

Fiscal Year 2012 Annual Water Quality Report



***City of Santa Barbara
Creeks Division***

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Introduction

The following report described sampling and results that were based on the Fiscal Year 2012 Research and Monitoring Plan (Appendix A). The Research Plan is organized around program elements and research questions that have been reviewed by the Creeks Advisory Committee (CAC). The Research and Monitoring Program is adaptive, and as questions are answered or modified, sampling strategies change as well. The program elements and research questions are provided below. Where possible, the report is organized around the research questions. ***The primary purpose of this report is to serve as an internal record of data collection and analysis. Please see the Creeks Division 2001-2006 report for a discussion of methods, information on water quality criteria, and a glossary of monitoring terms.***

In June 2011, the CAC concurred with the staff recommendation to implement the Research Plan for Fiscal Year 2012 (FY12), including the Source Tracking/Illicit Discharge Detection element. The Source Tracking/Illicit Discharge Detection element includes the Source Tracking Protocol Development Project, which was funded by the State Water Board's Clean Beaches Initiative Proposition 50 Grant Program. The project was conducted in partnership with Dr. Patricia Holden at the University of California Santa Barbara. Due to remaining work that followed up on new information learned during the previous year's research, in December 2011 Creeks Division staff proposed to focus research and monitoring efforts through FY12 on completing the Source Tracking Protocol Development Project. This decision necessitated postponing some planned monitoring and hiring temporary hourly assistance for other monitoring efforts. The CAC concurred with this recommendation. Sections that were postponed are noted in the report. ***Note that this Annual Report is greatly reduced in scale due to the focus on the Source Tracking Protocol Development Project. Data analysis that remains to be completed will be included in the next FY13 Annual Report.***

Summary of Results

First Flush Storm Sampling

Each fall the Creeks Division samples the first storm of the season, as this "first flush" is known to produce the highest concentrations of contaminants in stormwater runoff. In most previous years, creek "integrator sites" (lowest sites on creeks, integrating water quality issues across the entire watershed) have been sampled during every first flush event. Following the changes to the FY11 Research Plan, storm drain and gutters were included in first flush sampling, which took place on October 5, 2011. Runoff was collected from street gutters and storm drains at Montecito/Olive Sts., Laguna/Cota Sts., Gutierrez/Quarantina Sts., and Salsipuedes/Cota. Sts., along with the integrator sites Laguna Channel at Chase Palm Park, Mission Creek at Montecito Street, Arroyo Burro at Cliff Drive, and Sycamore Creek at the railroad bridge.

These sites were sampled between 5:15 AM and 9:15 AM, when 0.02" to 0.68" of rain had fallen. Water was tested for metals, pesticides, hydrocarbons, surfactants, and toxicity. Metals and hydrocarbons were not detected at elevated concentrations; however some other results were concerning.

In previous years, very few detections of pesticides have been found in creek samples, during both dry and wet weather. Based on a recommendation by the State-funded UP3 Priority Pesticide list, several pesticides were added to the testing suite in FY11. The wood preservative pentachlorophenol was found in almost every sample the first flush of fall 2010, albeit at low levels. This result was corroborated in first flush 2011 samples, when pentachlorophenol was found in five of nine samples. In addition, 2,4-D, an ingredient in some weed killers, was detected for the first time, and in several samples. The detection limit for this compound was ten times lower than in previous years, which is the likely reason behind the sudden detections. Pyrethroids were also detected, with bifenthrin found at elevated levels in four of nine samples.

Unlike in 2010, organochlorine pesticides, including DCPA (dacthal), were not detected in drain samples. It is thought that faulty laboratory procedures led to false positives of dacthal in previous samples.

Continuing a change made in FY11, storm water toxicity in creeks was tested using invertebrates and algae, which are thought to be more sensitive to some constituents than the vertebrate fathead minnow, which had been used in most previous tests. No toxicity was observed in creek sites. Storm drain and catch basin sites were tested with fathead minnows. Results showed high toxicity in some drain samples. These results show that while Santa Barbara creeks are generally not toxic to aquatic organisms during storm events, due to large amounts of dilution with clean runoff, runoff that is sampled closer to the site of urban activities exhibits toxicity to sensitive species.

Coal-based Parking Lot Sealcoat

Research around the country has raised concerns about the high toxicity of runoff from parking lots sealed with coal-based sealcoat as compared to runoff from asphalt-based sealcoat. According to industry leaders, coal tar is not used in California, but the Creeks Division sought to test this assumption by testing parking lots located in Santa Barbara. A field test was conducted on 50 parking lots throughout the City. Results suggest that approximately 30% of parking lots in the City may contain coal-based sealants. Recently a State Bill banning coal-based parking lot sealcoat was proposed but did not reach a vote in the State Assembly. Work in FY 13 will include a comparison of the toxicity of runoff from the two different types of parking lot sealcoats.

Mission Creek Toxicity

Mission Creek is listed under the Clean Water Act as impaired for “Unknown Toxicity.” The Creeks Division has worked to understand the original basis for the listing, and any potential current toxicity problems in Mission Creek. After conducting many toxicity tests with fathead minnows and invertebrates, the City found no signs of toxicity in Mission Creek. However, the Regional Water Board conducted tests at Mission Creek at Montecito Street which showed toxicity to the algae *Selenastrum*, suggesting the presence of herbicides in creek water. In Fiscal Year 2012, the Creeks Division collected samples from several locