|---|---|---|
| ***Infiltration and Detention Basins*** | | | | | | |
| CSD-40 | Cesar Chavez Community Center | Proposed retrofit for additional water quality mitigation. Addition of a hydromodification BMP in the grass and shrub area adjacent to the northwest corner of the parking lot extending west behind the baseball field and using the open space in the northwest corner of the park. Diverts storm water runoff from approximately 3.31 acres of drainage area. The retrofit will treat runoff from 144,184 square feet of impervious surface. | Tijuana River WMA | FY15 | Ongoing | T&SW with PWD |
| CSD-41 | Otay Mesa Drainage Improvements - Detention Basin | New detention basin per Otay Mesa Community Plan update EIR. Address recurrent roadway flooding problems by improving surface and/or subsurface drainage facilities in conjunction with private development or redevelopment projects. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, 3) staff resources are identified and secured, 4) partners have been identified and formal MOUs have been developed, and 5) permits required by regulatory agencies are secured. | Tijuana River WMA | Optional | TBD | T&SW with PWD |
| CSD-42 | Otay Truck Route Widening Phase 3 - La Media Rd along border fence | New detention basin will be installed on La Media Rd along border fence. | Tijuana River WMA | Prior to FY16 | Ongoing | T&SW with PWD |
| ***Stream, Channel and Habitat Rehabilitation Projects*** | | | | | | |
| CSD-43 | If interim load reduction goals are not met and additional stream, channel, and habitat rehabilitation projects are required, implement as needed. | This strategy may be triggered as 1) funding to address MS4 discharges is identified and secured, 2) staff resources are identified and secured, 3) partners have been identified and formal MOUs have been developed, 4) permits required by regulatory agencies are secured, 5) recommendations from the community are identified and consensus and community support has been achieved, and 6) it can be determined that the benefit of preventing increased pollutant loads and minimizing impacts of future growth through land conservation is a more cost effective strategy to meet interim and final numeric goals than other recommended strategies included in this plan (Chesapeake Bay Commission, 2013). | Areas identified during feasibility studies | Optional | TBD | T&SW |
| **Water Quality Improvement BMPs** | | | | | | |
| ***Proprietary BMPs*** | | | | | | |
| CSD-44 | Fire Station #29 - 198 West San Ysidro Blvd. | 4 drainage inserts planned for implementation on San Ysidro Blvd. | Tijuana River WMA | Prior to FY16 | Ongoing | T&SW with PWD |
| ***Dry Weather Flow Separation and Treatment Projects*** | | | | | | |
| CSD-45 | If interim load reduction goals are not met and additional dry weather flow separation and treatment projects are required, implement as needed. | Construction of dry weather flow separation and treatment projects, where identified. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, 3) staff resources are identified and secured, and 4) permits required by regulatory agencies are secured. | Downstream reaches where persistent dry weather flows have been observed | Optional | TBD | T&SW with PWD |
| ***Trash Segregation*** | | | | | | |

| ID | Strategy | Implementation Approach | Location | Implementation or Construction Year Start | Frequency of Implementation | Responsible City Department and Other Collaborating Departments or Agencies |
|---|---|---|---|---|---|---|
| CSD-46 | If interim load reduction goals are not met and additional trash segregation projects are required, implement as needed. | Construction of trash segregation (Trash Guards, etc.) projects, where identified. This strategy may be triggered as 1) interim goals are not met, 2) funding to address MS4 discharges is identified and secured, 3) staff resources are identified and secured, and 4) permits required by regulatory agencies are secured. | High-loading areas city-wide | Optional | TBD | T&SW with PWD |

DSD= Development Services Department; PUD = Public Utilities Department; PWD = Public Works Department; T&SW = Transportation and Storm Water Division; WAMP = Watershed Asset Management Plan; "Refer to Section X" will be updated upon submittal of the City's JRMP in June 2015; TBD = will be determined during the next fiscal year.

Reference: Chesapeake Bay Commission. 2013. *Crediting Conservation: Accounting for the Water Quality Value of Conserved Lands Under the Chesapeake Bay TMDL*. Available online at http://www.chesbay.us/Publications/CreditingConservationReport.pdf. June.

**Table 2. City of San Diego Annual Schedule**

Construction
Ongoing Implementation/ O&M
As needed/Design

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Jurisdictional Strategies** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Development Planning*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***All Development Projects*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-1 | Establish guidelines and standards for all development projects; provide technical support related to implementation of source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area or implement easements to protect water quality, where applicable and feasible. Includes internal coordination and collaboration between City departments (DSD, PWD, and Engineering) to improve success and long-term benefits of BMPs. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-1.1 | Investigation and research of emerging technology. | City-wide | Prior to FY16 | As Needed | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-1.2 | Approve and implement a green infrastructure policy. | City-wide on public parcels | FY16 (Begin) | As Needed | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-1.3 | Develop Design Standards for Public LID BMPs. | City-wide | FY14-FY15 | As Needed | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-1.4 | Outreach to impacted industry regarding minimum BMP requirement updates. | City-wide | FY15 | As Needed | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-2 | Train staff on LID regulatory changes and LID practices. | City-wide | FY16 | | As Needed | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-3 | Amend municipal code and ordinances, including zoning ordinances, to facilitate and encourage LID opportunities to support compliance with the MS4 Permit and TMDLs in a reasonable manner. Ensure consistency with the City of San Diego's BMP Design Manual. Update the Storm Water Standards Manual accordingly. | City-wide | FY15 | As Needed | | | | | | | | | | | | | | | | | | | | | | | | | |

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CSD-4 | Create a manual that outlines right-of-way design standards. | City-wide | FY15 | One time | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-5 | Provide technical education and outreach to the development community on the design and implementation requirements of the MS4 Permit and Water Quality Improvement Plan requirements. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Priority Development Projects (PDPs)*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-6 | For PDPs, provide technical support to other City departments to ensure implementation of on-site structural BMPs to control pollutants and manage hydromodification by developing City wide storm water development standards and design guidelines. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-6.1 | Institute a program to verify and enforce maintenance and performance of treatment control BMPs. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-7 | Update BMP Design Manual procedures to determine nature and extent of storm water requirements applicable to development projects and to identify conditions of concern for selecting, designing, and maintaining appropriate structural BMPs. | City-wide | FY15 | Cycle | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-7.1 | Amend BMP Design Manual for trash areas. Require full four-sided enclosure, siting away from storm drains and cover. Consider the retrofit requirement. | City-wide | FY15 | One time | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-7.2 | Amend BMP Design Manual for animal-related facilities, such as such as animal shelters, "doggie day care" facilities, veterinary clinics, breeding, boarding and training facilities, groomers, and pet care stores. | City-wide | FY15 | One time | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-7.3 | Amend BMP Design Manual for nurseries and garden centers. | City-wide | FY15 | One time | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-7.4 | Amend BMP Design Manual for auto-related uses. | City-wide | FY15 | One time | | | | | | | | | | | | | | | | | | | | | | | | | |

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
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| CSD-8 | Develop and administer an alternative compliance program for on-site structural BMP implementation (includes identifying Watershed Management Area Analysis [WMAA] candidate projects). Refer to Section 4.2.5. | City-wide | FY15 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-8.1 | Create a fund that allows habitat acquisition, protection enhancement, and restoration in conjunction with other cooperating entities including community groups, academic institutions, state county, and federal agencies, etc. | City-wide | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| ***Construction Management*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-9 | Coordinate with other City departments to promote and confirm a thorough understanding of requirements for implementing temporary BMPs that control sediment and other pollutants during the construction phase of projects. Included in that understanding are requirements to inspect at appropriate frequencies and effectively enforce requirements through process controlled by other City departments. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| **Existing Development** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Commercial, Industrial, Municipal, and Residential Facilities and Areas*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-10 | Administer a program to require implementation of minimum BMPs for existing development (commercial, industrial, municipal, and residential) that are specific to the facility, area types, and PGAs, as appropriate. Includes inspection of existing development at appropriate frequencies and using appropriate methods. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-10.1 | Update minimum BMPs for existing residential, commercial, and industrial development. Specific updates to BMPs include required street sweeping, catch basin cleaning, and maintenance of private roads and parking lots in targeted areas. | City-wide | FY15 | Cycle | | | | | | | | | | | | | | | | | | | | | | | | | |

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
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| CSD-10.2 | Outreach to property managers and trash haulers to elevate the emphasis of power washing as a pollutant source. | City-wide Residential, commercial and industrial areas | FY15 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-10.3 | Implement property based inspections. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-10.4 | Review policies and procedures to ensure discharges from swimming pools meet permit requirements. | City-wide | FY15 | As Needed | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-11 | Promote and encourage implementation of designated BMPs for residential and non-residential areas. | City-wide Residential and Commercial Areas | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-11.1 | Residential and Commercial BMP: Rain Barrel | City-wide Residential Areas | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-11.2 | Residential and Commercial BMP: Grass Replacement | City-wide Residential and Commercial Areas | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-11.3 | Residential and Commercial BMP: Downspout Disconnect | City-wide Residential and Commercial Areas | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-11.4 | Residential and Commercial BMP: Microirrigation | City-wide Residential Areas | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-11.5 | Provide Onsite Water Conservation Surveys. | City-wide Residential and Commercial Areas | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***MS4 Infrastructure*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-12 | Implementation of operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, channels as allowed by resource agencies, detention basins, etc.) for water quality improvement and for flood control risk management. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
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| CSD-12.1 | Enhanced catch basin cleaning to increase pollutant removal (between 2-4 times per year in medium priority areas in the rainy season). | Tijuana River WMA: Medium priority areas identified in pilot study | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-12.2 | Increased frequency of catch basin inspection and as-needed cleaning. | Tijuana River WMA (15 open channel segments) | FY13 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-12.3 | Proactively repair and replace MS4 components to provide source control from MS4 infrastructure. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-13 | Coordinate with other City departments (PUD) to implement controls to prevent infiltration of sewage into the MS4 from leaking sanitary sewers. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-13.1 | Identify sewer leaks and areas for sewer pipe replacement prioritization. | City-wide | FY16 | | As Needed | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Roads, Street, and Parking Lots*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-14 | Implement operation and maintenance activities for public streets, unpaved roads, paved roads, and paved highways. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-14.1 | Initiate sweeping of medians on high-volume arterial roadways. | City-wide | FY17 | | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-14.2 | Implement additional street sweeping (Settlement Agreement). | Tijuana River WMA | FY13 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Pesticide, Herbicides, and Fertilizer BMP Program*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-15 | Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Retrofit and Rehabilitation in Areas of Existing Development*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-16 | Develop and implement a strategy to identify candidate areas of existing development appropriate for retrofitting projects and facilitate the implementation of such projects. | City-wide | TBD | | | | | | | | | | | | | | | | | | | | | | | | | | |

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
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| CSD-17 | Develop and implement a strategy to identify candidate areas of existing development for stream, channel, or habitat rehabilitation projects and facilitate implementation of such projects. | City-wide | TBD | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Illicit Discharge, Detection, and Elimination (IDDE) Program*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-18 | Implement Illicit Discharge, Detection, and Elimination (IDDE) Program per the JRMP. Requirements include: maintaining an MS4 map, using municipal personnel and contractors to identify and report illicit discharges, maintaining a hotline for public reporting of illicit discharges, monitoring MS4 outfalls, and investigating and addressing any illicit discharges. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Public Education and Participation*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19 | Implement a public education and participation program to promote and encourage development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water prioritized by high-risk behaviors, pollutants of concern, and target audiences. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.1 | Continue implementation of a Pet Waste Program. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.2 | Promote and encourage implementation of designated BMPs in commercial and industrial areas. | City-wide Non-residential Areas | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.3 | Expand outreach to homeowners' association (HOA) common lands and HOA incentives. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.4 | Develop an outreach and training program for property managers responsible for HOAs and maintenance districts. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.5 | Enhance and expand trash cleanups through community-based organizations involving target audiences. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.6 | Improve consistency and content of websites to highlight enforceable conditions and reporting methods. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CSD-19.7 | Develop a targeted education and outreach program for homeowners with orchards or other agricultural land uses on their property. | Tijuana River WMA | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| CSD-19.8 | Enhance school and recreation-based education and outreach. | City-wide | FY15 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.9 | Develop education and outreach to reduce irrigation runoff. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.10 | Develop regional training for water-using mobile businesses. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.11 | Enhance education and outreach based on results of effectiveness survey and changing regulatory requirements. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-19.12 | Continue to promote and encourage implementation of Integrated Pest Management (IPM) for residents and businesses. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Enforcement Response Plan*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-20 | Continue to implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Storm Water Code Enforcement Unit's Standard Operating Procedures (SOPs) - Enforcement Response Plan. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-20.1 | Increase enforcement of irrigation runoff. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-20.2 | Increase enforcement of water-using mobile businesses. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-21 | Increase enforcement of all minimum BMPs for existing residential, commercial, and industrial development. | City-wide | FY16 | | As needed | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-22 | Increase enforcement associated with property-based inspections. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-23 | Increase enforcement of sweeping and maintenance of private roads and parking lots in targeted areas. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CSD-24 | Increase identification and enforcement of actionable erosion and slope stabilization issues on private property and require stabilization and repair. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Additional Nonstructural Strategies*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-25 | Conduct a Comprehensive Benefits Analysis to identify benefits other than water quality that are applicable to each of the specific WQIP strategies. | City-wide | FY15 | One time | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-26 | Address and clean up trash from transient encampments with collaboration from the Homeless Outreach Team. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-27 | Continue participating in source reduction initiatives. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-27.1 | Coordinate with Fleet Services to replace City-owned vehicle brake pads with copper-free brake pads as they become commercially available. | City-wide | FY18 | | | | Ongoing | | | | | | | | | | | | | | | | | | | | | | |
| CSD-28 | Proactively monitor for erosion, and complete minor repair and slope stabilization on municipal property. | City-wide | FY16 | | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-29 | Lower Tijuana River WMA Sediment Source Characterization Study | Tijuana River WMA | FY16 | | One time | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-29.1 | Participate in Reference Watershed Study. | Region-wide | Prior to FY16 | One time | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-29.2 | Conduct a Cost of Service Study. | City-wide | FY16 | | One time | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-30 | Conduct Sustainable Return on Investment (SROI) analysis to estimate strategies' co-benefits and impacts to the public and the private sector on a common scale. | City-wide | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| CSD-31 | Collaborate with the County, if a County-led regional social services effort is established, to provide sanitation and trash management for individuals experiencing homelessness and determine if the program is suitable and appropriate for jurisdictional needs to meet goals. | City-wide | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| CSD-32 | Identify strategy, resources, and funding to support mapping and assessment of agricultural operations. | Tijuana River WMA | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CSD-33 | Participate in an assessment to determine if implementation of an urban tree canopy (UTC) program would benefit water quality and other City goals, where feasible. | City-wide | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| CSD-34 | Conduct a feasibility study to test Permeable Friction Course (PFC), a porous asphalt that overlays impermeable asphalt. | City-wide | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| CSD-35 | As opportunities arise and funding sources are identified, protect areas that are functioning naturally by avoiding impervious development and degradation on unpaved open space areas, creating permanent open space protections on undeveloped city-owned land, and accepting privately-owned undeveloped open areas. | City-wide | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| CSD-36 | Participate in a watershed council or group if one is established. | City-wide | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| CSD-37 | Prohibit introduction of invasive plants in new development and redevelopment projects. | City-wide | Prior to FY16 | Ongoing | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Green Infrastructure*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-38 | If interim load reduction goals are not met and green infrastructure is required, publicly-owned parcels will be identified as potential opportunities for green infrastructure implementation. | Prioritized public parcels in Tijuana WMA | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| ***Green Streets*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-39 | If interim load reduction goals are not met and green infrastructure is required, the additional acreage of bioretention and permeable pavement may be implemented through green streets if potential opportunities for green infrastructure implementation on public parcels are not available. | Tijuana River WMA | Optional | | | | | | | | | | | | If triggered, begin planning (acquire funding and resources, conduct site feasibility analysis and site selection) to construct additional green streets projects. | | | | | | | | | | | | | | |
| **Multiuse Treatment Areas** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Infiltration and Detention Basins*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-40 | Cesar Chavez Community Center | Tijuana River WMA | FY15 | | | | | | | | | | | | | | | | | | | | | | | | | | |

| ID | Strategy | Location | Implementation or Construction Year Start | FY 15 and Earlier | FY 16 | FY 17 | FY 18 | FY 19 | FY 20 | FY 21 | FY 22 | FY 23 | FY 24 | FY 25 | FY 26 | FY 27 | FY 28 | FY 29 | FY 30 | FY 31 | FY 32 | FY 33 | FY 34 | FY 35 | FY 36 | FY 37 | FY 38 | FY 39 | FY 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CSD-41 | Otay Mesa Drainage Improvements - Detention Basin | Tijuana River WMA | Optional | | | | | | | | | | | | If triggered, begin planning, acquiring funding and resources | | | | | | | | | | | | | | |
| CSD-42 | Otay Truck Route Widening Phase 3 - La Media Rd along border fence | Tijuana River WMA | Prior to FY16 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Stream, Channel and Habitat Rehabilitation Projects*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-43 | If interim load reduction goals are not met and additional stream, channel, and habitat rehabilitation projects are required, implement as needed. | Areas identified during feasibility studies | Optional | | | | | | | | | | | | If triggered, begin planning (acquire funding and resources, conduct site feasibility analysis and site selection) to implement rehabilitation projects. | | | | | | | | | | | | | | |
| **Water Quality Improvement BMPs** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Proprietary BMPs*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-44 | Fire Station #29 - 198 West San Ysidro Blvd. | Tijuana River WMA | Prior to FY16 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ***Dry Weather Flow Separation and Treatment Projects*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-45 | If interim load reduction goals are not met and additional dry weather flow separation and treatment projects are required, implement as needed. | Downstream reaches where persistent dry weather flows have been observed | Optional | | | | | | | | | | | | If triggered, begin planning (acquire funding and resources, conduct site feasibility analysis and site selection) to implement dry weather flow separation projects. | | | | | | | | | | | | | | |
| ***Trash Segregation*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CSD-46 | If interim load reduction goals are not met and additional trash segregation projects are required, implement as needed. | High-loading areas city-wide | Optional | | | | | | | | | | | | If triggered, begin planning (acquire funding and resources, conduct site feasibility analysis and site selection) to implement trash segregation projects. | | | | | | | | | | | | | | |

## Appendix H.3 County of San Diego Strategies and Schedules

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Jurisdictional Runoff Management Programs (JRMP) Strategies** | | | | | | | | | | | | |
| *Illicit Discharge, Detection, and Elimination (IDDE) Program* | | | | | | | | | | | | |
| 1 | Maintain MS4 map to facilitate IDDE program | GIS | Base | GIS | N/A | N/A | None | FY15 | Annually | Rolled-up TBD | County | ED |
| 2a | Use municipal personnel/contractors to identify and report ICIDs | Field staff/training | Base | JRMP | IC/IDs | all IC/IDs | None | ongoing | ongoing | Rolled-up TBD | County | WPP |
| | *updated focused training for County field staff* | Internal updates to focus on HPWQC | Enhanced | JRMP | all pollutants | bacteria | None | FY16 | Annually | Rolled-up TBD | County | ED |
| 2b | Effluent on the ground (EOG), SSO data | Internal training | Base | JRMP | OWTS/SSO | bacteria, nutrients | None | ongoing | ongoing | Rolled-up TBD | County | DEH |
| | *work with DEH to address septic system failures* | Internal coordination | Base | JRMP | human sources | bacteria, nutrients | None | ongoing | ongoing | Rolled-up TBD | County, all Cities within W/S | ED and PS, Refer to DEH |
| 3 | Maintain a hotline and email address for public reporting of potential ICIDs. | Phone/email | Base | Database/ Annual Report | IC/IDs | all IC/IDs | None | ongoing | ongoing | Rolled-up TBD | All jurisdictions | ED |
| | *Refer homeless issue complaints to Sheriff or appropriate jurisdictions* | Complaint response | Base | JRMP | human sources | bacteria, nutrients, trash | SDR river bed | ongoing | ongoing | Rolled-up TBD | County | ED |
| | *Bilingual hotline answered by I Love a Clean San Diego (ILACSD; live operator) with multiple avenues for online reporting* | Hotline | Enhanced | JRMP | IC/IDs | all IC/IDs | None | FY16 | ongoing | Rolled-up TBD | All jurisdictions | ED |
| | *investigate the feasibility of developing a pilot program (including training) - volunteer surveillance program; develop public facing mobile phone application (2 years out)* | Volunteer Program | Optional | JRMP/Annual Report | IC/IDs | all IC/IDs | low priority areas | FY16 | TBD/in dev. | Rolled-up TBD | County | ED |
| 4 | Implement practices and procedures to address spills that may discharge into MS4 | ICID Manual/Training | Base | JRMP | IC/IDs | all IC/IDs | None | ongoing | ongoing | Rolled-up TBD | County | Refer to DEH |
| | *coordination with responsible sewer agencies* | Internal/External Coordination | Base | JRMP | SSOs | all | None | FY16 | ongoing | Rolled-up TBD | County, RMWD | ED |
| | *coordination with internal County wastewater departments* | Internal coordination | Base | JRMP | SSOs | all | None | ongoing | ongoing | Rolled-up TBD | County | ED |

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *septic system rebate program with availability of grant funding* | Internal coordination | Optional | JRMP | OWTS | bacteria, nutrients | None | FY16 | ongoing | Rolled-up TBD | County | ED |
| | *develop a pilot online septic system maintenance outreach program in collaboration with DEH* | External outreach via www | Optional committed | JRMP | OWTS | bacteria, nutrients | None | ongoing | ongoing | Rolled-up TBD | County | ED and DEH |
| 5 | Implement practices and procedures to prevent/limit infiltration of seepage from sanitary sewers | Internal/External Coordination | Base | JRMP/Annual Report | Sewer infrastructure | bacteria, nutrients | None | ongoing | ongoing | Rolled-up TBD | County, RMWD | ED and Wastewater |
| 6 | Coordinate with upstream Copermittees and/or entities to prevent ID from upstream sources into the MS4 | External coordination | Base | JRMP | IC/IDs | all IC/IDs | None | ongoing | ongoing | Rolled-up TBD | County and upstream | ED and PS |
| 7 | Monitor MS4 outfalls for discharges of potential ICIDs | Monitoring and Surveillance | Base | Database/Annual Report | Persistent/ transient flows | bacteria, nutrients | Prioritized drainage areas | ongoing | Once per year | Rolled-up TBD | All jurisdictions | PS |
| 8 | Develop and implement a strategy for investigating and addressing ICIDs. | ICID Manual/Training | Base | JRMP | IC/IDs | all IC/IDs | None | FY15 | One time | Rolled-up TBD | County | ED and PS |
| | *Collaborate with watershed partners to evaluate feasibility of invasive plant and animal removal* | External coordination | Optional | JRMP/Annual Report | encampments | bacteria, nutrients, trash | SDR river bed | ongoing | ongoing | Rolled-up TBD | County | PS |
| *Development Planning* | | | | | | | | | | | | |
| 9 | All development projects: Implement source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area, where applicable and feasible. | Internal plan review and approval | Base | JRMP/Annual Report | new and redevelopment | all pollutants; flow | None | ongoing | ongoing | Rolled-up TBD | County | DC |
| 10 | Priority Development Projects: In addition to requirement for all development projects, PDPs must implement onsite structural BMPs to control pollutants and manage hydromodification. | Internal plan review and approval | Base | JRMP/Annual Report | new and redevelopment | all pollutants; flow | None | ongoing | ongoing | Rolled-up TBD | County | DC |

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | Update BMP Design Manual procedures to determine nature and extent of storm water requirements applicable to development projects and to identify conditions of concern for selecting, designing, and maintaining appropriate structural BMPs. | regional updates, jurisdictional updates | Base | BMP Design Manual | new and redevelopment | all pollutants; flow | None | FY16 | in development | Rolled-up TBD | Regional and County | DC |
| | *BMP Manual Training - Internal* | staff training | Base | Annual Report | new and redevelopment | all pollutants; flow | None | FY16 | one time | Rolled-up TBD | County | DC |
| | *BMP Manual Training - External* | LID and Watershed Planning for Community | Enhanced | Annual Report | new and redevelopment | all pollutants; flow | None | FY16 | one time | Rolled-up TBD | County and/or Regional | DC |
| 13 | Implement a program that requires and confirms PDP structural BMPs are designed, constructed, and maintained to remove pollutants. | inspections and certification program | Base | JRMP/Annual Report | new and redevelopment | all pollutants; flow | None | ongoing | ongoing | Rolled-up TBD | County | DC |
| 14 | Enforce legal authority established for all development projects to achieve compliance. | inspections and certification program | Base | Enforcement Response Plan | new and redevelopment | all pollutants; flow | None | ongoing | ongoing | Rolled-up TBD | County | DC |
| | *updates to county ordinance related to land development; reference to updated BMP manual* | internal coordination with legal | Base | Ordinance/ Enforcement | new and redevelopment | all pollutants; flow | None | FY15 | one time | Rolled-up TBD | County | DC |
| | *Investigate feasibility of developing a Green Streets Program* | TBD | Optional | JRMP/Annual Report | All | All | None | TBD | TBD | Rolled-up TBD | City | DC |
| *Construction Management* | | | | | | | | | | | | |
| 15 | Maintain and update a watershed-based inventory of all construction projects issued a local permit that allows ground disturbance or soil disturbing | database (Accela) | Base | JRMP/Annual Report | Construction: waste | bacteria, trash | None | FY16 | quarterly | Rolled-up TBD | County | DC |
| 16 | Implement or require implementation of BMPs that are site specific, seasonally appropriate and construction phase appropriate. Includes inspections at an | inspections program | Base | JRMP | Construction: waste | bacteria, trash | None | ongoing | TBD/in dev. | Rolled-up TBD | County | DC |
| 17 | Enforce legal authority established for all its inventoried construction sites to achieve compliance. | inspections program | Base | Enforcement Response Plan | Construction: waste | bacteria, trash | None | ongoing | as necessary | Rolled-up TBD | County | DC |

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *updates to county ordinance related to construction; reference to existing grading ordinance* | Internal coordination with legal | Base | Ordinance/ Enforcement | Construction: waste | bacteria, trash | None | FY15 | one time | Rolled-up TBD | County | DC |
| 18 | Internal Training on Construction Management | Internal training prior to rainy season | Base | JRMP | Construction: waste management, portable toilets | bacteria, trash | None | ongoing | Annual | Rolled-up TBD | County | DC |
| *Existing Development* | | | | | | | | | | | | |
| 19 | Maintain and update a watershed-based inventory of all existing development within its jurisdiction that may discharge a pollutant load to and from the MS4. | GIS and database | Base | JRMP/Annual Report | ICMR | all | watershed based | on going | annual | Rolled-up TBD | County | ED |
| | *improvements to tracking watershed based inventories via consolidated database* | database | Optional committed | Database | ICMR | all | watershed based | FY16 | one time | Rolled-up TBD | County | ED |
| 20 | Designate a minimum set of BMPs required for all inventories existing development, including special event venues. The designated minimum BMPs must be specific to facility or area types and pollutant generating activities, as appropriate. | BMP manual | Base | JRMP | ICMR | all | None | on going | one time | Rolled-up TBD | County | ED |
| | *Equestrian BMP Handbook* | develop new material | Optional Committed | Annual Report | equestrian land uses | bacteria, nutrients, sediment | equestrian areas | FY16 | one time | Rolled-up TBD | County, Oceanside, Vista | ED |
| 21 | Require implementation of minimum BMPs for existing development (commercial, industrial, municipal, and residential) that are specific to the facility, area types and pollutant generating activities, as appropriate. | Inspections and outreach programs | Base | JRMP/Annual Report | ICMR | all | None | ongoing | ongoing | Rolled-up TBD | County | ED |
| | *pet waste management and outreach in County Parks* | Installation and maintenance of stations | Enhanced | JRMP/Annual Report | municipal parks | bacteria, nutrients | County parks | ongoing | ongoing | Rolled-up TBD | County | DPR |
| 22 | Implementation of operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, detention basins, etc.). | MS4 inspections/ cleaning | Base | JRMP/Annual Report | MS4 | bacteria, nutrients, sediment, trash | None | ongoing | Annual | Rolled-up TBD | County | ED Referral, FC and Roads |

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | Implementation of operation and maintenance activities for County maintained streets, unpaved roads, paved roads, and paved highways | CIP/street sweeping | Base | JRMP/Annual Report | transportation corridors | bacteria, nutrients, sediment, trash | None | ongoing | per JRMP | Rolled-up TBD | County | Roads |
| 24 | Require implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications. | outreach | Base | JRMP | ICMR | nutrients, pesticides | Parks, Residental | ongoing | ongoing | Rolled-up TBD | County | AWM |
| 25 | Promote and encourage implementation of designated BMPs at residential areas. | outreach and inspections | Base | JRMP | residential | all | Residential | FY16 | ongoing | Rolled-up TBD | County | ED |
| 26 | Conduct inspections of inventoried existing development to ensure compliance | inspections program | Base | Annual Report | ICMR | all | None | FY16 | 20% per year, all within 5 years | Rolled-up TBD | County | ED |
| | *focused residential inspections based on strategic assessments (modeling, MST, persistent flows, regulatory, monitoring data, SFR/MFR (112 RMAs based on HSA)* | inspections program | Enhanced | JRMP/Annual Report | residential | bacteria, nutrients, pesticides | focused drainage areas | FY16 | 20% per year, all within 5 years | Rolled-up TBD | County | ED |
| | *Investigating the feasibility of a residential inspections tracking program via mobile platform - miles, violations, etc.* | database /electronic tracking | Optional Committed | JRMP/Annual Report | residential | bacteria, nutrients, pesticides | focused drainage areas | FY16 | ongoing with inspections | Rolled-up TBD | County | ED |
| | *Investigating the feasibility of improvements to inspections data tracking through mobile phone applications* | | Optional | Database | ICRM | all | None | FY16 | | Rolled-up TBD | | ED |
| 27 | Enforce legal authority established for all inventoried existing development to achieve compliance | inspections program | Base | Enforcement Response Plan | ICMR | all | None | Ongoing | ongoing | Rolled-up TBD | County | ED |
| | *updates to county ordinance related to existing development; reference to existing guidance documents* | coordination with legal | Enhanced | Ordinance/ Enforcement | ICMR | all | None | FY15 | one time | Rolled-up TBD | County | ED |

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | Develop a strategy to identify candidate areas of existing development appropriate for retrofitting projects and facilitate the implementation of such projects. | WMAA and internal | Base | JRMP/WMAA | municipal areas | all | None | FY15 | internal and WMAA | Rolled-up TBD | Regional and County | WPP |
| | *promote rain barrel incentive programs* | MET, CWA, City of SD | Enhanced | Annual Report | residential/ commercial | all | None | ongoing | ongoing | Rolled-up TBD | County and other CoP | ED |
| | *collaborate with partner agencies to promote incentive programs for BMP retrofits* | MET, CWA, City of SD | Enhanced | Annual Report | residential/ commercial | all | None | ongoing | ongoing | Rolled-up TBD | County and other CoP | ED |
| | *Investigate the feasibility of developing and implementing an incentive program for BMP Retrofits* | | Optional committed | | | | None | | | | | ED, PS |
| | *Promote Live Turf Replacement Incentive Program as part of the public-private partnership* | SLP and partner programs | Enhanced | Annual Report | residential/ commercial | bacteria, nutrients, pesticides | None | SLP - FY16; others ongoing | ongoing | Rolled-up TBD | County | ED |
| 29 | Develop a strategy to identify candidate areas of existing development for stream, channel, and/or habitat rehabilitation projects and facilitate implementation of such projects. | WMAA and internal | Base | JRMP/WMAA | municipal | all | dependent on WMAA results | FY15 | internal and WMAA | Rolled-up TBD | Regional and County | WPP |
| *Outreach and Public Participation* | | | | | | | | | | | | |
| | *Promote Water Smart Incentive for Outdoor Water Efficiency as part of the public-private partnership* | SLP and partner programs | Enhanced | Annual Report | residential/ commercial | bacteria, nutrients, pesticides | None | SLP - FY16; others ongoing | ongoing | Rolled-up TBD | ED | ED |
| | *Develop Sustainable Landscapes Program based on available grant funding* | program development and public outreach | Optional | JRMP/Annual Report | residential/ commercial | bacteria, nutrients, pesticides | Residential | FY16 | ongoing | Rolled-up TBD | County | ED |
| | *develop, improve, distribute outreach materials for existing development* | updated material | Enhanced | JRMP/Annual Report | ICMR | all | None | ongoing | ongoing | Rolled-up TBD | County | ED |
| | *outreach presentations to elementary, middle, and high school students* | Coordinated with SDCOE, ILACSD | Enhanced | JRMP/Annual Report | ICMR | all | None | ongoing | ongoing | Rolled-up TBD | County | ED |
| | *outreach to mobile landscaping service providers* | via Ag Weights and Measures; special events | Enhanced | JRMP/Annual Report | ICMR | bacteria, nutrients, pesticides | None | ongoing | ongoing | Rolled-up TBD | County | AWM |
| | *Sponsor Trash Collection Events* | sponsorships and labor | Enhanced | JRMP/Annual Report | existing land use | trash, bacteria | SDR, SLR River Beds | ongoing | multiple | Rolled-up TBD | Coordinated w/SLRWC, SDRPF | ED |
| | *Educational Workshops (e.g., IPM, manure management)* | periodic workshops | Enhanced | JRMP/Annual Report | residential | bacteria, nutrients, sediment, pesticides | | ongoing | ongoing | Rolled-up TBD | County | ED |

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Education & Outreach Effectiveness Survey* | surveys and assessment | Enhanced | JRMP/Annual Report | ICMR | all | | ongoing | annual | Rolled-up TBD | County | ED |
| *Enforcement Response Plan* | | | | | | | | | | | | |
| 30 | Implement escalating enforcement responses to compel compliance with statutes, ordinances, permits, contracts, orders, and other requirements for IDDE, development planning, construction management, and existing development in the Enforcement Response Plan. | inspections, code enforcement | Base | Annual Report, Enforcement Response Plan | All MS4 related sources | all pollutants flow | none | ongoing | ongoing | Rolled-up TBD | County | ED, DC |
| 31 | Notify the SDWB by email at Nonfilers_R9waterboards.ca.gov within five (5) calendar days of issuing escalated enforcement to a construction site that poses a significant threat to water quality as a result of violations or other noncompliance | Construction inspections | Base | Annual Report | construction | bacteria, trash | none | FY16 | ongoing | Rolled-up TBD | County | DC |
| 32 | Notify the SDWB by email (Nonfilers_R9waterboards.ca.gov) any persons required to obtain coverage under the statewide Industrial General Permit and Construction General Permit and failing to do so, within five (5) calendar days from the time the Copermittee become aware of the circumstances. | industrial inspections | Base | Annual Report | industrial | all pollutants | none | FY16 | ongoing | Rolled-up TBD | County | ED, DC |
| *Public Education and Participation* | | | | | | | | | | | | |
| 33 | Implement a public education and participation program to promote and encourage development of programs, management practices and behaviors that reduce the discharge of pollutants in storm water prioritized by high risk behaviors, pollutants of concern, and target audiences. | Various | Base | JRMP/Annual Report | MS4 Sources | bacteria, nutrients, sediment, pesticides, trash | none | ongoing | ongoing | Rolled-up TBD | County | ED |
| *Physical Strategies (Structural Controls from CLRP and others)* | | | | | | | | | | | | |
| 35 | Investigate feasibility of Incentives | TBD | Optional | JRMP/ Annual Report | Irrigation Runoff | Bacteria, Nutrients | none | existing development programs | TBD | Rolled-up TBD | County | DC |
| 36 | Investigate feasibility of Detention basins | TBD | Optional | JRMP/ Annual Report | TBD | All | none | land development programs | TBD | Rolled-up TBD | County | DC |

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 37 | Investigate feasibility of Treatment systems | TBD | Optional | JRMP/ Annual Report | TBD | Dependent on system | none | land development programs | TBD | Rolled-up TBD | County | DC |
| 39 | Investigate feasibility of Retrofitting projects in areas of existing development | TBD | Optional | JRMP/WMAA/ Annual Report | TBD | TBD | none | potential for implementation via alternative compliance program | TBD | Rolled-up TBD | County | DC |
| 40 | Investigate feasibility of Stream, channel, and/or habitat rehabilitation projects | TBD | Optional | JRMP/WMAA/ Annual Report | TBD | TBD | none | potential for implementation via alternative compliance program | TBD | Rolled-up TBD | County | DC |
| *Optional Planning Strategies developed during WQIP Process* | | | | | | | | | | | | |
| 42 | Consider development of incentive programs for water conservation (turf replacement, smart irrigation controllers, irrigation modifications, sustainable landscapes, rain barrels), in collaboration with water agencies and others, to reduce priority pollutants. | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 43 | Consider development of incentive programs for pumping septic systems in high risk areas adjacent to waterways (within 600 ft) or stormwater system | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 44 | Consider partnerships with Master Gardeners to provide education opportunities on water use and practices for gardening | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 45 | Consider collaboration with community groups to provide "boots on the ground" local information to focus implementation efforts on reducing bacteria and other pollutants, close to the source | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 46 | Consider collaboration with COSD internal departments to leverage mutually beneficial projects to promote retrofits to include installation of controls to address priority pollutants, if feasible. | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | Consider collaboration with watershed partners to encourage consistent messaging to specific targeted audiences (commercial, residents, and others) to conserve water and mitigate dry weather flows | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 48 | Consider collaboration with watershed partners on Round 4 of Proposition 84 IRWM grant opportunities to fund targeted educational programs, building of structural controls (brick and mortar projects), or incentive programs to reduce runoff | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 49 | Consider collaboration with watershed partners and Regional Water Quality Control Board on effective measures to reduce potential impact of pollutant loads to waterways from unauthorized encampments | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 50 | Consider collaboration with wastewater agencies to identify where sewer and stormwater infrastructure are in close proximity and confirm the absence of flow at nearby stormwater MS4 outfall during dry weather | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 53 | Consider collaboration with watershed partners to apply for grants to provide septic system rebates or incentives | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 54 | In collaboration with DEH, consider developing program for on-site wastewater treatment (septic) systems. May include mapping and risk assessment, inspection, or maintenance practices. | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 55 | Implement full scale residential pet waste projects (commitments, large property, urban) | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |

| ID | Strategy | Methodology | Program Type | Reporting Method | Sources | Priorities | Geographic Focus* (Location) | Timing | Frequency | Cost (Resource Needs) | Jurisdiction / Collaboration | Responsible Group (see notes at bottom) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 57 | Consider investigating diverting persistent dry weather flows from storm drains to sanitary sewer, where feasible | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 58 | Consider the design of structural controls for persistent unpermitted dry weather flows where outreach has been unsuccessful and groundwater has been ruled out | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |
| 59 | Consider developing a strategy to evaluate opportunities to naturalize concrete stormwater conveyances, and identify potential funding sources (such as grants) for design and implementation | TBD | Optional | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | PS |

**Program Type Notes:**
**Base** - Indicates requirements of the MS4 Permit that the County will implement.
**Enhanced** - Base program that has been enhanced beyond the MS4 Permit requirements. The enhanced portions of these strategies would be implemented if needed and if funding is available.
**Optional** - Strategies that are not required by the MS4 Permit. These strategies would be implemented if needed and if funding is available. Those that are "committed" are currently funded this fiscal year (FY14-15) and/or being undertaken or planned for undertaking.

**Responsible party notes:**
WPP = DPW Watershed Protection Program
ED = WPP, Existing Development
PS = WPP, Planning and Science
DC = WPP, Development and Construction
FC = DPW Flood Control
DEH = Department of Environmental Health
AWM = Department of Agriculture, Weights and Measures

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# Tijuana River Watershed Management Area Analysis ATTACHMENTS

*Lake Henshaw*

***September 8, 2014***

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

***Prepared by:***

Geosyntec consultants
engineers | scientists | innovators

RICK ENGINEERING COMPANY

# 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**

| | A | | | B | | | C | | | D | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Land Use | 0–2% | 2–6% | 6%+ | 0–2% | 2–6% | 6%+ | 0–2% | 2–6% | 6%+ | 0–2% | 2–6% | 6%+ |
| Cultivated land | 0.08[a] | 0.13 | 0.16 | 0.11 | 0.15 | 0.21 | 0.14 | 0.19 | 0.26 | 0.18 | 0.23 | 0.31 |
| | 0.14[b] | 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 | 0.25 | 0.28 | 0.31 | 0.27 | 0.30 | 0.35 | 0.30 | 0.33 | 0.38 | 0.33 | 0.36 | 0.42 |
| size 1/8 acre | 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 | 0.22 | 0.26 | 0.29 | 0.24 | 0.29 | 0.33 | 0.27 | 0.31 | 0.36 | 0.30 | 0.34 | 0.40 |
| size 1/4 acre | 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 | 0.19 | 0.23 | 0.26 | 0.22 | 0.26 | 0.30 | 0.25 | 0.29 | 0.34 | 0.28 | 0.32 | 0.39 |
| size 1/3 acre | 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 | 0.16 | 0.20 | 0.24 | 0.19 | 0.23 | 0.28 | 0.22 | 0.27 | 0.32 | 0.26 | 0.30 | 0.37 |
| size 1/2 acre | 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 | 0.14 | 0.19 | 0.22 | 0.17 | 0.21 | 0.26 | 0.20 | 0.25 | 0.31 | 0.24 | 0.29 | 0.35 |
| size 1 acre | 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 |

[a] Runoff coefficients for storm recurrence intervals less than 25 years.

[b] 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 | 42100NativeGrassland | | Agricultural/Grass |
| 3 | 42110 Valley Needlegrass Grassland | | Agricultural/Grass |
| 4 | 42120ValleySacatonGrassland | | Agricultural/Grass |

| Id | SanGIS Legend | SanGIS Grouping | Land Cover Grouping |
|---|---|---|---|
| 5 | 42200 Non-Native Grassland | Grasslands, Vernal Pools, Meadows, and Other Herb Communities | Agricultural/Grass |
| 6 | 42300WildflowerField | | 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 | 45100MontaneMeadow | | Agriculture/Grass |
| 11 | 45110 Wet Montane Meadow | | Agriculture/Grass |
| 12 | 45120DryMontaneMeadows | | Agriculture/Grass |
| 13 | 45300 Alkali Meadows and Seeps | | Agriculture/Grass |
| 14 | 45320AlkaliSeep | | Agriculture/Grass |
| 15 | 45400 Freshwater Seep | | Agriculture/Grass |
| 16 | 46000AlkaliPlayaCommunity | | Agriculture/Grass |
| 17 | 46100 Badlands/Mudhill Forbs | | Agriculture/Grass |
| 18 | Non-NativeGrassland | | Agriculture/Grass |
| 19 | 18000 General Agriculture | Non-Native Vegetation, Developed Areas, or Unvegetated Habitat | Agriculture/Grass |
| 20 | 18100OrchardsandVineyards | | 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 | 18310Field/Pasture | | Agriculture/Grass |
| 25 | 18310 Pasture | | Agriculture/Grass |
| 26 | 18320RowCrops | | Agriculture/Grass |
| 27 | 12000 Urban/Developed | | Developed |
| 28 | 12000Urban/Develpoed | | Developed |
| 29 | 81100 Mixed Evergreen Forest | Forest | Forest |
| 30 | 81300OakForest | | Forest |
| 31 | 81310 Coast Live Oak Forest | | Forest |
| 32 | 81320CanyonLiveOakForest | | Forest |
| 33 | 81340 Black Oak Forest | | Forest |
| 34 | 83140TorreyPineForest | | 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 |

| Id | SanGIS Legend | SanGIS Grouping | Land Cover Grouping |
|---|---|---|---|
| 38 | 84140CoulterPineForest | Forest | Forest |
| 39 | 84150 Bigcone Spruce (Bigcone Douglas Fir)-Canyon Oak Forest | | Forest |
| 40 | 84230SierranMixedConiferousForest | | Forest |
| 41 | 84500 Mixed Oak/Coniferous/Bigcone/Coulter | | Forest |
| 42 | 85100JeffreyPineForest | | 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 | 61300SouthernRiparianForest | | 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 | 61510WhiteAlderRiparianForest | | Forest |
| 51 | 61810 Sonoran Cottonwood-willow Riparian Forest | | Forest |
| 52 | 61820MesquiteBosque | | Forest |
| 53 | 62000 Riparian Woodlands | | Forest |
| 54 | 62200DesertDryWashWoodland | | Forest |
| 55 | 62300 Desert Fan Palm Oasis Woodland | | Forest |
| 56 | 62400 Southern Sycamore-alder Riparian Woodland | | Forest |
| 57 | 70000 WOODLAND | Woodland | Forest |
| 58 | 71000CismontaneWoodland | | Forest |
| 59 | 71100 Oak Woodland | | Forest |
| 60 | 71120BlackOakWoodland | | Forest |
| 61 | 71160 Coast Live Oak Woodland | | Forest |
| 62 | 71161OpenCoastLiveOakWoodland | | Forest |
| 63 | 71162 Dense Coast Live Oak Woodland | | Forest |
| 64 | 71162 Dense Coast Love Oak Woodland | | Forest |

| Id | SanGIS Legend | SanGIS Grouping | Land Cover Grouping |
|---|---|---|---|
| 65 | 71180 Engelmann Oak Woodland | Woodland | Forest |
| 66 | 71181OpenEngelmannOakWoodland | | 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 | 77000MixedOakWoodland | | Forest |
| 73 | 78000 Undifferentiated Open Woodland | | Forest |
| 74 | 79000 Undifferentiated Dense Woodland | | Forest |
| 75 | Engelmann Oak Woodland | | Forest |
| 76 | 52120SouthernCoastalSaltMarsh | Bog and Marsh | Other |
| 77 | 52300 Alkali Marsh | | Other |
| 78 | 52310CismontaneAlkaliMarsh | | Other |
| 79 | 52400 Freshwater Marsh | | Other |
| 80 | 52410 Coastal and Valley Freshwater Marsh | | Other |
| 81 | 52420 Transmontane Freshwater Marsh | | Other |
| 82 | 52440EmergentWetland | | Other |
| 83 | 44000 Vernal Pool | Grasslands, Vernal Pools, Meadows, and Other Herb Communities | Other |
| 84 | 44320SanDiegoMesaVernalPool | | Other |
| 85 | 44322 San Diego Mesa Claypan Vernal Pool (southern mesas) | | Other |
| 86 | 13100OpenWater | Non-Native Vegetation, Developed Areas, or Unvegetated Habitat | Other |
| 87 | 13110 Marine | | Other |
| 88 | 13111Subtidal | | Other |
| 89 | 13112 Intertidal | | Other |
| 90 | 13121DeepBay | | Other |
| 91 | 13122 Intermediate Bay | | Other |
| 92 | 13123ShallowBay | | Other |
| 93 | 13130 Estuarine | | Other |
| 94 | 13131Subtidal | | Other |
| 95 | 13133 Brackishwater | | Other |

| Id | SanGIS Legend | SanGIS Grouping | Land Cover Grouping |
|---|---|---|---|
| 96 | 13140Freshwater | Non-Native Vegetation, Developed Areas, or Unvegetated Habitat | Other |
| 97 | 13200 Non-Vegetated Channel, Floodway, Lakeshore Fringe | | Other |
| 98 | 13300Saltpan/Mudflats | | Other |
| 99 | 13400 Beach | | Other |
| 100 | 21230SouthernForedunes | 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 | 29000ACACIASCRUB | | Scrub/Shrub |
| 105 | 63000 Riparian Scrubs | Riparian and Bottomland Habitat | Scrub/Shrub |
| 106 | 63300SouthernRiparianScrub | | Scrub/Shrub |
| 107 | 63310 Mule Fat Scrub | | Scrub/Shrub |
| 108 | 63310MulefatScrub | | Scrub/Shrub |
| 109 | 63320 Southern Willow Scrub | | Scrub/Shrub |
| 110 | 63321 Arundo donnax Dominant/Southern Willow Scrub | | Scrub/Shrub |
| 111 | 63330 Southern Riparian Scrub | | Scrub/Shrub |
| 112 | 63400GreatValleyScrub | | Scrub/Shrub |
| 113 | 63410 Great Valley Willow Scrub | | Scrub/Shrub |
| 114 | 63800ColoradoRiparianScrub | | Scrub/Shrub |
| 115 | 63810 Tamarisk Scrub | | Scrub/Shrub |
| 116 | 63820ArrowweedScrub | | Scrub/Shrub |
| 117 | 31200 Southern Coastal Bluff Scrub | Scrub and Chaparral | Scrub/Shrub |
| 118 | 32000CoastalScrub | | Scrub/Shrub |
| 119 | 32400 Maritime Succulent Scrub | | Scrub/Shrub |
| 120 | 32500DieganCoastalSageScrub | | 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 | 32710RiversidianUplandSageScrub | | Scrub/Shrub |
| 125 | 32720 Alluvial Fan Scrub | | Scrub/Shrub |
| 126 | 33000SonoranDesertScrub | | Scrub/Shrub |
| 127 | 33100 Sonoran Creosote Bush Scrub | | Scrub/Shrub |
| 128 | 33200SonoranDesertMixedScrub | | Scrub/Shrub |
| 129 | 33210 Sonoran Mixed Woody Scrub | | Scrub/Shrub |

| 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 | 33300ColoradoDesertWashScrub | | Scrub/Shrub |
| 133 | 33600 Encelia Scrub | | Scrub/Shrub |
| 134 | 34000MojaveanDesertScrub | | Scrub/Shrub |
| 135 | 34300 Blackbush Scrub | | Scrub/Shrub |
| 136 | 35000GreatBasinScrub | | Scrub/Shrub |
| 137 | 35200 Sagebrush Scrub | | Scrub/Shrub |
| 138 | 35210BigSagebrushScrub | | Scrub/Shrub |
| 139 | 35210 Sagebrush Scrub | | Scrub/Shrub |
| 140 | 36110DesertSaltbushScrub | | Scrub/Shrub |
| 141 | 36120 Desert Sink Scrub | | Scrub/Shrub |
| 142 | 37000Chaparral | | Scrub/Shrub |
| 143 | 37120 Southern Mixed Chaparral | | Scrub/Shrub |
| 144 | 37120SouthernMixedChapparal | | Scrub/Shrub |
| 145 | 37121 Granitic Southern Mixed Chaparral | | Scrub/Shrub |
| 146 | 37121SouthernMixedChaparral | | Scrub/Shrub |
| 147 | 37122 Mafic Southern Mixed Chaparral | | Scrub/Shrub |
| 148 | 37130NorthernMixedChaparral | | Scrub/Shrub |
| 149 | 37131 Granitic Northern Mixed Chaparral | | Scrub/Shrub |
| 150 | 37132MaficNorthernMixedChaparral | | Scrub/Shrub |
| 151 | 37200 Chamise Chaparral | | Scrub/Shrub |
| 152 | 37210GraniticChamiseChaparral | | Scrub/Shrub |
| 153 | 37220 Mafic Chamise Chaparral | | Scrub/Shrub |
| 154 | 37300RedShankChaparral | | Scrub/Shrub |
| 155 | 37400 Semi-Desert Chaparral | | Scrub/Shrub |
| 156 | 37500MontaneChaparral | | Scrub/Shrub |
| 157 | 37510 Mixed Montane Chaparral | | Scrub/Shrub |
| 158 | 37520MontaneManzanitaChaparral | | Scrub/Shrub |
| 159 | 37530 Montane Ceanothus Chaparral | | Scrub/Shrub |
| 160 | 37540MontaneScrubOakChaparral | | Scrub/Shrub |
| 161 | 37800 Upper Sonoran Ceanothus Chaparral | | Scrub/Shrub |
| 162 | 37830CeanothuscrassifoliusChaparral | | Scrub/Shrub |
| 163 | 37900 Scrub Oak Chaparral | | Scrub/Shrub |
| 164 | 37A00InteriorLiveOakChaparral | | Scrub/Shrub |

| Id | SanGIS Legend | SanGIS Grouping | Land Cover Grouping |
|---|---|---|---|
| 165 | 37C30 Southern Maritime Chaparral | Scrub and Chaparral | Scrub/Shrub |
| 166 | 37G00CoastalSage-ChaparralScrub | | Scrub/Shrub |
| 167 | 37K00 Flat-topped Buckwheat | | Scrub/Shrub |
| 168 | 39000UpperSonoranSubshrubScrub | | Scrub/Shrub |
| 169 | Diegan Coastal Sage Scrub | | Scrub/Shrub |
| 170 | GraniticNorthernMixedChaparral | | Scrub/Shrub |
| 171 | Southern Mixed Chaparral | | Scrub/Shrub |
| 172 | 11000Non-NativeVegetation | Non-Native Vegetation, Developed Areas, or Unvegetated Habitat | Unknown |
| 173 | 11000 Non-Native VegetionVegetation | | Unknown |
| 174 | 11200DisturbedWetland | | Unknown |
| 175 | 11300 Disturbed Habitat | | Unknown |
| 176 | 13000UnvegetatedHabitat | | 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 |

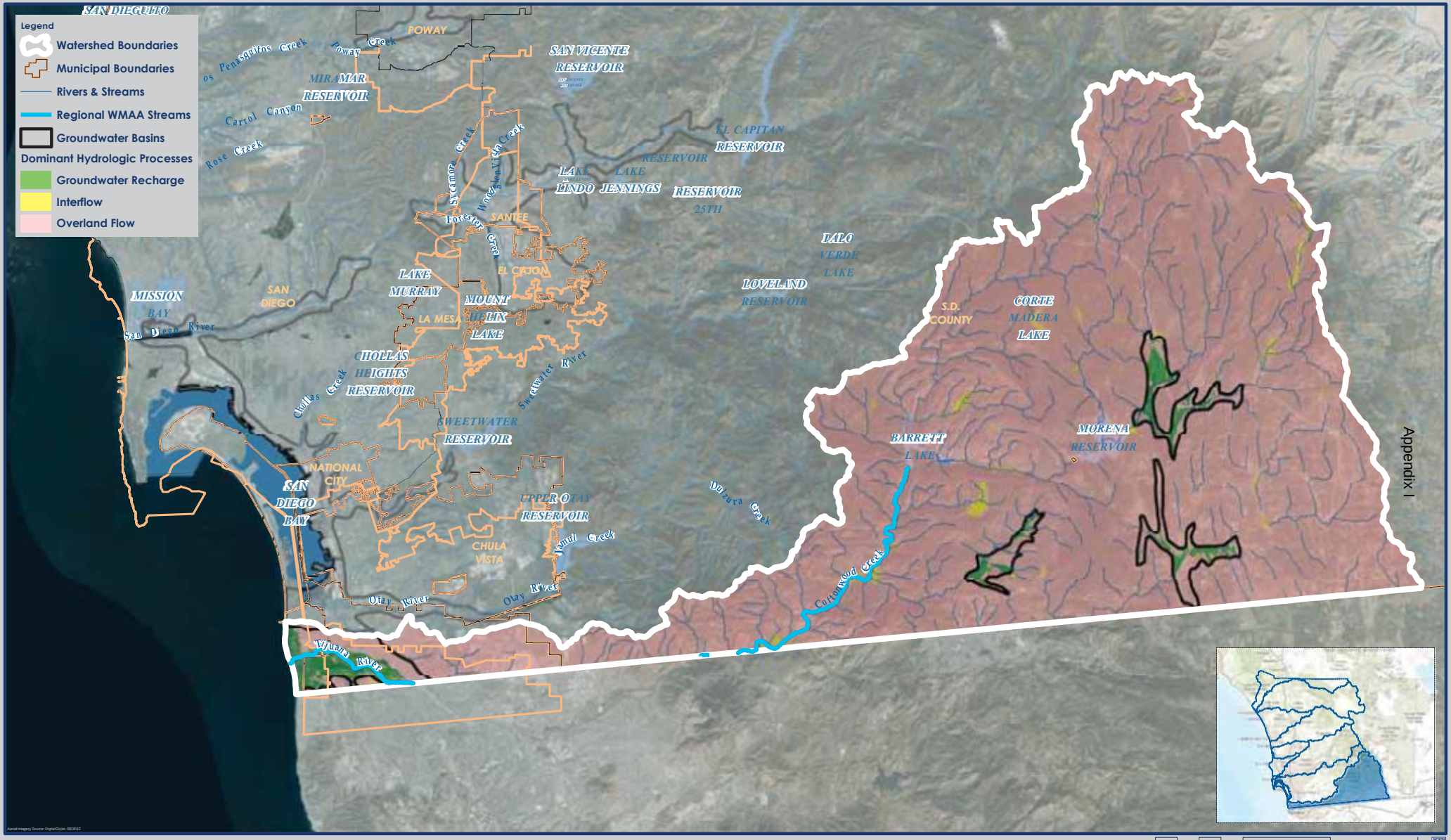
| Land Cover | Soil | Gradient | Runoff Coeff. | ET Coeff. | Infiltration Coeff. | Runoff/ Infiltration Ratio | Hydrologic Process Designation |
|---|---|---|---|---|---|---|---|
| Forest | A | 0-2% | 0.05 | 0.80 | 0.15 | 0.33 | I |
| Forest | A | 2-6% | 0.08 | 0.80 | 0.12 | 0.67 | U |
| Forest | A | 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




Appendix I

# Exhibit Showing Dominant Hydrologic Processes

## Tijuana Watershed - HU 911.00, 467 mi2

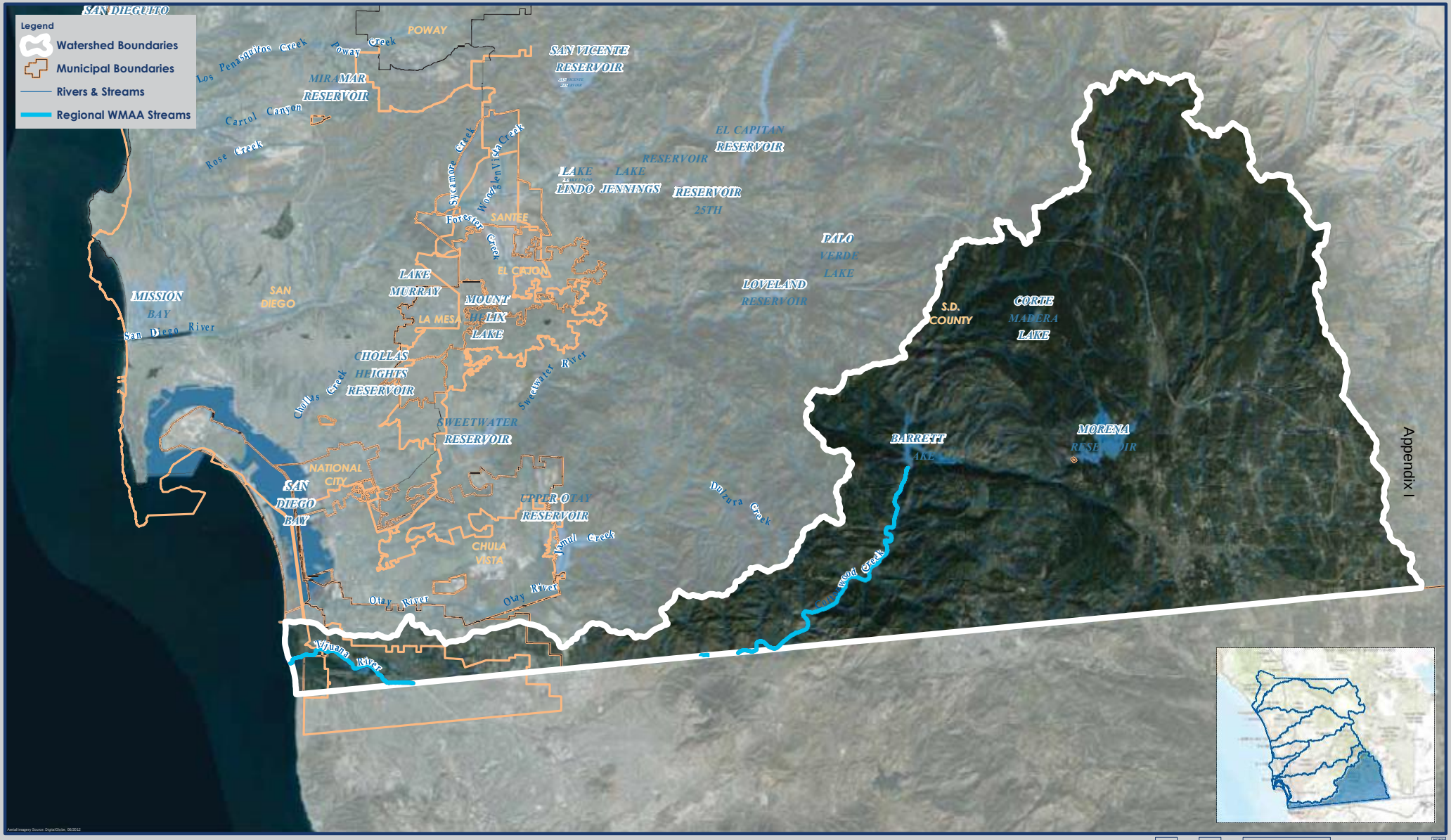
Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK

# ATTACHMENT A.2

## STREAM CHARACTERIZATION



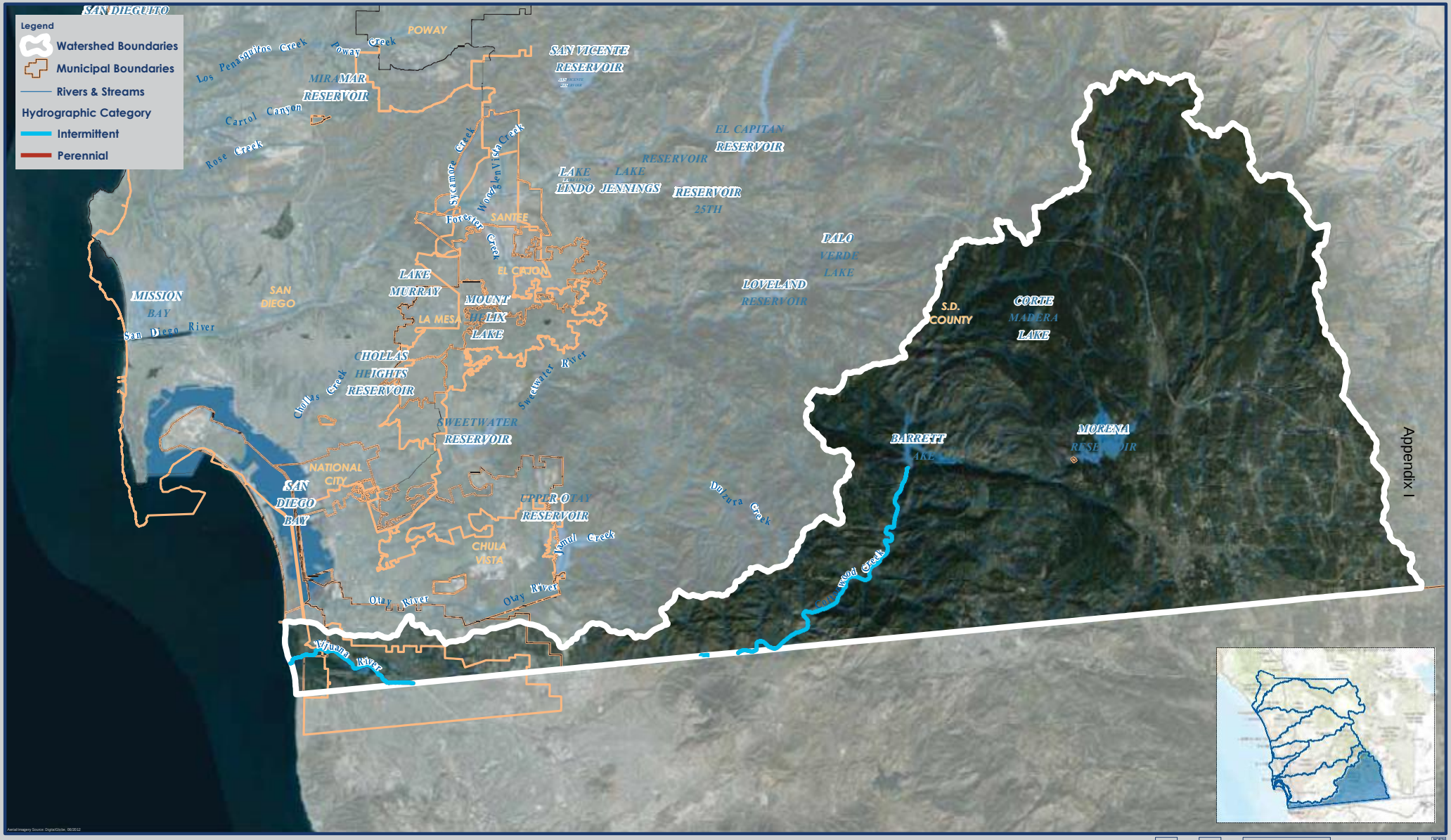

# Watershed Management Area Streams

## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK




Appendix I

Miles 0 25 50 100 150

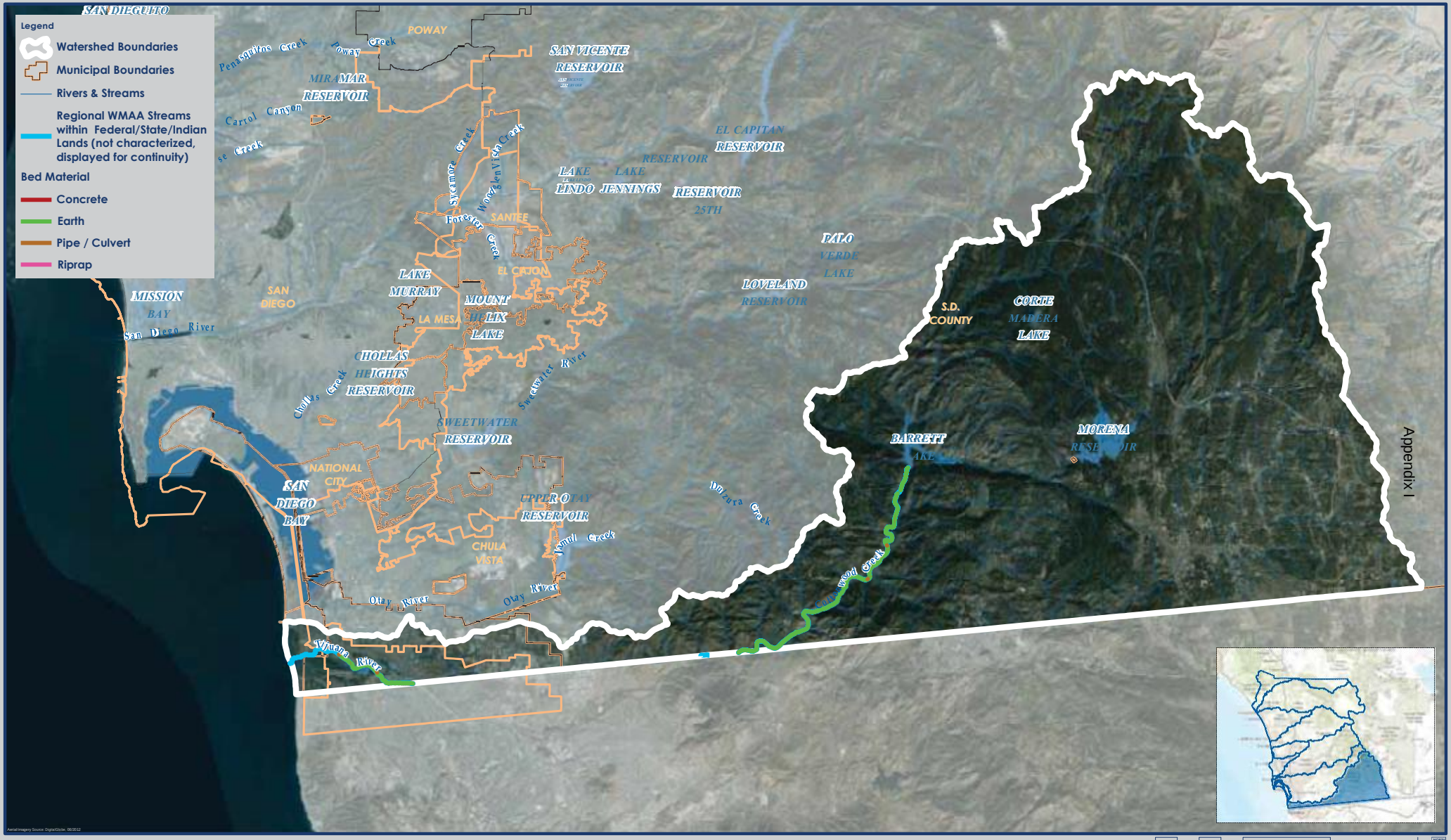
# Watershed Management Area Streams by Hydrographic Category

## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK




Miles 0 25 50 100 150

# Watershed Management Area Streams by Bed Material

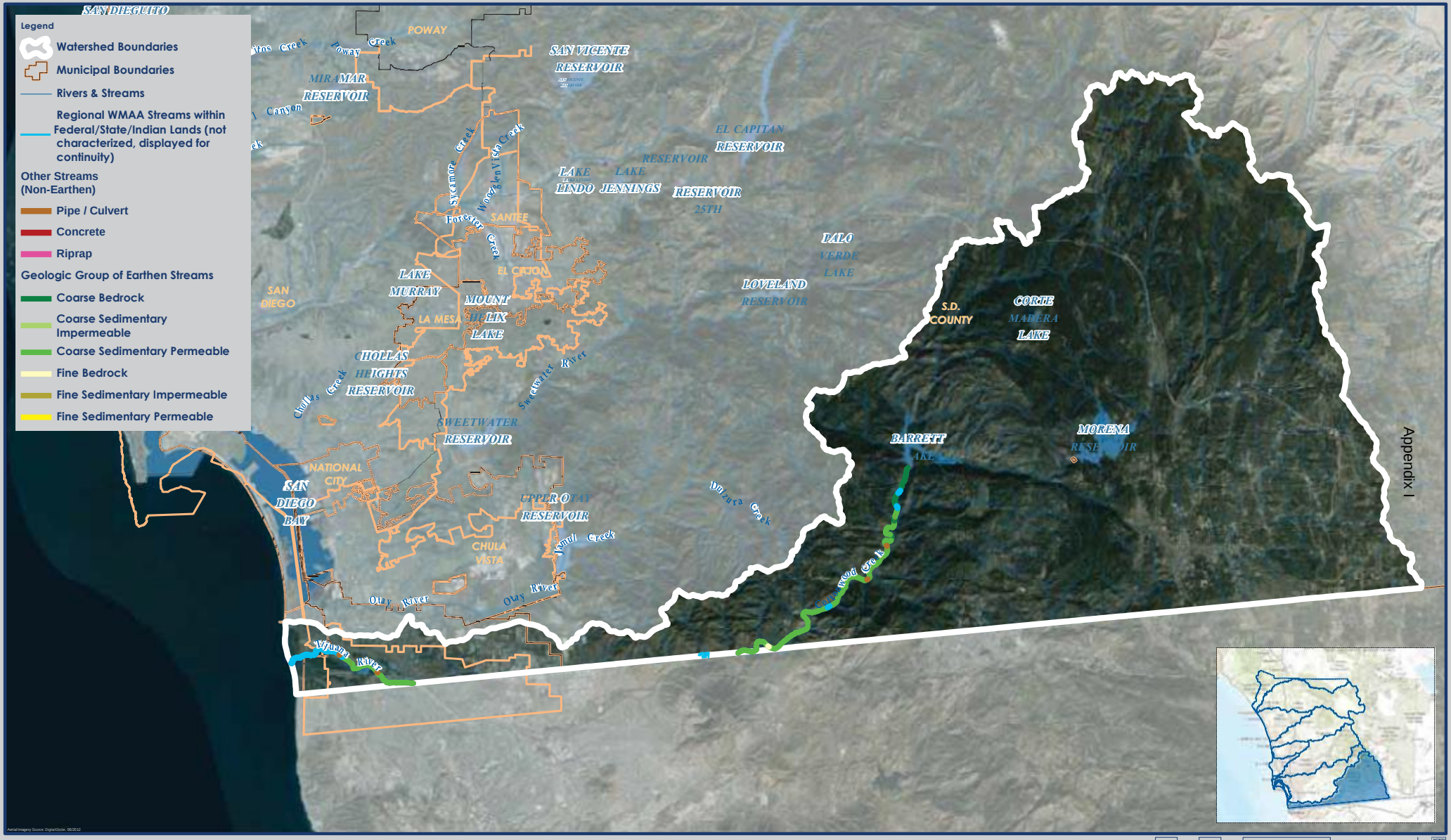
## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK

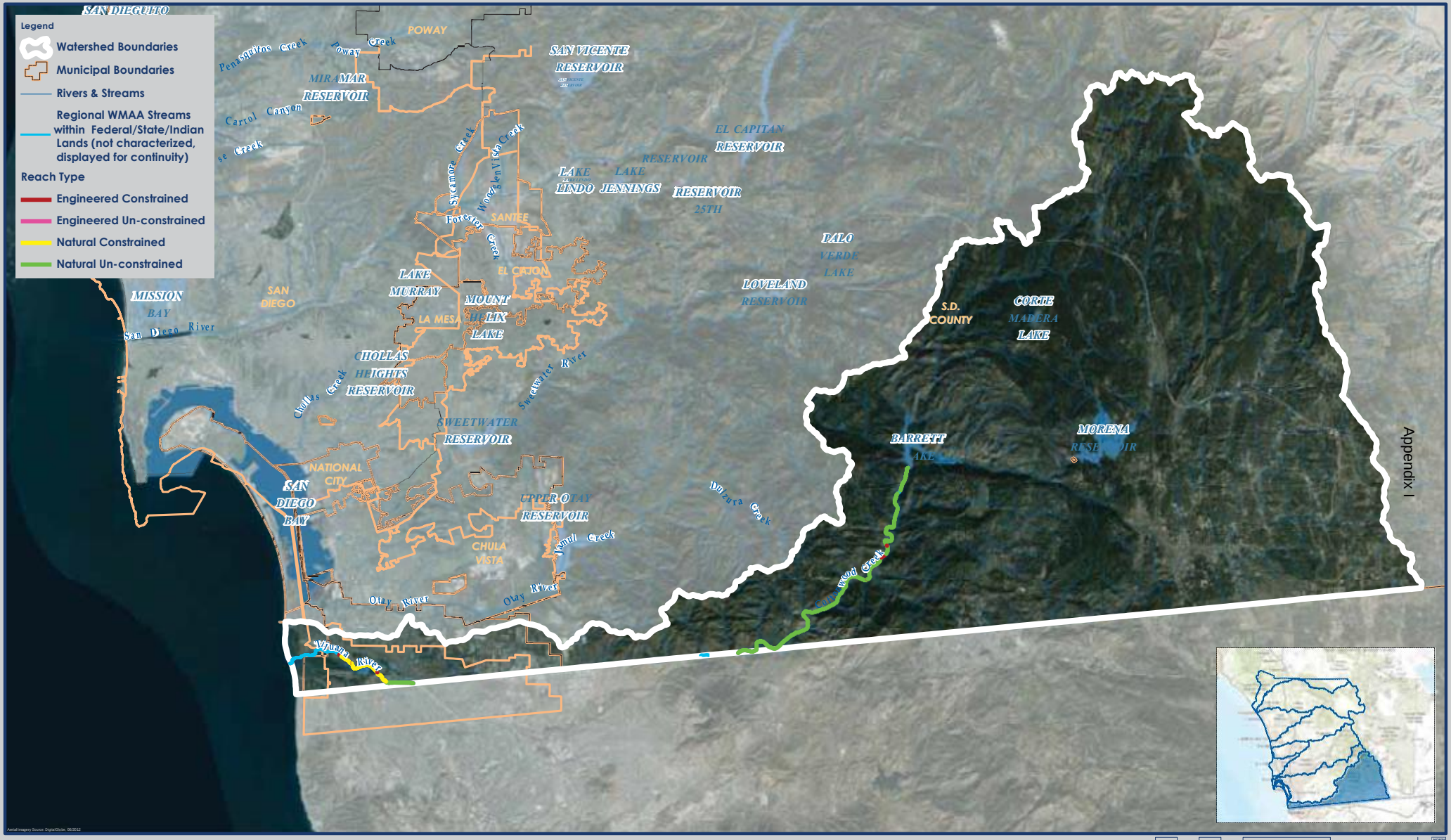
Appendix I




# Watershed Management Area Streams by Geologic Group

## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014




# Watershed Management Area Streams by Reach Type

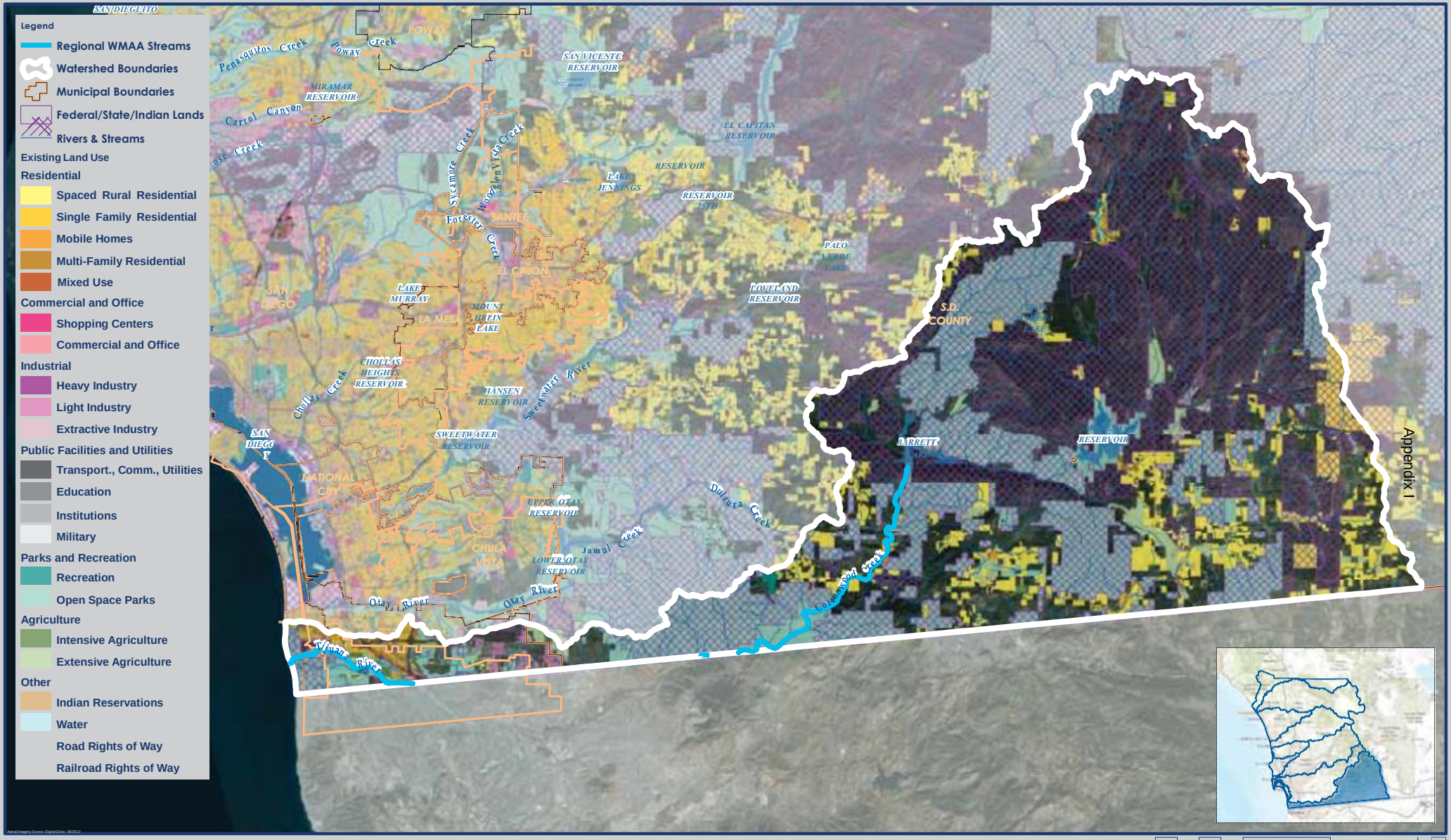
## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK

# ATTACHMENT A.3
## LAND USES




Appendix I

# Existing Land Use

## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

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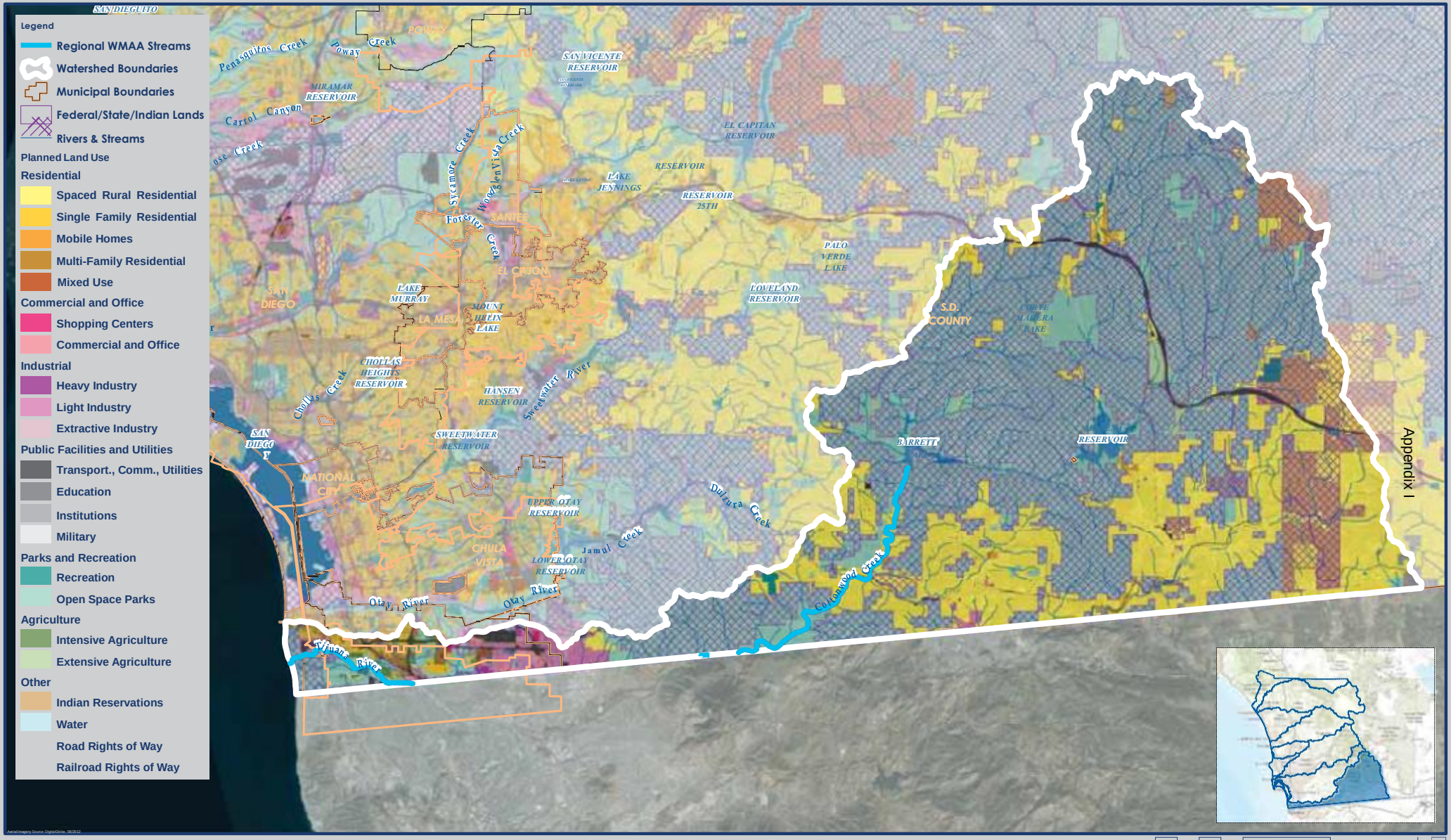


Appendix I

# Planned Land Use

## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

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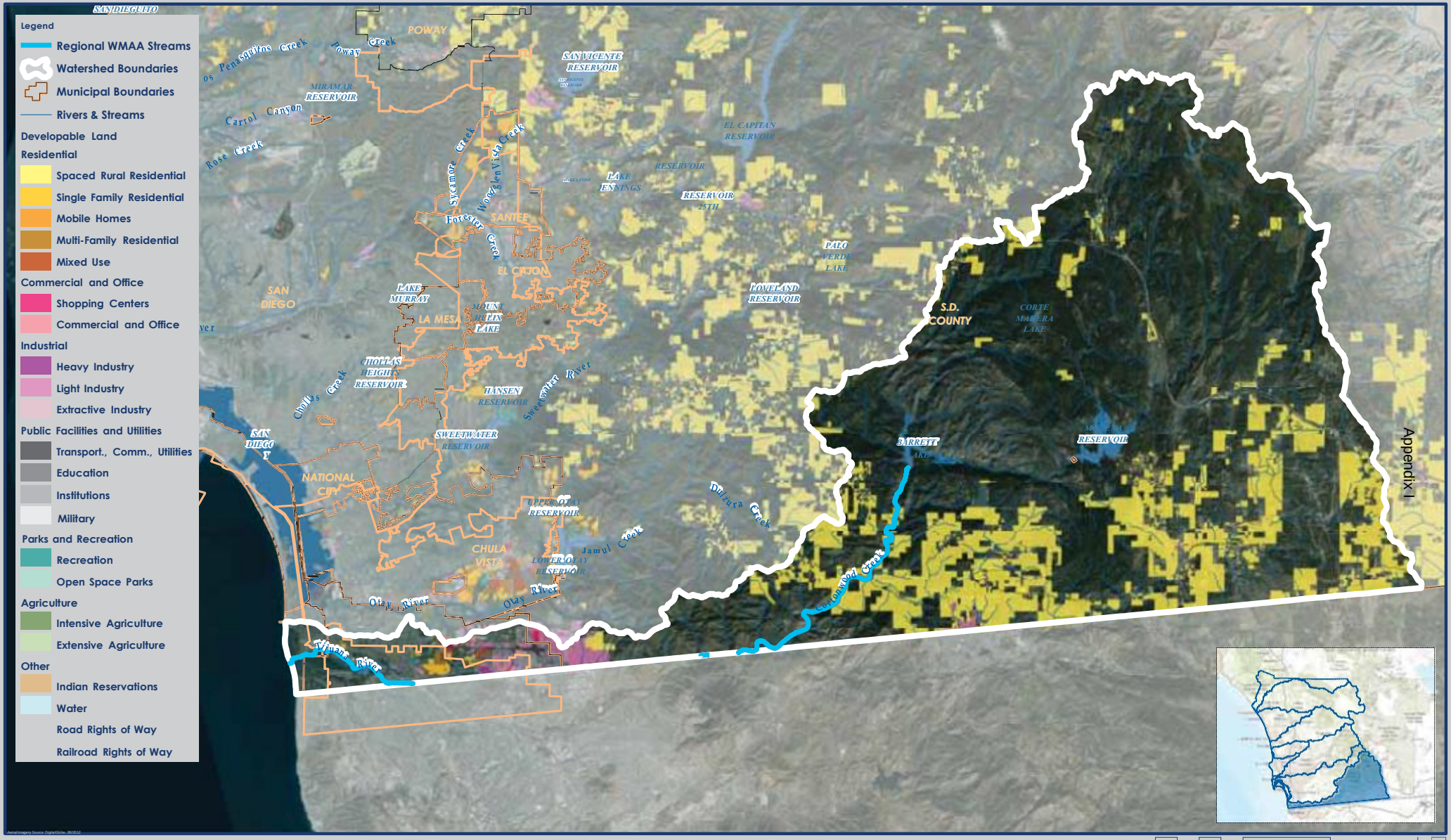



Appendix I

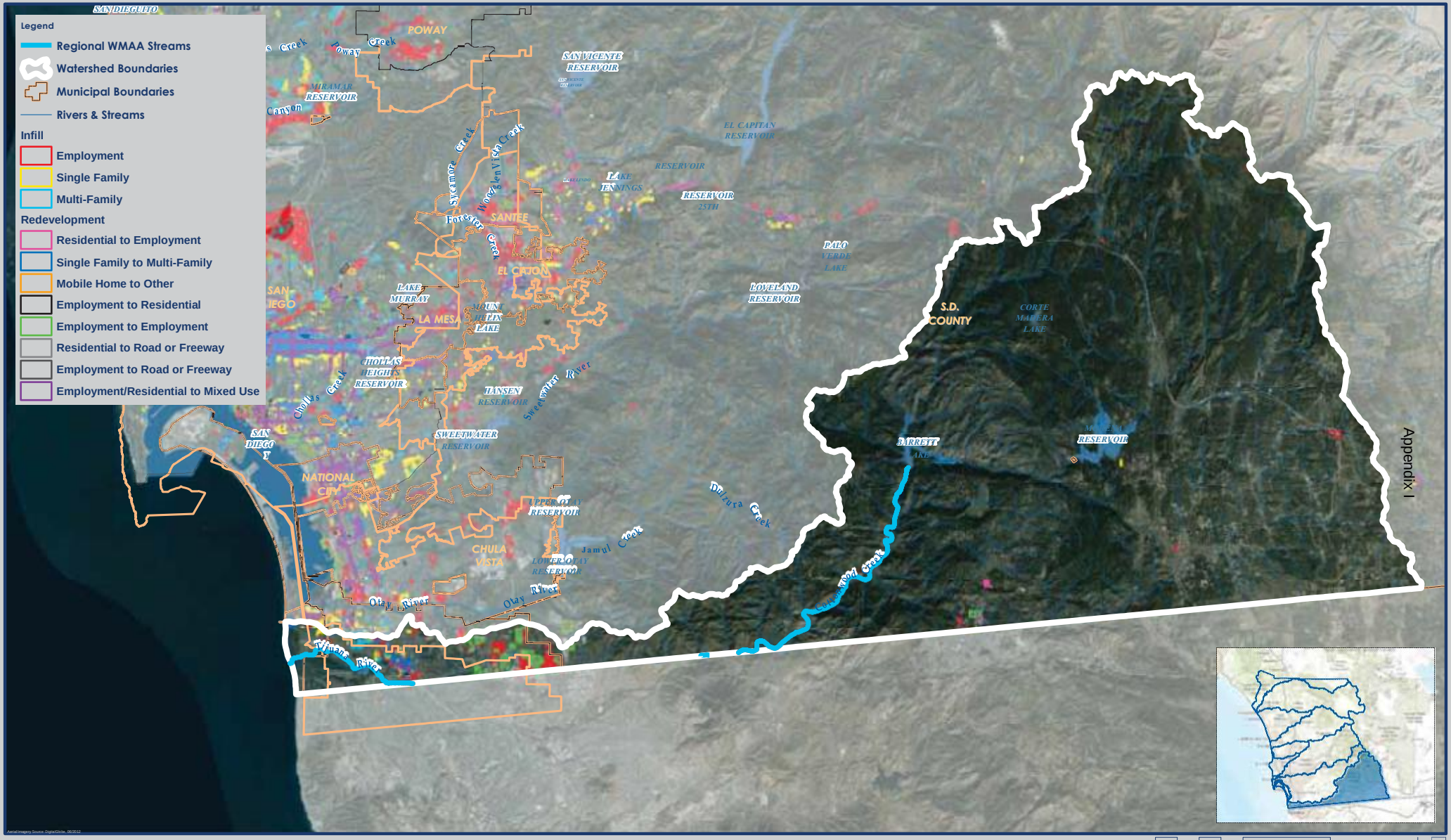
# Developable Land

## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK




Appendix I

# Redevelopment and Infill Areas

## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK

# 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 | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |
| Jsp | El Cajon 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Ka | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kbm | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kbp | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kcc | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kcg | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kcm | El Cajon 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kcp | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kd | San Diego & Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kdl | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kg | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kgbf | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kgd | San Diego & Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kgdf | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kgh | San Diego 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kgm | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kgm1 | El Cajon 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kgm2 | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kgm3 | El Cajon 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kgm4 | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kgp | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kgr | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kgu | San Diego 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Khg | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Ki | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kis | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kjd | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| KJem | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |
| KJld | El Cajon 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kjv | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |

| 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 | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Klp | El Cajon 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Km | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kmg | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kmgp | ElCajon30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kmm | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kpa | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kpv | El Cajon 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kqbd | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kr | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Krm | Oceanside30'x60' | 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 | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Kwm | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Kwp | Oceanside30'x60' | 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 | Oceanside30'x60' | Coarse | Bedrock | Impermeable | CB |
| Mzq | Oceanside 30' x 60' | Coarse | Bedrock | Impermeable | CB |
| Mzs | Oceanside30'x60' | 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 | ElCajon30'x60' | 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 | SanDiego30'x60' | Coarse | Sedimentary | Impermeable | CSI |
| Kl | San Diego, Oceanside & El Cajon 30' x 60' | Coarse | Sedimentary | Impermeable | CSI |
| Ku | Jennings;CA | Coarse | Sedimentary | Impermeable | CSI |

| 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 | SanDiego30'x60' | Coarse | Sedimentary | Impermeable | CSI |
| Qvop9a | San Diego 30' x 60' | Coarse | Sedimentary | Impermeable | CSI |
| Tmsc | SanDiego30'x60' | 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 | SanDiego30'x60' | 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 | SanDiego30'x60' | Coarse | Sedimentary | Impermeable | CSI |
| Tsm | Oceanside 30' x 60' | Coarse | Sedimentary | Impermeable | CSI |
| Tso | Oceanside30'x60' | 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 | Oceanside30'x60' | Coarse | Sedimentary | Impermeable | CSI |
| Qvoa13 | Oceanside 30' x 60' | Coarse | Sedimentary | Impermeable | CSI |
| Qvoc | Oceanside30'x60' | 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 | SanDiego30'x60' | Coarse | Sedimentary | Impermeable | CSI |
| Qvop11 | San Diego & Oceanside 30' x 60' | Coarse | Sedimentary | Impermeable | CSI |

| Map Unit | Map Name | Anticipated Grain size of Weathered Material | Bedrock or Sedimentary | Impermeable/ Permeable | Geology Grouping |
|---|---|---|---|---|---|
| Qvop11a | SanDiego30'x60' | 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 | SanDiego30'x60' | Coarse | Sedimentary | Impermeable | CSI |
| Tsa | Oceanside 30' x 60' | Coarse | Sedimentary | Impermeable | CSI |
| Qof | Oceanside30'x60' | Coarse | Sedimentary | Permeable | CSP |
| Qof1 | Oceanside 30' x 60' | Coarse | Sedimentary | Permeable | CSP |
| Qof2 | Oceanside30'x60' | Coarse | Sedimentary | Permeable | CSP |
| Q | Jennings; CA | Coarse | Sedimentary | Permeable | CSP |
| Qa | Oceanside30'x60' | Coarse | Sedimentary | Permeable | CSP |
| Qd | Oceanside 30' x 60' | Coarse | Sedimentary | Permeable | CSP |
| Qf | Oceanside30'x60' | 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 | Oceanside30'x60' | Coarse | Sedimentary | Permeable | CSP |
| Qt | El Cajon 30' x 60' | Coarse | Sedimentary | Permeable | CSP |
| Qoa1-2 | Oceanside30'x60' | Coarse | Sedimentary | Permeable | CSP |
| Qoa2-6 | Oceanside 30' x 60' | Coarse | Sedimentary | Permeable | CSP |
| Qoa5 | Oceanside30'x60' | Coarse | Sedimentary | Permeable | CSP |
| Qoa6 | Oceanside 30' x 60' | Coarse | Sedimentary | Permeable | CSP |
| Qoa7 | Oceanside30'x60' | Coarse | Sedimentary | Permeable | CSP |

| 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 | Oceanside30'x60' | Coarse | Sedimentary | Permeable | CSP |
| Qc | El Cajon 30' x 60' | Coarse | Sedimentary | Permeable | CSP |
| Qu | ElCajon30'x60' | Coarse | Sedimentary | Permeable | CSP |
| Qoa | San Diego, Oceanside & El Cajon 30' x 60' | Coarse | Sedimentary | Permeable | CSP |
| Qop2-4 | SanDiego30'x60' | Coarse | Sedimentary | Permeable | CSP |
| Qop3 | Oceanside 30' x 60' | Coarse | Sedimentary | Permeable | CSP |
| Qop4 | Oceanside30'x60' | 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 | Oceanside30'x60' | Fine | Bedrock | Impermeable | FB |
| Kc | El Cajon 30' x 60' | Fine | Bedrock | Impermeable | FB |
| Kgb | Oceanside30'x60' | Fine | Bedrock | Impermeable | FB |
| KJvs | El Cajon 30' x 60' | Fine | Bedrock | Impermeable | FB |
| Kmv | ElCajon30'x60' | Fine | Bedrock | Impermeable | FB |
| Ksp | El Cajon 30' x 60' | Fine | Bedrock | Impermeable | FB |
| Kvsp | Oceanside30'x60' | 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 | Oceanside30'x60' | Fine | Bedrock | Impermeable | FB |
| Tv | Oceanside 30' x 60' | Fine | Bedrock | Impermeable | FB |
| Tvsr | Oceanside30'x60' | Fine | Bedrock | Impermeable | FB |
| Kgdfg | Oceanside 30' x 60' | Fine | Bedrock | Impermeable | FB |
| Ta | SanDiego30'x60' | Fine | Sedimentary | Impermeable | FSI |
| Tcs | Oceanside 30' x 60' | Fine | Sedimentary | Impermeable | FSI |
| Td | SanDiego&Oceanside | Fine | Sedimentary | Impermeable | FSI |

| 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 | SanDiego30'x60' | 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 | SanDiego30'x60' | 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 ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_R_Factor/ |
| RUSLE – K Factor | SWRCB | 2014 | Regional K factor map was downloaded from ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_K_Factor/ |
| RUSLE – LS Factor | SWRCB | 2014 | Regional LS factor map was downloaded from ftp://swrcb2a.waterboards.ca.gov/pub/swrcb/dwq/cgp/Risk/RUSLE/RUSLE_LS_Factor/ |
| RUSLE – C Factor | USEPA | 2014 | Regional C factor map was downloaded from http://www.epa.gov/esd/land-sci/emap_west_browser/pages/wemap_mm_sl_rusle_c_qt.htm#mapnav |

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 |

| 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 |

| 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 |

| 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 |

| 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 |

| 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 |

| 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 |

| 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%

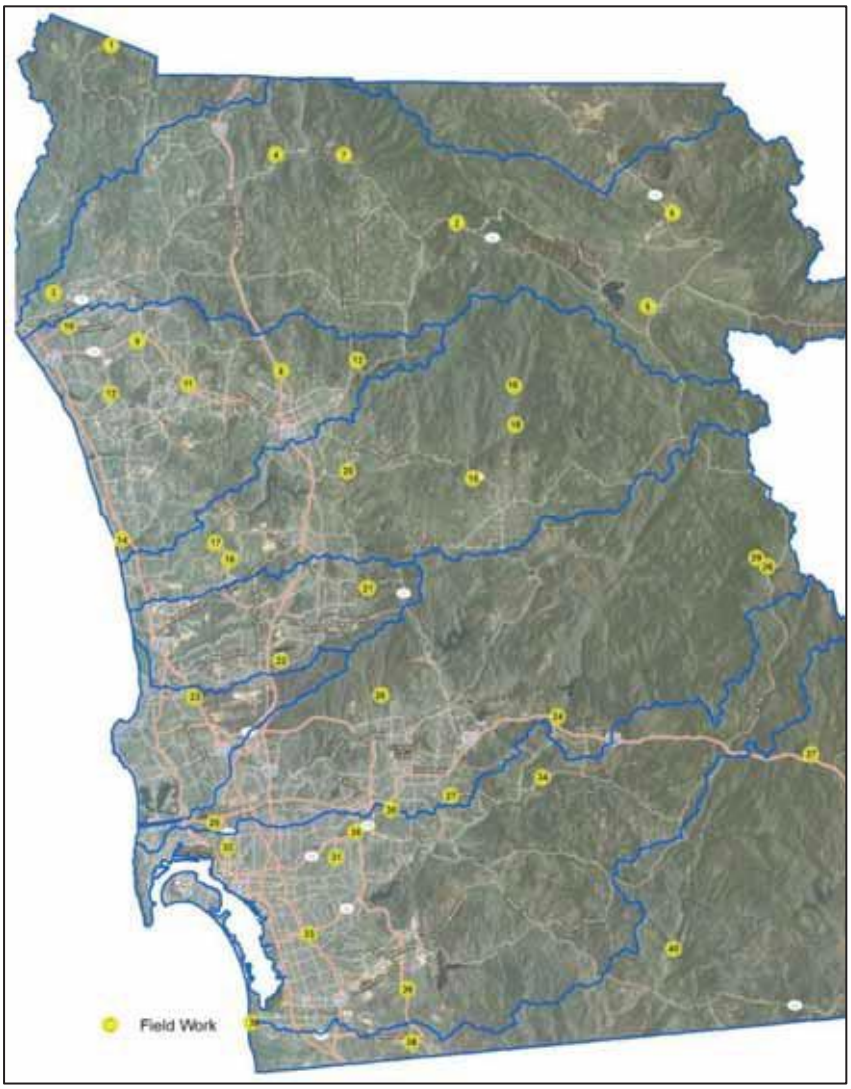
## A4.3 Field Assessment

**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 CONDTIONS

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**

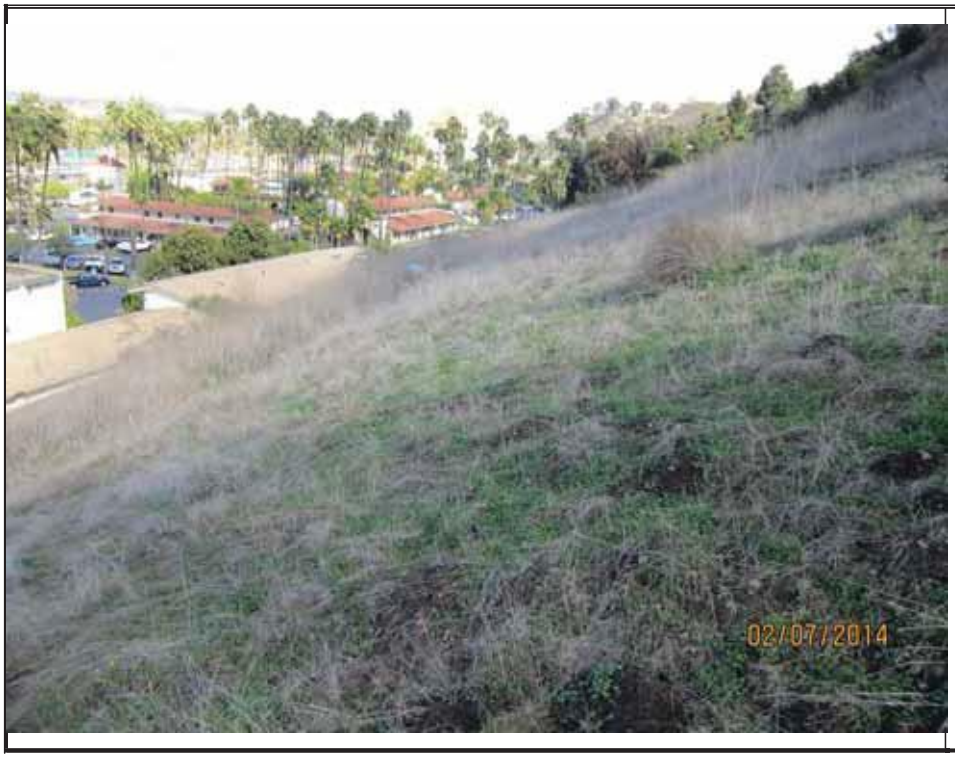
**GLU: CB-Unknown-4**

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**

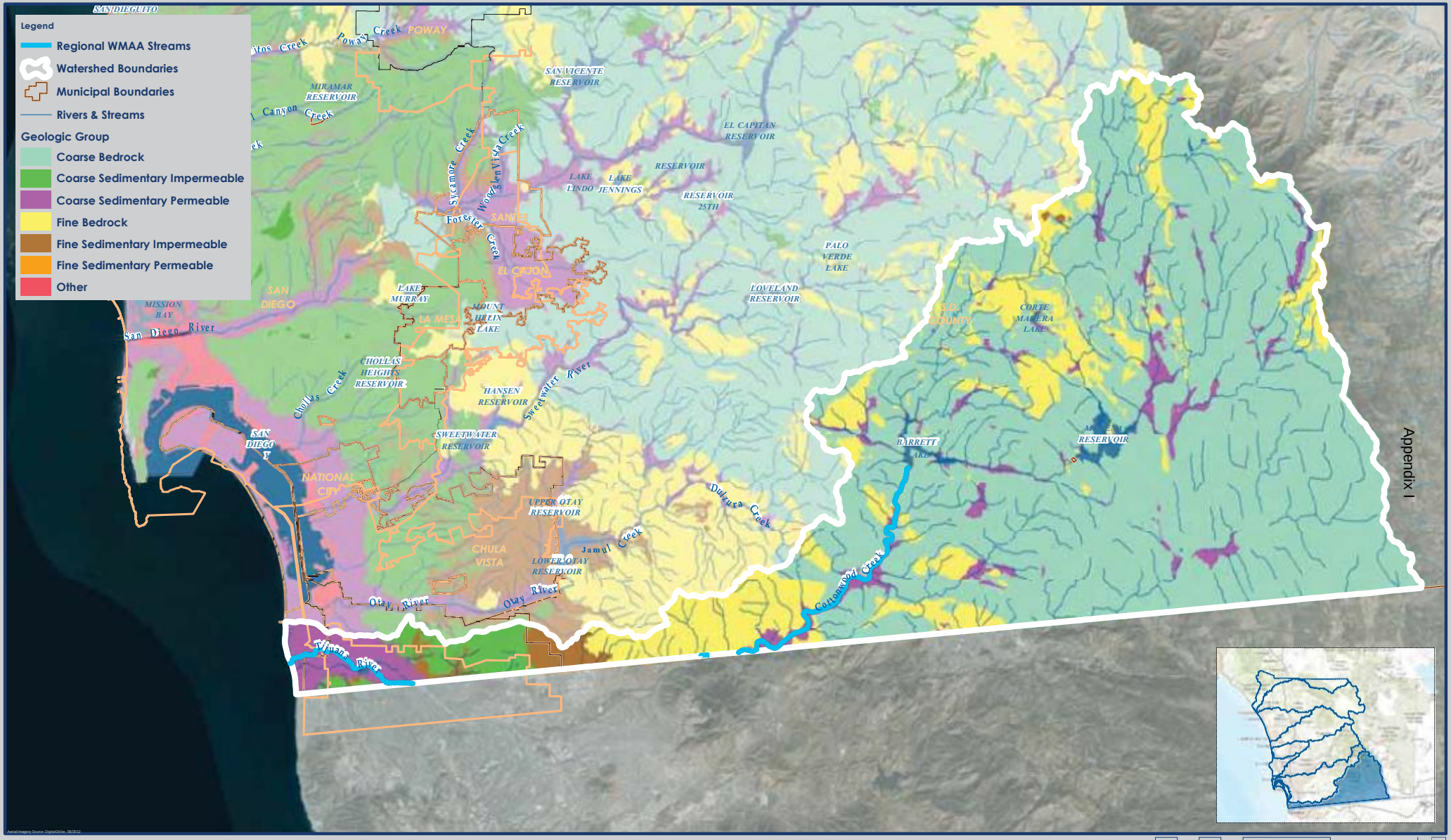
**GLU: CSP-Scrub/Shrub-4**

View: Looking south

Existing sediment production: Med

Potential sediment production: High

Existing veg. cover: 90-95%




Appendix I

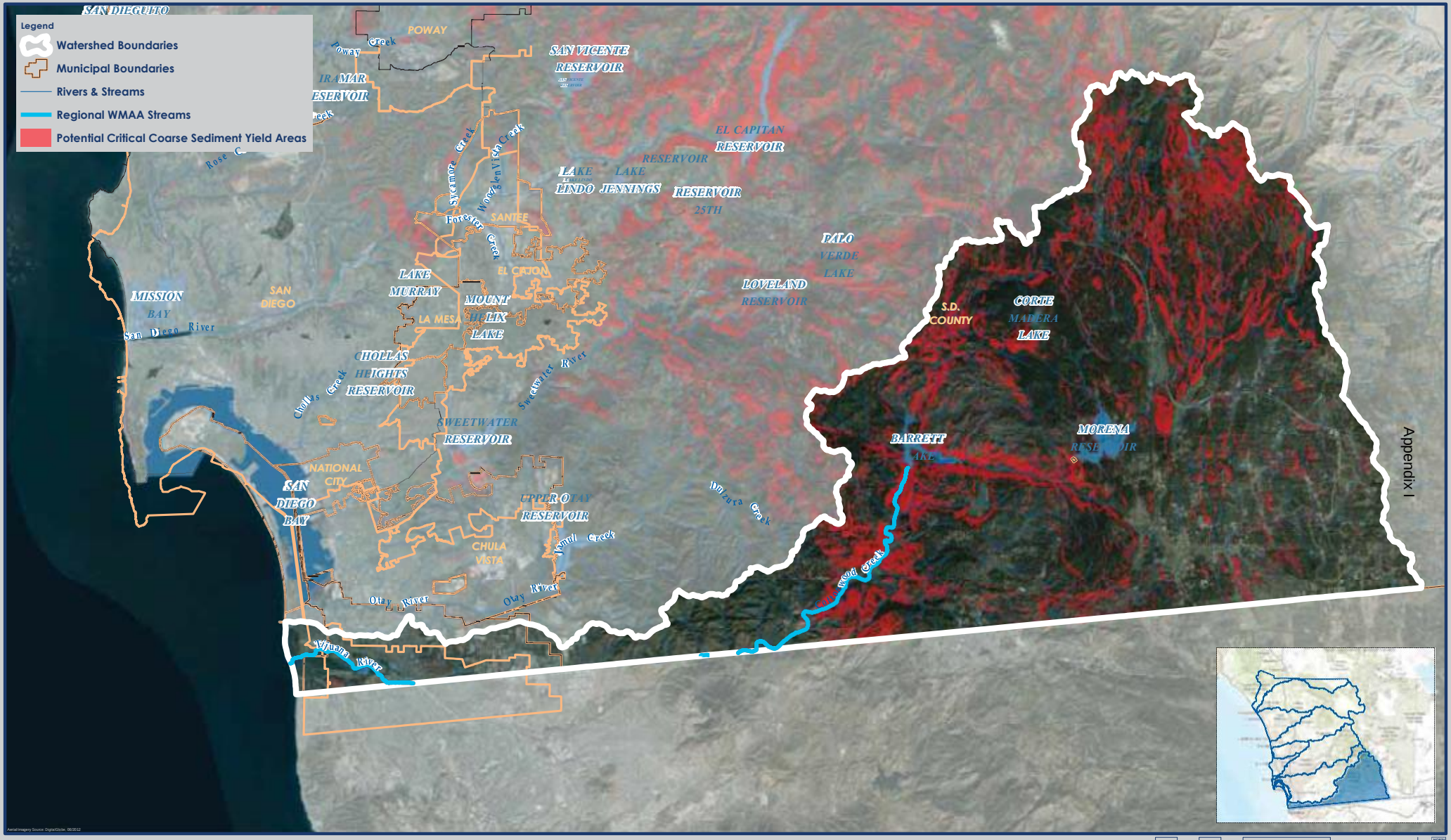
# Geologic Group

## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK




# Potential Critical Coarse Sediment Yield Areas

## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK

# 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). |

| 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. |

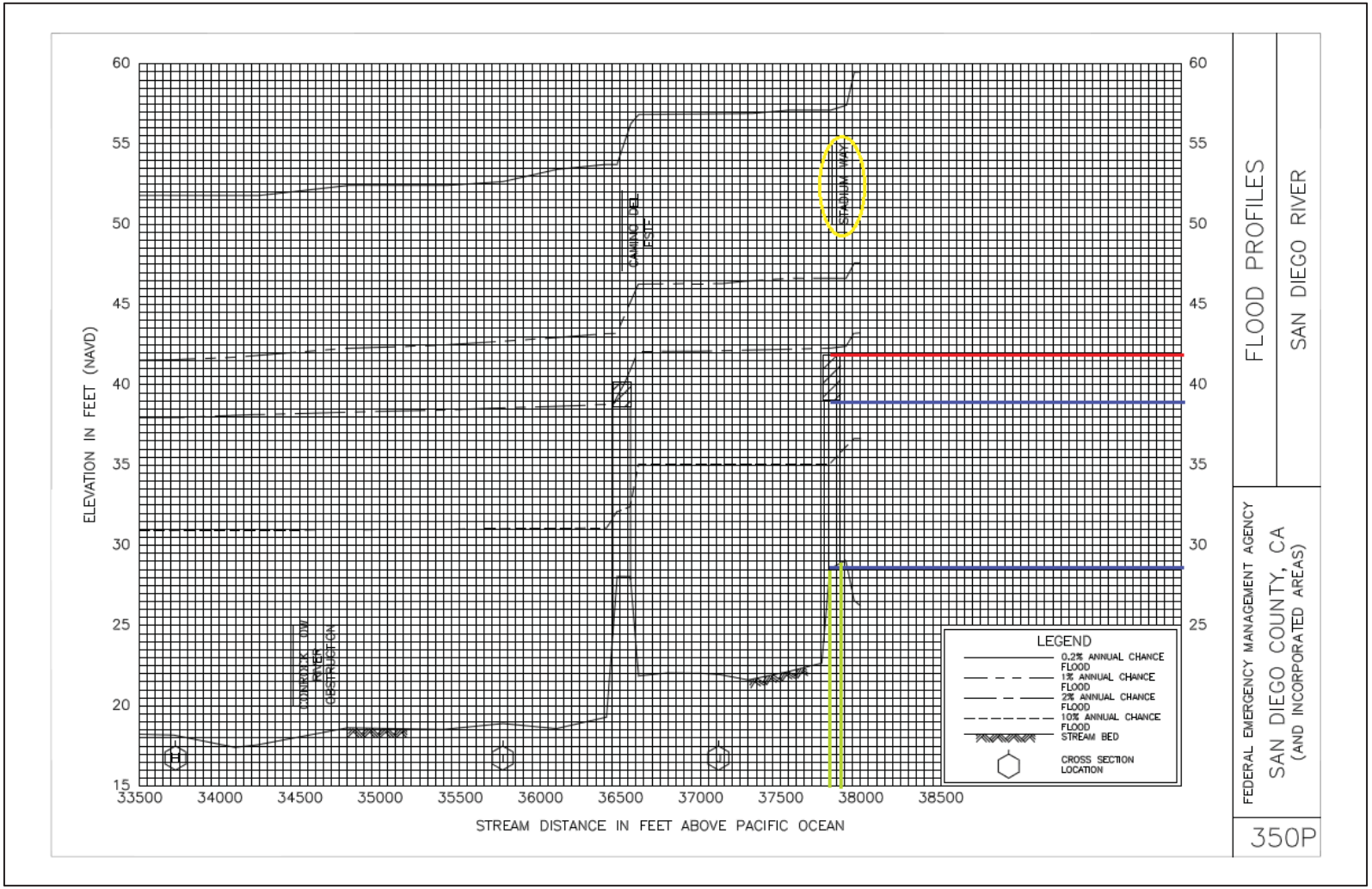
| Attribute | Description |
|---|---|
| RD_EL_NAVD | The Roadway Elevation (NAVD) field, when applicable, provides the known roadway elevation (in US feet, NAVD) for select structure types. When roadway elevations were determined using FEMA FIS Flood Profiles, the horizontal projection onto the vertical 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.

Table Of Contents
Layers
RIM_Structures
SD County
City of SD
Santee
FEMA NFHL
S_JS
S_LEVEE
S_GEN_STRUCT
Municipal
SanDiegoRiverWMA
World imagery
S_GEN_STRUCT
FID
Shape
DFIRM_ID
VERSION_ID
STRUCT_ID
STRUCT_TYP
CST_STRUCT
STRUCT_NM
136 Polyline 06073C 1.1.1.0 06073C_117 1 PCT Annual Chance Flood Discharge Contained in Structure
137 Polyline 06073C 1.1.1.0 06073C_118 Culvert CULVERT
138 Polyline 06073C 1.1.1.0 06073C_119 Culvert CULVERT CONTAINS 1 PCT FLOOD EVENT
554 Polyline 06073C 1.1.1.0 06073C_72 Culvert CULVERT
S_GEN_STRUCT

**Figure A.5.2: Typical FEMA FIS Flood Profile**




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

Figure AS.3: Google Map Imagery for Structure Identification

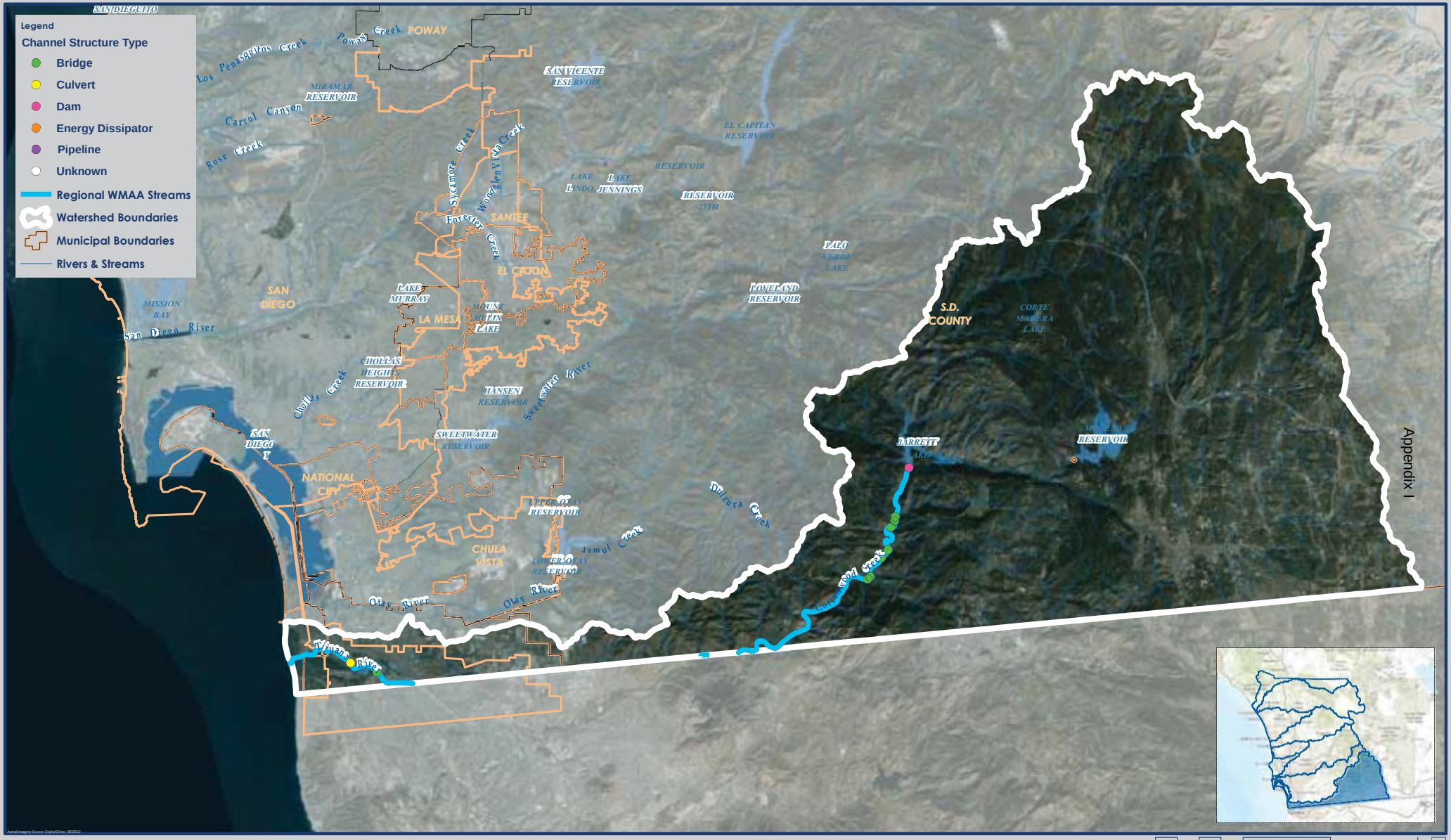
The following bridge structure dimensional attributes were included in the point feature attributes:

- 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 | SanDiego |
| 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 | InfofromFEMANFHLshapefiledata/FISFPV.9-350P |




Appendix I

Miles 0 25 50 100 150

# Watershed Management Area Streams with Channel Structures

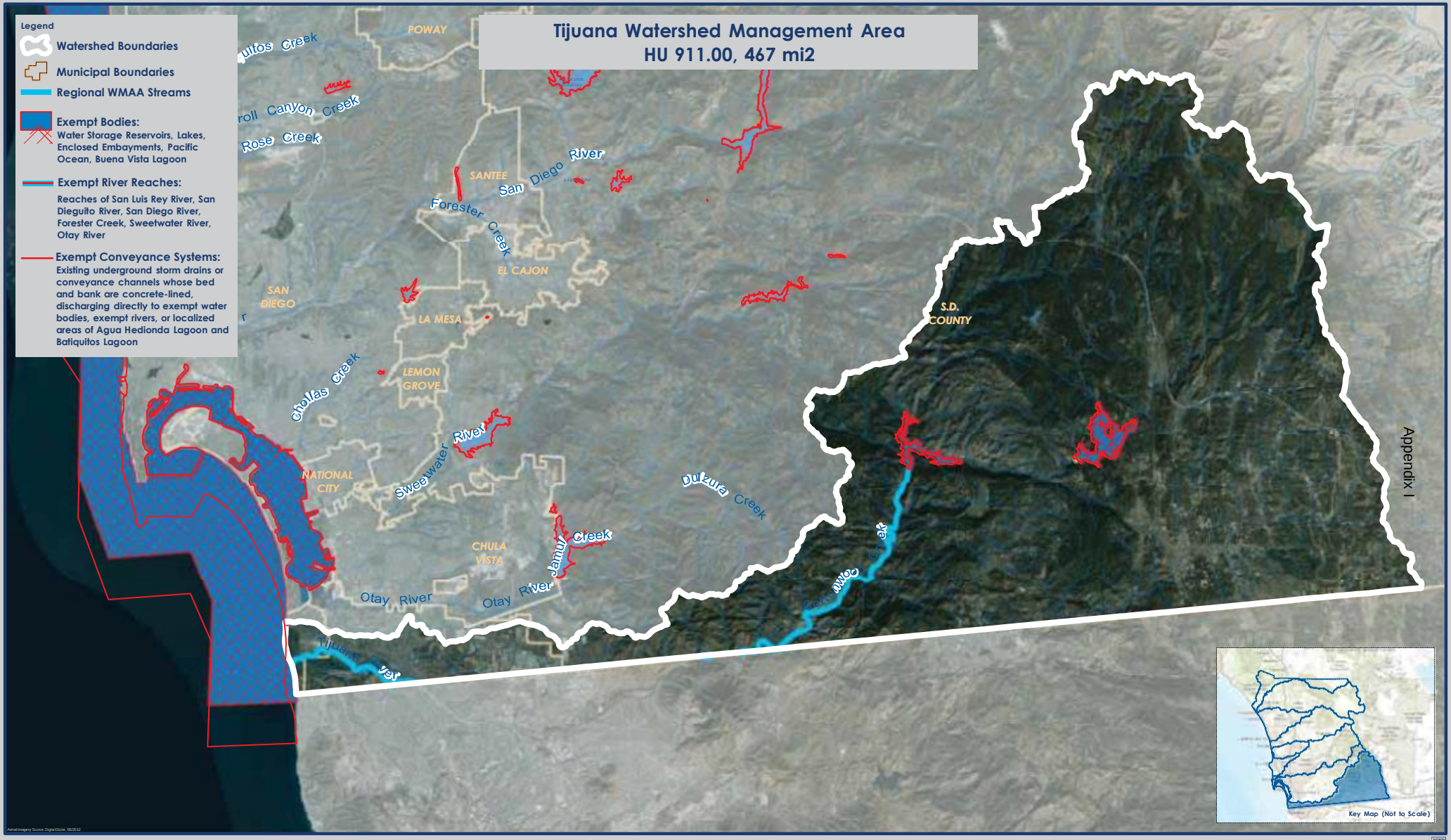
## Tijuana Watershed - HU 911.00, 467 mi2

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK

# ATTACHMENT B
# HYDROMODIFICATION MANAGEMENT EXEMPTION MAPPING




Appendix I

0 4.5 9 18 Miles

# Receiving Waters and Conveyance Systems Exempt from Hydromodification Management Requirements

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK

# ATTACHMENT C
# ELECTRONIC FILES

# Electronic Folder titled "Tijuana_WMAA_Attachment C Electronic_Data.zip" Contents:

1. ArcMap 10.0 and 10.1 map files created for purpose of viewing Regional WMAA data
   - x WMAA_09_Tijuana_Data_2014_0908_v10.mxd
   - x WMAA_09_ Tijuana _Data_2014_0908_v101.mxd
2. ESRI Geodatabase titled " WMAA_09_ Tijuana _Data_2014_0908_v10.gdb" containing the following data:
   - x WatershedBoundaries
     - Watershed_Boundaries
   - x HydrologicProcesses
     - HRUAnalysis
   - x 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)
   - x 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
   - x PotentialCoarseSedimentYield
     - GLUAnalysis
     - PotentialCoarseSedimentYieldAreas
     - MacroLevelPotentialCriticalAreas
     - PotentialCriticalCoarseSedimentYieldAreas
   - x ChannelStructures
     - ChannelStructures
   - x HydromodExemptions
     - Exempt_Systems
     - Exempt_Bodies
   - x Floodplains: included for reference
     - FEMA_NFHL
   - x Baselayers: included for reference
     - SanGIS_Lakes
     - link to ESRI World Imagery (internet connection is required to access ESRI World Imagery basemap)

# Electronic Folder titled "Mission Bay La Jolla _WMAA_Attachment C Electronic_Data.zip" Contents, continued:

3. Google Earth – KMZ file titled: "WMAA_09_ Tijuana _Data_2014_0908_GoogleEarth.kmz"**,** containing the following data:
   - x WatershedBoundaries
   - x Streams
     - o SD Regional WMAA Streams (streams selected for detailed analysis)
     - o SD NHD Streams (portion of NHD dataset included for reference)
   - x LandUsePlanning
     - o Municipal Boundaries
     - o Federal/State/Indian Lands
   - x ChannelStructures
   - x HydromodExemptions
     - o Exempt_Systems
     - o Exempt_Bodies
   - x Floodplains: included for reference
     - o FEMA Floodplain
   - x Dominant Hydrologic Processes
   - x Potential Critical Coarse Sediment Yield Areas

**Notes:**

x Open a map file (with extension .mxd) using ArcMap to view the data.

x 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 |

# Tijuana River Watershed Management Area Analysis

*Lake Henshaw*

***September 8, 2014***

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

***Prepared by:***

Geosyntec consultants
engineers | scientists | innovators

RICK ENGINEERING COMPANY

## TABLE OF CONTENTS

**1. INTRODUCTION ..... 1**

1.1. BACKGROUND ..... 1
1.2. WATERSHED MANAGEMENT AREA ANALYSIS (WMAA) ..... 1
1.3. SCOPE OF WORK FOR REGIONAL WMAA ..... 2
1.4. PROJECT PROCESS ..... 3
1.5. REPORT ORGANIZATION ..... 4
1.6. TERMS OF REFERENCE ..... 4

**2. WATERSHED MANAGEMENT AREA CHARACTERIZATION ..... 5**

2.1. DOMINANT HYDROLOGIC PROCESSES ..... 6
*2.1.1. Datasets Used for identifying dominant hydrologic processes ..... 7*
*2.1.2. Methodology/Assumptions/Criteria for identifying dominant hydrologic processes ..... 8*
*2.1.3. Results for identifying dominant hydrologic processes ..... 12*
*2.1.4. Limitations for identifying dominant hydrologic processes ..... 13*
2.2. STREAM CHARACTERIZATION ..... 14
*2.2.1. Datasets Used for stream characterization ..... 14*
*2.2.2. Methodology/Assumptions/Criteria for stream characterization ..... 14*
*2.2.3. Results for stream characterization ..... 18*
*2.2.4. Limitations for stream characterization ..... 19*
2.3. LAND USES ..... 20
*2.3.1. Datasets Used for land uses ..... 20*
*2.3.2. Methodology/Assumptions/Criteria for land uses ..... 20*
*2.3.3. Results for land uses ..... 21*
*2.3.4. Limitations ..... 22*
2.4. POTENTIAL COARSE SEDIMENT YIELD AREAS ..... 23
*2.4.1. Datasets Used for identifying potential coarse sediment yield areas ..... 23*
*2.4.2. Methodology/Assumptions/Criteria for identifying potential coarse sediment yield areas ..... 23*
*2.4.3. Results for identifying potential coarse sediment yield areas ..... 26*
*2.4.4. Limitations for identifying potential coarse sediment yield areas ..... 26*
2.5. PHYSICAL STRUCTURES ..... 28
*2.5.1. Approach for identifying physical structures ..... 28*
*2.5.2. Results for identifying physical structures ..... 28*

**3. TEMPLATE FOR CANDIDATE PROJECT LIST ..... 29**

**4. HYDROMODIFICATION MANAGEMENT APPLICABILITY/EXEMPTIONS ..... 31**

4.1. ADDITIONAL ANALYSIS FOR HYDROMODIFICATION MANAGEMENT EXEMPTIONS ..... 31
*4.1.1. Exempt River Reaches ..... 32*
*4.1.2. Stabilized Conveyance Systems Draining to Exempt Water Bodies ..... 32*
*4.1.3. Highly Impervious/Highly Urbanized Watersheds and Urban Infill ..... 32*
*4.1.4. Tidally Influenced Lagoons ..... 32*

**5. CONCLUSIONS ..... 33**

5.1. WATERSHED MANAGEMENT AREA CHARACTERIZATION ..... 33
5.2. TEMPLATE FOR CANDIDATE PROJECT LIST ..... 34
5.3. HYDROMODIFICATION MANAGEMENT EXEMPTIONS ..... 34

**6. REFERENCES ..... 36**

## TABLE OF CONTENTS CONTINUED

**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 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 |
| $S_P$ | 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 WMA;
- 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 Tijuana 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 is 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 | 1/3rd 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 |

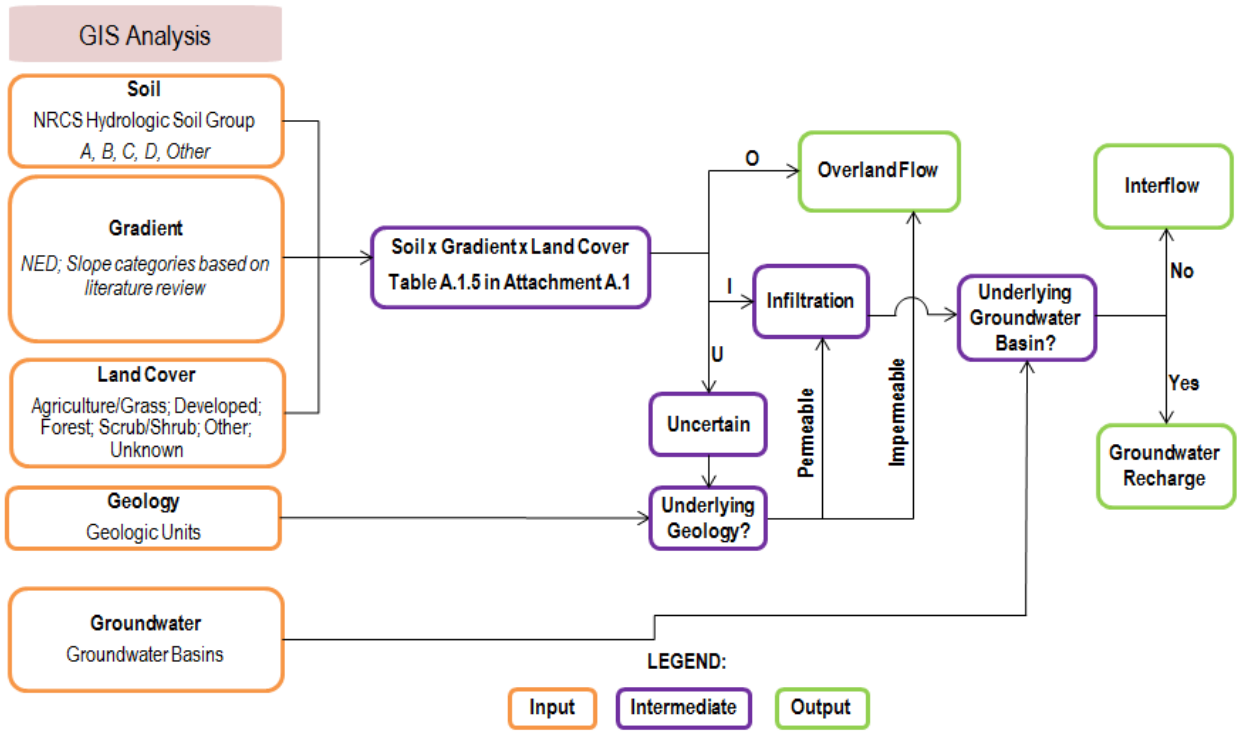
| Dataset | Source | Year | Description |
|---|---|---|---|
| Geology | Kennedy, M.P., and Tan, S.S. | 2002 | Geologic Map of the Oceanside 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale. |
| | Kennedy, M.P., and Tan, S.S. | 2008 | Geologic 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 Tijuana 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.

   Runoff Coefficient + Infiltration Coefficient + 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 "I" 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 Tijuana River WMA is provided in Attachment A.1. An ArcMap document file which presents the results from each step of the methodology is included in Attachment C, as well as a Google Earth KMZ file. Based on this analysis, overland flow is the predominant hydrologic process in all 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.1 |
| | Map Layer Title | Soil<br>Land Cover<br>Slope<br>Hydrologic Response Unit<br>Initial Rating<br>Permeability<br>Groundwater Basin<br>Dominant Hydrologic Processes | |
| | Geodatabase Feature Dataset | HydrologicProcesses | |
| | Geodatabase Feature Class | HRUAnalysis | |
| | Geodatabase Geometry Type | Polygon | |
| KMZ [1] | KMZ File Name | Dominant Hydrologic Processes | Attachment C.2 |

[1] 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 (http://www.google.com/earth/).

### 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 Tijuana River WMA, stream characterization and detailed mapping is provided for Tijuana River and Cottonwood 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 Copermittes' 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 Copermittees 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 Copermittees' 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-yeaer 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 | • "Watershed Management Area Streams"<br>• "Watershed Management Area Streams by Hydrographic Category"<br>• "Watershed Management Area Streams by Bed Material"<br>• "Watershed Management Area Streams by Geologic Group"<br>• "Watershed Management Area Streams by Reach | Attachment A.2 |

| Format | Item | Description | Location |
|---|---|---|---|
| | | Type" | |
| GIS | Map Group Title | Not Grouped | Attachment C.1 |
| | Map Layer Title | SD_Regional_WMAA_Streams | |
| | Geodatabase Feature Dataset | Streams | |
| | Geodatabase Feature Class | SD_Regional_WMAA_Streams | |
| | Geodatabase Geometry Type | Line | |
| KMZ [1] | KMZ File Name | SD_Regional_WMAA_Streams | Attachment C.2 |

[1] 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/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).

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 | • "Existing Land Use"<br>• "Planned Land Use"<br>• "Developable Land"<br>• "Redevelopment and Infill Areas" | Attachment A.3 |
| GIS | Map Group Title | Land Use Planning | Attachment C.1 |
| | Map Layer Title | Municipal Boundaries<br>Federal/State/Indian Lands<br>SanGIS_ExistingLandUse<br>SanGIS_PlannedLandUse<br>SanGIS_DevelopableLand<br>SanGIS_RedevelopmentandInfill<br>FEMA Floodplain<br>MHPA_SD MSCP_CN<br>MSCP_EAST_DRAFT_CN<br>Draft_North_County_MSCP_Version_8_Categories | |
| | Geodatabase Feature Dataset | LandUsePlanning | |
| | Geodatabase Feature Class | SanGIS_MunicipalBoundaries<br>Federal_State_Indian_Lands<br>SanGIS_ExistingLandUse<br>SanGIS_PlannedLandUse | |

| Format | Item | Description | Location |
|---|---|---|---|
| | | SanGIS_DevelopableLand<br>SanGIS_RedevelopmentandInfill<br>FEMA_NFHL<br>SanGIS_MHPA_SD<br>SanGIS_MSCP_CN<br>SanGIS_MSCP_EAST_DRAFT_CN<br>SanGIS_Draft_North_County_MSCP_Version_8_Categories | |
| | Geodatabase Geometry Type | Polygon | |
| KMZ [1] | KMZ File Name | Municipal Boundaries<br>Federal/State/Indian Lands<br>Floodplains<br>Due to file size limitations, SanGIS land use datasets were not converted to KMZ. | Attachment C.2 |

[1] 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/Zipped) file that can be viewed with the free download version of Google Earth (http://www.google.com/earth/).

### 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 Tijuana 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

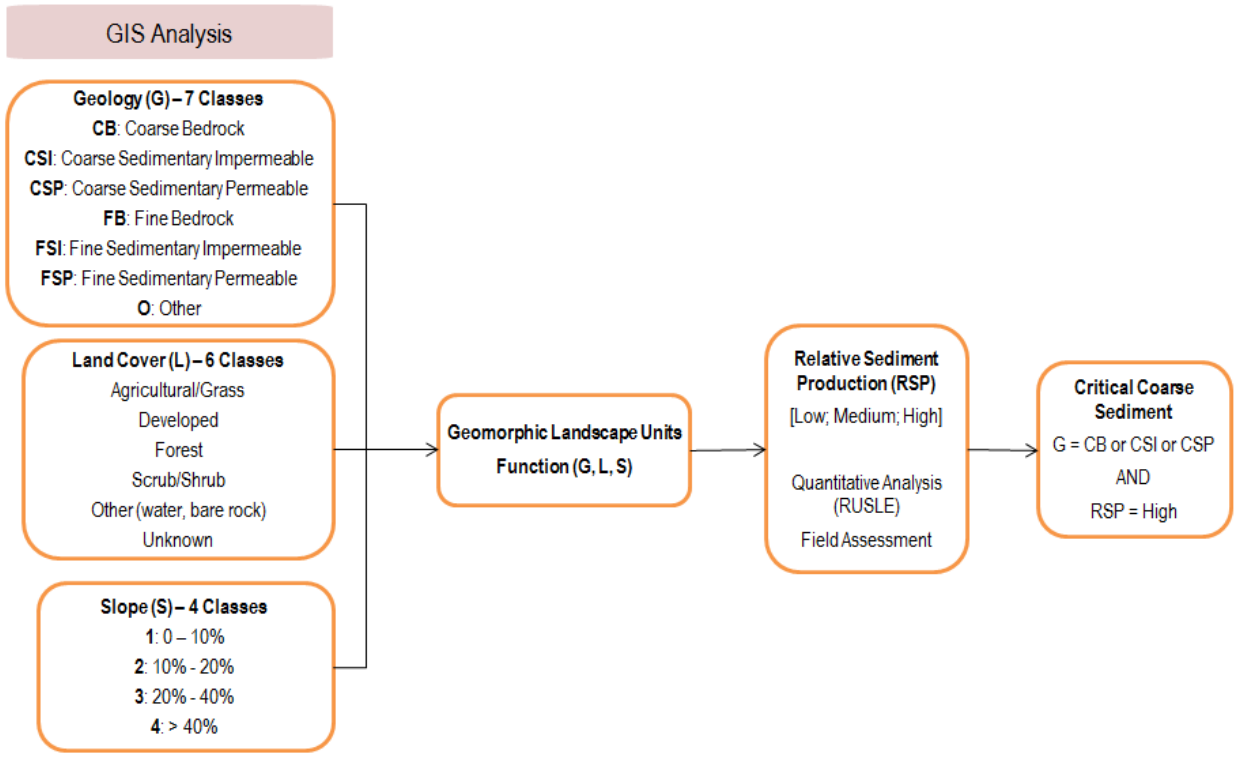
The following datasets were used in the analysis

| Dataset | Source | Year | Description |
|---|---|---|---|
| Elevation | USGS | 2013 | 1/3rd 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 Tijuana River WMA.

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 Copermittees 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 critical coarse sediment yield areas

The resulting GIS maps showing the spatial distribution of geologic grouping and critical coarse sediment yield areas within the Tijuana 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 18 % 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 Tijuana River WMA for their respective jurisdictional area.

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

| Format | Item | Description | Location |
|---|---|---|---|
| Report | Figures | "Geologic Grouping"<br>"Potential Critical Coarse Sediment Yield Areas" | Attachment A.4 |
| GIS | Map Group Layer Name | Potential Coarse Sediment Yield | Attachment C.1 |
| | Map Layer Title | Geologic Grouping<br>Land Cover<br>Slope Category<br>Geomorphic Landscape Unit<br>Potential Coarse Sediment Yield Area<br>Relative Sediment Production<br>Potential Critical Coarse Sediment Yield Area | |
| | Geodatabase Feature Dataset | PotentialCoarseSedimentYield | |
| | Geodatabase Feature Class | GLUAnalysis<br>PotentialCoarseSedimentYieldAreas<br>PotentialCriticalCoarseSedimentYieldAreas | |
| | Geodatabase Geometry Type | Polygon | |
| KMZ [1] | KMZ File Name | Potential Critical Coarse Sediment Yield Areas | Attachment C.2 |

[1] 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/Zipped) 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 Copermittees 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 [1] | Kmz File Name | ChannelStructures | Attachment C.2 |

[1] 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<br>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.<br>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.<br>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.<br>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".<br>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.<br>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 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 evaluate the following exemptions that were originally part of the approved 2011 Final Hydromodification Management Plan but were not included in the current Regional MS4 Permit and provides recommendation based on the results from the analysis performed if these exemptions should be reinstated through WMAA:

- 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

There are no river reaches currently recommended for exemption from hydromodification management requirements in the Tijuana River WMA. Potential river reach exemptions may be studied using the recommended approach documented in the Regional WMAA. Refer to the Regional WMAA for the criteria and an example exemption studies that were prepared for the five river reaches included in the San Diego County Final HMP dated March 2011.

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

There are no stabilized conveyance systems currently recommended for exemption from hydromodification management requirements in the Tijuana River WMA. If engineered conveyance systems that are stabilized with materials other than concrete, such as riprap, turf reinforcement mat, or vegetation, including rehabilitated stream systems, are identified as potential candidates for exemption, they may be studied and may be recommended exempt if they meet specific criteria presented in the Regional WMAA for this exemption. Refer to the Regional WMAA for the criteria and an example study that was prepared for Forester Creek in the San Diego River WMA.

### 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 Tijuana River WMA are currently recommended for highly impervious/highly urbanized watershed or urban infill exemption.

### 4.1.4. Tidally Influenced Lagoons

There are no areas recommended for exemption from hydromodification management requirements under the tidally influenced lagoons category in the Tijuana 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 Tijuana 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 watershed-scale projects and management decisions based (as opposed to piecemeal project identification) 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 |
|---|---|
| Dominant Hydrologic Process:<br>• Overland flow<br>• Infiltration<br>• Interflow | • Identify areas for enhanced infiltration or collection of storm water for treatment<br>• Implement management measures that correspond to pre-development conditions – promotes long-term channel stability and health<br>• Increases understanding of the natural functioning of the watershed and what has been (or is at risk of being) altered by urbanization. |
| Stream Characterization:<br>• Reach type<br>• Bed material<br>• Bank material<br>• Hydrographic category<br>• Channel Structures | • Preliminary dataset that can be used to conduct stream power evaluations<br>• Identify channel systems for preservation or restoration<br>• Identification of appropriate space for channel processes to occur (e.g., flood plain connectivity)<br>• Insight to sensitivity of receiving stream reach<br>• Indicates the features within channels that affect water and sediment |

| Characterization Data | Utilization Potential |
|---|---|
| | movement through the watershed |
| Land Use:<br>• Existing<br>• Future | • 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<br>• Encourage infill development |
| Potential Critical Coarse Sediment Yield Areas | • Preservation of areas or function that contributes critical sediment within the watershed to stream armoring/stability<br>• Assist with identifying potentially susceptible stream reaches that require uninterrupted coarse sediment supplies to remain stable<br>• Dual goal of open space conservation |

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 Tijuana 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

There are no additional exemptions recommended based on studies in the Tijuana River WMA.

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Appendix J.1

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| 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.** | | | | | | | | | | | | |
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| **Public Parcels Identified as Suitable for Further Assessment to Determine Feasibility of Retrofitting** | | | | | | | | | | | | |
| **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.** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **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.** | | | | | | | | | | | | |
| | | | | | | | | | | | | |

# Appendix J.3

| 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 | Potential Pollutant | Project Size & Parameters | | | | Regulatory Requirement | Project Timeline | Other Notes | Watershed Number | Secondary Category | Originating Report | E-Mail | Phone | Contact Address |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Type | Owner Information | Address | APN | Latitude | Longitude | Name | Contact Information | | | | Contributing Drainage Area (acres) | Parcel Size (acres) | Project Footprint (acres) | Parameters (with units as necessary) | | | | | | | | | |
| TJ-1 | Tijuana | Tijuana Valley | San Ysidro | SAN DIEGO | Tijuana River Valley Regional Park Proposed 60.2 AC Restoration Project | Public | COUNTY OF SAN DIEGO | N/A | 6370107300 | 1783595.291 | 6308310.111 | Rick Engineering Company | | Stream or Riparian Rehabilitation | Habitat Restoration | | | | 60.2 | | | | | 911.11 | Floodplain Preservation | Tijuana River Valley Regional Park, Area Specific Management Directives, June 22, 2007 (Final_TJ_ASMD_6_22_07.pdf | rcronquist@rickengineering.com | 619-291-0707 | |
| TJ-2 | Tijuana | Tijuana Valley | San Ysidro | IMPERIAL BEACH | Tijuana River Nave/SD County/other | | UNITED STATES OF AMERICA | N/A | 6350800100 | 1784169.138 | 6299165.075 | River Partners | | | | | | | | | | | | 911.11 | | | nfo@riverpartners.org | (530) 894-5401 | |
| TJ-6 | Tijuana | Tijuana Valley | San Ysidro | SAN DIEGO | Tijuana River Valley Regional Park Proposed 60.2 AC Restoration Project | Public | COUNTY OF SAN DIEGO | HIGHWAY 94 | 6370107300 | 1783595.291 | 6308310.111 | Rick Engineering Company | | Stream or Riparian Rehabilitation | Habitat Restoration | | | | 60.2 | | | | | 911.11 | Floodplain Preservation | Tijuana River Valley Regional Park, Area Specific Management Directives, June 22, 2007 (Final_TJ_ASMD_6_22_07.pdf | rcronquist@rickengineering.com | 619-291-0707 | |
| TJ-7 | Tijuana | Morena | undefined | S.D. COUNTY | Bioretention Basin | Private | HALL TRUST 06-01-92 | Quail Road and Morena View | 6060820100 | 1827095.399 | 6483734.355 | Miles Safa | | retrofitting | Construction of bioretention basin | pollutants from street surface flow | 0 | 0 | 0 | | 2013 permit | | May have potential to earn credit toward a CIP project that has problem meeting water quality/hydromodification requirements on site. This property has soil type "B" indicating that biorention is suitable for this site. | 911.5 | groundwater recharge | | miles.Safa@sdcounty.ca.gov | 858-694-3890 | County of San Diego<br>5510 Overland Avenue<br>San Diego, CA, 92123 |
| TJ-3 | Tijuana | Campo | Canyon City | S.D. COUNTY | highway run-off into creek that feeds to riparian area and Campo Creek | | RYDBERG VICTORIA | N/A | 6541001400 | 1795169.447 | 6476511.205 | Billie Jo Jannen | | | | | | | | | | | | 911.82 | | | jannen@inbox.com | 619-415-6298 | 28736 Highway 94 -- this is also the address where CalTrans is directing this run-off. |
| TJ-4 | Tijuana | Campo | Canyon City | S.D. COUNTY | Campo Valley reclamation | Private | Barry deVorzan | Unknown/several | 6550902600 | 1805248.29 | 6492697.158 | Billie Jo Jannen | | Floodplain | wetland/creek | nitrates, road run- | 500 | | | area shown on map | unknown | urgent | This area provides water for all of | 911.82 | Groundwater | community | jannen@inbox.com | 619-415-6298 | 28736 Highway 94 |
| TJ-5 | Tijuana | Campo | Canyon City | S.D. COUNTY | possible sewage pollution | Private | Mountain Empire RV | 29146 Highway 94, | 6560600800 | 1795390.76 | 6480867.573 | Billie Jo Jannen | | Floodplain | | sewage, household | | | | | | urgent | The owners have dammed a | 911.82 | Water Supply | | jannen@inbox.com | 619-415-6298 | 28736 Highway 94, Campo |

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# SECTION 1 INTRODUCTION

This municipal separate storm sewer system (MS4) outfall monitoring work plan satisfies the requirements of the San Diego Regional Water Quality Control Board (Regional Board) Order R9-2013-0001 (MS4 Permit) Provision D.2. for the 2015-2016 fiscal/monitoring year for the Tijuana River Watershed Management Area (WMA). This work plan assumes the reader is familiar with the requirements of MS4 Permit and the Tijuana River Water Quality Improvement Plan within which this work plan is contained.

To assess potential impacts on receiving water and identify potential pollutant sources, the RAs are required to monitor the wet weather and non-storm water discharges from the MS4 outfalls in the Tijuana River WMA during implementation of the Tijuana River Water Quality Improvement Plan to assess the effectiveness of their jurisdictional runoff management programs (JRMPs) toward effectively prohibiting non-storm water discharges into the MS4 and reducing pollutants in storm water discharges from their MS4s to the maximum extent practicable (MEP) (Regional Board 2013).

Table 1-1 presents the RAs, land area, and percent of area within the Tijuana River WMA. Table 1-2 presents areas within the Tijuana River WMA that are currently listed on the United States Environmental Protection Agency (USEPA) 303(d) list. Figure K-1 provides an illustration of the Tijuana River WMA, jurisdictional boundaries, and proposed monitoring locations.

**Table 1-1**
**Responsible Agencies within the Tijuana River WMA**

| Responsible Agency | Land Area (acres) | Percent of WMA |
|---|---|---|
| City of Imperial Beach | 2,146 | 0.7% |
| City of San Diego | 14,026 | 4.7% |
| County of San Diego | 282,669 | 94.6% |

**Table 1-2**
**Applicable 303(d) Listed Analytes within the Tijuana River WMA**

| Receiving Water Segment | Pollutant | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Indicator Bacteria | Total Coliform | Fecal Coliform | Enterococcus | Turbidity | Solids | Sedimentation/Siltation | Trash | Total Nitrogen as N | Ammonia as Nitrogen | Phosphorus | Eutrophic | Low Dissolved Oxygen | Pesticides | Surfactants (MBAS) | Lead | Manganese | Nickel | Selenium | Thallium | Trace Elements | Synthetic Organics | Perchlorate | Color | pH | Toxicity |
| Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River | | • | • | • | | | | | | | | | | | | | | | | | | | | | | |
| Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive | | • | • | • | | | | | | | | | | | | | | | | | | | | | | |
| Pacific Ocean Shoreline, Tijuana HU, at Monument Road | | • | • | | | | | | | | | | | | | | | | | | | | | | | |
| Pacific Ocean Shoreline, Tijuana HU, at the US Border | | • | • | • | | | | | | | | | | | | | | | | | | | | | | |
| Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth | | • | • | • | | | | | | | | | | | | | | | | | | | | | | |
| Tijuana River (6 miles affected) | • | | | | | • | • | • | • | | • | • | • | • | • | | | | • | | • | • | | | | • |
| Tijuana River Estuary (1320 acres affected) | • | | | | • | | | • | | | | • | • | • | | • | | • | | • | | | | | | |
| Tecate Creek (1 mile affected) | | | | | | | | | | | | | | | | | | | • | | | | | | | |
| Barrett Lake (125 acres affected) | | | | | | | | | • | | | | | | | | • | | | | | | • | • | • | |
| Pine Valley Creek (Upper) (3 miles affected) | | | | | • | | | | | | | | | | | | | | | | | | | | | |
| Morena Reservoir (104 acres affected) | | | | | | | | | | • | • | | | | | | • | | | | | | | • | • | |
| Cottonwood Creek (53 miles affected) | | | | | | | | | | | | | | | | | | | • | | | | | | | |

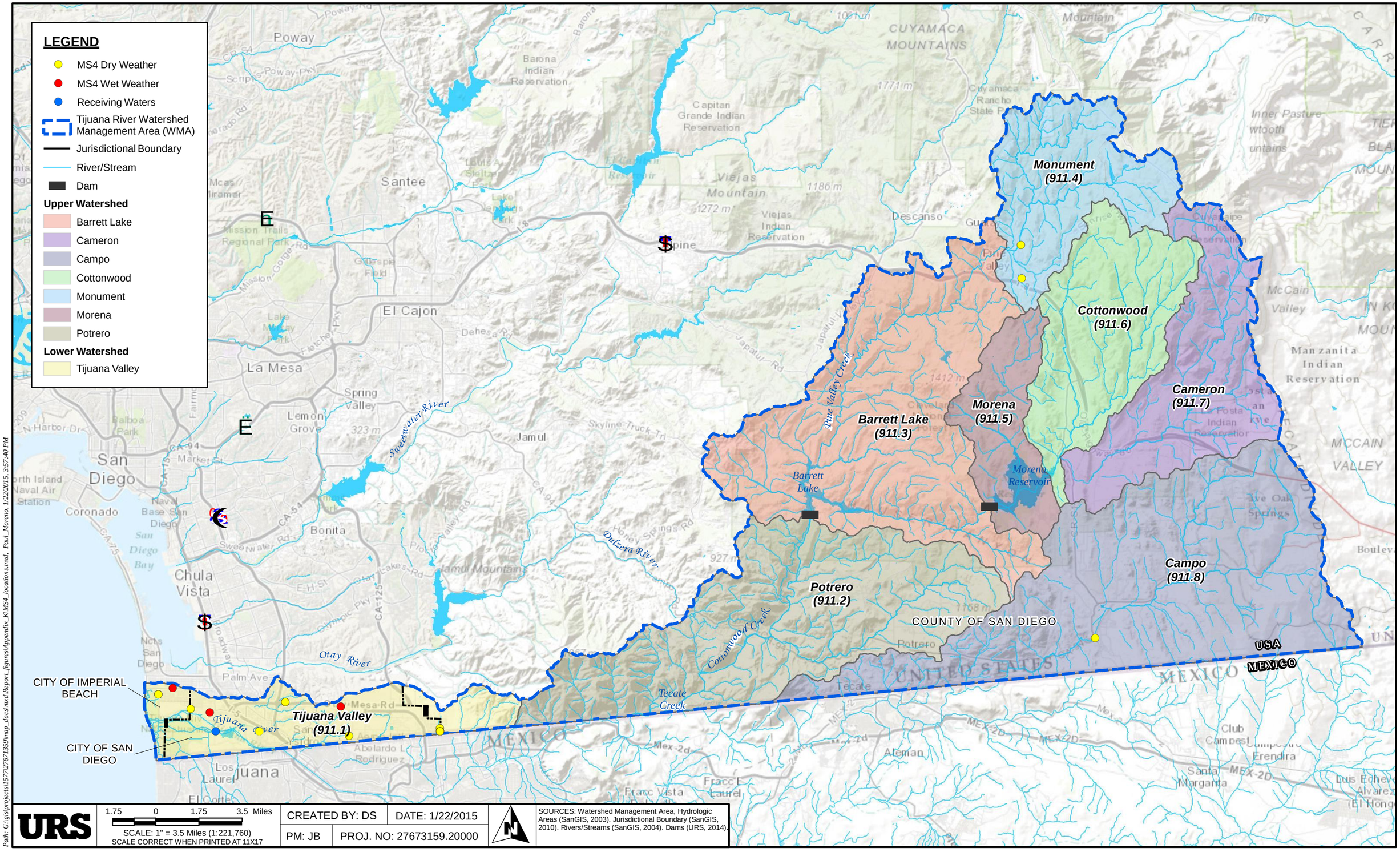


**FIGURE K-1 TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA) MS4 OUTFALL AND RECEIVING WATER MONITORING LOCATIONS**

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# SECTION 2 MONITORING

This section details the monitoring required to comply with the MS4 Permit.

## 2.1 NON-STORM WATER MS4 OUTFALL DISCHARGE MONITORING

Each RA is required to perform non-storm water MS4 outfall prioritization and monitoring to aid in the identification of non-storm water and illicit discharges within their respective jurisdictions as required by Provision D.2.b of the MS4 Permit.

### 2.1.1 MS4 Outfall Inventory

The RAs have identified the known major MS4 outfalls[1] that discharge directly to receiving waters within their respective jurisdictions within the Tijuana River WMA. The identified major MS4 outfalls have been geo-located on respective Geographic Information System (GIS) jurisdictional maps[2] of the Tijuana River WMA as required by Provision D.2.a.(1) of the MS4 Permit. Each RA will maintain, confirm, and updated their respective maps during annual field screening (Section 2.1.2). The respective jurisdictional MS4 maps contain the following items that, at a minimum, will be confirmed and updated during annual field screening as applicable:

- Segments of the MS4 owned, operated, and maintained by the RA;
- Known locations of inlets that discharge and/or collect runoff into the RA's MS4;
- Known locations of connections with other MS4s not owned or operated by the RA;
- Known locations of MS4 outfalls and private outfalls that discharge runoff collected from areas within the RA's jurisdiction;
- Segments of receiving waters within the RA's jurisdiction that receive and convey runoff discharged from the RA's MS4 outfalls;
- Locations of the MS4 outfalls within each RA's respective jurisdiction; and
    - Latitude and longitude of MS4 outfall point of discharge;
    - Watershed Management Area;
    - Hydrologic subarea;
    - Outlet size;
    - Accessibility (i.e. safety and without disturbance of critical habitat);
    - Approximate drainage area; and
    - Classification of whether the MS4 outfall is known to have persistent non-storm water flows, transient non-storm water flows, no non-storm water flows, or unknown non-storm water flows.

[1] A major outfall is defined as 36 inches or larger in diameter

[2] Geo-located MS4 outfall maps are not included in the work plan due to size

- Locations of the selected non-storm water persistent flow MS4 outfall discharge monitoring stations within each RA's respective jurisdiction (Section 2.1.3).

Table 2-1 presents the number of identified major outfalls in the Tijuana River WMA by RA.

**Table 2-1**
**Number of Identified Major Outfalls by RA in the Tijuana River WMA**

| RA | Identified Major Outfalls |
|---|---|
| City of Imperial Beach | 3 |
| City of San Diego | 30 |
| County of San Diego | 4 |

### 2.1.2 Field Screening

Each RA is required to conduct field screening to determine which non-storm water MS4 outfall discharges are transient flows and which are persistent flows, and prioritize the non-storm water MS4 discharges that will be investigated and eliminated in accordance with the Illicit Discharge Detection and Elimination (IDDE) program.

#### *2.1.2.1 Major Outfall Selection and Screening Frequency*

Per the requirements of Provision D.2.a.(2).(a) of the MS4 Permit, the number of major outfalls required to be screened is dependent upon the number of known major outfalls present in a RA's inventory. The requirements are as follows:

- For RAs with fewer than 125 known major MS4 outfalls that discharge to receiving waters within a WMA, at least 80 percent of the outfalls are required be visually inspected two times per year during non-storm water conditions.
- For RAs with 125 major MS4 outfalls or more, but fewer than or equal to 500 that discharge to receiving waters within a WMA, all the outfalls is required be visually inspected at least annually during non-storm water conditions.
- For RAs with more than 500 major MS4 outfalls that discharge to receiving waters within a WMA, at least 500 outfalls are required to be visually inspected at least annually during non-storm water conditions. RAs with more than 500 major MS4 outfalls within a WMA are required to identify and prioritize at least 500 outfalls to be inspected considering the following:
    - Assessment of connectivity of the discharge to a flowing receiving water;
    - Reported exceedances of NALs in water quality monitoring data;
    - Surrounding land uses;
    - Presence of constituents listed as a cause for impairment of receiving waters in the WMA listed on the Clean Water Act (CWA) section 303(d) List; and
    - Flow rate.

- For an RA with portions of its jurisdiction in more than one WMA and more than 500 major MS4 outfalls within its jurisdiction, at least 500 major MS4 outfalls within its inventory are required to be visually inspected at least annually during non-storm water conditions. RAs with more than 500 major MS4 outfalls in more than one WMA are required to identify and prioritize at least 500 outfalls to be inspected considering the following:
    - Assessment of connectivity of the discharge to a flowing receiving water;
    - Reported exceedances of NALs in water quality monitoring data;
    - Surrounding land uses;
    - Presence of constituents listed as a cause for impairment of receiving waters in the Watershed Management Area listed on the CWA section 303(d) List; and
    - Flow rate.
- Inspections of major MS4 outfalls conducted in response to public reports and staff or contractor reports and notifications may count toward the required visual inspections of MS4 outfall discharge monitoring stations.

Based on these criteria, Table 2-2 details the number of major outfalls that each respective RA will inspect within their respective jurisdictions and frequency3 within the Tijuana River WMA. The location of the major MS4 outfalls which will be screened by each RA are included in Appendix A.

**Table 2-2**
**MS4 Outfall Screening Number and Frequency by RA**

| RA | Number of Outfalls | Frequency |
|---|---|---|
| City of Imperial Beach | 3 | Two times per year |
| City of San Diego | 30 | Two times per year |
| County of San Diego | 4 | Two times per year |

### *2.1.2.2 Field Screening Visual Observations*

During a field screening visual observation inspection, each MS4 outfall selected for screening will be inspected following at least 72 hours of dry weather following any storm event producing greater than 0.10” of rainfall within a 24-hour period. Table 2-3 details the visual observations that will be recorded during each field screening visual observation inspection. A copy of the field observation form that will be used to record field screening visual observations is included in Appendix B.

[3] The field screening monitoring frequencies and locations for the MS4 outfalls in RAs respective inventories may be modified to aid in the identification and elimination of sources of persistent flow non-storm water discharges in accordance with the highest priority water quality conditions identified in the WQIP, provided the requisite number of visual inspections are performed.

**Table 2-3**
**Field Screening Visual Observations for MS4 Outfall Discharge Monitoring Stations**

| Field Observations |
|---|
| • Station identification and location<br>• Presence of flow, or pooled or ponded water<br>• If flow is present:<br>  o Flow estimation (i.e. width of water surface, approximate depth of water, approximate flow velocity, flow rate)<br>  o Flow characteristics (i.e. presence of floatables, surface scum, sheens, odor, color)<br>  o Flow source(s) suspected or identified from non-storm water source investigation<br>  o Flow source(s) eliminated during non-storm water source identification<br>• If pooled or ponded water is present:<br>  o Characteristics of pooled or ponded water (i.e. presence of floatables, surface scum, sheens, odor, color)<br>  o Known or suspected source(s) of pooled or ponded water<br>• Station description (i.e. deposits or stains, vegetation condition, structural condition, observable biology)<br>• Presence and assessment of trash in and around station<br>• Evidence or signs of illicit connections or illegal dumping |

#### *2.1.2.3 Illicit Discharge Detection and Elimination*

Based on the field screenings the RAs will conduct follow up investigations under the IDDE program as applicable. The IDDE program is part of each respective RA's JRMP and thus, is not included in this monitoring plan.

### 2.1.3 Non-Storm Water Persistent Flow MS4 Outfall Discharge Monitoring

Each RA is required to perform non-storm water persistent flow MS4 outfall discharge monitoring to determine if persistent non-storm water discharges may be impacting receiving water quality.

#### *2.1.3.1 Outfall Prioritization and Selection*

Based upon the field screening, the highest priority water quality conditions identified in the Water Quality Improvement Plan, and any additional criteria developed by the RA (e.g. historical data), the RAs are required to prioritize their respective major outfalls. Each RA is required to select, at a minimum, five high priority major MS4 outfalls with non-storm water persistent flows. Each respective RA will monitor the five selected major MS4 outfalls within its jurisdiction. In the event that a RA has fewer than five major outfalls, then the RA is required to monitor each of the known major MS4 outfalls with persistent flows within its respective jurisdiction within the Tijuana River WMA. Table 2-4 details the major outfalls selected for monitoring within each jurisdiction within the Tijuana River WMA. Figure K-2 illustrates the location of the selected major MS4 outfalls for dry weather monitoring within the Tijuana River WMA by jurisdiction.

**Table 2-4**
**Selected Locations for Non-Storm Water Persistent Flow Monitoring**

| Jurisdiction | Station ID | Outfall Location Latitude | Outfall Location Longitude |
|---|---|---|---|
| City of Imperial Beach | IB_E1A | 32.572874 | -117.12315 |
| | IB_E1B | 32.572874 | -117.12315 |
| | IB_ F | 32.572795 | -117.12309 |
| City of San Diego | SD-DW0224 | 32.564575 | -117.10139 |
| | SD-DW0304 | 32.549406 | -116.99104 |
| | SD-DW1032 | 32.568977 | -117.03604 |
| | SD-DW1034 | 32.551811 | -117.05301 |
| | SD-DW1151 | 32.554197 | -116.92789 |
| County of San Diego | CT-MS4-TIJ-001 | 32.6087 | -116.47461 |
| | CT-MS4-TIJ-002 | 32.8198 | -116.52623 |
| | CT-MS4-TIJ-003 | 32.83939 | -116.52688 |
| | CT-MS4-TIJ-004 | 32.55246 | -116.92768 |

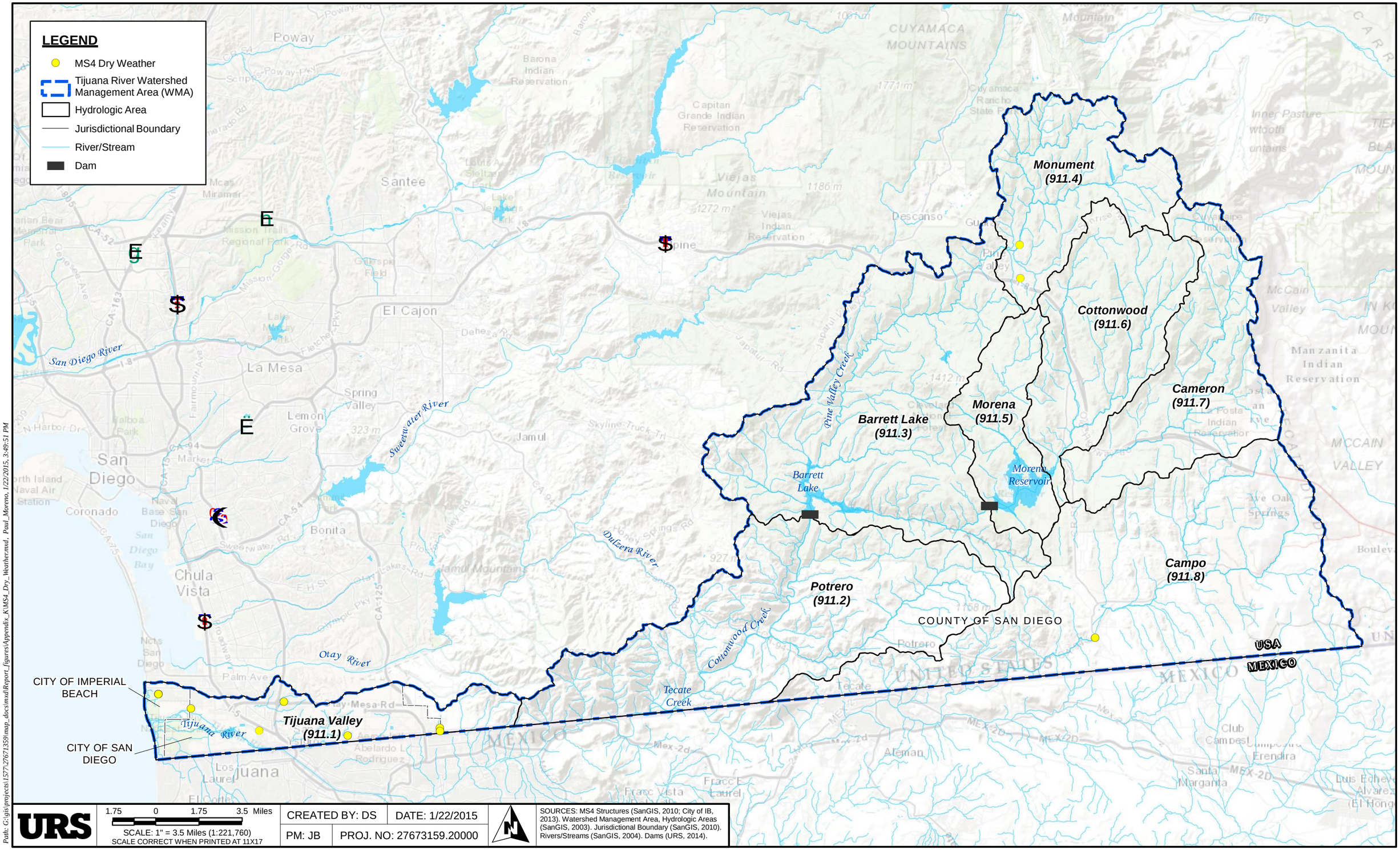


**FIGURE K-2 TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA) MS4 OUTFALL DRY WEATHER MONITORING LOCATIONS**

#### 2.1.3.2 Monitoring Frequency

Each of the selected major outfalls detailed in Table 2-4 will be monitored twice during the 2015-2016 fiscal/monitoring year. An alternate major outfall may be substituted for a selected major outfall in the event that one of the following criteria becomes applicable:

- The non-storm water discharges have been effectively eliminated (i.e. no flowing, pooled, or ponded water) for three consecutive non-storm water monitoring events[4] .
- The source(s) of the persistent flows has been identified as a category of non-storm water discharges that does not require an NPDES permit and does not have to be addressed as an illicit discharge because it was not identified as a source of pollutants.
- The constituents in the persistent flow non-storm water discharge do not exceed non-storm water action levels (NALs).
- The source(s) of the persistent flows has been identified as a non-storm water discharge authorized by a separate NPDES permit.

#### 2.1.3.3 Field Observations

During the two annual monitoring events field observations consistent with Table 2-3 will be recorded at each of the selected major outfall persistent flow monitoring sites. The dry weather field observation form is presented in Appendix C.

#### 2.1.3.4 Field Monitoring

During the two annual monitoring events the parameters detailed in Table 2-5 will be recorded from *in-situ* measurements at each of the selected major outfall persistent flow monitoring sites.

**Table 2-5**
**Field Monitoring Parameters**

| Parameters |
|---|
| pH |
| Temperature |
| Specific conductivity |
| Dissolved oxygen |
| Turbidity |

[4] Meeting this criterion during a single monitoring year is unlikely, thus it is presented in this Work Plan for informational purposes only.

#### *2.1.3.5 Analytical Monitoring*

During the two annual monitoring events, provided sufficient measurable flow is present, samples will be collected for analysis by an analytical laboratory. Grab samples will be collected according to the procedures described in Section 3.2.1, and will follow Surface Water Ambient Monitoring Program (SWAMP) protocols[5] .

The required analyses[6] are based upon the following four groupings of constituents:

1. Constituents contributing to the highest priority water quality conditions identified in the Tijuana River WMA Water Quality Improvement Plan;
2. Constituents listed as a cause for impairment of receiving waters in the Tijuana River WMA as listed on the 303(d) list;
3. Applicable non-storm water action level (NAL) constituents listed in Provision C.1 of the MS4 Permit; and
4. Constituents listed in Table D-7 of the MS4 Permit.

Table 2-6 details the analyses required for each of the selected MS4 outfall persistent flow monitoring. Analytical methods and detection limits for each analyte are provided in Appendix D.

## 2.2 STORM WATER MS4 OUTFALL DISCHARGE MONITORING

Each RA is required to perform wet weather MS4 outfall prioritization and monitoring to aid in the identification of pollutants in storm water discharges from the MS4s and to guide pollutant source identification efforts.

[5] Flow or Time Weighted composite sampling may also be performed at the discretion of the RA.

[6] If, during a monitoring event, the RA identifies and eliminates the source of the persistent flow non-storm water discharge, the sample will not be analyzed.

**Table 2-6**
**Non-Storm Water Persistent Flow Required Analysis by Site**

| Analyte | City of Imperial Beach | | | City of San Diego | | | | | County of San Diego | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IB_E1A | IB_E1B | IB_F | SD-DW0224 | SD-DW0304 | SD-DW1032 | SD-DW1034 | SD-DW1151 | CT-MS4-TIJ-001 | CT-MS4-TIJ-002 | CT-MS4-TIJ-003 | CT-MS4-TIJ-004 |
| **Conventional Parameters** | | | | | | | | | | | | |
| Total Hardness[1] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| TDS[1] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| TSS[1,2,3] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MBAS[3,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Turbidity[2,3] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Suspended Sediment Concentration[2,3] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Indicator Bacteria** | | | | | | | | | | | | |
| Total Coliform[1,3] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Fecal Coliform[1,3,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Enterococcus[1,3,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Inorganic Analytes** | | | | | | | | | | | | |
| Cadmium (Dissolved)[1,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Cadmium (Total)[1,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Chromium III (Dissolved)[4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Chromium III (Total)[4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Chromium VI (Dissolved)[4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Chromium VI (Total)[4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Copper (Dissolved)[1,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Copper (Total)[1,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Iron (Dissolved)[4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Iron (Total)[4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Lead (Dissolved)[1,3,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Lead (Total)[1,3,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Manganese (Dissolved)[4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Manganese (Total)[4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Nickel (Dissolved)[3,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Nickel (Total) [3,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Selenium (Dissolved)[3] | | | | | | | | | | √ | √ | |
| Selenium (Total)[3] | | | | | | | | | | √ | √ | |
| Silver (Dissolved)[4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Silver (Total)[4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Thallium (Total)[3] | √ | √ | √ | | | | | | | | | |
| Thallium (Dissolved)[3] | √ | √ | √ | | | | | | | | | |

| Analyte | City of Imperial Beach | | | City of San Diego | | | | | County of San Diego | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IB_E1A | IB_E1B | IB_F | SD-DW0224 | SD-DW0304 | SD-DW1032 | SD-DW1034 | SD-DW1151 | CT-MS4-TIJ-001 | CT-MS4-TIJ-002 | CT-MS4-TIJ-003 | CT-MS4-TIJ-004 |
| Zinc (Dissolved)[1,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Zinc (Total)[1,4A,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Nutrients** | | | | | | | | | | | | |
| Total Phosphorus[1,3,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Dissolved Phosphorus[2] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Orthophosphate[1,2] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Nitrite[1,3] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Nitrate[1,3] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| TKN[1,3] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Ammonia[1,3] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Total Nitrogen[3,4B] | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **Pesticides** | | | | | | | | | | | | |
| Organophosphate Pesticides[3] | √ | √ | √ | √ | √ | | | | | | | |
| Pyrethroid Pesticides[3] | √ | √ | √ | √ | √ | | | | | | | |
| **Organics** | | | | | | | | | | | | |
| Trace Elements[3] | √ | √ | √ | √ | √ | | | | | | | |
| Synthetic Organics[3] | √ | √ | √ | √ | √ | | | | | | | |

Notes:

1. Parameter listed in Table D-7 of the MS4 Permit.
2. Parameter contributes to a highest priority water quality condition identified in the Tijuana River WMA Water Quality Improvement Plan.
3. Parameter listed as a cause for impairment of receiving waters in the Tijuana River WMA on the 303(d) list.

4A. Parameter listed in NALs for discharges from MS4s to Bays, Harbors, and Lagoons/Estuaries (MS4 Permit Provision C.1.a(2))

4B. Parameter listed in NALs for discharges from MS4s to Inland Surface Waters (MS4 Permit Provision C.1.a(3))

*Nitrate and nitrite may be combined and reported as nitrate+nitrite

### 2.2.1 Outfall Prioritization and Selection

The RAs may adjust the wet weather MS4 outfall discharge monitoring locations in the Tijuana River WMA, as needed, to identify pollutants in storm water discharges from MS4s, to guide pollutant source identification efforts in accordance with the highest priority water quality conditions identified in the Tijuana River WMA Water Quality Improvement Plan.

The requirements for outfall monitoring location selection are as follows:

- At least five (5) wet weather MS4 outfall discharge monitoring stations that are representative of storm water discharges from areas consisting primarily of residential, commercial, industrial, and typical mixed-use land uses present within the Tijuana River WMA; and
- At least one (1) wet weather MS4 outfall discharge monitoring station for each RA within the Tijuana River WMA.

The selected outfalls are listed in Table 2-7. Figure K-3 illustrates the location of the RAs' selected wet weather MS4 outfall discharge monitoring sites within the Tijuana River WMA.

**Table 2-7.**
**Selected Major Outfalls for MS4 Outfall Storm Water Monitoring**

| Site ID | Jurisdiction | Outfall Size (in.) | Outfall Type | Outfall Location |
|---|---|---|---|---|
| IB_F | City of Imperial Beach | TBD[1] | Pipe | ~32º 34' 35.89<br>~-117 º 07' 23.13 |
| SD-DW0223 | City of San Diego | 240 x 60 | Culvert | 32.562647<br>-117.088167 |
| SD-DW1022 | City of San Diego | 60 | Pipe | 32.566834<br>-116.996656 |
| SD-DW1032 | City of San Diego | 42 | Outfall | ~32.568977<br>~-117.036042 |
| CT-MS4-TIJ-004 | County of San Diego | TBD[1] | Outfall | ~32º 38' 08.63<br>116 º 55' 39.67 |

[1]Pipe diameter to be determined.

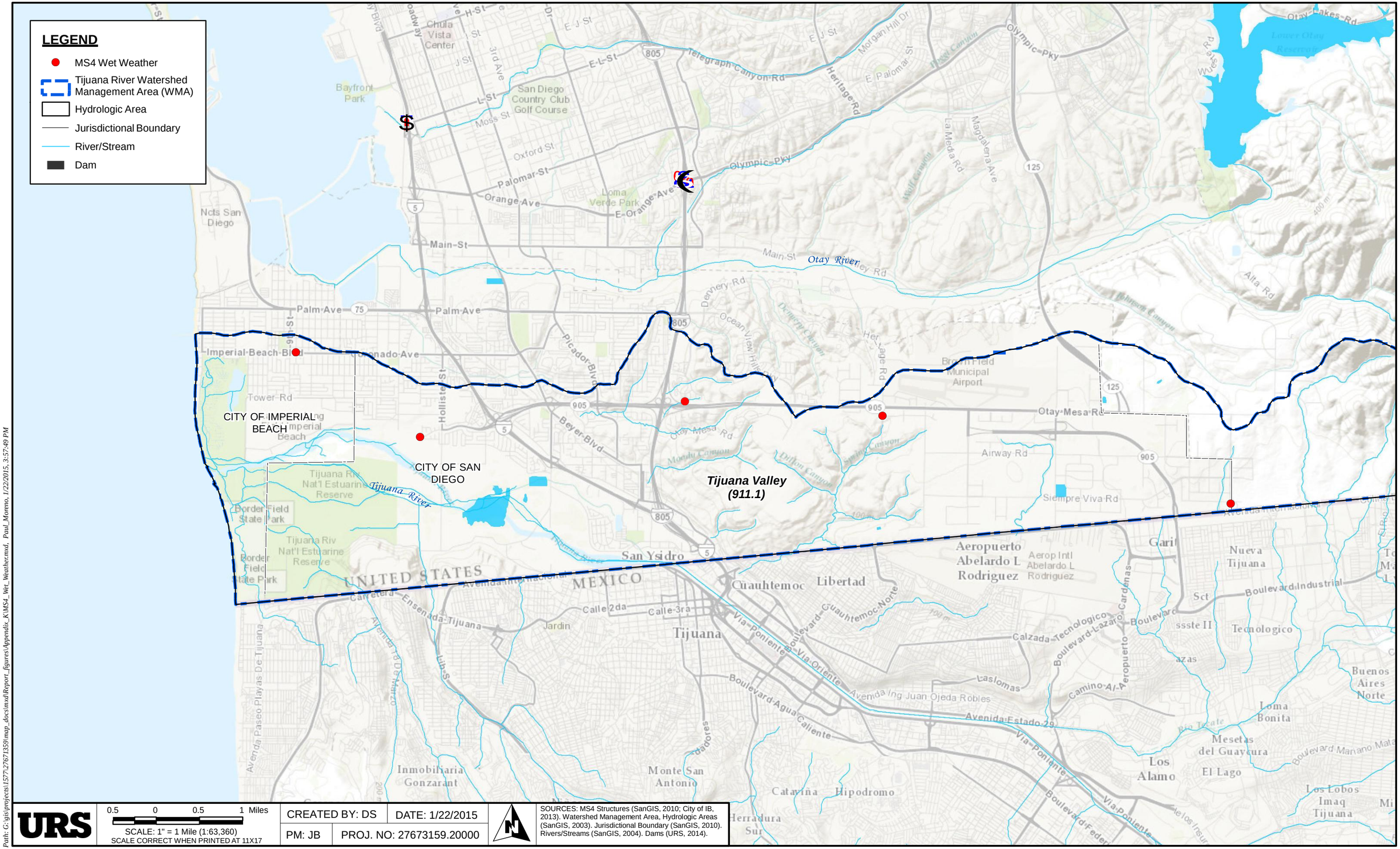


**FIGURE K-3 TIJUANA RIVER WATERSHED MANAGEMENT AREA (WMA) MS4 OUTFALL WET WEATHER MONITORING LOCATIONS**

### 2.2.2 Monitoring Frequency

Each RA will monitor their wet weather MS4 outfall discharge monitoring station(s) in the Tijuana River WMA one (1) time during the 2015-2016 fiscal/monitoring year[7].

### 2.2.3 Field Observations

During the wet weather monitoring event, the following narrative descriptions and observations will be recorded at each wet weather MS4 outfall discharge monitoring station:

- Narrative description of the monitoring event.
- Location
- Date
- Duration of the storm event
- Storm event rainfall total.
- Antecedent dry period.
- Flow hydrograph and volume estimations as detailed in Section 3.2.2.

### 2.2.4 Field Monitoring

During the wet weather monitoring event, the RAs will monitor and record the parameters in Table 2-5 at each wet weather MS4 outfall discharge monitoring station. Field observations and monitoring will be documented on the storm water field observation form presented in Appendix E.

### 2.2.5 Analytical Monitoring

During the wet weather monitoring event, samples will be collected for analysis by an analytical laboratory.

- Grab samples will be collected for the analytes listed in Table 2-8, according to the procedures detailed in Section 3.1.2.1.
- Analytes amenable to composite sampling will be composited over the course of the storm using time-weighted automated sampling[8] , according to the procedures in Section 3.1.2.2.

[7] The RAs may conduct additional monitoring in order to identify pollutants in storm water discharges from the MS4s causing or contributing to the highest priority water quality conditions or to guide pollutant source identification efforts. This effort would be above and beyond permit requirements.

[8] Flow weighted composite sampling may also be utilized at the discretion of the RA.

**Table 2-8**
**Wet Weather MS4 Grab Samples.**

| Parameters |
|---|
| pH[1] |
| Temperature[1] |
| Specific conductivity[1] |
| Dissolved oxygen[1] |
| Turbidity[1] |
| Hardness |
| Indicator Bacteria |
| Analytical Methods not amenable to grab sampling (e.g. Suspended Sediment Concentration) |

1. This analyte will be monitored *in-situ.*

Per MS4 Permit Provision D.2.c.(5).(a), analytes that are field measured are not required to be analyzed in a laboratory.

The required analyses[9] are based upon the following four groupings of constituents:

1. Constituents listed in Table D-7 of the MS4 Permit
2. Constituents contributing to the highest priority water quality conditions identified in the Tijuana River WMA Water Quality Improvement Plan;
3. Constituents listed as a cause for impairment of receiving waters in the Tijuana River WMA as listed on the 303(d) list; and
4. Applicable storm water action level (SAL) constituents listed in Provision C.2 of the MS4 Permit.

Table 2-9 details the analyses required for each of the selected wet weather MS4 outfall discharge monitoring locations. Sample collection will follow SWAMP protocols. Analytical methods and detection limits for each analyte are provided in Appendix F.

[9] The RAs may adjust the analytical monitoring required for the Tijuana River WMA if they are able to provide information demonstrating that analysis of the constituent is not necessary.

**Table 2-9**
**Storm Water Required Analysis by Site**

| Analyte | City of Imperial Beach | City of San Diego | | | County of San Diego |
|---|---|---|---|---|---|
| | IB_F | SD-DW0223 | SD-DW1022 | SD-DW1032 | CT-MS4-TIJ-004 |
| **Conventional Parameters** | | | | | |
| Total Hardness[1] | √ | √ | √ | √ | √ |
| Turbidity[2,3,4] | √ | √ | √ | √ | √ |
| TDS[1] | √ | √ | √ | √ | √ |
| TSS[1,2] | √ | √ | √ | √ | √ |
| SCC[2] | √ | √ | √ | √ | √ |
| MBAS[3] | | √ | √ | √ | √ |
| **Indicator Bacteria** | | | | | |
| Total Coliform[1,3] | √ | √ | √ | √ | √ |
| Fecal Coliform[1,3] | √ | √ | √ | √ | √ |
| Enterococcus[1,3] | √ | √ | √ | √ | √ |
| **Inorganic Analytes** | | | | | |
| Cadmium (Dissolved)[1,4] | √ | √ | √ | √ | √ |
| Cadmium (Total)[1,4] | √ | √ | √ | √ | √ |
| Copper (Dissolved)[1,4] | √ | √ | √ | √ | √ |
| Copper (Total)[1,4] | √ | √ | √ | √ | √ |
| Lead (Dissolved)[1,3,4] | √ | √ | √ | √ | √ |
| Lead (Total)[1,3,4] | √ | √ | √ | √ | √ |
| Nickel (Dissolved)[3] | √ | | | | |
| Nickel (Total) [3] | √ | | | | |
| Selenium (Dissolved)[3] | | √ | √ | √ | √ |
| Selenium (Total)[3] | | √ | √ | √ | √ |
| Thallium (Total) [3] | √ | | | | |
| Thallium (Dissolved)[3] | √ | | | | |
| Zinc (Total)[1,4] | √ | √ | √ | √ | √ |
| Zinc (Dissolved)[1,4] | √ | √ | √ | √ | √ |
| **Nutrients** | | | | | |
| Total Phosphorus[1,3,4] | √ | √ | √ | √ | √ |
| Dissolved Phosphorus[3] | | √ | √ | √ | √ |
| Orthophosphate[1] | √ | √ | √ | √ | √ |

| Analyte | City of Imperial Beach | City of San Diego | | | County of San Diego |
|---|---|---|---|---|---|
| | IB_F | SD-DW0223 | SD-DW1022 | SD-DW1032 | CT-MS4-TIJ-004 |
| Nitrite[1,3,4] | √ | √ | √ | √ | √ |
| Nitrate[1,3,4] | √ | √ | √ | √ | √ |
| Total Nitrogen[3] | √ | √ | √ | √ | √ |
| Ammonia[1,3] | √ | √ | √ | √ | √ |
| TKN[1,3] | √ | √ | √ | √ | √ |
| **Pesticides** | | | | | |
| Organophosphate Pesticides[3] | √ | √ | √ | √ | √ |
| Pyrethroid Pesticides[3] | √ | √ | √ | √ | √ |
| **Organics** | | | | | |
| Trace Elements[3] | | √ | √ | √ | √ |
| Synthetic Organics[3] | | √ | √ | √ | √ |

Notes:

1. Parameter listed in Table D-7 of the MS4 Permit
2. Parameter contributes to a highest priority water quality condition identified in the Tijuana River WMA Water Quality Improvement Plan.
3. Parameter listed as a cause for impairment of receiving waters in the Tijuana River WMA on the 303(d) list.
4. Parameter listed in SALs for discharges of storm water from the MS4 (MS4 Permit Provision C.2.a)

# SECTION 3 METHODOLOGIES AND EQUIPMENT

This section describes the methodologies and equipment that are proposed to be used to complete the MS4 outfall monitoring program for the Tijuana River WMA, as well as the installation and maintenance procedures.

Flow estimation and water quality sampling are dynamic processes which may require modification based on current site and channel conditions. Thus, the methodologies presented are subject to modification or substitution in order to meet the requirements of this monitoring program described in Section 2.

## 3.1 FLOW ESTIMATION METHODOLOGIES

### 3.1.1 Non-Storm Water Flow Estimation

During non-storm water screening and MS4 outfall monitoring, flow will be estimated visually and/or manually using one of the methodologies detailed in Section 3.2.2 of the USEPA document *NPDES Storm Water Guidance Document* (USEPA 1992) which is included in Appendix G. These methodologies include, but are not limited to the "float method" and the "bucket and stopwatch method".

### 3.1.2 Storm Water Flow Estimation

Flow hydrograph and volume estimations will be captured utilizing estimated flow rates in accordance with the Section 3.2.1 of the USEPA document *NPDES Storm Water Sampling Guidance Document* (USEPA, 1992) which is presented in Appendix H.

Due to flood control concerns typically associated with MS4 outfalls during storm events, a primary measurement device such as a weir or flume is unlikely to be selected. Thus, a lower profile secondary flow measurement device, such as an area-velocity senor or bubbler pressure transducer, are recommended for flow estimation from MS4 Outfalls.

If a secondary measurement device is selected, an American Sigma 950 flow meter (or equivalent) will be used. The American Sigma 950 flow meter can be connected to an automated sampler through a 4-20 milliampere (mA) range output. In this configuration, the flow meter provides a method to control or pace the sampler, and store sampling data and other auxiliary data. The flow meter will measure and log estimated flow, rainfall, and sample history.

The flow meter will utilize one of a variety of sensor types to measure flow velocity and/or level depending on the site conditions. The sensors that may be used include:

- Submerged area-velocity (AV) sensor;
- Submerged AV sensor with a bubbler;
- Pressure transducer level sensor;
- Pressure bubbler level sensor;

- Low profile velocity sensor; or
- Ultrasonic sensor (Hach, 2009).

Should a flow meter be utilized, one-minute average flow and rainfall data will be recorded during monitored storm events. The flow meter converts instantaneous flow into total runoff volume. Data containing storm and hydrological information is electronically stored in the flow meter, with each monitoring event stored separately. The recorded information includes:

- Flow rates.
- Time of peak flow rate.
- Cumulative rainfall.
- Rainfall intensity.
- Discharge volume totals.
- Time of each sample.
- Success or failure of each sample.

## 3.2 WATER QUALITY SAMPLING

### 3.2.1 Grab Sample Collection

Grab samples will be collected directly into the laboratory supplied sampling jars if possible (hand, grab pole, or decontaminated bucket). An automated sampler may be used to collect grab samples only if manual sample collection is determined to be infeasible. The decision regarding the method of sample collection will be made on a case-by-case basis by the field sampling team and documented.

### 3.2.2 Composite Sample Collection

For wet weather events, a time-weighted[10] composite sample will be collected over the length of the storm event or a 24 hour period, whichever is shorter. At least one sample aliquot every 30 minutes will be collected during a storm event. The automated sampler will be programmed to collect 500-milliliter (mL) sample aliquots in a 19-L borosilicate glass bottle.

The representativeness of any composite sample depends on many factors. Best professional judgment will be used to determine whether samples with questionable representativeness will be analyzed. Ideally, the following criteria will be achieved, but these are not considered requirements.

- A minimum of 20 sample aliquots during the monitoring event
- Collection of sample aliquots from the onset of rainfall until flow returns to within 10% of base flow or sampling has been undertaken for 24 hours

[10] Flow weighted composite sampling may be utilized at the discretion of the RA.

- Sample aliquots that represent at least 75% of the monitoring event total flows or a 24-hour time period
- If flow weighted composite sampling is utilized, sufficient sample pacing so that the stream flow does not lead to the automated sampler becoming outpaced (i.e., unable to keep up with required sample collection)

If automated compositing is not feasible, a composite sample will be collected using a minimum of 4 grab samples, collected during the first 24 hours of the storm water discharge, or for the entire storm water discharge if the storm event is less than 24 hours.

The typical automated sampler used for this project is an American Sigma 900 MAX or equivalent system, which consists of an intake strainer, Teflon-lined intake tubing, flexible silicon pump tubing, a peristaltic pump, and sample bottles. Depending on the sampling program, the samplers will be programmed to collect time-weighted composite samples throughout a monitoring event.

The intake strainers will be securely fastened at the desired sampling point in the runoff flow stream. Attempts will be made to collect samples from the middle of the water column. The intake tubing will be securely fastened to the intake strainer and will be housed in protective conduit to the point where the tubing enters the monitoring equipment enclosure. The intake tubing will be attached to the flexible silicon pump tubing at the sampler. The flexible silicon pump tubing will run through the sampler peristaltic pump to fill the sample bottle.

#### *3.2.2.1 Installation of Monitoring Equipment*

Field teams will mount equipment securely using best professional judgment. Sampler tubing and wiring will be routed through conduits that will be placed between the monitoring locations and the sampling equipment or enclosures. Above-ground instruments will be protected within a site equipment enclosure. Depending on site configuration, enclosures may be semi-permanent (installed before monitoring begins and removed only when the monitoring program ends) or temporary. Exposed conduit, intakes, and sensors will be securely fastened using stainless steel brackets, screws, and anchors. Once the study is completed, monitoring equipment will be removed except for the enclosures.

The American Sigma 900MAX automated samplers and American Sigma 950 flow meters will be powered by 12-VDC rechargeable gel cell power sources.

Monitoring equipment will be mounted within fiberglass or metal enclosures that will be bolted to concrete or wooden monitoring foundations or chained to nearby structure or vegetation and locked to secure the monitoring equipment.

#### *3.2.2.2 Maintenance and Calibration of Monitoring Equipment*

Maintenance and calibration of monitoring equipment will be performed during installation and prior to monitoring events. A calibration log will be maintained for calibrations performed in the field. Prior to monitoring events, field teams will verify that the batteries are sufficiently charged, that the automated samplers and flow monitoring equipment are calibrated and active, and that the system pumps are functioning as designed. The flow sensors should be cleared of debris. Additional preparation for

monitoring events includes performing general equipment inspections to confirm that the sites are operational.

The Sigma 950 flow meters will be calibrated using the procedures described in the Sigma 950 operations and maintenance (O&M) manual (Hach Catalogue No. 3314). For flow meter calibration, the recorded water level will be checked by operation of the flow meter while the sensor device measures water of a known depth. Level adjustments can be made directly on the flow meter. Results that deviate significantly from the known level and do not maintain an adjusted offset will be documented and the equipment will be replaced or repaired. Velocity cannot be calibrated; therefore, if a low profile velocity sensor reports erroneous velocity measurements it will be replaced.

The American Sigma 900MAX sampler will be calibrated using the procedures described in the American Sigma 900MAX O&M manual (Hach Catalogue No. DOC026.53.00742). For automated sampler calibration, the aliquot volume will be calibrated using a graduated flask or beaker.

Calibration of flow meters and automated samplers will be conducted prior to installation, and per the calibration frequencies discussed in Table 3-1.

**Table 3-1**
**Calibration of Field Sampling Equipment and Monitoring Instruments**

| Equipment | Calibration Description | Responsible Person | Frequency | SOP Reference |
|---|---|---|---|---|
| Sigma 950 flow meter (level only) | Water level check against known levels | Sampling Team | Semi-annually | Sigma 950 O&M Manual 3314 |
| Sigma 900MAX automated sampler | Aliquot calibration | Sampling Team | Semi-annually | Sigma 900MAX Sampler O&M Manual DOC026.53.00742 |

Notes:
O&M = operations and maintenance.
SOP = standard operating procedure.

## SECTION 4 STORM WATER EVENT MONITORING LOGISTICS

Storm events will be considered viable for mobilization if they are predicted to produce at least 0.10 inch of rainfall in the drainage area with at least a 70% chance of rainfall. Each storm of at least 0.1 inch of rainfall must be separated by a minimum of 72 hours, and the forecasted storm volume within + 50% of the average storm volume and duration for the region. These mobilization criteria must be met at least 24 hours prior to the anticipated onset of rainfall. For the purposes of these criteria, storm forecasts will be obtained from the National Weather Service website (http://www.wrh.noaa.gov/sgx/).

For each monitoring event, a narrative description of the station, which includes the location, date, and duration of the storm event(s) sampled; rainfall estimates of the storm event; and the duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event, will be recorded.

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# SECTION 5 PERSONNEL

Water quality monitoring tasks require a variety of skills and positions. The recommended personnel include:

- Project Manager.
- Sampling Manager.
- Field Technicians.

***Project Manager*** – During monitoring events, the Project Manager will monitor the status of the monitoring stations via communication with field crews. The Project Manager must be able to obtain and interpret the most recent weather forecasts to provide guidance to field technicians on when samples should be collected. It is also the responsibility of the Project Manager to notify personnel of shift start- and end-time changes.

The Project Manager must have excellent decision-making and dispatch skills as well as a thorough understanding of the project requirements. If an assistant fills this position, the consultant's Project Manager should be available to answer questions.

***Sampling Manager*** – The Sampling Manager is a technically-skilled, experienced field supervisor and is the most experienced member of the field team. This position requires a thorough understanding of project requirements, sampling procedures, and equipment operations. The Sampling Manager will communicate frequently with the Project Manager to determine task priorities. The Sampling Manager will also monitor the ability of field teams to complete their shifts safely and effectively, and will notify the Project Manager of the need for relief teams. The Sampling Manager must be able to troubleshoot the common problems that could be experienced by any of the field teams, and will be responsible for directing the procedures at each site visit and for making sure that data are recorded properly. The Sampling Manager will also provide on-site weather observations for the Project Manager.

***Field Technicians*** – The Sampling Manager will usually have one to three field technicians assisting. This will be dependent on the number of sites being monitored for a given storm event. Field technicians are field personnel trained in water quality sample collection and Health and Safety issues. Field technicians may also be used as couriers.

## 5.1 MONITORING EVENT PREPARATION

Monitoring for flow and water quality of runoff requires considerable planning prior to an actual monitoring event occurring. Obtaining representative samples and complete flow data is only possible using well-trained and alert field teams. The uncertainty of weather forecasts coupled with abrupt changes in the weather can greatly alter the expected workload. It is critical to plan and prepare for numerous aspects of the field effort well in advance of a storm event. Each pre- and post-event mobilization team should be made up of two field individuals. A Staffing Plan, which designates personnel and equipment required for each facet of monitoring, will be completed for each potential monitoring event.

The Staffing Plan should include the following:

- Personnel assigned for monitoring.
- Shift (e.g., start-up and relief).
- Equipment mobilization.
- Communication channels.

Field teams will not be mobilized during or near certain holidays if either the mobilization or the laboratory analysis is projected to continue through that holiday. This includes the following holidays and dates:

- Thanksgiving: November 26 and 27, 2015.
- Christmas: December 24 and 25, 2015.
- New Year's: December 31, 2015, and January 1, 2016.

### 5.1.1 Weather Tracking

Weather will be tracked for monitoring purposes from October 1 to April 30 of each monitoring year. Throughout the wet weather season, several sources of weather information will be periodically monitored. The National Weather Service webpage will be the primary source used to determine whether and when to mobilize monitoring crews.

### 5.1.2 Storm Selection Criteria

The following criteria will be used to determine whether to mobilize for an impending storm event:

- Storm forecasts must meet criteria at least 48 hours prior to the onset of rain;
- A storm must be forecast to produce at least 0.25 inch of rain;
- The probability of precipitation must be greater than 70 percent; and
- A storm event must be preceded by at least 72 hours of dry conditions (<0.10 inch of precipitation in a 24 hour period).

The field sampling manager and/or project manager may modify the criteria on a storm by storm basis, in consultation with the RAs.

### 5.1.3 Station Preparation

Prior to a monitoring event, stations will be made ready for monitoring. These preparations include verifying that the automated samplers and flow monitoring equipment are calibrated and active, and that the system pumps are functioning as designed. The flow sensors should be cleared of debris. Additional preparation for monitoring events includes performing general equipment inspections to confirm that the sites are operational.

A maintenance program will be performed for monitoring equipment before each wet weather event. Maintenance will include checking the performance of the equipment, checking power supplies and replacing batteries as required, inspecting and clearing intake structures, checking the status of instrumentation desiccant, and performing any necessary equipment repairs to keep the monitoring equipment operational.

Field teams will verify that the automated sampler has been reset and that it has been programmed properly.

### 5.1.4 Additional Sampling Gear

Equipment needed for water quality sampling includes: sampling equipment and containers, safety equipment, personal rain gear, storm kits, mobile phones, and vehicles equipped with safety equipment. The necessary equipment should be loaded into the appropriate vehicles early in the preparation sequence. During the monitoring season, field crews will utilize the safety equipment, personal rain gear, and other site maintenance equipment listed in Table 5-1.

**Table 5-1**
**Storm Kit Equipment and Mobilization List**

| Storm Kit Equipment List | Mobilization List |
|---|---|
| Flashlights (2)<br>Maps<br>High-quality alkaline D-cell batteries<br>Spare sample labels<br>Pencils and indelible markers<br>Desiccant (packages and jar)<br>Diagonal clipper<br>Electrical tape<br>Cable ties (assorted sizes)<br>Utility knife<br>Ziploc bags (assorted sizes)<br>Nitrile gloves<br>Keys<br>Sampling pole for grab samples<br>Manhole lifter | Field notebook (including Job Hazard Analysis (JHA) and Tailgate Safety Meeting Forms)<br>Paper towels<br>Spare chains of custody<br>Sample control paperwork<br>Extra-fine indelible markers<br>Sample bottles<br>Reagent-grade, analyte-free deionized water (3-gallon jug) from the laboratory<br>Cellular phone<br>Personal rain gear<br>Digital or disposable camera<br>Necessary safety gear (see Appendix J - *Health and Safety Plan*) |

### 5.1.5 Communication Channels

Communication channels will be established for personnel to contact each other before and during the event. Cellular telephone communication links to field teams are essential for efficient water quality monitoring because the Project Manager and the Sampling Manager will need to track the location and workload of each field team and direct them to priority tasks. The project field notebook will include

phone lists with home, work, and cellular numbers of the field team, and work numbers for primary laboratory contacts and RA personnel to aid in communication.

### 5.1.6 Data Retrieval

After each successful water quality monitoring event, flow and rainfall data will be downloaded from the flow meter.

# SECTION 6 SAMPLE IDENTIFICATION, TRANSPORT, AND CUSTODY

## 6.1 SAMPLE PRESERVATION

### 6.1.1 Grab Sample

Once a grab sample is collected it will be sealed, labeled, and placed directly into a cooler with wet ice sufficient to maintain a sample temperature of four degrees Celsius or less and under chain of custody (COC).

### 6.1.2 Composite Sample

Composite samples will be collected into a 19-L borosilicate glass bottle. These bottles will be kept in protective buckets with wet ice sufficient to maintain a sample temperature of four degrees Celsius or less and under chain of custody. Following completion of a sampling event, they will be sealed and labeled. Composite sample bottles will remain under COC during each sampling event.

## 6.2 SAMPLE LABELING

Water quality sample bottles will be pre-labeled, to the extent possible, before each monitoring event. Pre-labeling bottles simplifies field activities and leaves only date, time, sample ID, and sampling personnel names to be filled out in the field. Each sample collected will be labeled with the following information:

- Project name
- Monitoring program
- Event number
- Date and time(24 hour time)
- Site ID number
- Bottle __ of __ (for multi-bottle samples)
- Collected by
- Analysis type
- Preservation (if applicable)

## 6.3 CHAIN-OF-CUSTODY FORMS

COC forms will be pre-printed along with the bottle labels. These forms will contain at a minimum the same data as the sample labels do. The COC forms will be completed in the field with dates, times, and sample team names, and will be cross-checked with the bottle labels. For composite samples, the start of

the holding time will be considered to be the time that the last sample aliquot was collected. An example COC is presented in Appendix I.

COC procedures will be followed for each sample throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the COC form. For each sample, data will be recorded on a COC form the day it is collected. Data entries will be made manually, in indelible ink. Corrections will be made by drawing a single line through the error (leaving the original information legible), writing in the correct information, then dating and initialing the change. Blank lines and spaces on the COC form will be lined out, dated, and initialed by the individual maintaining custody. If used, electronic COC (eCOC) forms generated from a custom field application will be emailed directly to the laboratory and QA officer.

A sample will be considered to be in one's custody if they are:

- In the custodian's possession or view,
- In a secured location (under lock) with restricted access, or
- In a container that is secured with an official seal so that the sample is unlikely to be accessed without breaking the seal.

Each person in custody of samples will sign the COC form validating that the samples were not left unattended without being properly secured. Copies of all COC forms will be retained in the project files.

## 6.4 SAMPLE TRANSPORT

Transport of the samples will be coordinated with the laboratories by the project manager. Samples will be transported to the selected analytical laboratory by the field team, a lab courier, or a shipping company.

Specific sample-handling procedures are as follows:

- Coolant ice will be sealed in separate double plastic bags and placed in the shipping containers for subsamples.
- Individual sample containers (post-compositing and subsampling) will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass jars will be separated in the shipping container by shock-absorbent material (e.g., bubble wrap) to prevent breakage.
- Upon transfer of sample possession to the analytical laboratory, each person responsible for custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the receiver will record the condition of the samples on a sample receipt form. COC forms will be used internally in the laboratory to track sample handling and final disposition.

# SECTION 7 QUALITY ASSURANCE AND QUALITY CONTROL

## 7.1 FIELD QUALITY ASSURANCE/QUALITY CONTROL

This section presents quality assurance/quality control (QA/QC) activities associated with field sampling. Field QA/QC samples will be used to evaluate potential contamination and sampling errors applicable to automated composite samples and grab samples that may be introduced prior to submittal of the samples to the analytical laboratory.

### 7.1.1 Training

Field personnel will be trained in the use of the monitoring equipment and clean sampling techniques along with appropriate health and safety protocols (Appendix J). The Health and Safety plan must be reviewed and updated as required prior to each monitoring event.

Each field team member will review the Health and Safety Plan and consult with the Sampling Manager if they have any questions before mobilization. The Sampling Manager will train field personnel in sampling protocols and procedures in accordance with this Monitoring Plan. Field training also will be provided before the beginning of the wet season to make field personnel aware of the project-specific goals and objectives

### 7.1.2 *In-situ* Field Measurements

The quality of *in-situ* field data will be assessed by accuracy and completeness. Applicable quantitative goals for field data are presented in Table 7-1.

**Table 7-1**
***In-Situ* Field Measurement Data Quality Objectives**

| Parameter | Range | Accuracy | Resolution | Completeness |
|---|---|---|---|---|
| Electrical Conductivity | 0 to 100 mS/cm | ± 0.5% of reading + 0.001 mS/cm | 0.001 to 0.1 mS/cm (range-dependant) | 90% |
| pH | 0 to 14 units | ±0.2 units | 0.01 unit | 90% |
| Temperature | -5 to +50 ˚C | ±0.15 ˚C | 0.01 ˚C | 90% |
| Dissolved Oxygen | 0 to 50 mg/L | 0 to 20 mg/L ±0.01 mg/L or 1% of reading, whichever is greater; 20 to 50 mg/L ±15% of reading. | 0.01 mg/L | 90% |
| Turbidity | 0 to 1,000 NTU | ±2% of reading or 0.3 NTU, whichever is greater | 0.1 NTU | 90% |

Notes:
˚C - degrees Celsius
mg/L - milligrams per liter
mS/cm - milliSiemens per centimeter
NTU - nephelometric turbidity units

### 7.1.3 Field Quality Control Samples

The field QA/QC samples that will be utilized are field blanks, field duplicates, and equipment blanks. Sample types, measurement objectives, and frequencies based on SWAMP guidelines are summarized in Table 7-2.

**Table 7-2**
**Field Quality Control Samples**

| Sample Type | Measurement Objective | | | Frequency of Analysis |
|---|---|---|---|---|
| | Field Duplicate | Field Blank | Equipment Blank | |
| Conventionals | RPD<25%[a] | <RL for target analyte | <RL for target analyte | 5% of total project sample count |
| Indicator Bacteria | RPD<25%[c] | Negative Response | Negative Response | 5% of total project sample count |
| Metals | RPD<25%[a] | <RL for target analyte | <RL for target analyte | 5% of total project sample count |
| Nutrients | RPD<25%[a] | <RL for target analyte | <RL for target analyte | 5% of total project sample count |
| Solid Parameters | RPD<25%[a] | <RL for target analyte | <RL for target analyte | 5% of total project sample count |
| Organics | Per method | <RL for target analyte | <RL for target analyte | 5% of total project sample count |
| Toxicity | NA | NA | NA | NA |

Notes:
RL = reporting limit.
RPD = relative percent difference.
a. NA if native concentration of either sample<RL.
b. For equipment blanks, the frequency is 5% per batch or lot. A batch is defined as the group of bottles that have been cleaned at the same time, in the same manner, or, if decontaminated bottles are sent directly from the manufacturer, the batch would be the lot designated by the manufacturer in their testing of the bottles.
c. Field duplicates are not a current SWAMP requirement for indicator bacteria. However, the collection and analysis of a field duplicate is recommended.

#### *7.1.3.1 Equipment Blanks*

The selected analytical laboratory will clean the 19-L sample bottles, Teflon-lined tubing, silicone pump tubing, silicone bottle stoppers, and stainless steel sample intake strainers. The following blank samples will be created for analysis:

- One blank sample representative of the cleaned silicone and Teflon-lined tubing. Blank water will be passed through at least 10% of cleaned tubing and be representative of both silicone and Teflon-lined tubing.
- One blank representing the bottles and stoppers. Blank water will be passed into/over at least 10% of cleaned bottles and stoppers.

The analytical laboratory will analyze the equipment blanks for total organic carbon and total metals at a minimum. The analytical laboratories will analyze blank water from the cleaned sampling equipment at the same detection level proposed for sample analysis; this will verify that the sampling equipment in contact with sample water is clean and is not a likely source of contamination.

If a blank sample produces an analyte detection above the RL, the equipment will be cleaned and blanked again. Cleaned and blanked sampling equipment will not be deployed for sampling until an acceptable blank analysis has occurred unless directed by the RAs.

#### *7.1.3.2 Field Duplicates*

A field duplicate sample will be collected during each of the two non-storm water events and one storm water monitoring event. A field duplicate of *in-situ* parameters will not be performed.

#### *7.1.3.3 Field Blanks*

A field blank sample will be prepared during each of the two non-storm water monitoring events. A field blank will not be conducted during the storm water monitoring event. The field blanks will be created by pouring laboratory-grade distilled, deionized water into laboratory supplied bottles at one of the monitoring sites.

### 7.1.4 Inspection/Acceptance of Supplies and Consumables

Sample bottles (provided by the laboratory) and collection equipment will be inspected prior to their use. Procured supplies will be examined for damage prior to use per Table 7-3.

Field supplies will be stored at the sampling team's offices; laboratory supplies will be stored at the laboratory. Inspection and testing requirements for laboratory supplies are covered in the laboratory's QA/QC procedures.

**Table 7-3**
**Inspection/Acceptance Testing Requirements for Consumables and Supplies**

| Project-Related Supplies/ Consumables | Inspection/Testing Specifications/Source | Acceptance Criteria | Frequency | Responsible Party |
|---|---|---|---|---|
| Pre-cleaned sample bottles | Closed bottle | Lids screwed on bottles | 100% | Sampling Team |
| Composite sample bottles | Laboratory cleaned | Pass blanking analysis | Clean bottles each monitoring event | Laboratory/Sampling Team |
| Silicone tubing | Laboratory cleaned | Pass blanking analysis | New tubing each season | Laboratory/Sampling Team |
| Teflon tubing | Laboratory cleaned | Pass blanking analysis | New tubing each season | Laboratory/Sampling Team |
| Gloves | New box | New box | As needed | Sampling Team |

### 7.1.5 Field Audits

The project manager may conduct spot verifications that field activities are being conducted in accordance with this work plan, and has the authority to issue a stop work order on sample collection. Identified non-conformances will be discussed in the Water Quality Improvement Plan annual report.

### 7.1.6 Field Corrective Action

The project manager will be responsible for correcting equipment malfunctions during field sampling. In the case of field instruments, problems will be addressed through cleaning the instrument, repairing it, or replacing parts or the entire instrument, as warranted. Field crews will carry basic spare parts and consumable supplies with them, and will have access to spare parts.

## 7.2 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

This section addresses QA/QC activities associated with laboratory analyses. Laboratory QA/QC samples provide information to assess potential laboratory contamination, analytical precision, and accuracy. Analytical quality assurance for this program includes the following:

- Employing analytical chemists trained in the procedures to be followed.
- Adherence to documented procedures, United States Environmental Protection Agency (USEPA) approved methods, and written Standard Operating Procedures (SOPs).
- Calibration of analytical instruments.
- Use of quality control samples, internal standards, surrogates, and Standard Reference Materials (SRMs).
- Complete documentation of sample tracking and analysis.

Internal laboratory quality control checks will include the use of laboratory replicates, method blanks, matrix spikes/matrix spike duplicates (MS/MSDs), and laboratory control samples (LCSs). The quality control checks performed by constituent class is presented in Table 7-4. The frequency of the laboratory QA/QC samples is presented in Appendix K.

**Table 7-4**
**Laboratory Quality Control Samples by Constituent Class**

| Laboratory Quality Control | Constituent Class | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Conventionals | Indicator Bacteria | Inorganic Analytes | Nutrients | Solid Parameters | Acute Toxicity | Chronic Toxicity | Synthetic Organic Compounds |
| Calibration Standard | ✓ | – | ✓ | ✓ | – | – | – | – |
| Calibration Verification | ✓ | – | ✓ | ✓ | – | – | – | ✓ |
| Laboratory Blank | ✓ | ✓ | ✓ | ✓ | ✓ | – | – | ✓ |
| Reference Material | ✓ | – | ✓ | ✓ | – | – | – | ✓ |
| Matrix Spike | ✓ | – | ✓ | ✓ | – | – | – | ✓ |
| Matrix Spike Duplicate | ✓ | – | ✓ | ✓ | – | – | – | ✓ |
| Laboratory Duplicate | ✓ | ✓ | ✓ | ✓ | ✓ | – | – | – |
| Internal Standard | ✓ | – | ✓ | – | – | – | – | ✓ |
| Sterility Checks | – | ✓ | – | – | – | – | – | – |
| Laboratory Positive Control | – | ✓ | – | – | – | – | – | – |
| Laboratory Negative Control | – | ✓ | – | – | – | – | – | – |
| Laboratory Water Control | – | | – | – | – | ✓ | ✓ | – |
| Conductivity/Salinity Control Water | – | – | – | – | – | ✓ | ✓ | – |
| Additional Control Water | – | – | – | – | – | ✓ | ✓ | – |
| Sediment Control | – | – | – | – | – | ✓ | ✓ | – |
| Reference Toxicant Tests | – | – | – | – | – | ✓ | ✓ | – |
| Tuning | – | – | – | – | – | – | – | ✓ |
| Surrogate | – | – | – | – | – | – | – | ✓ |
| Calibration | – | – | – | – | – | – | – | ✓ |

### 7.2.1 Data Quality Objectives

Data quality objectives (DQOs) are quantitative and qualitative statements that define project objectives and specify the acceptable ranges of field sampling and laboratory performance. Numeric DQOs for *in-situ* measurements and water samples are listed in Appendix K. DQOs for this project will include the following:

- Accuracy
- Precision

- Completeness

Accuracy describes how close the measurement is to its true value. Accuracy is the measurement of a sample of known concentration and comparing the known value against the measured value. The accuracy of chemical measurements will be checked by performing tests on a standard prior to and/or during sample analysis. A standard is a known concentration of a certain solution. Standards can be purchased from chemical or scientific supply companies. Standards might also be prepared by a professional partner (e.g., a commercial or research laboratory). The concentrations of the standards should be within the mid-range of the equipment. Recovery measurements are determined by spiking a replicate sample in the laboratory with a known concentration of the analyte. Accuracy of the project data will be determined by comparing results from MS/MSDs, LCSs, field blanks, and equipment blanks to the accuracy objectives specified in Appendix K.

Precision describes how well repeated measurements agree. The evaluation of precision described here applies to repeated measurements and samples collected in the field (field duplicates) or the laboratory (laboratory replicates and MS/MSDs). Precision measurements will be determined by comparing results from field duplicates, laboratory replicates and MSD to the precision objectives specified in Appendix K. Relative Percent Differences (RPDs) will be calculated to determine the precision between duplicate samples. This calculation is presented in Equation 1.

$$RPD = \frac{abs[x_1 - x_2]}{0.5 * (x_1 + x_2)} \qquad \text{Equation 1}$$

where:

abs is the absolute value.
$x_1$ is measurement 1.
$x_2$ is measurement 2.

Completeness is the fraction of planned data that must be collected to fulfill the statistical criteria of the project. There are no statistical criteria that require a certain percentage of data. However, the anticipated target is 90%. This accounts for adverse weather conditions, safety concerns, and equipment problems. The project team determined completeness by comparing the number of measurements planned to be collected with the number of measurements actually collected that are deemed valid. An invalid measurement would be one that does not meet the sampling method requirements. Completeness will be measured as a percentage of the number of samples collected that meet the respective DQOs compared to the anticipated number of samples. This calculation is presented in Equation 2.

$$Completens\ s = \frac{Actual\ \ number\ \ of\ \ samples\ \ collected}{\Pr oject\ \ required\ \ total\ \ samples\ \ to\ be\ \ collected} * 100 \qquad \text{Equation 2}$$

### 7.2.2 Instrument/Equipment Calibration and Frequency

Laboratory equipment will be calibrated based on manufacturer recommendations and in accordance with the method and laboratory SOP. The laboratory SOP is maintained by the respective Laboratory Directors and QA officers, and is available upon request.

### 7.2.3 Corrective Action

Corrective action will be taken when an analysis is deemed suspect. Reasons a sample may be considered suspect consist of exceedances of the RPD ranges, spike recoveries, and blanks. The corrective action may vary from analysis to analysis, but typically will involve the following:

- Check of procedures.
- Review of documents and calculations to identify possible errors.
- Error correction.
- Re-analysis of the sample extract, if available, to see if results can be improved.
- Reprocessing and re-analysis of additional sample material, if it is available.

Malfunctions that occur during data collection and laboratory analyses will be the responsibility of the field crew or laboratory conducting the work, respectively. In the case of field instruments, problems will be addressed through instrument cleaning, repair, or replacement of parts or the instrument, as warranted. Field crews should carry basic spare parts and consumables with them, and have access to spare parts. The laboratories have procedures in place to follow when failures occur, and have identified individuals responsible for corrective action and developed appropriate documentation as needed.

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## SECTION 8 ASSESSMENT AND REPORTING

The RAs within the Tijuana River WMA are required to submit a Water Quality Improvement Plan Annual Report for the 2015-2016 reporting year by January 31, 2017. The results of the wet and dry weather MS4 outfall discharge monitoring data collected under this work plan will be presented in that report. The following will be reported at a minimum:

- Applicable data will be presented in tabular form.
- Applicable data will be presented in graphical form.
- A summary of the removal or re-prioritization of the highest priority persistent flow MS4 outfall monitoring stations[11].

[11] Persistent flow MS4 outfall monitoring stations that have been removed will be replaced with the next highest prioritized MS4 outfall in the respective RA's jurisdiction in the Tijuana River WMA, unless there are no remaining qualifying major MS4 outfalls within the RA's jurisdiction in the WMA.

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## SECTION 9 REFERENCES

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# Toxicity Identification Evaluation / Toxicity Reduction Evaluation Implementation Draft Work Plan

**Prepared for:**

San Diego County Regional Copermittees

**Prepared by: Weston**

**Solutions, Inc.**
5817 Dryden Place, Suite 101
Carlsbad, California 92008

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## TABLE OF CONTENTS

1.0 INTRODUCTION ..... 1

2.0 Receiving Water Toxicity Testing ..... 3

3.0 TIE/TRE PROCESS ..... 3
- 3.1 Information and Data Acquisition ..... 3
- 3.2 TIE Testing ..... 3
- 3.3 Toxicity Source Evaluation ..... 5
- 3.4 Toxicity Control Evaluation ..... 7
- 3.5 Toxicity Control Implementation ..... 8
- 3.6 Quality Assurance/Quality Control ..... 8
- 3.7 TIE/TRE Limitations ..... 9

4.0 REFERENCES ..... 10

## LIST OF FIGURES

Figure 1-1. Example Receiving Water Monitoring and TIE/TRE Decision Framework ..... 2
Figure 3-1. The Toxicity Source Evaluation Approach ..... 6
Figure 3-2. Components of Toxicity Control Evaluation ..... 8

## LIST OF TABLES

Table 2-1. Transitional and Long-Term Receiving Water Toxicity Tests ..... 3
Table 3-1. Phase I TIE Receiving Water Sample Manipulations ..... 4

## LIST OF ACRONYMS

| | |
|---|---|
| 2007 Permit | RWQCB Order No. R9-2007-0001 |
| 2013 Permit | RWQCB Order No. R9-2013-0001 |
| BMP | best management practice |
| BSA | bovine serum albumin |
| CLRP | Comprehensive Load Reduction Plan |
| Copermittees | San Diego Regional Copermittees |
| EDTA | ethylenediaminetetraacetic acid |
| IWC | instream waste concentration |
| JRMP | Jurisdictional Runoff Management Plan |
| $LC_{50}$ | median lethal concentration |
| LID | low impact development |
| MAP | Monitoring and Assessment Plan |
| MEP | maximum extent practicable |
| MS4 | multiple separate storm sewer system |
| NOEC | no observed effect concentration |
| NPDES | National Pollutant Discharge Elimination System |
| PBO | piperonyl butoxide |
| QA/QC | quality assurance/quality control |
| RWQCB | Regional Water Quality Control Board |
| SMC | Stormwater Monitoring Coalition |
| SPE | solid phase extraction |
| STS | sodium thiosulfate |
| SWRCB | State Water Resources Control Board |
| TDS | total dissolved solids |
| TIE | toxicity identification evaluation |
| TMDL | Total Maximum Daily Load |
| TRE | toxicity reduction evaluation |
| TST | Test of Significant Toxicity |
| USEPA | United States Environmental Protection Agency |
| WMA | Watershed Management Area |
| WQIP | Water Quality Improvement Plan |
| WURMP | Watershed Urban Runoff Management Program |

## UNITS OF MEASURE

| | |
|---|---|
| ppt | parts per thousand |
| % | percent |
| < | less than |
| > | greater than |

# 1.0 INTRODUCTION

In May of 2013, San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2013-0001 (2013 Permit) was adopted. Provision B of the 2013 Permit requires Copermittees in each Watershed Management Area (WMA) to develop a Water Quality Improvement Plan (WQIP) which, per Provision B.4, incorporates a Monitoring and Assessment Program (MAP). Also, per Provision D.1.c.(4)(f), "*If chronic toxicity is detected in receiving waters, the Copermittees must discuss the need for conducting a TIE/TRE in the assessments required under Provision D.4.a.(2), and develop a plan for implementing the TIE/TRE to be incorporated in the Water Quality Improvement Plan*."

A toxicity identification evaluation (TIE) is defined by the 2013 Permit as "*A set of procedures for identifying the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests*." A toxicity reduction evaluation (TRE) is defined as "*A study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices and best management practices. A TIE may be required as part of the TRE, if appropriate*."

This Work Plan outlines the process used to identify chronic toxicity in receiving waters, as well as guidance to prioritize the need to implement a TIE/TRE based on the magnitude and persistence of chronic toxicity. The Work Plan refers to the appropriate references for detailed sampling and analytical/toxicity test methods specific to the TIE/TRE treatment process. An example of a potential TRE decision process for receiving water samples (Stormwater Monitoring Coalition (SMC) Model Monitoring Technical Committee, 2004) is presented in Figure 1-1. The process should be modified on location-specific and pollutant-specific basis, and a detailed work plan should be developed for the implementation of a pollutant reduction program once the specific pollutant(s) causing toxicity exceedances are identified.

This Work Plan focuses primarily on the implementation of the TIE/TRE process, recognizing the limitations of utilizing TRE guidance developed for point source discharges. Receiving water stations potentially capture pollutants from many sources with runoff flows and contaminant concentrations likely more variable than those from point source discharges. However, with modifications to the TRE guidance developed for point source discharges, a TRE may be conducted to attempt to identify sources of toxicity, propose mitigation measures for these sources, and conduct follow-up studies to confirm toxicity reduction. Any activities that result in consistently reducing toxicity to an acceptable level may be considered TRE activities (USEPA 2001).

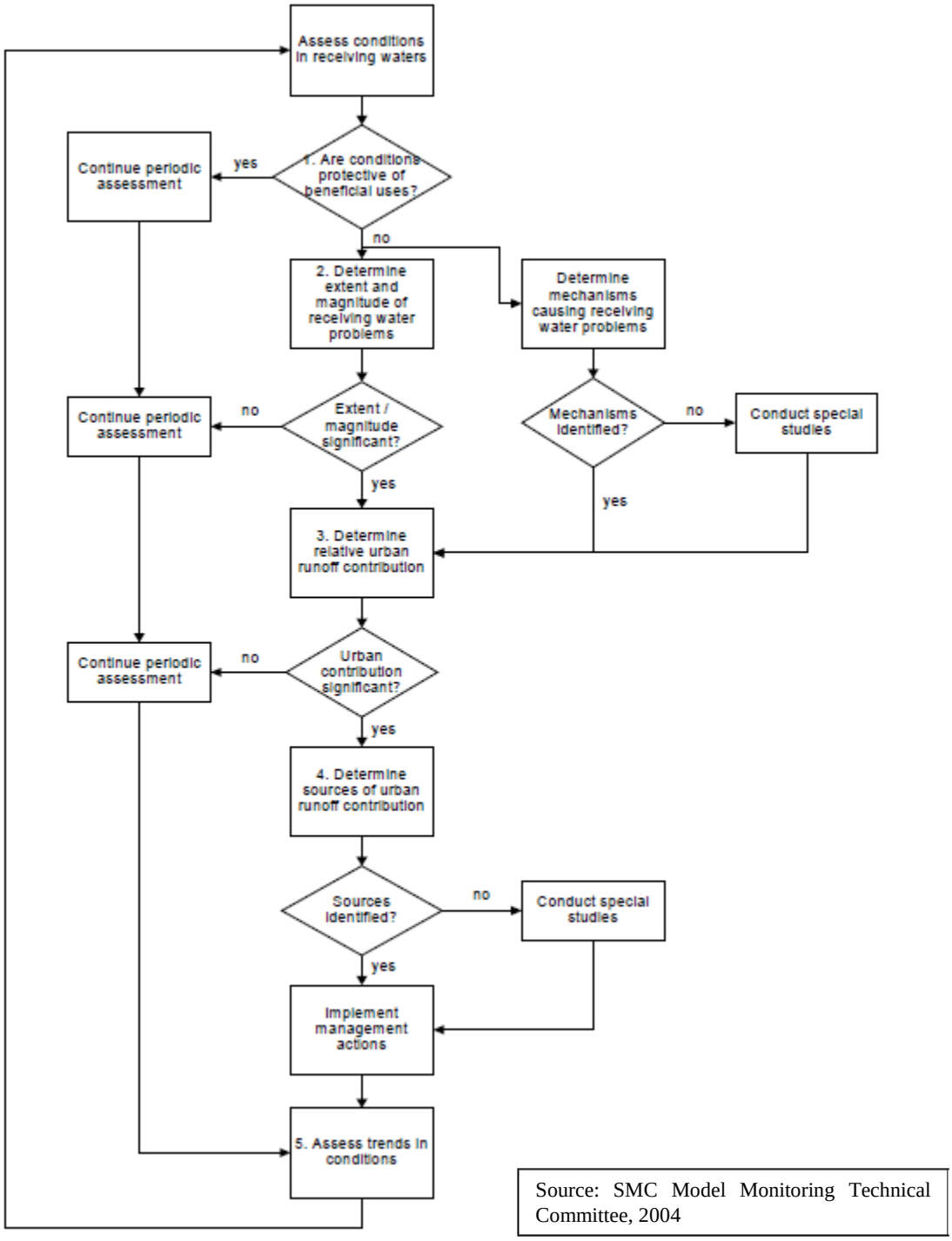


**Figure 1-1. Example Receiving Water Monitoring and TIE/TRE Decision Framework**

# 2.0 RECEIVING WATER TOXICITY TESTING

Receiving water monitoring is conducted by the San Diego Regional Copemittees (Copermittees) in accordance with Provision D of the 2013 Permit and chronic toxicity is one of the parameters evaluated in both wet and dry weather receiving water samples. Under the long-term monitoring requirements of the 2013 Permit, chronic toxicity tests are conducted in accordance with Provision D.1.c.(4)(e) as summarized in Table 2-1. Toxicity is evaluated using the Test of Significant Toxicity (TST) as outlined in the *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (USEPA, 2010). The TST approach assigns a Pass or Fail result based on whether the organism response observed at the chronic instream waste concentration (IWC) of 100 percent (%) receiving water is significantly different from that in the control treatment. When chronic toxicity is observed in receiving water samples (i.e., the sample receives a "Fail" based on the TST), implementation of a TIE/TRE process following the phased approach described in subsequent sections will be considered, as appropriate.

**Table 2-1. Transitional and Long-Term Receiving Water Toxicity Tests**

| Organism | Endpoint | Toxicity Threshold | USEPA Protocol |
|---|---|---|---|
| Monitoring in accordance with Order No. R9-2013-0001, Salinity < 1 ppt | | | |
| *Ceriodaphnia dubia* | Chronic survival and reproduction | Pass/Fail | EPA-821-R-02-013 |
| *Selenastrum capricornutum* | Chronic growth | | |
| *Pimephales promelas* | Chronic survival and growth | | |
| Monitoring in accordance with Order No. R9-2013-0001, Salinity ≥ 1 ppt | | | |
| *Strongylocentrotus purpuratus* | Chronic development | Pass/Fail | EPA-600-R-95-136 |

# 3.0 TIE/TRE PROCESS

## 3.1 Information and Data Acquisition

Prior to initiating the TIE/TRE process, an evaluation of sampling and toxicity testing procedures should be conducted to assess whether toxicity may have been introduced during these procedures or errors may have been made. This may include a review of the following:

- Sampling equipment decontamination procedures
- Field and laboratory logs
- Laboratory reports

If all test acceptability criteria are met and no errors are identified, Copermittees will consider implementing the TIE/TRE process. Conducting a TIE is often the first step to identifying the toxicant.

## 3.2 TIE Testing

TIEs may be conducted in accordance with USEPA guidance for characterizing, identifying, and confirming toxicity (USEPA 1991, 1992, 1993a, and 1993bPriority may be given to stations

exhibiting significant and persistent toxicity that has not previously been characterized and where analytical results indicate that a specific toxicant may be causing or contributing to toxicity. The sample may be evaluated for TIE suitability using the following assessments:

- Presence of Persistent Toxicity: toxicity is considered persistent if more than 50% of samples (generally during a monitoring year) collected at a station receive a "Fail" based on the test of significant toxicity (TST) .
- Magnitude of Toxicity: based on past experience, a 50% response rate(i.e. 50% of test organisms respond in a 100% receiving water sample) can provide a reasonable opportunity for a successful TIE.
- Previous Characterization: TIEs are generally prioritized for receiving water stations where previous TIEs have not characterized the pollutant(s) causing toxicity. However, TIE/TRE procedures should not be ruled out for previously characterized stations since contributor(s) to toxicity may change over time.

The TIE approach is divided into three phases, as described in USEPA (1991) and summarized as follows:

- Phase I – characterizes the physical/chemical nature of the constituent(s) which cause or contribute to toxicity. Such characteristics as solubility, volatility and filterability are determined without specifically identifying the toxicants.
- Phase II – utilizes methods to specifically identify toxicants.
- Phase III – utilizes methods to confirm the suspected toxicants.

Phase I (characterization) manipulations of receiving water samples generally include those presented in Table 3-1.

**Table 3-1. Phase I TIE Receiving Water Sample Manipulations**

| Physical and Chemical Manipulations on Receiving Water Samples | Purpose of Test |
|---|---|
| Baseline | Confirms toxicity is still present in the sample at time of TIE testing |
| Filtration | Detects particulates or particulate-bound toxicants |
| Aeration | Detects volatile, oxidizable, sublatable, or spargeable compounds |
| Ethylenediaminetetraacetic acid (EDTA) addition | Detects cationic metals (e.g., cadmium) |
| Sodium thiosulfate (STS) addition | Detects oxidative compounds (e.g., chlorine) |
| Solid phase extraction (SPE) over C18 column (may be followed by methanol elution) | Detects non-polar organics and some surfactants (methanol elution adds toxicity back to sample) |
| Piperonyl butoxide (PBO) addition | Detects organophosphate pesticides and pyrethroids |

| | |
|---|---|
| Carboxyl esterase addition* | Hydrolyzes pyrethroids |
| Bovine serum albumin (BSA) addition | Protein BSA is used as a control for the carboxyl esterase |
| Temperature reduction | Increases toxicity of pyrethroid pesticides |
| pH adjustment | Detects pH-dependent toxicants (e.g., ammonia and sulfides) |
| * Carboxylesterase addition has been used in recent studies to help identify pyrethroid-associated toxicity (Wheelock et al., 2004; Weston and Amweg, 2007). However, this treatment is experimental in nature and should be used along with other pyrethroid-targeted TIE treatments (e.g., PBO addition). | |

Adjustments may be made to these TIE protocols if specific contaminants are suspected to be contributing to toxicity. For example, total dissolved solids (TDS) controls and/or mock effluents to mimic TDS concentrations observed in samples are often added to the treatments listed in Table 3-1 if ionic imbalance or elevated TDS are suspected. Toxicity due to ionic imbalance occurs when ion concentrations are not within the tolerance range of the selected test organism; utilizing *S. purpuratus* for toxicity tests conducted for samples with salinity > 1 ppt may help to alleviate this common issue, especially during dry weather.

Phase II and III TIEs may be necessary, depending whether the Phase I determination of toxicant class is sufficient for identifying pollutants for outfall monitoring and/or identifying source control measures. If necessary, Phase II and III procedures may include toxicant removal and add-back, serial additions, and/or toxicant spiking experiments in accordance with USEPA 1993a and 1993b.

It should be noted that, due to intermittent toxicity and/or toxicity resulting from multiple toxicants, TIEs are not always conclusive. In such cases, conducting toxicity tests with additional organisms (SMC Model Monitoring Technical Committee, 2004) and/or serially identifying toxicants (USEPA, 2001) may help characterize observed toxicity. When a receiving water sample exhibits persistent toxicity of a high magnitude, as is generally the case when TIEs are conducted, TIEs are typically successful (USEPA, 2001).

## 3.3 Toxicity Source Evaluation

Once any toxicants have been identified during the TIE process, Copermittees must discuss the need for conducting a TRE. The following sections provide an outline for developing specific monitoring elements intended to focus the effort in locating the source(s) of the pollutant(s).

If urban runoff is suspected as a significant source of the pollutant(s) characterized by a TIE to be a contributor to toxicity at a receiving water station, source identification procedures may need to be considered. An evaluation of chemistry and bioassessment data for the receiving water station and chemistry data for upstream outfalls may help to confirm whether urban runoff is a significant source of the pollutant(s) causing toxicity and may justify further source identification procedures.

More comprehensive source identification procedures, if warranted, may include compiling descriptions of all potential sources to the receiving water station, determining actual sources and

their relative magnitudes, and quantitatively estimating loads from these sources. A model for a source identification investigation study is outlined in the *Model Monitoring Program for Municipal Separate Storm Sewer Systems in Southern California* (SMC Model Monitoring Technical Committee, 2004) and more detailed source identification study methodology is outlined in USEPA (1993c) and by Pitt (2004). The general approach may include a combination of the components presented in Figure 3-1.

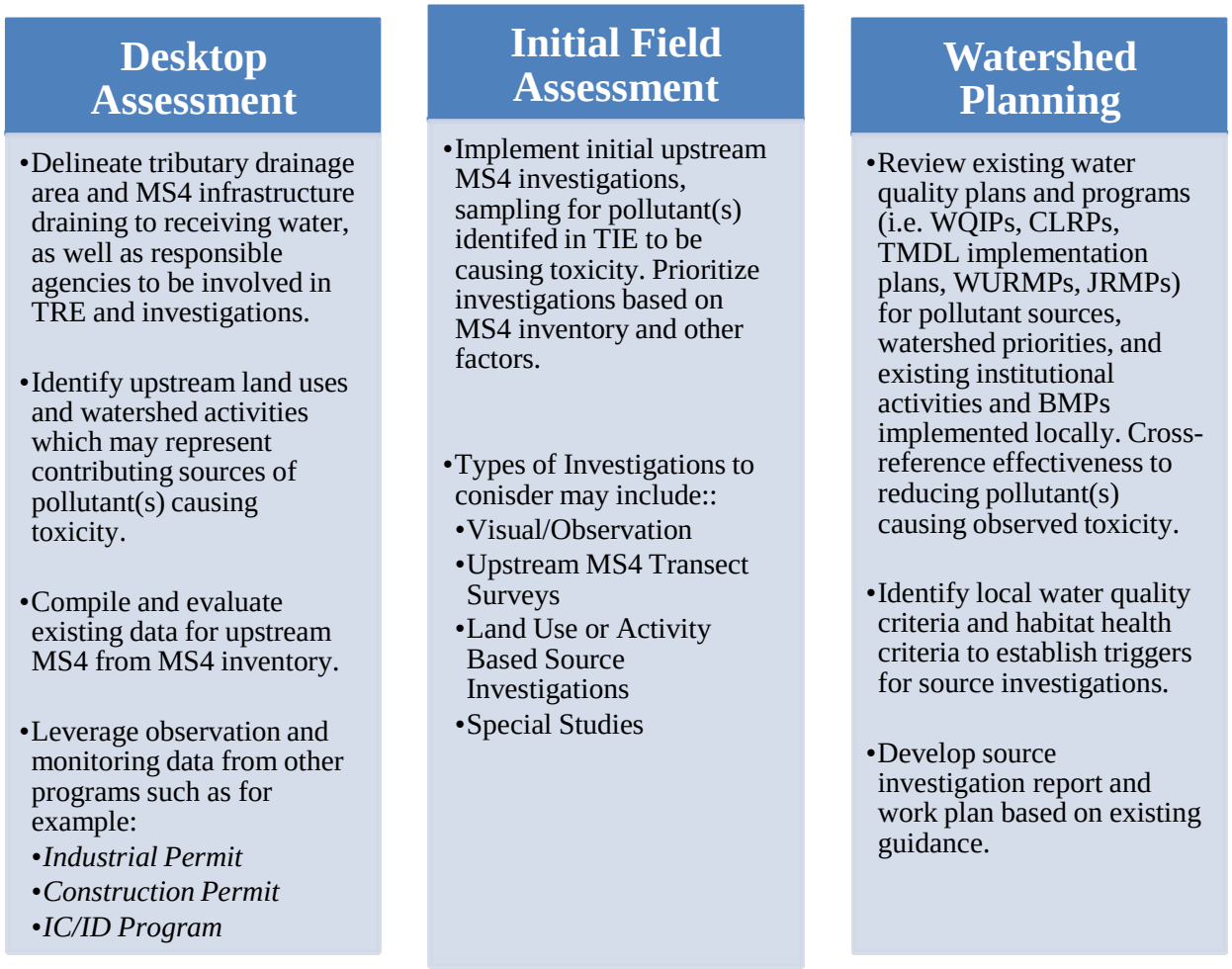


**Figure 3-1. The Toxicity Source Evaluation Approach**

Source identification efforts may coordinate with monitoring and assessment activities necessary for compliance with the following Provisions:

- Provision A.4.a.(2) – If it is determined that discharges from the MS4 are causing or contributing to a new exceedance of an applicable water quality standard not addressed by the WQIP, update the WQIP with the water quality improvement strategies implemented or to be implemented, the implementation schedule, and the monitoring and assessment program updates intended to track progress toward achieving compliance.

- Provision B.2.d – identify and prioritize known and suspected sources of stormwater and non-stormwater pollutants from MS4 outfalls that contribute to the highest priority water quality conditions, as identified in the WQIP.
- Provision B.3 – identify water quality improvement goals and strategies to address the highest priority water quality conditions, as identified in the WQIP.
- Provision D.2.b – perform dry weather MS4 outfall monitoring to identify non-storm water flows and illicit discharges within its jurisdiction and to prioritize these discharges for investigation and elimination.
- Provision D.2.c – perform wet weather MS4 outfall monitoring to identify pollutants in storm water discharges from the MS4, guide pollutant source identification efforts, and determine compliance with applicable Total Maximum Daily Loads (TMDLs).
- Provision D.3 – conduct special studies related to the highest priority water quality conditions. Provision D.3.c specifies that special studies related to pollutant and/or stressor source identification should include a compilation of known information on the pollutant and/or stressor, an identification of data gaps intended to be filled by the studies, and a monitoring plan which includes, among other required elements, a prioritization of sources of the pollutant and/or stressor.
- Provision E.2 – implement a program to detect and eliminate illegal discharges and improper disposal into the MS4.

If no source can be identified as a major contributor to receiving water toxicity, more intensive follow-up studies may be required.

## 3.4 Toxicity Control Evaluation

Using the results from the TRE elements conducted to this point, alternatives for reducing receiving water toxicity may be identified and the most feasible approach(es) may be selected. Pollution Prevention measures are designed to target pollutants and wastes before they are generated, while Source Controls are designed to reduce or eliminate pollutants before entering the MS4. These measures may include outreach, incentive programs, regulatory controls, and enforcement activities, as well as broader “true source controls” that must be implemented at a national or state level (e.g., product regulation). Institutional Programs, such as street sweeping, MS4 cleaning and repair, and other institutional services are typically maintenance activities implemented by agencies at various targeted frequencies to meet pollutant load reduction goals and minimum National Pollutant Discharge Elimination System (NPDES) Permit compliance criteria. Treatment Controls include structural systems designed to remove pollutants from stormwater and non-stormwater flows and may include a variety of low impact development (LID) and best management practices (BMPs) (e.g., infiltration-type, bioremediation, treatment trains, etc.). These BMPs are intended to protect receiving waters by eliminating or reducing the discharge of pollutants to the maximum extent practicable (MEP). Advantages and disadvantages of BMP alternatives should be considered, and appropriate BMPs should be selected based on site-specific conditions and pollutant(s) of concern. An integrated approach using a combination of Pollution Prevention measures, Institutional Programs, and Treatment Controls may be appropriate if more than one pollutant is identified to be causing or contributing to toxicity, or if

the source is unknown. These three components of the toxicity control evaluation are shown in Figure 3-2.

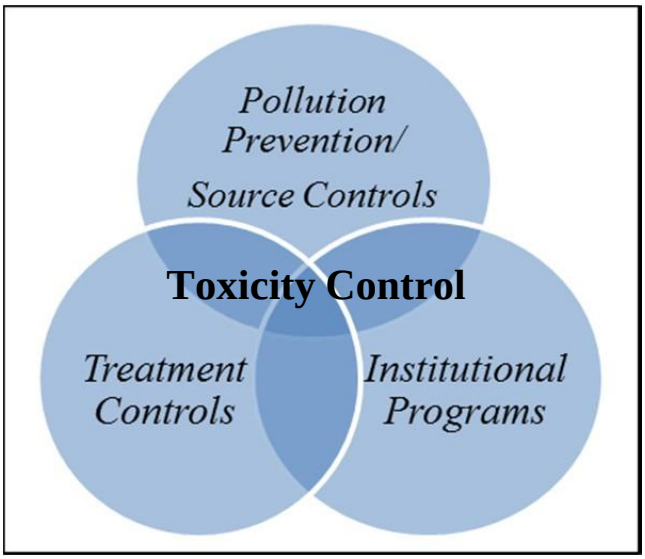


**Figure 3-2. Components of Toxicity Control Evaluation**

## 3.5 Toxicity Control Implementation

Once the selected toxicity control method(s) are implemented, monitoring may be continued and possibly accelerated to confirm that toxicity reduction objectives are being met. Depending on the location and pollutant(s) being evaluated, some of this monitoring may be satisfied by Permit-required monitoring of receiving water and outfall locations (see Section 3.3).

Compliance with the monitoring and assessment requirements of the 2013 Permit, including Provision D.1.c.(4)(f) which requires the implementation of the TIE/TRE process described in this Work Plan, is intended to meet the discharge and receiving water limitations outlined in the 2013 Permit to the MEP. Updates to the monitoring programs developed to comply with these provisions will be incorporated into the WQIP through the adaptive management process outlined in Provisions B.4 and B.5 in order to continually monitor effectiveness and re-evaluate the programs.

## 3.6 Quality Assurance/Quality Control

A quality assurance/quality control (QA/QC) program for the TIE/TRE should be developed in order to ensure reliability of data collected throughout the process. The QA/QC program should include the QA/QC objectives, sample collection and preservation techniques, chain of custody procedures, analytical QA/QC, laboratory equipment maintenance, QA/QC training requirements, documentation and reporting procedures, and corrective action protocols (USEPA, 1993c). In addition, toxicology and analytical laboratories should be experienced and qualified to conduct the TIE/TRE.

## 3.7 TIE/TRE Limitations

There are inherent limitations associated with the TIE/TRE process summarized in this Work Plan, including the difficulty of characterizing intermittent toxicity (USEPA, 1993c) and/or toxicity resulting from multiple toxicants (USEPA, 2001). In addition, existing TRE guidance was developed primarily for point source discharges from wastewater treatment plants whereas receiving waters potentially capture pollutants from many sources and contain contaminants at more variable concentrations than those from a wastewater treatment facility, especially during a storm event.

# 4.0 REFERENCES

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# San Diego County Municipal Copermittees
# Bight 2013 Workplan
# FINAL

**Prepared For:**

**County of San Diego Municipal Copermittees**

**July 25, 2013**

# San Diego County Municipal Copermittees Bight 2013 Workplan

**Prepared For:**

**County of San Diego Municipal Copermittees**

**Prepared By: Weston**

**Solutions, Inc.**
5817 Dryden Place, Ste 101
Carlsbad, California 92008

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## TABLE OF CONTENTS

1.0 Introduction ..... 1

2.0 San Diego Regional Copermittees Bight ’13 Workgroup Participation ..... 3

3.0 Coastal Ecology Main Group Current Program Design ..... 4
- 3.1 Sediment Design and Program ..... 4
- 3.2 Water Quality Sampling ..... 10
- 3.3 Prevention of the Spread of Aquatic Invasive Species ..... 10

4.0 Data Management and Reporting ..... 10

## LIST OF TABLES

Table 3-1. Bight ’13 Sediment Analytical List, Methods, and Detection Limits ..... 5
Table 3-2. Additional Chemical Analyses Conducted as Special Studies in Sediments from San Diego Lagoons ..... 8
Table 3-3. Additional Toxicity Analyses Conducted as Special Studies in Sediments from San Diego Lagoons ..... 9
Table 3-4. Water Quality Parameters ..... 10

Appendix A
Station Location Maps

Appendix B
Bight ‘13 Contaminant Impact Assessment Workplan

Appendix C
Bight ‘13 Contaminant Impact Assessment Quality Assurance Manual

# 1.0 INTRODUCTION

The purpose of this workplan is to outline the activities that will be conducted by the San Diego Regional Copermittees (Copermittees) to contribute in-kind services to the Southern California Bight 2013 Regional Monitoring Program (Bight '13). This is a working document coinciding with the development of the Bight '13 Program.

**Background**

The aquatic health of the San Diego estuaries and lagoons have been assessed as part of the previous Bight Surveys in 2003 (Bight '03) and 2008 (Bight '08). It has also been assessed in the Copermittees' three-year Ambient Bay and Lagoon Monitoring (ABLM) Program from 2003-2005 and from 2010-2012. Additionally in 2008, the sediment conditions within San Diego estuaries were evaluated following the protocols of the State Water Resources Control Board's (SWRCB) *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (referred to as Sediment Quality Objectives (SQOs)). This section provides an overview of the Bight '03, Bight '08, and ABLM study results relevant to San Diego estuaries.

**2003 and 2008 Bight Surveys**

The Bight program is a regional assessment of the Southern California Bight (Bight) organized every five years by the Southern California Coastal Water Research Project (SCCWRP), conducted from Point Conception to the Mexican border. Bight Surveys were initiated in 1994 based on recommendations received from marine monitoring program reviews by the National Academy of Sciences in 1989. SCCWRP is the lead coordinating agency for the Bight Surveys, bridging the regulated and regulatory communities. Previous surveys have been conducted in 1994, 1998, 2003, and 2008. Detailed information related to previous Bight surveys as well as information regarding the current Bight '13 survey can be found on the SCCWRP website at: http://www.sccwrp.org/Documents/BightDocuments.aspx.

In Bight '03, the ecological health of Southern California estuaries was assessed and compared to conditions found in coastal and offshore areas. As part of the Coastal Ecology Bight Study, sediment chemistry, toxicity, and benthic communities were measured at 60 stations in estuaries and embayments, with most of the sampling effort allocated to the Los Angeles region. Out of all surveyed marine habitats, embayments were found to have lower sediment quality in comparison to nearshore and offshore environments. Trace metals and total polyaromatic hydrocarbons (PAHs) had higher concentrations in sediments from embayments, especially within marinas and urban estuaries. Marinas and estuaries (particularly in Los Angeles) also contained the greatest incidence of sediment toxicity. Toxicity was present in 50% of the marina area and 41% of the estuarine area. Furthermore, assessments of benthic community condition indicated that most of the moderate and high disturbance of benthic infauna occurred in embayments.

The Bight '08 Survey represented the first effort to monitor and evaluate results in accordance with the SQO Policy across Southern California's embayments. The SQOs are based on a multiple lines of evidence (MLOE) approach in which the lines of evidence (LOE) are sediment toxicity, sediment chemistry, and benthic community condition. The MLOE results were integrated through the evaluation of the severity of biological effects and the potential for chemically mediated effects to provide a final station level assessment. In Bight '08, sediment chemistry, toxicity, and benthic communities were measured at 60 stations in estuaries and

embayments with 40 stations allocated to the San Diego region. Similar to Bight ’03 results, embayments were again found to have lower sediment quality in comparison to nearshore and offshore environments. Approximately 27% of embayments within the Bight were considered contaminant impacted with at least half of the area in marinas and estuaries exhibiting contamination. Trace metals such as zinc, PAHs, and current use pesticide concentrations were observed in many estuaries as a result of urban runoff from adjacent watersheds. Marinas and estuaries also contained the greatest incidence of sediment toxicity with substantial toxicity present in 24% of marina sediments and 22% of estuary sediments. In addition, approximately 59% of southern California’s estuaries and 37.4% of marinas had benthic communities in poor condition.

**Ambient Bay and Lagoon Monitoring**

The Copermittees conducted a three year ABLM to assess San Diego’s lagoons from 2003 through 2005. The ABLM program applied a weight of evidence approach using a triad assessment of indicators which included chemistry, toxicity, and benthic infaunal communities to evaluate the sediment quality in the lagoons. The program design used a targeted approach to assess the finest grain size and highest total organic carbon. This approach was used to conservatively assess if the areas in the lagoons that were likely to be impacted exceeded published benchmarks or exhibited toxic effects. Three discreet samples were collected and composited into one composite sample for each lagoon per year. The three years of data were compiled to form a baseline of information, providing a worst case benchmark for comparison of future sampling results. Based on the ABLM study, San Diego County lagoon’s sediment health was rated as fair based on the triad of indicators Sediment contamination was low during sampling years, as was toxicity. However, benthic infaunal communities were generally more disturbed than would have been expected based on the chemistry and toxicity data. Given that the ABLM study utilized composite sampling, future studies are needed to better understand the spatial distribution of conditions within San Diego estuaries.

The Copermittees also conducted a three year ABLM program from 2010 through 2012. By building on information gained through the 2003-2005 ABLM and the Bight ’08 Survey, it was determined that special studies within each lagoon would provide more relevant information for addressing the permit management questions. Because the data collected previously were more indicative of stressors to the benthic community and did not suggest relationships to chemical influences, the 2010-2012 ABLM Program focused on benthic community assessments. Priority was given to those lagoons that had impacted benthos with associated toxicity or with the presence of chemistry exceedances. During the three year period, five lagoons/estuaries were monitored including Agua Hedionda Lagoon, Sweetwater River Estuary, San Elijo Lagoon, Batiquitos Lagoon, and Tijuana River Estuary. The sediment qualities of the five lagoons/estuaries were evaluated utilizing the SQO tool. Sampling consisted of water quality sampling for chemistry and physical parameters and sediment sampling for chemistry, toxicity, and benthic infaunal assessments. Each sampling site included three replicate samples to evaluate benthic conditions and one replicate water quality site. Data for this study were collected using methods consistent with previous data from this program, the Bight program, and SQOs to allow for comparisons to the past and likely data needs of the future. The majority of sites assessed exhibited minimal to low chemistry exposure, low to no toxicity, and low to high benthic disturbance. Comparisons to the benthic community from previous studies, as well as the analysis of the water quality, revealed that disturbances to the benthic community at the majority

of the sites were most likely associated with natural biological variation and physical disturbances rather than chemically mediated effects.

**Regulatory Commitment**
The San Diego Region Municipal NPDES Permit Order No. 2013-0001 (Permit) was adopted on May 8, 2013. Section D.1.e.(1).(b) of the Permit requires the Copermittees to participate in the Southern California Bight Regional Monitoring.

The Copermittees' Regional Monitoring Workgroup has indicated it will participate in the Bight '13 Survey by providing in-kind services. The Copermittees have agreed to contribute to the Bight '13 Survey by sampling up to 22 lagoon stations within the San Diego Region.

Participation by the Copermittees in the Bight '13 Survey will provide data useful in addressing the goals of the Monitoring and Assessment Sections of the Permit. Furthermore, the Copermittee's contribution to the Bight Survey will build on an existing dataset that provides a regional assessment of the coastal marine health, while simultaneously providing a local assessment of the San Diego Region Lagoons.

**Technical Approach**
This workplan is designed to provide data needed to answer questions related to the Southern California Bight, the San Diego Region, and the individual lagoons of study. Lagoons/estuaries selected for the Bight '13 program will be chosen based on whether or not they meet the requirements of the SQO tool (i.e. salinity, subtidal, open to ocean, etc.) and sampling stations will be located using a tessellated random sampling design consistent with Bight protocols.

The Copermittees data will be used to provide data needed to answer the following Bight '13 Contaminant Impact Assessment (CIA) (formerly Coastal Ecology) Program questions:

- *What is the extent and magnitude of direct impact from sediment contaminants?*
- *What is the trend in extent and magnitude of direct impacts from sediment contaminants?*

In addition, the Copermittees lagoon sampling effort will be used to satisfy the first iteration of sampling required for this Permit term in accordance with the Sediment Quality Monitoring requirements in Section D.1.e.(2) and the SQO Policy. Any stations with SQO results other than unimpacted or likely unimpacted will require follow-up evaluations in subsequent monitoring years within the Permit term in accordance with the SQO Policy.

# 2.0 SAN DIEGO REGIONAL COPERMITTEES BIGHT '13 WORKGROUP PARTICIPATION

The San Diego Regional Copermittees are participating in the CIA workgroup. This workgroup is the core of the Bight Program. This study will be used to assess sediment quality (chemistry, toxicity, and benthic community health) in nine of San Diego's lagoons. The CIA Workplan is included in Appendix B.

# 3.0 COASTAL ECOLOGY MAIN GROUP CURRENT PROGRAM DESIGN

The lagoons/estuaries selected for the Bight ’13 program were chosen based on whether or not they meet the requirements of the SQO tool (e.g., salinity, subtidal, open to ocean, etc.). Sampling stations will be located using a tessellated random sampling design consistent with Bight protocols. Samples will be collected in areas considered to be in the lagoon or estuarine environments with salinities $\geq$ 25 ppt. Sampling will occur one time at each location during the summer of 2013 and is tentatively scheduled to occur from July through September 2013.

Nine lagoons/estuaries were selected in the San Diego Region for inclusion in the Bight ’13 program and are presented as follows:

1. Santa Margarita Estuary
2. Agua Hedionda Lagoon
3. Batiquitos Lagoon
4. San Elijo Lagoon
5. San Dieguito Lagoon
6. Los Peñasquitos Lagoon
7. San Diego River Estuary
8. Sweetwater River Estuary
9. Tijuana River Estuary

Maps of the nine lagoons/estuaries are provided in Appendix A.

Lagoons/estuaries that were excluded from the Bight ’13 Program, as well as the reasons for their exclusion, are presented below:

1. San Luis Rey River Estuary – not identified as suitable from National Wetlands Inventory due to depth/low salinity.
2. Loma Alta Slough– Too small, closed during summer months, low salinity.
3. Buena Vista Lagoon – Freshwater, closed lagoon.
4. Famosa Slough – Too small for program, somewhat disconnected from marine environment.

Several of the lagoons do require annual maintenance dredging at the ocean inlet to ensure that flows are not restricted. This dredging is typically restricted to the areas near the mouth and often occurs in late spring. Maintenance dredging is not expected to affect stations selected for the lagoon sample draw. In the event a sample location occurs in an area that was recently dredged, an alternate sample will be randomly selected outside of the area of influence.

## 3.1 Sediment Design and Program

Sediment samples will be collected in accordance with the Bight ’13 sampling protocols. Weston’s staff is attending all Bight ’13 field technical sub-workgroup meetings to ensure that samples will be collected following all Bight protocols. Sediment samples will be collected using a Van Veen grab sampler and analyzed for chemistry, toxicity, and benthic community.

## Chemistry

The Bight ’13 program core sediment chemistry list is presented in Table 3-1. Sediment samples will be analyzed according to Bight ’13 protocols. Additional chemistry analyses provided by the Bight Program from other participating agencies as special studies are included in Table 3-2.

**Table 3-1. Bight ’13 Sediment Analytical List, Methods, and Detection Limits**

| Group/Analyte | Method | Units | RL* | Laboratory |
|---|---|---|---|---|
| **General Parameters** | | | | |
| Total Solids | EPA 160.3 | % Wet Weight | 0.05 | Physis |
| Particle Size Distribution | Laser Particle Size | µm | - | City of San Diego |
| Total Organic Carbon | EPA 9060A | % Dry Weight | 0.1 | Physis |
| Total Nitrogen | EPA 9060A | % | 0.1 | Physis |
| Total Phosphorus | SM 4500-P E | mg/g | 0.05 | Physis |
| **Trace Metals** | | | | |
| Aluminum (Al) | EPA 6020 | µg/dry g | 5 | Physis |
| Antimony (Sb) | EPA 6020 | µg/dry g | 10 | |
| Arsenic (As) | EPA 6020 | µg/dry g | 1.6 | |
| Barium (Ba) | EPA 6020 | µg/dry g | 0.05 | |
| Beryllium (Be) | EPA 6020 | µg/dry g | 0.2 | |
| Cadmium (Cd) | EPA 6020 | µg/dry g | 0.09 | |
| Chromium (Cr) | EPA 6020 | µg/dry g | 16 | |
| Copper (Cu) | EPA 6020 | µg/dry g | 7 | |
| Iron (Fe) | EPA 6020 | µg/dry g | 5 | |
| Lead (Pb) | EPA 6020 | µg/dry g | 9.3 | |
| Mercury (Hg) | EPA 245.7 | µg/dry g | 0.03 | |
| Nickel (Ni) | EPA 6020 | µg/dry g | 4.2 | |
| Selenium (Se) | EPA 6020 | µg/dry g | 1 | |
| Silver (Ag) | EPA 6020 | µg/dry g | 0.2 | |
| Zinc (Zn) | EPA 6020 | µg/dry g | 30 | |
| **Synthetic Pyrethroids** | | | | |
| Allethrin | GCMS-NCI | ng/dry g | 0.5 | Physis |
| Bifenthrin | GCMS-NCI | ng/dry g | 0.5 | |
| Cyfluthrin | GCMS-NCI | ng/dry g | 0.5 | |
| Cypermethrin | GCMS-NCI | ng/dry g | 0.5 | |
| Danitol (Fenpropathrin) | GCMS-NCI | ng/dry g | 0.5 | |
| Deltamethrin | GCMS-NCI | ng/dry g | 0.5 | |
| Esfenvalerate | GCMS-NCI | ng/dry g | 0.5 | |
| Fenvalerate | GCMS-NCI | ng/dry g | 0.5 | |
| L-Cyhalothrin | GCMS-NCI | ng/dry g | 0.5 | |

| Group/Analyte | Method | Units | RL* | Laboratory |
|---|---|---|---|---|
| Permethrin | GCMS-NCI | ng/dry g | 0.5 | |
| Prallethrin | GCMS-NCI | ng/dry g | 0.5 | |
| **Organochlorine Pesticides** | | | | |
| 2,4'-DDT | EPA 8270 | ng/dry g | 0.5 | Physis |
| 4,4'-DDT | EPA 8270 | ng/dry g | 0.5 | |
| 2,4'-DDD | EPA 8270 | ng/dry g | 0.5 | |
| 4,4'-DDD | EPA 8270 | ng/dry g | 0.5 | |
| 2,4'-DDE | EPA 8270 | ng/dry g | 0.5 | |
| 4,4'-DDE | EPA 8270 | ng/dry g | 0.5 | |
| 4,4’-DDMU | EPA 8270 | ng/dry g | 0.5 | |
| alpha-Chlordane | EPA 8270 | ng/dry g | 0.5 | |
| gamma-Chlordane | EPA 8270 | ng/dry g | 0.5 | |
| Oxychlordane | EPA 8270 | ng/dry g | 0.5 | |
| cis-nonachlor | EPA 8270 | ng/dry g | 0.5 | |
| trans-nonachlor | EPA 8270 | ng/dry g | 0.5 | |
| **Polychlorinated Biphenyls (PCBs) Congeners** | | | | |
| PCB-18 | EPA 8270 | ng/dry g | 7.5 | Physis |
| PCB-28 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-37 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-44 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-49 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-52 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-66 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-70 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-74 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-77 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-81 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-87 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-99 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-101 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-105 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-110 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-114 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-118 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-119 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-123 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-126 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-128 | EPA 8270 | ng/dry g | 7.5 | |

| Group/Analyte | Method | Units | RL* | Laboratory |
|---|---|---|---|---|
| PCB-138 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-149 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-151 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-153 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-156 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-157 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-158 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-167 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-168 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-169 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-170 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-177 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-180 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-183 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-187 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-189 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-194 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-201 | EPA 8270 | ng/dry g | 7.5 | |
| PCB-206 | EPA 8270 | ng/dry g | 7.5 | |
| **Polynuclear Aromatic Hydrocarbons** | | | | |
| 1-Methylnaphthalene | EPA 8270 | ng/dry g | 50 | Physis |
| 1-Methylphenanthrene | EPA 8270 | ng/dry g | 50 | |
| 1,6,7-Trimethylnaphthalene | EPA 8270 | ng/dry g | 50 | |
| 2,6-Dimethylnaphthalene | EPA 8270 | ng/dry g | 50 | |
| 2-Methylnaphthalene | EPA 8270 | ng/dry g | 50 | |
| Acenaphthene | EPA 8270 | ng/dry g | 50 | |
| Acenaphthylene | EPA 8270 | ng/dry g | 50 | |
| Anthracene | EPA 8270 | ng/dry g | 50 | |
| Benz[a]anthracene | EPA 8270 | ng/dry g | 50 | |
| Benzo[a]pyrene | EPA 8270 | ng/dry g | 50 | |
| Benzo[b]fluoranthene | EPA 8270 | ng/dry g | 50 | |
| Benzo[e]pyrene | EPA 8270 | ng/dry g | 50 | |
| Benzo[g,h,i]perylene | EPA 8270 | ng/dry g | 100 | |
| Benzo[k]fluoranthene | EPA 8270 | ng/dry g | 50 | |
| Biphenyl | EPA 8270 | ng/dry g | 50 | |
| Chrysene | EPA 8270 | ng/dry g | 50 | |
| Dibenz[a,h]anthracene | EPA 8270 | ng/dry g | 100 | |
| Fluoranthene | EPA 8270 | ng/dry g | 50 | |

| Group/Analyte | Method | Units | RL* | Laboratory |
|---|---|---|---|---|
| Fluorene | EPA 8270 | ng/dry g | 50 | |
| Indeno[1,2,3-c,d]pyrene | EPA 8270 | ng/dry g | 100 | |
| Naphthalene | EPA 8270 | ng/dry g | 50 | |
| Perylene | EPA 8270 | ng/dry g | 50 | |
| Phenanthrene | EPA 8270 | ng/dry g | 50 | |
| Pyrene | EPA 8270 | ng/dry g | 50 | |
| **Polybrominated Diphenyl Ethers (PBDEs)** | | | | |
| BDE 17 | GCMS-NCI | ng/dry g | 0.1 | Physis |
| BDE 28 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 47 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 49 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 66 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 85 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 99 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 100 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 138 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 153 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 154 | GCMS-NCI | ng/dry g | 0.1 | |
| BDE 183 | GCMS-NCI | ng/dry g | 0.1 | |

*Actual RLs provided by Physis may be lower than those required by the Bight ’13 Monitoring Program.

**Table 3-2. Additional Chemical Analyses Conducted as Special Studies in Sediments from San Diego Lagoons**

| Group/Analyte | Laboratory |
|---|---|
| Contaminants of Emerging Concern (CECs) | Physis/Calscience/Weck |

**Toxicity**

Sediment toxicity samples will be collected and analyzed following the Bight ’13 protocols. The Bight ’13 program will use the following toxicity tests:

- *Eohaustorius estuarius* - 10 day amphipod test.
- *Mytilus galloprovincialis* - 48 hour sediment-pore water interface.

Additional toxicity analyses provided by the Bight Program from other participating agencies as special studies are included in Table 3-3.

**Table 3-3. Additional Toxicity Analyses Conducted as Special Studies in Sediments from San Diego Lagoons**

| Special Study | Laboratory |
|---|---|
| Sediment Toxicity Identification Evaluation in Embayments | SCCWRP/ABC Labs/LACSD/Nautilus |
| Gene Microarray Analysis of Sediment Toxicity Samples | SCCWRP/Bight '13 toxicity testing laboratories |
| Alternative Toxicity Test Species Comparison | LACSD/Bight '13 toxicity testing laboratories |

**Benthic Community Assemblage**

Benthic community assemblage samples will be collected and analyzed following Bight '13 protocols. Samples will be processed and preserved in the field. Samples initially will be sorted to five major phyletic groups for distribution to taxonomists who will identify organisms to species. Weston's taxonomists will utilize the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) Edition 8 for nomenclature and orthography. Additionally, Bight quality assurance/quality control (QA/QC) procedures will be followed both during sorting and during subsequent taxonomic identifications.

## 3.2 Water Quality Sampling

Water quality parameters will be measured at each sediment location prior to the sediment sample collection. Field parameters will be collected using a YSI 6600 data sonde at 6" below surface, mid depth, and 6" above the bottom. Data collected at each site include temperature, depth, salinity, dissolved oxygen, and pH. Salinity measurements must be above 25 ppt in order to meet the acceptability criteria for sampling.

**Table 3-4. Water Quality Parameters**

| Analyte | Method/Instrument | Units | Reporting Limit | Laboratory |
|---|---|---|---|---|
| pH | Field/YSI 6600 | pH Units | 1-14 | Field |
| Salinity | Field/YSI 6600 | PPT | 1-75 | Field |
| Temperature | Field/YSI 6600 | °C | 0-100 | Field |
| Dissolved oxygen | Field/YSI 6600 | mg/l | 0.2 | Field |

## 3.3 Prevention of the Spread of Aquatic Invasive Species

Southern California marine waters are known to have a number of aquatic invasive species. Weston field scientists are aware of and can identify the macro flora and fauna in the region (e.g., *Caulerpa taxifolia*, *Musculista senhousia*, and *Mytilus galloprovincialis*). Since the vessels to be used in the project are routinely stored on dry land, fouling organisms are not anticipated to be an issue. However, many invasive species are difficult to detect and may be entrained in muds, sediment, or the water column, additional measures are recommended.

In order to prevent the spread of aquatic invasive species from one lagoon or harbor to another, the following precautions will be taken:

- All boat surfaces will be inspected for mud/sediment and aquatic vegetation when initially hauled out from a given water body. Any observed sediment or vegetation will be cleaned off the boat at the site, including the trailer wheels and frame.
- All sampling equipment will be inspected for mud/sediment and aquatic vegetation and cleaned as necessary. Most equipment will be rinsed and decontaminated at the completion of each sampling station, and a final inspection will be conducted prior de-mobilizing and before leaving each water body.
- All personal gear, especially footwear, will be inspected and cleaned before leaving each water body.
- No site water will be transferred between water bodies or discharged from one to another.

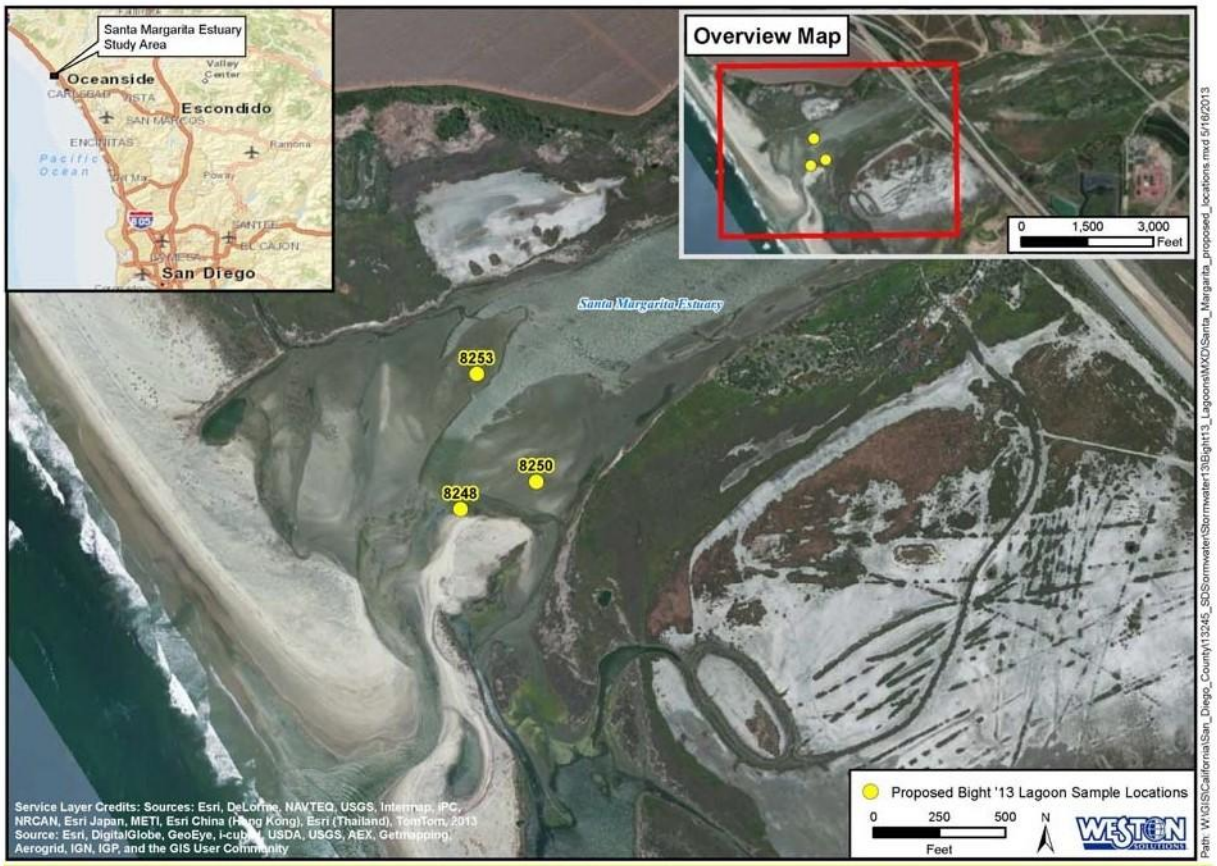
# 4.0 DATA MANAGEMENT AND REPORTING

The current workplan provides for data collection and submittal of electronic deliverables to SCCWRP. All sample results will be reviewed for adherence to the quality guidelines provided by the individual technical workgroups. Results will undergo thorough quality control review, will be entered into a data sharing template, and will be submitted to SCWWRP.

Data analysis and reporting will be included in the first Transitional Annual Monitoring Report due to the RWQCB in January 2015 prior to the release of the Bight '13 work product in approximately 2018.

# APPENDIX A

# Station Location Maps


Santa Margarita Estuary Study Area
Oceanside
Escondido
San Diego
Overview Map
0 1,500 3,000 Feet
Santa Margarita Estuary
8253
8250
8248
Proposed Bight '13 Lagoon Sample Locations
0 250 500 Feet
N
WESTON SOLUTIONS
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013 Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Oceanside
Escondido
Agua Hedionda Lagoon Study Area
San Diego
Chula Vista
Overview Map
0 0.5 1 Miles
Agua Hedionda Lagoon
8222
8218
8219
Proposed Bight '13 Lagoon Sample Locations
0 500 1,000 Feet
N
WESTON SOLUTIONS

Oceanside
Escondido
Batiquitos Lagoon Study Area
Pacific Ocean
San Diego
Chula Vista
Overview Map
0 2,000 4,000 Feet
Batiquitos Lagoon
Batiquitos Lagoon
8205
8202
8200
Proposed Bight '13 Lagoon Sample Locations
0 350 700 Feet
N
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
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Overview Map
0 1,200 2,400 Feet
8188
San Elijo Lagoon
8189
Oceanside
Escondido
San Elijo Lagoon Study Area
Pacific Ocean
San Diego
Chula Vista
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
N
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
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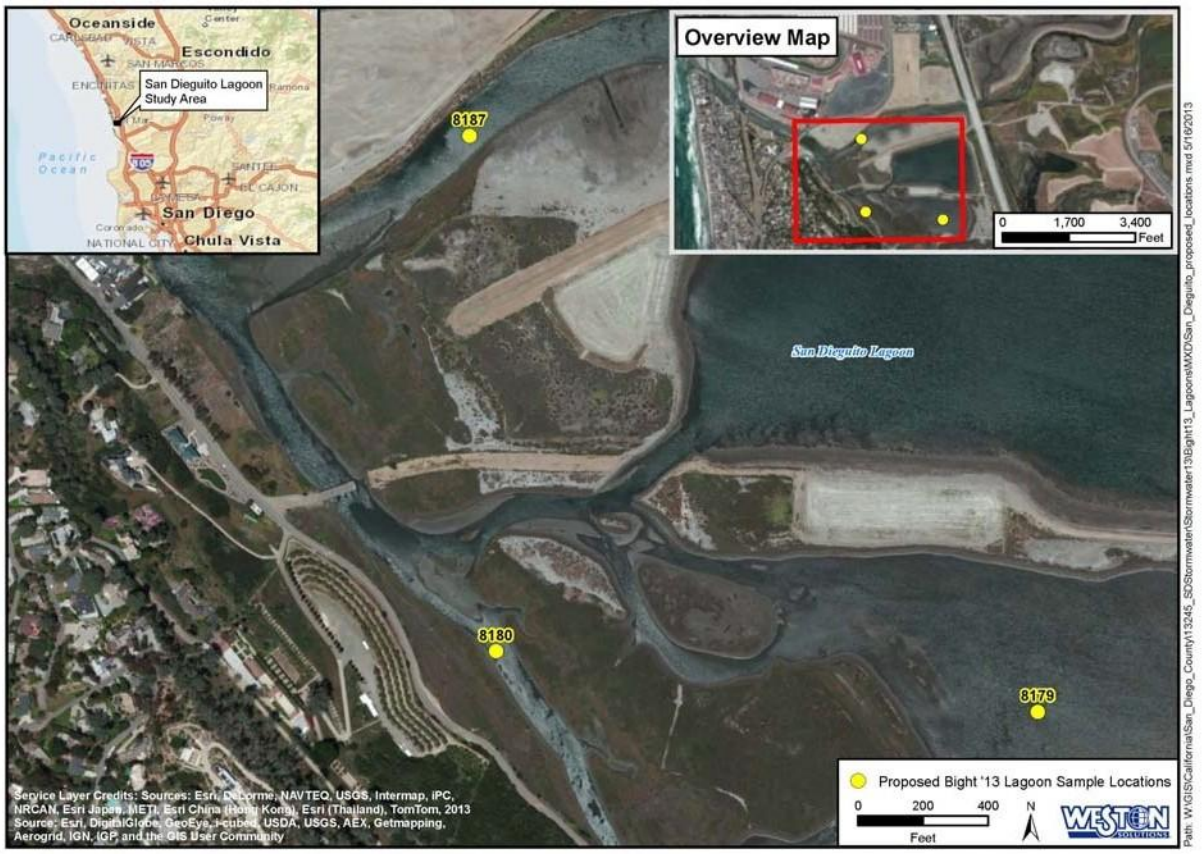
Oceanside
Escondido
San Dieguito Lagoon Study Area
San Diego
Chula Vista
Overview Map
0 1,700 3,400 Feet
San Dieguito Lagoon
8187
8180
8179
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
N
WESTON SOLUTIONS
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013 Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
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Oceanside
Escondido
Los Peñasquitos Lagoon Study Area
San Diego
Chula Vista
Overview Map
0 1,500 3,000 Feet
Los Peñasquitos Lagoon
8176
8169
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
N
WESTON SOLUTIONS
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013 Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
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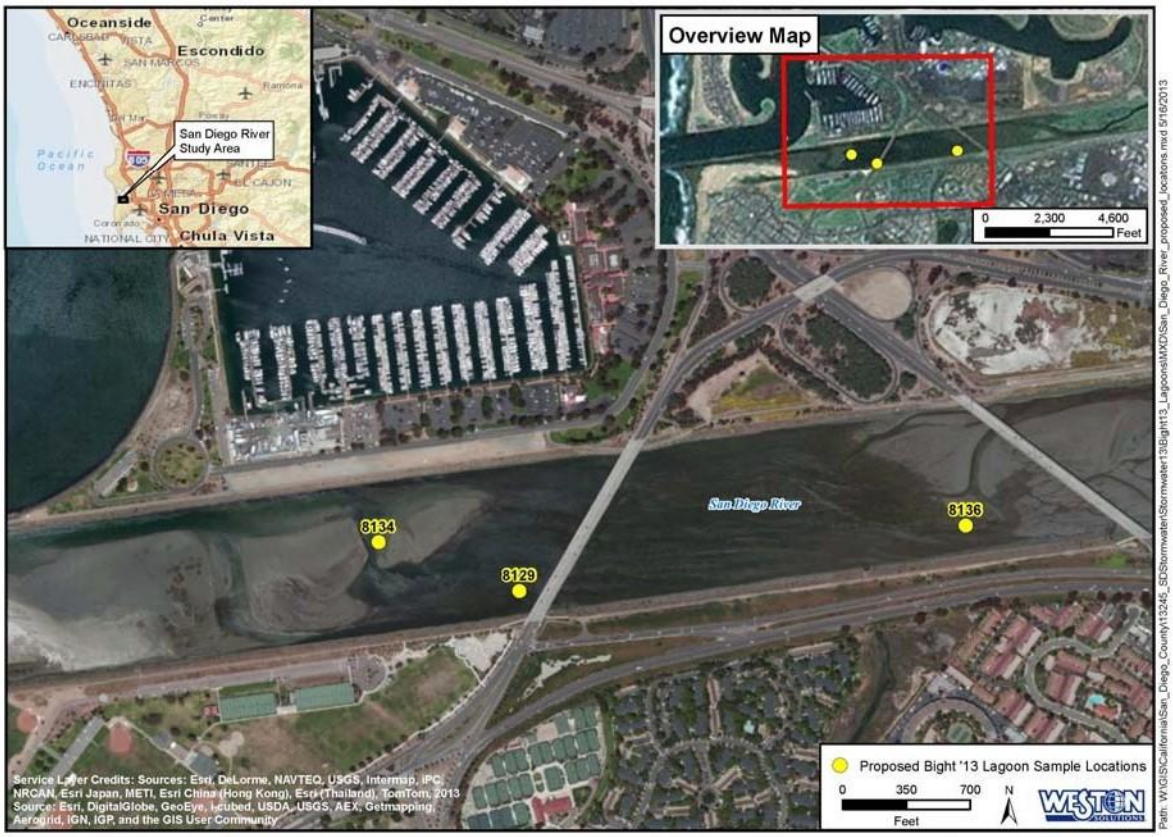
Oceanside
Escondido
San Diego River Study Area
San Diego
Chula Vista
Overview Map
0 2,300 4,600 Feet
San Diego River
8134
8129
8136
Proposed Bight '13 Lagoon Sample Locations
0 350 700 Feet
N
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
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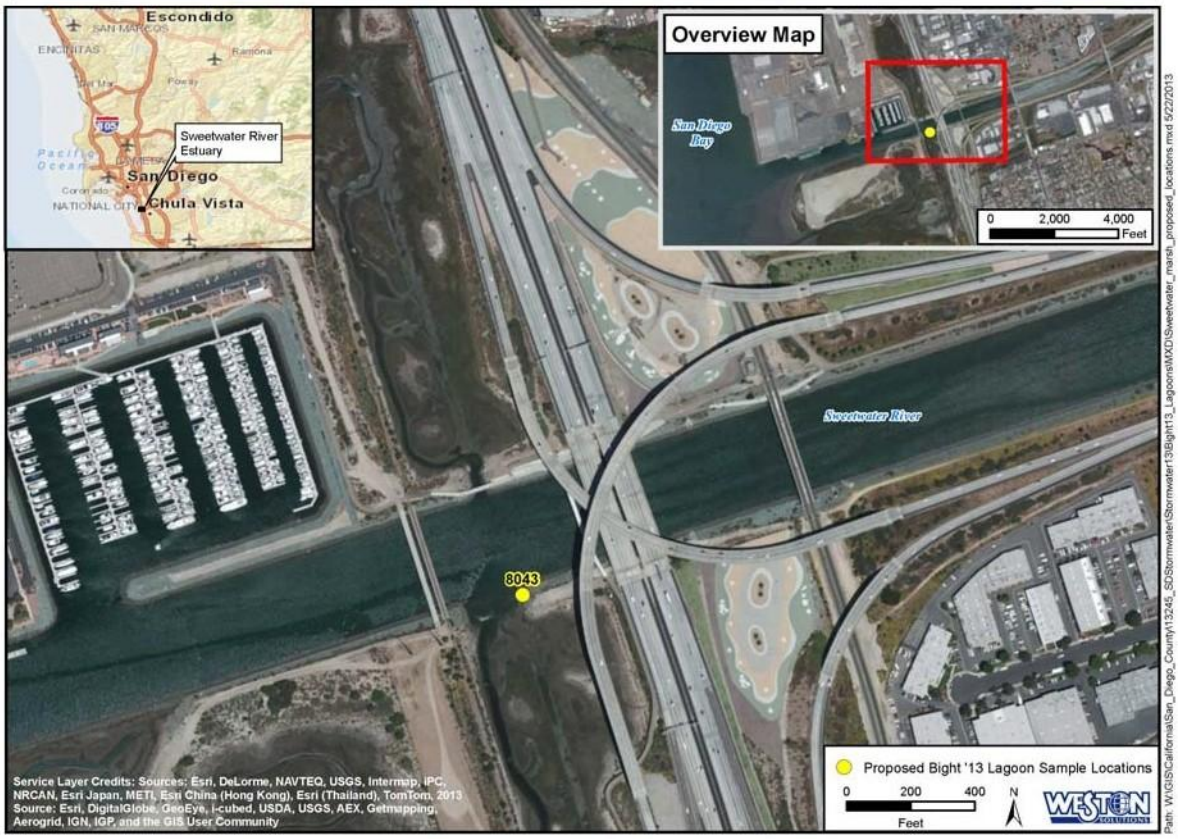
Escondido
Sweetwater River Estuary
San Diego
Chula Vista
Overview Map
San Diego Bay
0 2,000 4,000 Feet
Sweetwater River
8043
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
N
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
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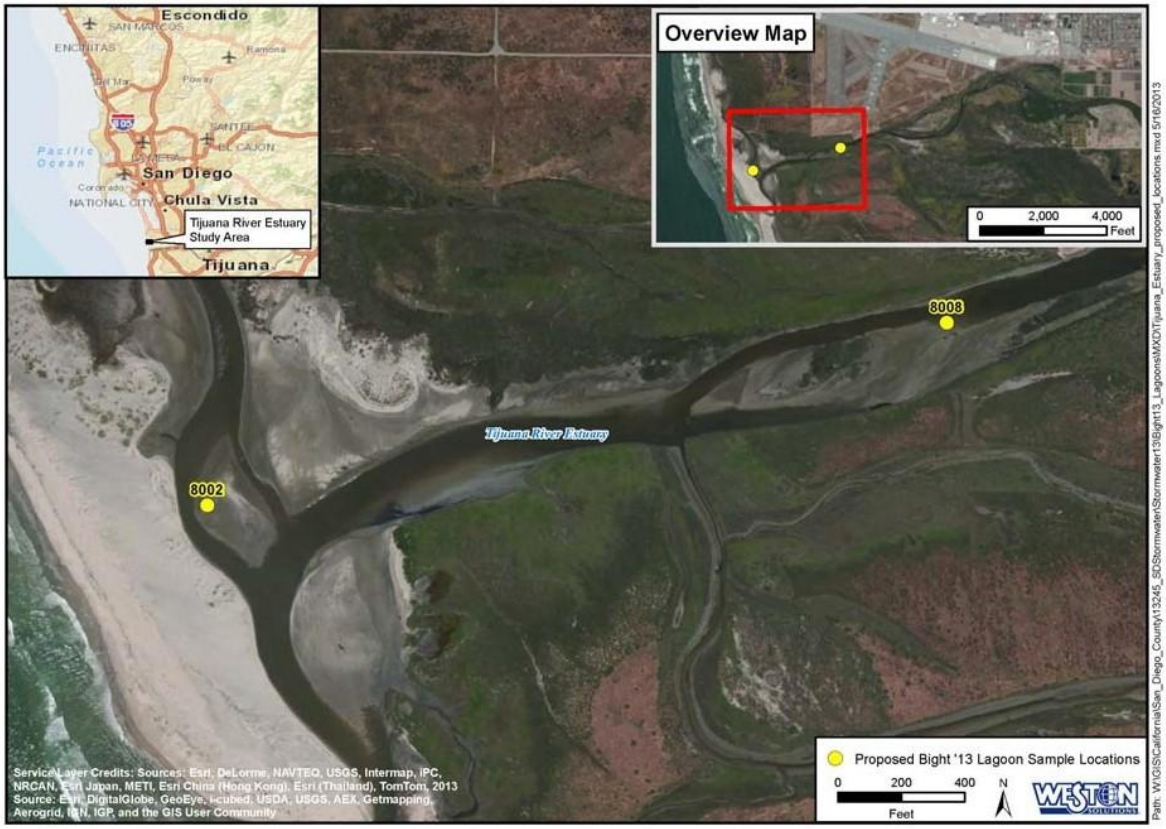
Escondido
SAN MARCOS
ENCINITAS
Ramona
Del Mar
Poway
SANTEE
EL CAJON
Pacific Ocean
MESA
San Diego
Coronado
NATIONAL CITY
Chula Vista
Tijuana River Estuary Study Area
Tijuana
Overview Map
0 2,000 4,000 Feet
8008
Tijuana River Estuary
8002
Proposed Bight '13 Lagoon Sample Locations
0 200 400 Feet
N
WESTON SOLUTIONS
Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013 Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
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# APPENDIX B

# Bight '13 Contaminant Impact Assessment Workplan
# (Separate attachment)

# APPENDIX C

# Bight '13 Contaminant Impact Assessment Quality Assurance Manual (Separate attachment)

# San Diego County Municipal Copermittees 2014 Sampling and Analysis Plan for Bight '13 Follow-Up Investigations FINAL

**Prepared For:**

**County of San Diego Municipal Copermittees**

**May 2014**

# San Diego County Municipal Copermittees 2014 Sampling and Analysis Plan for Bight '13 Follow-Up Investigations

## FINAL

**Prepared For:**

**County of San Diego Municipal Copermittees**

**Prepared By: Weston**

**Solutions, Inc.**
5817 Dryden Place, Ste 101
Carlsbad, California 92008

May 2014

## TABLE OF CONTENTS

1.0 Introduction ..... 1
1.1 Background ..... 1
1.2 Regulatory Commitment ..... 1
1.3 Technical Approach ..... 2
2.0 MATERIALS AND METHODS ..... 2
2.1 Field Collection Program ..... 2
2.1.1 Sampling Locations ..... 4
2.1.2 Navigation ..... 9
2.1.3 Sediment Sampling and Handling ..... 9
2.1.4 Water Quality Sampling and Handling ..... 10
2.1.5 Prevention of the Spread of Aquatic Invasive Species ..... 11
2.1.6 Shipping ..... 11
2.1.7 Documentation of Chain-of-Custody ..... 12
2.2 Physical and Chemical Analysis ..... 12
2.2.1 Sediment Samples ..... 12
2.2.2 Water Samples ..... 15
2.2.3 Quality Assurance/Quality Control ..... 15
2.3 Toxicity Testing ..... 16
2.3.1 Solid Phase Testing ..... 16
2.3.2 Sediment-Water Interface Testing ..... 18
2.3.3 Stressor Identification Studies ..... 19
2.4 Benthic Infauna Analysis ..... 20
2.5 Data Review, Management and Analysis ..... 21
2.5.1 Data Review ..... 21
2.5.2 Data Management ..... 21
2.5.3 Data Analysis ..... 21
2.6 Reporting ..... 25
2.6.1 Draft and Final Reports ..... 25
2.6.2 Quality Assurance/Quality Control and Laboratory Data Report ..... 25
2.7 Schedule ..... 25
3.0 REFERENCES ..... 26

Appendix A Field Sediment Sampling Log
Appendix B Chain-of-Custody Form

## LIST OF TABLES

Table 2-1. Sample Locations and Analyses ..... 4
Table 2-2. Analytical Laboratories and Shipping Information ..... 11
Table 2-3. Chemical and Physical Parameters for Sediment Samples ..... 13
Table 2-4. Chemical and Physical Parameters for Water Samples ..... 15
Table 2-5. Toxicity Testing Proposed to Evaluate the Benthic Condition of San Diego County Bays and Lagoons ..... 16
Table 2-6. Conditions for the 10-Day Solid Phase Bioassay with *E. estuarius* ..... 17
Table 2-7. Conditions for the 48-Hour Sediment-Water Interface Bioassay with ..... 19
Table 2-8. Sediment Toxicity Categorization Values for *E. estuarius* ..... 22
Table 2-9. Sediment Toxicity Categorization Values for *M. galloprovincialis* ..... 22
Table 2-10. Sediment Chemistry Guideline Categorization ..... 23
Table 2-11. Benthic Index Categorization Values for Southern California Marine Bays ..... 23
Table 2-12. Schedule of Activities ..... 25

## LIST OF FIGURES

Figure 2-1. Proposed Sampling Locations within Agua Hedionda Lagoon ..... 5
Figure 2-2. Proposed Sampling Locations within Batiquitos Lagoon ..... 6
Figure 2-3. Proposed Sampling Locations within San Dieguito Lagoon ..... 7
Figure 2-4. Proposed Sampling Locations within San Diego River Estuary ..... 8
Figure 2-5. Van Veen Grab Sampler ..... 10

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ABLM | Ambient Bay and Lagoon Monitoring |
| ALS | ALS Environmental |
| ANOSIM | analysis of similarities |
| APHA | American Public Health Association |
| ASTM | American Society for Testing and Materials |
| AVS-SEM | acid volatile sulfide – simultaneously extracted metals |
| Bight '03 | Bight 2003 Regional Monitoring Program |
| Bight '08 | Bight 2008 Regional Monitoring Program |
| Bight '13 | Bight 2013 Regional Monitoring Program |
| BRI | Benthic Response Index |
| Cal EPA | California Environmental Protection Agency |
| CA LRM | California Logistic Regression Model |
| $CdCl_2$ | cadmium chloride |
| COC | chain-of-custody |
| Copermittees | San Diego Regional Copermittees |
| CSI | Chemical Score Index |
| $CuCl_2$ | copper chloride |
| CVAA | cold vapor atomic absorption |
| DD | decimal degrees |
| DGPS | Differential Global Positioning System |
| DO | dissolved oxygen |
| DOC | dissolved organic carbon |
| $EC_{50}$ | median effective concentration |
| ER-L | effects range–low |
| ER-M | effects range–median |
| GC/MS | gas chromatography/mass spectrometry |
| HSD | honestly significant difference |
| IBI | Index of Biotic Integrity |
| ICP-AES | inductively coupled plasma-atomic emission spectrometry |
| ICP/MS | inductively coupled plasma/mass spectrometry |
| ID | inner diameter |
| $LC_{50}$ | median lethal concentration |
| LOE | line of evidence |
| MDLs | method detection limits |
| MDS | multidimensional scales |
| $MgSO_4$ | magnesium sulfate |
| MLOE | multiple lines of evidence |
| Nautilus | Nautilus Environmental |
| NCI | negative chemical ionization |
| $NH_4$ | ammonium chloride |
| PAHs | polycyclic aromatic hydrocarbons |
| PCBs | polychlorinated biphenyls |
| pH | hydrogen ion concentration |

| | |
|---|---|
| $P_{MAX}$ | maximum probability model |
| PRIMER | Plymouth Routines in Multivariate Ecological Research |
| QA | quality assurance |
| QC | quality control |
| RBI | Relative Benthic Index |
| RIVPACS | River Invertebrate Prediction and Classification System |
| SAP | Sampling and Analysis Plan |
| SCAMIT | Southern California Association of Marine Invertebrate Taxonomists |
| SCCWRP | Southern California Coastal Water Research Project |
| SIM | selective ion monitoring |
| SIMPER | similarity percentages |
| SM | Standard Methods |
| SOPs | Standard Operating Procedures |
| SP | solid phase |
| SQOs | Sediment Quality Objectives |
| SVOCs | semi-volatile organic compounds |
| SWI | sediment-water interface |
| SWRCB | State Water Resources Control Board |
| TIE | toxicity identification evaluation |
| TOC | total organic carbon |
| TSS | total suspended solids |
| USEPA | United States Environmental Protection Agency |
| Weck | Weck Laboratories, Inc. |
| WESTON | Weston Solutions, Inc. |
| WGS 84 | World Geodetic System 1984 |

## UNITS OF MEASURE

| | |
|---|---|
| cm | centimeter |
| °C | degrees Celsius |
| L | liter |
| µg/kg | microgram per kilogram |
| µm | micrometer |
| m | meter |
| mg | milligram |
| mg/kg | milligram per kilogram |
| mg/L | milligram per liter |
| mL | milliliter |
| mm | millimeter |
| ppt | parts per thousand |
| % | percent |

# 1.0 INTRODUCTION

The purpose of this Sampling and Analysis Plan (SAP) is to outline the activities that will be conducted by the San Diego Regional Copermittees (Copermittees) to satisfy the Sediment Quality Objective (SQO) requirement for possibly impacted sites identified as part of the Bight 2013 Lagoon Sediment Monitoring (Bight '13).

In 2003, the State Water Resources Control Board (SWRCB) initiated a program to develop SQOs for enclosed bays and estuaries. The primary objective is to protect benthic communities and aquatic life from exposure to contaminants in sediment. The Phase I SQOs are based on a multiple lines of evidence (MLOE) approach in which the lines of evidence (LOE) are sediment toxicity, sediment chemistry, and benthic community condition, as described in the *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (SWRCB and California Environmental Protection Agency [Cal EPA], 2009) (Sediment Control Plan). Phase I SQOs have been approved by the SWRCB and Office of Administrative Law. Regional Water Quality Control Board Order R9-2013-0001 (Permit) requires the Copermittees to perform sediment monitoring to assess compliance with sediment quality receiving limits applicable to MS4 discharges to enclosed bays and estuaries in accordance with the Sediment Control Plan. The Permit also requires the Copermittees to participate in Bight Regional Monitoring. The Copermittees participated in the Bight '13 Contaminant Impact Assessment Program by conducting lagoon monitoring during summer 2013. A total of 22 sample stations were collected throughout the nine lagoons/estuaries within the San Diego Region. Of the 22 sample stations four were identified as possibly impacted with one site in each of the following lagoons: Agua Hedionda Lagoon, Batiquitos Lagoon, San Dieguito Lagoon, and San Diego Estuary. The four possibly impacted sites were recommended for follow-up activities. This SAP details the follow-up investigations to confirm and characterize the possibly impacted lagoon sites.

## 1.1 Background

The aquatic health of the San Diego estuaries and lagoons were assessed as part of the previous Bight Surveys in 2003 (Bight '03), 2008 (Bight '08), and most recently during 2013 (Bight '13). Lagoons and estuaries were also assessed in the Copermittees' three-year Ambient Bay and Lagoon Monitoring (ABLM) Program from 2003-2005 and from 2010-2012. Additionally in 2008-2013, the sediment conditions within San Diego estuaries were evaluated following the protocols of the Sediment Control Plan.

## 1.2 Regulatory Commitment

The San Diego Permit was adopted on May 8, 2013. Section D.1.e.(1).(b) of the Permit requires the Copermittees to participate in the Southern California Bight Regional Monitoring. The Copermittees' Regional Monitoring Workgroup participated in the Bight '13 Survey by providing in-kind services. The Copermittees contributed to the Bight '13 Survey by sampling up to 22 lagoon stations within the San Diego Region. This participation provides data useful in addressing the goals of the Monitoring and Assessment Sections of the Permit and satisfies the requirements of the Sediment Control Plan. Furthermore, the Copermittee's contribution to the Bight Survey will build on an existing dataset that provides a regional assessment of the coastal

marine health, while simultaneously providing a local assessment of the San Diego Region Lagoons.

In accordance with the Sediment Control Plan follow-up confirmation monitoring will be conducted for the results with possibly impacted SQO scores. One location in each of the following lagoons received a possibly impacted SQO score:

- Agua Hedionda Lagoon (Bight 13' Station 8222)
- Batiquitos Lagoon (Bight 13' Station 8202)
- San Dieguito Lagoon (Bight 13' Station 8179)
- San Diego River Estuary (Bight 13' Station 8136)

The remaining 18 stations were classified with unimpacted or likely unimpacted SQO scores. Based on the Bight '13 Lagoon Monitoring, the following lagoons do not require any follow-up actions at this time:

- Santa Margarita River Estuary
- San Elijo Lagoon
- Los Penasquitos Lagoon
- Sweetwater River Estuary
- Tijuana River Estuary

## 1.3 Technical Approach

This SAP is designed to provide data needed to answer questions related to characterizing the possibly impacted sites identified during the Bight '13 Monitoring Program. The goal is to characterize whether physical, chemical, or other potential stressors are contributing to the observed conditions in each follow-up lagoon location. The study follows a similar approach as during the previous follow-up studies conducted from 2010-2012 as part of the ABLM Program. However, special considerations will be needed and are discussed for each lagoon.

# 2.0 MATERIALS AND METHODS

## 2.1 Field Collection Program

Based on the results from the Bight '13 Lagoon Monitoring, sediment quality follow-up monitoring will be conducted in focused study areas in Agua Hedionda Lagoon, Batiquitos Lagoon, San Dieguito Lagoon, and San Diego River Estuary. One location in each of the lagoons/estuaries received a possibly impacted SQO score. To confirm the result at each location to determine response to changes in the physical environment, a sufficient number of samples must be collected to examine the patterns. Each sampling site will include three replicate samples of benthic condition (benthic community condition, sediment toxicity, sediment chemistry) on a relatively small spatial scale (10-15 meters [m]), and one replicate water quality station placed at the original location. The water quality characteristics are expected to be similar

on smaller spatial scales; therefore, only one water quality station will be used to describe the water quality within each of the sample sites.

To determine the physical and chemical factors that influence the distribution of organisms the following metrics will be used:

1. Sediment quality (3 samples per water quality station):
    a. Sediment physical and chemical analyses at the four lagoons/estuaries: grain size, total organic carbon (TOC), metals, synthetic pyrethroids, organochlorine pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs), ammonia, nutrients, total sulfides
    b. Additional sediment chemical analyses at San Diego River Estuary to determine bioavailability of metals to benthic organisms: acid volatile sulfide – simultaneously extracted metals (AVS-SEM)
    c. Sediment toxicity
        i. 10-day acute solid phase (SP) test with the amphipod *Eohaustorius estuarius*
        ii. 48-hr sediment-water interface (SWI) test with the mussel larvae *Mytilus galloprovincialis*
    d. Benthic community
        i. Traditional taxonomic techniques will be used to describe benthic communities
        ii. SQO benthic indices and marine indices will be calculated for comparison
    e. Stressor Identification Studies may be conducted based on a review of sediment quality objective results and data comparisons
2. Water quality measurements will be collected at one water quality station in each lagoon/estuary. A YSI 6600 Multiparameter Water Quality Sonde will be deployed for a minimum of two weeks at each water quality station. In addition, discrete water samples will be collected. Data to be collected will include:
    a. Temperature
    b. Salinity
    c. Dissolved oxygen (DO)
    d. Hydrogen ion concentration (pH)
    e. Dissolved organic carbon (DOC)
    f. Chlorophyll-a
    g. Nutrients (total nitrogen and total phosphorus)
    h. TSS

Prior to all field activities, encroachment permits will be obtained from the respective agency maintaining jurisdiction over the lagoon to be monitored (permits should be obtained within 2 months prior to the planned sampling). All sampling equipment will be deployed using inflatable Zodiac® type vessels or other applicable vessel.

Analytical chemistry for sediment and water will be provided by ALS Environmental (ALS) and Weck Laboratories, Inc. (Weck). Nautilus Environmental (Nautilus) will perform biological testing for SP and SWI analyses. Benthic infaunal and grain size analysis will be conducted by Weston Solutions, Inc (WESTON).

### 2.1.1 Sampling Locations

The proposed follow-up sampling locations for each of the four lagoons/estuaries are presented in Table 2-1. The Bight '13 station for which the follow-up monitoring is occurring is also provided for reference. Each of the four lagoons/estuaries consists of one sampling site. As described above, each sampling site includes three replicate samples of benthic condition (benthic community condition, sediment toxicity, sediment chemistry), and one replicate water quality station placed at the original Bight '13 location. Specific locations of each sampling site are presented in maps on the following pages (Figure 2-1 through Figure 2-4).

**Table 2-1. Sample Locations and Analyses**

| Lagoon or Estuary | Bight '13 Site ID | ABLM 2014 Site ID | Latitude | Longitude | Analysis |
|---|---|---|---|---|---|
| **Agua Hedionda Lagoon** | 8222 | AH14 | 33.14010 | -117.32430 | Water Quality/Chemistry |
| | | AH14-A | 33.14020 | -117.32421 | Sediment Chemistry, Toxicity, and Benthic Infauna |
| | | AH14-B | 33.13998 | -117.32423 | |
| | | AH14-C | 33.14009 | -117.32446 | |
| **Batiquitos Lagoon** | 8202 | BL14 | 33.08810 | -117.29130 | Water Quality/Chemistry |
| | | BL14-A | 33.08823 | -117.29128 | Sediment Chemistry, Toxicity, and Benthic Infauna |
| | | BL14-B | 33.08804 | -117.29117 | |
| | | BL14-C | 33.08803 | -117.29142 | |
| **San Dieguito Lagoon** | 8179 | SDL14 | 32.96610 | -117.25250 | Water Quality/Chemistry |
| | | SDL14-A | 32.96621 | -117.25240 | Sediment Chemistry, Toxicity, and Benthic Infauna |
| | | SDL14-B | 32.96597 | -117.25245 | |
| | | SDL14-C | 32.96612 | -117.25266 | |
| **San Diego River Estuary** | 8136 | SDR14 | 32.75790 | -117.22740 | Water Quality/Chemistry |
| | | SDR14-A | 32.75801 | -117.22731 | Sediment Chemistry, AVS-SEM, Toxicity, and Benthic Infauna |
| | | SDR14-B | 32.75777 | -117.22734 | |
| | | SDR14-C | 32.75791 | -117.22756 | |

**Figure 2-1. Proposed Sampling Locations within Agua Hedionda Lagoon**

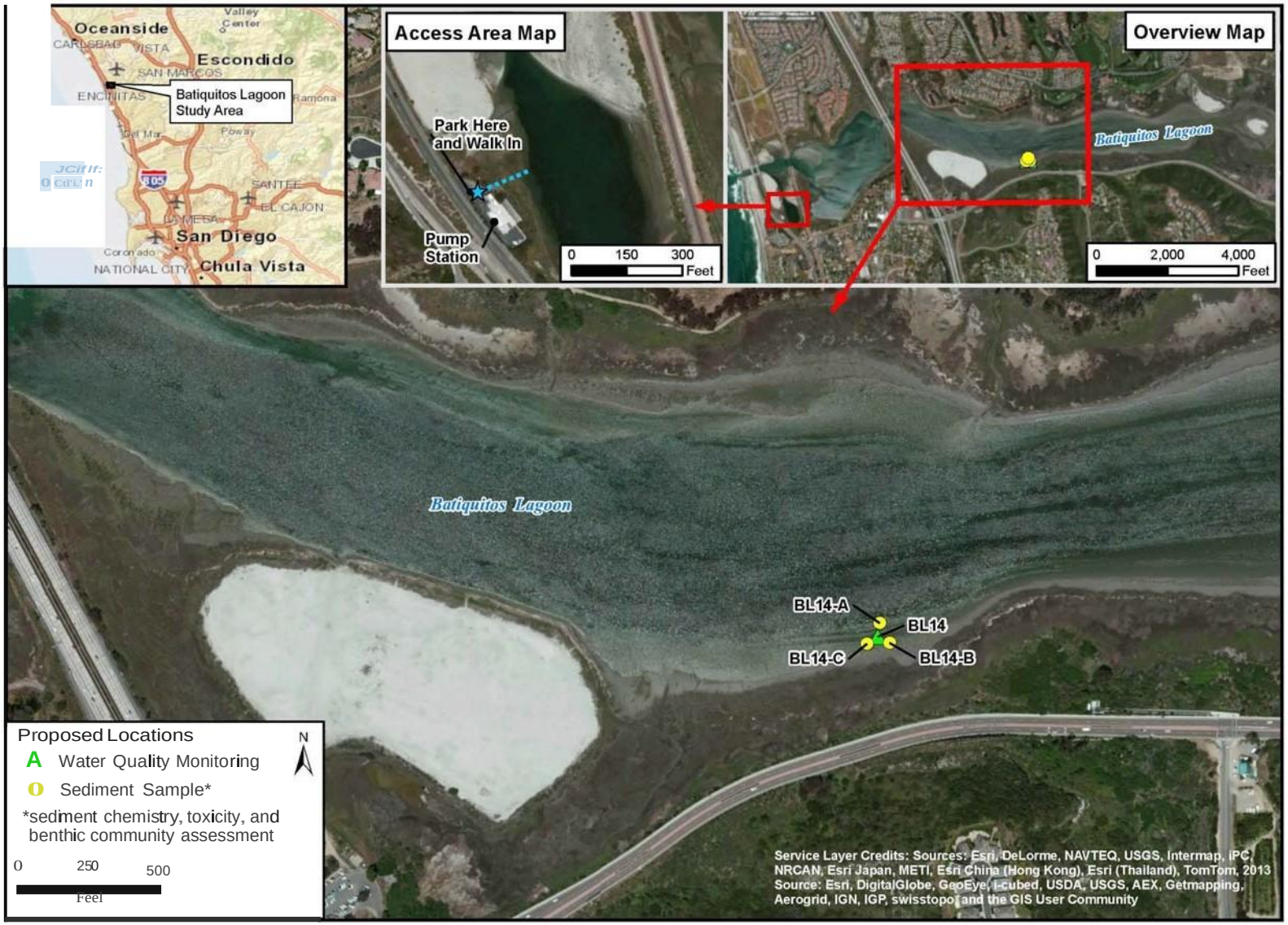


**Figure 2-2. Proposed Sampling Locations within Batiquitos Lagoon**

**Figure 2-3. Proposed Sampling Locations within San Dieguito Lagoon**

**Figure 2-4. Proposed Sampling Locations within San Diego River Estuary**

### 2.1.2 Navigation

All station locations will be pre-plotted prior to sampling activities. Locations will be located using a Furuno GP 1650D Differential Global Positioning System (DGPS) or similar type GPS. The system uses U.S. Coast Guard differential correction data, and is accurate within 10 ft. All final station locations will be recorded in the field using positions from the DGPS.

### 2.1.3 Sediment Sampling and Handling

Benthic sediments will be collected using a stainless steel, 0.1-$m^2$ Van Veen grab sampler (Figure 2-5). A sample will be determined to be acceptable if the surface of the grab is even, there is minimal surface disturbance, and there is a penetration depth of at least five centimeters (cm). Rejected grabs will be discarded and re-sampled. Upon retrieval, if the grab is acceptable, the overlying water will be carefully drained, and the sediment will be processed depending on analysis and use. Data will be logged onto field data sheets (Appendix A). All Van Veen equipment will be cleaned prior to sampling. Between sampling locations, the Van Veen grab sampler and stainless steel scoop will be rinsed with site water. Sediment grabs will be collected for the following analyses: benthic infauna, chemistry, grain size, and toxicity.

Samples collected for benthic infaunal analysis will be rinsed through a 1.0 millimeter (mm) mesh screen. The material retained on the screen will be transferred to a labeled quart jar. A 7 percent (%) magnesium sulfate ($MgSO_4$) seawater solution will be added to relax the collected specimens. After 30 minutes, the samples will be fixed in a 10% buffered formalin solution.

Sediment chemistry and toxicity samples will be collected from the top 5 cm of the grab using a pre-cleaned stainless steel scoop. Sediment within 1 cm of the sides of the grab will be avoided to prevent interaction of any contaminants and the steel sampling device. Approximately 10 liters (L) of sediment will be collected for acute and chronic toxicity testing and placed in clean food-grade polyethylene bags. Sediment for chemical analyses will be placed in 250 milliliter (mL) certified clean glass jars with Teflon®-lined lids. Sediment collected for grain size will be placed in quart-sized Ziploc™ bags. All sediment samples will be logged on a chain-of-custody (COC) form (see Section 2.1.7) and placed in a cooler on ice until delivered to WESTON's Carlsbad Office. At WESTON, sediment samples will be stored at 4 degrees Celsius (°C) in the dark until delivered to the appropriate laboratory for analysis. ALS will analyze the sediment samples for metals, PCBs, PAHs, organochlorine pesticides, ammonia, total sulfides, AVS-SEM (only for San Diego River Estuary), total nitrogen, total phosphorus, percent solids, and TOC. Weck will analyze the sediment for synthetic pyrethroids. WESTON will conduct the grain size and benthic infaunal analysis. Nautilus will perform the acute and chronic toxicity testing.

**Figure 2-5. Van Veen Grab Sampler**

### 2.1.4 Water Quality Sampling and Handling

Water quality sampling will be conducted using YSI 6600 Multiparameter Water Quality Sondes. The YSI meter will be deployed for a minimum of two weeks at each water quality station to capture both the spring and neap tide. Water quality data collected will include depth, temperature, salinity, DO, and pH. YSI sondes will be attached to an anchored mounting support and placed horizontally approximately six inches above the SWI. A surface buoy will be used to mark the location of the sonde unless it poses a navigational hazard. The sondes will be set up to log data at 15 minute intervals. Recorded sonde data will be saved in the unit's internal memory until downloaded on a computer upon retrieval from the field.

In addition, discrete water samples will be collected 6 inches above the sediment water interface using a Niskin bottle. Water samples will be transferred to labeled containers for analysis of TSS, DOC, chlorophyll-a, total nitrogen, and total phosphorus.

All water samples will be logged on a COC form (see Section 2.1.7) and placed in a cooler on ice until delivered to WESTON's Carlsbad Office. At WESTON, water samples will be stored at 4°C in the dark until shipped or delivered to Weck for analysis. All water samples will be delivered within 24 hours of collection.

### 2.1.5 Prevention of the Spread of Aquatic Invasive Species

Southern California marine waters are known to have a number of aquatic invasive species. WESTON field scientists are aware of and can identify the macro flora and fauna in the region (e.g., *Caulerpa taxifolia*, *Musculista senhousia*, and *Mytilus galloprovincialis*). Since the vessels to be used in the project are routinely stored on dry land, fouling organisms are not anticipated to be an issue. However, many invasive species are difficult to detect and may be entrained in muds, sediment, or the water column, additional measures are recommended.

In order to prevent the spread of aquatic invasive species from one lagoon or harbor to another, the following precautions will be taken:

- All boat surfaces will be inspected for mud/sediment and aquatic vegetation when initially hauled out from a given water body. Any observed sediment or vegetation will be cleaned off the boat at the site, including the trailer wheels and frame.
- All sampling equipment will be inspected for mud/sediment and aquatic vegetation and cleaned as necessary. Most equipment will be rinsed and decontaminated at the completion of each sampling station, and a final inspection will be conducted prior to de-mobilizing and before leaving each water body.
- All personal gear, especially footwear, will be inspected and cleaned before leaving each water body.
- No site water will be transferred between water bodies or discharged from one to another.

### 2.1.6 Shipping

Prior to shipping, sample containers will be placed in sealable plastic bags and securely packed inside the cooler with ice. COC forms will be filled out (see Section 2.1.7), and the original signed COC forms will be inserted in a sealable plastic bag and placed inside the cooler. The cooler lids will be securely taped shut and then delivered to the analytical laboratories listed in Table 2-2.

**Table 2-2. Analytical Laboratories and Shipping Information**

| Laboratory | Volume (per sample) | Analyses Performed | Shipping Information |
|---|---|---|---|
| Nautilus Environmental | 5L sediment (SP toxicity testing), 5L (SWI toxicity testing), | Toxicity testing (SP and SWI) | Nautilus Environmental<br>4340 Vandever Avenue<br>San Diego, CA 92120 |
| ALS Environmental | 500 mL sediment | Sediment chemistry | ALS Environmental<br>1317 South 13th Ave<br>Kelso, WA 98626 |
| Weck Laboratories, Inc | 250 mL sediment, 2L water | Sediment (synthetic pyrethroids only) and water chemistry | Weck Laboratories<br>14859 E. Clark Ave<br>City of Industry, CA 91745 |
| Weston Solutions, Inc. | 250 mL sediment, benthic infaunal samples (varies) | Grain size and benthic infaunal analysis | Weston Solutions, Inc.<br>5817 Dryden Place, Ste 101<br>Carlsbad, CA 92008 |

### 2.1.7 Documentation of Chain-of-Custody

This section describes the program requirements for sample handling and COC procedures. Samples are considered to be in custody if they are: (1) in the custodian's possession or view, (2) retained in a secured place (under lock) with restricted access, or (3) placed in a secured container. The principal documents used to identify samples and to document possession are COC records, field log books, and field tracking forms. COC procedures will be used for all samples throughout the collection, transport, and analytical process, and for all data and data documentation, whether in hard copy or electronic format.

COC procedures will be initiated during sample collection. A COC record will be provided with each sample or sample group (sample form provided in Appendix B). Each person who has custody of the samples will sign the form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include the following:

- Sample identification
- Sample collection date and time
- Any special notations on sample characteristics
- Initials of the person collecting the sample
- Date the sample was sent to the laboratory
- Shipping company and waybill information

The completed COC form will be placed in a sealable plastic envelope that will travel inside the ice chest containing the listed samples. The COC form will be signed by the person transferring custody of the samples. The condition of the samples will be recorded by the receiver. COC records will be included in the final analytical report prepared by the laboratory, and will be considered an integral part of that report.

## 2.2 Physical and Chemical Analysis

Physical and chemical measurements of water and sediment in the Sediment Monitoring Program were selected to provide data on chemicals of potential concern in bays and estuaries located in San Diego County. All analytical methods used to obtain contaminant concentrations will follow United States Environmental Protection Agency (USEPA), Standard Methods (SM 21$^{st}$ Edition; American Public Health Association [APHA], 2005), or American Society for Testing and Materials (ASTM).

### 2.2.1 Sediment Samples

The specific physical and chemical analyses, analytical methods, target method detection limits (MDLs) and target reporting limits (RLs) for sediment samples are specified in Table 2-3. Physical analyses of sediment will include grain size and percent solids. Grain size is analyzed to determine the general size classes that make up the sediment (e.g., gravel, sand, silt, and clay). The frequency distribution of the size ranges (reported in mm) of the sediment will be reported in

the final data report. Percent solids will also be measured to convert concentrations of the chemical parameters from a wet-weight to a dry-weight basis. Chemical analyses of sediment will include ammonia, TOC, nutrients including total nitrogen and total phosphorus, total sulfides, metals, synthetic pyrethroids, chlorinated pesticides, PCBs, and PAHs. In addition, sediment samples at San Diego River Estuary will be analyzed for AVS-SEM to determine the bioavailability of metals to aquatic organisms.

**Table 2-3. Chemical and Physical Parameters for Sediment Samples**

| Parameter | Method | Procedure | Target Method Detection Limit (dry weight) | Target Reporting Limit (dry weight) |
|---|---|---|---|---|
| **Physical / Conventional Tests** | | | | |
| Ammonia | USEPA 350.1 M | ICP/MS | 0.04 mg/wet kg | 0.5 mg/wet kg |
| Grain Size | Plumb (1981) | Sieve/Pipette | 1.0% | 1.0% |
| Percent Total Solids | USEPA 160.3 M | Gravimetric | 0.1% | 0.1% |
| Total Organic Carbon | USEPA 9060A | Combustion IR | 0.02% | 0.1% |
| Total Nitrogen | USEPA353.2M/ASTM D1426-93B M | NH3/NO2/NO3/TKN | 0.5 mg/kg | 1 mg/kg |
| Total Phosphorus | USEPA 365.3M | Colorimetric | 0.02 mg/kg | 0.1 mg/kg |
| Total Sulfides | USEPA 9030M | Distillation | 0.2 mg/kg | 0.5 mg/kg |
| Sulfides, Acid Volatile | GEN-AVS | ICP-AES | 0.004 µmol/g | 0.016 µmol/g |
| **Metals** | | | | |
| Aluminum (Al) | USEPA 6020A | ICP/MS | 0.4 mg/kg | 2 mg/kg |
| Antimony (Sb) | USEPA 6020A | ICP/MS | 0.02 mg/kg | 0.05 mg/kg |
| Arsenic (As) | USEPA 6020A | ICP/MS | 0.2 mg/kg | 0.5 mg/kg |
| Barium (Ba) | USEPA 6020A | ICP/MS | 0.02 mg/kg | 0.05 mg/kg |
| Beryllium (Be) | USEPA 6020A | ICP/MS | 0.006 mg/kg | 0.02 mg/kg |
| Cadmium (Cd) | USEPA 6020A | ICP/MS | 0.008 mg/kg | 0.02 mg/kg |
| Chromium (Cr) | USEPA 6020A | ICP/MS | 0.05 mg/kg | 0.2 mg/kg |
| Copper (Cu) | USEPA 6020A | ICP/MS | 0.04 mg/kg | 0.1 mg/kg |
| Iron (Fe) | USEPA 6020A | ICP/MS | 2.0 mg/kg | 4.0 mg/kg |
| Lead (Pb) | USEPA 6020A | ICP/MS | 0.005 mg/kg | 0.05 mg/kg |
| Mercury (Hg) | USEPA 7471B | CVAA | 0.002 mg/kg | 0.02 mg/kg |
| Nickel (Ni) | USEPA 6020A | ICP/MS | 0.09 mg/kg | 0.2 mg/kg |
| Selenium | USEPA 6020A | ICP/MS | 0.5 mg/kg | 1.0 mg/kg |
| Silver | USEPA 6020A | ICP/MS | 0.005 mg/kg | 0.02 mg/kg |
| Zinc (Zn) | USEPA 6020A | ICP/MS | 0.2 mg/kg | 0.5 mg/kg |
| **AVS-SEM** | | | | |
| Antimony (Sb) | USEPA 6010C | ICP-AES | 0.0003 µmol/g | 0.008 µmol/g |
| Arsenic (As) | USEPA 6010C | ICP-AES | 0.002 µmol/g | 0.003 µmol/g |
| Cadmium (Cd) | USEPA 6010C | ICP-AES | 0.0002 µmol/g | 0.0004 µmol/g |
| Chromium (Cr) | USEPA 6010C | ICP-AES | 0.0003 µmol/g | 0.001 µmol/g |
| Copper (Cu) | USEPA 6010C | ICP-AES | 0.0005 µmol/g | 0.0013 µmol/g |
| Lead (Pb) | USEPA 6010C | ICP-AES | 0.0005 µmol/g | 0.001 µmol/g |
| Nickel (Ni) | USEPA 6010C | ICP-AES | 0.0003 µmol/g | 0.003 µmol/g |
| Zinc (Zn) | USEPA 6010C | ICP-AES | 0.0003 µmol/g | 0.0031 µmol/g |
| **Synthetic Pyrethroids** | | | | |
| Allethrin | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| Bifenthrin | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| Cyfluthrin | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| Cypermethrin | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| Danitol (Fenpropathrin) | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| Deltamethrin | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| Esfenvalerate | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| Fenvalerate | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| L-Cyhalothrin | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |

## Table 2-3. Chemical and Physical Parameters for Sediment Samples

| Parameter | Method | Procedure | Target Method Detection Limit (dry weight) | Target Reporting Limit (dry weight) |
|---|---|---|---|---|
| Permethrin | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| Prallethrin | GC/MS SIM | GC/MS NCI SIM | 0.5 µg/kg * | 0.5 µg/kg* |
| **Organochlorine Pesticides** | | | | |
| 2,4′-DDD | USEPA 8081B | GC/MS/MS | 0.063 µg/kg | 0.1 µg/kg |
| 2,4′-DDE | USEPA 8081B | GC/MS/MS | 0.079 µg/kg | 0.1 µg/kg |
| 2,4′-DDT | USEPA 8081B | GC/MS/MS | 0.94 µg/kg | 0.1 µg/kg |
| 4,4′-DDD | USEPA 8081B | GC/MS/MS | 0.035 µg/kg | 0.1 µg/kg |
| 4,4′-DDE | USEPA 8081B | GC/MS/MS | 0.07 µg/kg | 0.1 µg/kg |
| 4,4′-DDT | USEPA 8081B | GC/MS/MS | 0.047 µg/kg | 0.1 µg/kg |
| Aldrin | USEPA 8081B | GC/MS/MS | 0.079 µg/kg | 0.1 µg/kg |
| BHC-alpha | USEPA 8081B | GC/MS/MS | 0.061 µg/kg | 0.1 µg/kg |
| BHC-beta | USEPA 8081B | GC/MS/MS | 0.061 µg/kg | 0.1 µg/kg |
| BHC-delta | USEPA 8081B | GC/MS/MS | 0.097 µg/kg | 0.1 µg/kg |
| BHC-gamma | USEPA 8081B | GC/MS/MS | 0.031 µg/kg | 0.1 µg/kg |
| Chlordane-alpha | USEPA 8081B | GC/MS/MS | 0.062 µg/kg | 0.1 µg/kg |
| Chlordane-gamma | USEPA 8081B | GC/MS/MS | 0.064 µg/kg | 0.1 µg/kg |
| cis-Nonachlor | USEPA 8081B | GC/MS/MS | 0.038 µg/kg | 0.1 µg/kg |
| Dieldrin | USEPA 8081B | GC/MS/MS | 0.077 µg/kg | 0.1 µg/kg |
| Endosulfan I | USEPA 8081B | GC/MS/MS | 0.088 µg/kg | 0.1 µg/kg |
| Endosulfan II | USEPA 8081B | GC/MS/MS | 0.015 µg/kg | 0.1 µg/kg |
| Endosulfan Sulfate | USEPA 8081B | GC/MS/MS | 0.061 µg/kg | 0.1 µg/kg |
| Endrin | USEPA 8081B | GC/MS/MS | 0.072 µg/kg | 0.1 µg/kg |
| Endrin Aldehyde | USEPA 8081B | GC/MS/MS | 0.1 µg/kg | 0.1 µg/kg |
| Endrin Ketone | USEPA 8081B | GC/MS/MS | 0.071 µg/kg | 0.1 µg/kg |
| Heptachlor | USEPA 8081B | GC/MS/MS | 0.039 µg/kg | 0.1 µg/kg |
| Heptachlor Epoxide | USEPA 8081B | GC/MS/MS | 0.073 µg/kg | 0.1 µg/kg |
| Methoxychlor | USEPA 8081B | GC/MS/MS | 0.019 µg/kg | 0.1 µg/kg |
| Mirex | USEPA 8081B | GC/MS/MS | 0.045 µg/kg | 0.1 µg/kg |
| Oxychlordane | USEPA 8081B | GC/MS/MS | 0.1 µg/kg | 0.1 µg/kg |
| Toxaphene | USEPA 8081B | GC/MS/MS | 14 µg/kg | 50 µg/kg |
| trans-Nonachlor | USEPA 8081B | GC/MS/MS | 0.058 µg/kg | 0.1 µg/kg |
| **PCBs** | | | | |
| PCB Congeners | USEPA 8082A | GC/ECD | 0.1 µg/kg | 0.5 µg/kg |
| **PAHs** | | | | |
| 1-Methylnaphthalene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.1 µg/kg |
| 1-Methylphenanthrene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| 2,6-Dimethylnaphthalene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| 2-Methylnaphthalene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Acenaphthene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Acenaphthylene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Anthracene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Benzo(a)anthracene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Benzo(a)pyrene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Benzo(b)fluoranthene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Benzo(e)pyrene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Benzo(g,h,i)perylene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Benzo(k)fluoranthene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Biphenyl | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Chrysene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Dibenzo(a,h)anthracene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Fluoranthene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Fluorene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |

**Table 2-3. Chemical and Physical Parameters for Sediment Samples**

| Parameter | Method | Procedure | Target Method Detection Limit (dry weight) | Target Reporting Limit (dry weight) |
|---|---|---|---|---|
| Indeno(1,2,3-cd)pyrene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Naphthalene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Perylene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Phenanthrene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |
| Pyrene | USEPA 8270D | GC/MS SIM | 0.05 µg/kg | 0.5 µg/kg |

*Target MDLs and RLs for synthetic pyrethroids provided in wet weight.

### 2.2.2 Water Samples

The specific analyses, analytical methods, and target reporting limits for water samples are specified in Table 2-4. Water quality measurements will be taken in the field using YSI 6600 Multiparameter Water Quality Sondes as described in Section 2.1.4. Parameters will include DO, pH, salinity, and temperature. Laboratory chemical and physical analysis of water samples will include TSS, total nitrogen, total phosphorus, chlorophyll-a, and DOC.

**Table 2-4. Chemical and Physical Parameters for Water Samples**

| Parameter | Method/Instrument | Units | Target Reporting Limit |
|---|---|---|---|
| **Field Measurements** | | | |
| Dissolved oxygen | YSI 6600 | mg/L | 0.2 |
| pH | YSI 6600 | pH units | 1-14 |
| Salinity | YSI 6600 | ppt | 1-75 |
| Temperature | YSI 6600 | °C | 0-100 |
| **Physical / Conventional Laboratory Tests** | | | |
| Chlorophyll-a | SM 10200 H | $mg/m^3$ | 10 |
| Dissolved Organic Carbon | SM 5310 B | mg/L | 0.1 |
| Total Nitrogen | USEPA 353.2/USEPA 351.2 | mg/L | 0.1 |
| Total Phosphorus | USEPA 365.3 | mg/L | 0.01 |
| Total Suspended Solids | SM 2540 D | mg/L | 5 |

### 2.2.3 Quality Assurance/Quality Control

The quality assurance (QA) objectives for chemical analysis conducted by the participating analytical laboratories are detailed in their Laboratory QA Manual(s). These objectives for accuracy and precision involve all aspects of the testing process, including the following:

- Methods and Standard Operating Procedures (SOPs)
- Calibration methods and frequency
- Data analysis, validation, and reporting
- Internal quality control (QC)
- Preventive maintenance
- Procedures to ensure data accuracy and completeness

Results of all laboratory QC analyses will be reported with the final data. Any QC samples that fail to meet the specified QC criteria in the methodology will be identified, and the corresponding data will be appropriately qualified in the final report.

All QA/QC records for the various testing programs will be kept on file for review by regulatory agency personnel.

## 2.3 Toxicity Testing

To evaluate the benthic condition of San Diego County's bays and lagoons, sediment toxicity testing will be conducted in accordance with the American Society for Testing and Materials (ASTM) and USEPA methods. The project plan is for analysis of three sediment samples per lagoon/estuary[1]. In addition, appropriate laboratory control samples will be run with each of the selected test species. Toxicity testing for this project will consist of a 10-day solid phase (SP) test using *Eohaustorius estuarius* and a 48-hour sediment-water interface (SWI) test using *Mytilus galloprovincialis*. The toxicity tests proposed for this project are summarized in Table 2-5. In addition, if significant toxicity is observed in the SP or SWI test, a toxicity identification evaluation (TIE) may be conducted as part of stressor identification studies described in Section 2.3.3.

**Table 2-5. Toxicity Testing Proposed to Evaluate the Benthic Condition of San Diego County Bays and Lagoons**

| Test Type | Type of Organism | Taxon | Project Sediments | Control | Reference Toxicant | Ammonia Reference Toxicant |
|---|---|---|---|---|---|---|
| Solid Phase | Amphipod | *Eohaustorius estuarius* | X | Control Sediment | X | X |
| Sediment-Water Interface | Mussel | *Mytilus galloprovincialis* | X | Control Water | X | X |

### 2.3.1 Solid Phase Testing

SP bioassays will be performed to estimate the potential toxicity of the collected sediments to benthic organisms. Ten-day SP tests using the marine amphipod *E. estuarius* will be conducted in accordance with procedures outlined in *Methods for Assessing Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Amphipods* (USEPA, 1994) and the ASTM method E1367-03 (ASTM, 2006). Test conditions are summarized in Table 2-6. On the day before test initiation, 2-cm aliquots of sample sediment will be placed in each of five replicate glass jars followed by approximately 800 mL of prepared seawater. Five replicate controls will be used to determine the health of the amphipods; this will be done by exposing the amphipods to clean sediment following the same protocols used for the test sediments. The test chambers will be left overnight to allow establishment of equilibrium between the sediment and overlying water. On day zero of the test, 20 amphipods will be randomly placed in each of the test chambers. Amphipods that do not bury in the sediment within an hour will be removed and replaced. Samples will be monitored daily for obvious mortality, sublethal effects, and abnormal

[1] Three replicate sediment samples will be collected per sampling site.

behavior. Water quality parameters, including DO, temperature, salinity, and pH, will be monitored daily. Overlying and interstitial ammonia will also be measured at test initiation and test termination. At the end of the test, organisms will be removed from the test chambers by sieving the sediment through a 0.5-mm mesh screen, and the numbers of live and dead amphipods in each test chamber will be recorded. Percent survival will be calculated for control and test sediments. Tests will be considered to be acceptable if there is more than 90% mean control survival.

Two 96-hour reference toxicity tests (cadmium chloride and ammonium chloride) will be conducted concurrently with each batch of sediment tests to establish the sensitivity of the test organisms used in the evaluation of the sediments and to evaluate the potential influence of ammonia toxicity on the test organisms. The cadmium reference toxicant test will be performed using the reference substance cadmium chloride ($CdCl_2$) with target concentrations of 1.25, 2.5, 5.0, 10.0, and 20.0 milligrams (mg) $CdCl_2$/L. Ten organisms will be added to each of four replicates for each concentration. The concentration of $CdCl_2$ that cause 50% mortality of the organisms (i.e., the median lethal concentration, or $LC_{50}$) will be calculated from the data. The $LC_{50}$ values will then be compared to historical laboratory data for the test species with cadmium chloride. The ammonia reference toxicant test will be performed using the reference substance ammonium chloride ($NH_4$) with target concentrations of 20.0, 40.0, 80.0, 160.0, and 320.0 mg $NH_4$/L. Ten test organisms will be added to each of four replicates for each concentration. Subsamples will be obtained at test initiation to measure the actual ammonia concentrations and to calculate un-ionized ammonia concentrations. The $LC_{50}$ values for total ammonia and un-ionized ammonia will be calculated from the data. The results of these reference toxicant tests will be used in combination with the control mortality to assess the health of the test organisms.

**Table 2-6. Conditions for the 10-Day Solid Phase Bioassay with *E. estuarius***

| Test Conditions<br>10-Day SP Bioassay | | |
|---|---|---|
| | Test Species | ***E. estuarius*** |
| | Test Procedures | USEPA (1994); ASTM 1367-03 (2006) |
| | Age/Size Class | Mature, 3-5 mm |
| | Test Type/Duration | Static - Acute SP/10 days |
| | Sample Storage Conditions | 4°C, dark, minimal head space |
| | Control Water Source | Scripps Pier seawater, 20 µm filtered, UV sterilized |
| Recommended Water Quality Parameters | Temperature | 15 ± 2°C |
| | Salinity | 20 ± 2 ppt |
| | Dissolved Oxygen | > 60% saturation (6.0 mg/L) |
| | pH | Monitor for pH drift |
| | Pore Water Total Ammonia | < 60 mg/L |
| | Pore Water Un-ionized Ammonia | < 0.8 mg/L |
| | Photoperiod | Continuous light |
| | Test Chamber | 1 L glass jars |

**Table 2-6. Conditions for the 10-Day Solid Phase Bioassay with *E. estuarius***

| Test Conditions<br>10-Day SP Bioassay | |
|---|---|
| Replicates/Sample | 5 |
| No. of Organisms/Replicate | 20 |
| Exposure Volume | 2 cm sediment, 800 mL water |
| Aeration | Constant gentle aeration |
| Feeding | None |
| Water Renewal | None |

### 2.3.2 Sediment-Water Interface Testing

SWI bioassays will be performed to estimate the potential chronic toxicity of contaminants fluxed from sediments to overlying water. Forty-eight-hour bivalve *M. galloprovincialis* SWI bioassays will be conducted in accordance with procedures outlined in *Short-term Methods for Measuring the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (USEPA 1995) and Anderson et al. (1996). Test conditions are summarized in Table 2-7. The day before test initiation, 5 cm aliquots of sample sediment will be placed in each of the five replicate glass chambers followed by approximately 300 mL of prepared seawater. Five replicate controls will be used to verify that the test system does not cause toxicity; this will be done by exposing the bivalve larvae to test chambers with screen tubes but no sediment. The test chambers will be left overnight to allow establishment of equilibrium between the sediment and overlying water. On day zero of the test, polycarbonate screen tubes will be lowered into each chamber so that larvae settled inside the screen tube will be in close proximity to the sediment surface. Approximately 250 bivalve larvae will be placed inside the screen tube in each of the test chambers. Water quality parameters, including DO, temperature, salinity, and pH, will be monitored daily. Overlying and interstitial ammonia will also be measured at test initiation and test termination. At the end of the test, organisms will be retrieved from the test chambers by removing the screen tubes and gently rinsing the larvae into glass shell vials with clean filtered seawater. The vials will be preserved with formalin to be analyzed by microscope. After microscope counts are performed, the percent normal-alive embryo development will be calculated for the control and test sediments. Tests will be considered to be acceptable if there is greater than 70% mean control normal-alive embryo development.

Two 48-hour reference toxicity tests (copper chloride and ammonium chloride) will be conducted concurrently with each batch of SWI tests to establish the sensitivity of the test organisms used in the evaluation of the sediments and to evaluate the potential influence of ammonia toxicity on the test organisms. The copper reference toxicant test will be performed using the reference substance copper chloride ($CuCl_2$) with target concentrations of 2.5, 5.0, 10.0, 20.0, and 40.0 micrograms (µg) $CuCl_2$/L. Approximately 250 larvae will be added to each of five replicates of these concentrations. The $LC_{50}$ value will be calculated from the data and will then be compared to historical laboratory data for the test species with copper chloride. The

ammonia reference toxicant test will be performed using the reference substance ammonium chloride with target concentrations of 1.0, 2.0, 4.0, 8.0, and 16 mg $NH_4$/L. Approximately 250 larvae will be added to each of five replicates of these concentrations. Subsamples will be obtained at test initiation to measure the actual ammonia concentrations and to calculate un-ionized ammonia concentrations. The $LC_{50}$ value for survival and the concentration causing a 50% reduction in normality (i.e., median effective concentration or $EC_{50}$) for total ammonia and un-ionized ammonia will be calculated from the data. The results of these reference toxicant tests will be used in combination with the percent control normal-alive embryo development to assess the health of the test organisms.

**Table 2-7. Conditions for the 48-Hour Sediment-Water Interface Bioassay with *M. galloprovincialis***

| Test Conditions<br>48-Hour SWI Bioassay | | |
|---|---|---|
| | Test Species | ***M. galloprovincialis*** |
| | Test Procedures | USEPA (1995), Anderson et al. (1996) |
| | Age/Size Class | < 4 hour old larvae |
| | Test Type/Duration | Static - Acute SWI/48 hours |
| | Sample Storage Conditions | 4°C, dark, minimal head space |
| | Control Water Source | Scripps Pier seawater, ≤ 1µm filtered, UV sterilized |
| Recommended Water Quality Parameters | Temperature | 15 ± 2°C |
| | Salinity | 32 ± 2 ppt |
| | Dissolved Oxygen | > 4.0 mg/L |
| | pH | Monitor for pH drift |
| | Photoperiod | 16 hours light: 8 hours dark |
| | Test Chamber | Polycarbonate core tube 7.3 cm ID and 16 cm high, or similar |
| | Replicates/Sample | 5 |
| | No. of Organisms/Replicate | Approximately 250 larvae |
| | Exposure Volume | 5 cm sediment, 300 mL water |
| | Aeration | Constant gentle aeration |
| | Feeding | None |
| | Water Renewal | None |

### 2.3.3 Stressor Identification Studies

Biological testing is a useful tool for determining the presence of toxicity from sediment contamination; however, it does not indicate the cause of toxicity. The current SQO guidelines recommend assessing the multiple lines of evidence and conducting stressor identification investigations for sites identified as clearly impacted or likely impacted. Segments or reaches identified as possibly impacted are recommended for confirmation sampling prior to initiating stressor identification studies. However, by reviewing the available data sets, deductive reasoning can be used to narrow the focus of future actions.

The stressor identification investigations use a variety of tools that can be used to determine if the reason for the narrative objective not being met is due to generic stressors other than toxic pollutants, such as physical alterations or other pollutant related stressors. According to the SQO guidelines "If there is compelling evidence that the SQO exceedances contributing to a receiving water limit exceedance are not due to toxic pollutants, then the assessment area shall be designated as having achieved the receiving water limit." To determine if a site is impacted from toxic pollutants, one or more of the following tools may be applied:

- Evaluate the spatial extent of the area of concern in relation to anthropogenic sources
- Evaluate the body burden of the pollutants accumulated in the animals used for exposure testing
- Evaluate the chemical constituent results to mechanistic benchmarks
- Compare chemistry and biology data to determine if correlations exist
- Alternative biological assessment such as bioaccumulation experiments, pore water toxicity, or pore water chemistry analyses may be conducted.
- Phase I TIEs may also be conducted and are often useful for determining the causative agent or class of compounds causing toxicity.

Stressor identification investigations may be conducted using one or more of the following; statistical, biological, or chemical investigation data. Following a review of the investigation data, conclusions will be made based on the data available and/or recommendations will be developed for future studies to further characterize or identify the condition causing the narrative impairment.

## 2.4 Benthic Infauna Analysis

The benthic infaunal samples will be transported from the field to the laboratory and stored in a formalin solution for a minimum of 6 days. The samples will then be transferred from formalin to 70% ethanol for laboratory processing. The organisms will initially be sorted using a dissecting microscope into five major phyletic groups: polychaetes, crustaceans, molluscs, echinoderms, and miscellaneous minor phyla. While sorting, technicians will keep a count for quality control purposes, as described in the following paragraph. After initial sorting, samples will be distributed to qualified taxonomists who will identify each organism to species or to the lowest possible taxon. WESTON's taxonomists will utilize the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) Edition 9 for nomenclature and orthography.

A QA/QC procedure will be performed on each of the sorted samples to ensure a 95% sorting efficiency. A 10% aliquot of a sample will be re-sorted by a senior technician trained in the QA/QC procedure. The number of organisms found in the aliquot will be divided by 10% and added to the total number found in the sample. The original total will be divided by the new total to calculate the percent sorting efficiency. When the sorting efficiency of the sample is below 95%, the remainder of the sample (90%) will be re-sorted.

## 2.5 Data Review, Management and Analysis

### 2.5.1 Data Review

All data will be reviewed and verified by participating team laboratories to determine whether all data quality objectives have been met, and that appropriate corrective actions have been taken, when necessary.

### 2.5.2 Data Management

All laboratories will supply analytical results in both hard copy and electronic formats. Laboratories will have the responsibility of ensuring that both forms are accurate. After completion of the data review by participating team laboratories, hard copy results will be placed in the project file at WESTON and the results in electronic format will be imported into WESTON's database system.

### 2.5.3 Data Analysis

Data analysis will consist of tabulation and comparison with regulatory guidelines. Chemistry data for sediment will be compared to relevant Sediment Quality Guidelines. Toxicity results will be compared to appropriate laboratory controls. Sediment toxicity, chemistry, and benthic community condition will be assessed using California's SQOs as described in the *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (SWRCB and Cal EPA, 2009).

#### *2.5.3.1 Sediment Quality Guidelines*

Results of chemical analyses of sediments will be compared to effects range-low (ER-L) and effects range-median (ER-M) values developed by Long et al. (1995). The effects range values (ER-L and ER-M) are helpful in assessing the potential significance of elevated sediment-associated contaminants of concern, in conjunction with biological analyses. Briefly, these values were developed from a large data set where results of both benthic organism effects (e.g., toxicity tests, benthic assessments) and chemical concentrations were available for individual samples. To derive these guidelines, the chemical values for paired data demonstrating benthic impairment were sorted in according to ascending chemical concentration. The $10^{th}$ percentile of this rank order distribution was identified as the ER-L and the $50^{th}$ percentile as the ER-M. While these values are useful for identifying elevated sediment-associated contaminants, they should not be used to infer causality because of the inherent variability and uncertainty of the approach. For certain pesticide compounds (i.e., chlordane and dieldrin) the ER-L and ER-M levels are so low as to make it largely impractical to detect them in typical estuarine sediments using routine analytical procedures. Accordingly, having non-detect results that are greater than the ER-L, ER-M, or MDLs would not require re-analysis.

#### *2.5.3.2 Application of California Sediment Quality Objectives*

Sediment quality from bays and lagoons in San Diego County will be assessed using California's SQOs. The goals of the SQOs are to determine if pollutants in sediments are present in quantities

that are toxic to benthic organisms and/or will bioaccumulate in marine organisms to levels that may be harmful to humans.

The SQOs are based on a MLOE approach in which sediment toxicity, sediment chemistry, and benthic community condition are the LOE. The MLOE approach evaluates the severity of biological effects and the potential for chemically-mediated effects to provide a final station level assessment. The specific methods associated with each LOE are described below.

Sediment Toxicity

Sediment toxicity will be assessed using two tests: a 10-day *E. estuarius* survival test and a sublethal test using the mussel *M. galloprovincialis*. Sediment toxicity test results from each station will be statistically compared to control test results, normalized to the control survival, and categorized as nontoxic, low, moderate, or high toxicity. The average of the test responses is calculated to determine the final toxicity LOE category (Table 2-8 and Table 2-9). If the average falls midway in between the two categories it is rounded up to the higher of the two.

**Table 2-8. Sediment Toxicity Categorization Values for *E. estuarius***

| % Survival of *E. estuarius* in Project Sediment | | |
|---|---|---|
| **If Significantly Different than Control Survival** | **If Not Significantly Different from Control** | **Category** |
| 90 – 100 | 82 – 100 | **Nontoxic** |
| 82 – 89[1] | 59 – 81[1] | **Low Toxicity** |
| 59 – 81[1] | | **Moderate Toxicity** |
| < 59[1] | < 59[1] | **High Toxicity** |

[1] These values are a percentage of the control

**Table 2-9. Sediment Toxicity Categorization Values for *M. galloprovincialis***

| % Normal of *M. galloprovincialis* in Project Sediment | | |
|---|---|---|
| **If Significantly Different than Control Survival** | **If Not Significantly Different from Control** | **Category** |
| 80 – 100 | 77 – 79 | **Nontoxic** |
| 77 – 79[1] | 42 – 76[1] | **Low Toxicity** |
| 42 – 76[1] | | **Moderate Toxicity** |
| < 42[1] | < 42[1] | **High Toxicity** |

[1] These values are a percentage of the control

Sediment Chemistry

Concentrations of chemicals detected in sediments will be compared to the California Logistic Regression Model (CA LRM) and the Chemical Score Index (CSI). The CA LRM is a maximum probability model ($P_{MAX}$) that uses logistic regression to predict the probability of sediment toxicity. The CSI is a predictive index that relates sediment chemical concentration to benthic community disturbance. Sediment chemistry results according to CA LRM and CSI are categorized as having minimal, low, moderate, and high exposure to pollutants ( Table 2-10). The final sediment LOE category is the average of the two chemistry exposure categories. If the average falls midway in between the two categories it is rounded up to the higher of the two. For

example if the CA LRM is low exposure and the CSI is moderate exposure, then the final sediment LOE category is moderate exposure.

**Table 2-10. Sediment Chemistry Guideline Categorization**

| Sediment Chemistry Guideline | | Category |
|---|---|---|
| <0.33 | <1.69 | **Minimal Exposure** |
| 0.33 - 0.49 | 1.69 - 2.33 | **Low Exposure** |
| 0.50 - 0.66 | 2.34 - 2.99 | **Moderate Exposure** |
| >0.66 | >2.99 | **High Exposure** |

Benthic Community Condition

Benthic community condition will be assessed using a combination of four benthic indices: the Benthic Response Index (BRI), Relative Benthic Index (RBI), Index of Biotic Integrity (IBI), and a predictive model based on the River Invertebrate Prediction and Classification System (RIVPACS). The four indices will be calculated following the January 21, 2008 guidance provided by the Southern California Coastal Water Research Project (SCCWRP) entitled *Determining Benthic Invertebrate Community Condition in Embayments* for southern California marine bays. Each benthic index result is categorized according to four levels of disturbance, including reference, low, moderate, and high disturbance.

- Reference: Equivalent to a least affected or unaffected site
- Low Disturbance: Some indication of stress is present, but is within measurement error of unaffected condition
- Moderate Disturbance: Clear evidence of physical, chemical, natural, or anthropogenic stress
- High Disturbance: High magnitude of stress

Specific categorization values, which are specifically tailored to southern California marine bays, are assigned for each index (Table 2-11). The final step to determine the benthic community condition is to integrate the four indices into a single category. In doing so, the median of the four benthic index response categories are computed to determine the benthic condition. If the median fell between two categories, the value is rounded to the next higher category to provide the most conservative estimate of benthic community condition.

**Table 2-11. Benthic Index Categorization Values for Southern California Marine Bays**

| Benthic Community Guideline | | | | Index |
|---|---|---|---|---|
| BRI | IBI | RBI | RIVPACS | |
| < 39.96 | 0 | > 0.27 | > 0.90 to < 1.10 | **Reference** |
| 39.96 to 49.14 | 1 | 0.17 to 0.27 | 0.75 to 0.90 or 1.10 to 1.25 | **Low Disturbance** |
| 49.15 to 73.26 | 2 | 0.09 to 0.16 | 0.33 to 0.74 or > 1.25 | **Moderate Disturbance** |
| > 73.26 | 3 or 4 | < 0.09 | < 0.33 | **High Disturbance** |

Station Level Assessment

The final station level assessment will be determined by the combination of the three LOE categories as presented in Attachment B of the *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality* (SWRCB and Cal EPA, 2009). Attachment B presents every possible LOE combination which corresponds to one of six possible station level assessments as follows:

- unimpacted
- likely unimpacted
- possibly impacted
- likely impacted
- clearly impacted
- inconclusive

#### *2.5.3.3 Statistical Analysis*

The data used in the statistical analysis will include macrobenthic measures such as abundances of all taxonomic groups, total abundance, and total number of taxa. Environmental variables include the sediment contaminant concentrations, water column nutrients, physical factors such as sediment grain size, TOC, temperature, DO, salinity, and amphipod and mussel toxicity. The analysis methods detailed below may be modified if data do not pass normality testing, or if the results of the methods below are inconclusive.

Data will be tested for normality, and transformed as necessary prior to statistical analysis. Percent data (organic content, grain size, and amphipod and mussel survivorship) will likely be arcsin square root transformed. Comparisons of environmental variables and macrofaunal metrics between sites will be conducted with a Tukey honestly significant difference (HSD) test for multiple comparisons for normally distributed data and Kraskal Wallace for non-parametric data. Statistical analyses will be performed using the PRIMER 5.0 (Plymouth Routines in Multivariate Ecological Research) SAS 9.1 (SAS Institute) software packages.

Non-metric multidimensional scales (MDS) ordinations and hierarchical agglomerative cluster analysis will be conducted to describe the benthic community composition at each site. Ordinations are based on Bray-Curtis similarities (Bray and Curtis, 1957). Differences in benthic community composition within and between sites will be tested using an analysis of similarities (ANOSIM) randomization test, based on rank similarities of samples (Clark, 1993). The similarity percentages (SIMPER; Clark, 1993) routine will be used to identify the taxa or benthic metric that made the greatest contribution to defining differences among sites identified in the ANOSIM tests (Clark and Warwick, 1994).

## 2.6 Reporting

### 2.6.1 Draft and Final Reports

After all results are received, statistical analyses completed, and all evaluations made, the monitoring program results will be included in the Annual Monitoring Report. At a minimum, the following will be included in the final report:

- Summary of all field activities, including a description of any deviations from the SAP
- Descriptions of each sample and all original field logs
- Locations of sediment and water sampling stations, reported in latitude and longitude (DD) World Geodetic System 1984 (WGS 84)
- Plan view of the project showing the actual sampling locations
- QA/QC results and comparison of possible data quality impacts, as described in Section 2.6.2
- Data Results and interpretation using the sediment quality objectives.
- Recommendations for future stressor identification studies if warranted.

### 2.6.2 Quality Assurance/Quality Control and Laboratory Data Report

Analytical laboratories will provide a QA/QC narrative that describes the results of the standard QA/QC protocols that accompany analysis of field samples. All hard copies of results will be maintained in the project files. In addition, back-up copies of results generated by each laboratory will be maintained at their respective facilities. At a minimum, the laboratory reports will contain results of the laboratory analysis, QA/QC results, methodology, and a case narrative of COC details.

## 2.7 Schedule

Sampling and Reporting will occur as specified in Table 2-12 below.

**Table 2-12. Schedule of Activities**

| Lagoon or Estuary | Permit Year | ABLM Sampling | Reporting |
|---|---|---|---|
| Agua Hedionda Lagoon | 2014 | July 2014 | Copermittees Annual Monitoring Report<br>Draft – November 2014<br>Final - January 2015 |
| Batiquitos Lagoon | | | |
| San Dieguito Lagoon | | | |
| San Diego River Estuary | | | |

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# APPENDIX A
# Field Sediment Sampling Log

## VAN VEEN TRACKING SHEET

**Please Record All Drops (GOOD and BAD)**

| DATE | STATION | (Enter all Drops) GRAB NUMBER | TIME | WATER DEPTH (m) | Penetration Depth (cm) | Grade good(G) fair(F) poor(P) | Sample Type Infauna(I), Tox (T), and/or Chem(C) | Volume (L) | Color | Odor | Latitude | Longitude | Comments |
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# APPENDIX B
# Chain-of-Custody Form

# CHAIN OF CUSTODY

O 5817 Dryden Place, Ste 101 • Carlsbad, CA 92008 _ (760) 795-6900, FAX931-1580

DATE PAGE OF

PROJECT NAME I SURVEY / PROJECT NUMBER

PROJECT MANAGER / CONTACT

CLIENT

ADDRESS

PHONE / FAX/ EMAIL

ANALYSIS TEST REQUESTED

FOR WESTON USE ONLY

| SITE ID location | SAMPLE ID | DATE | TIME | MATRIX | | | | | | | | | | PRESERVED HOW | SAMPLE TEMP. (°C) UPON RECEIPT | WESTON LAB ID |
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**Sample Mattix Codes:** FW= freshlier GW=QrOUld'f\ier SLT–salt water SW–storm wale r V##/:-waste water SED–sed ""'"+l A= r BIO=b Ologe SS=sol T=ticsue O=other (specifyl)

**Conttlner Code:** G=glass P=|>|0S||<; B'i>ag; **O** O=other

Shipped By: C Cooper C UPS C FeS< C USPS D Client drop off D Other

**Turnaround Time:** C 2-<lay C 5-<lay C 7-<lay C 1Q day D 14day D Standard D Other

**Reporting Requirements:** C PDF C FOO C Hard Copy D Email D Other

SAMPLED BY : PRINT SIGNATURE

COMMENTS I SPECIAL INSTRUCTIONS

| RELINQUISHED BY | | | | RECEIVED BY | | | |
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"M-tiTE – return to originator • YELLOW – lab • PINK – retained by originator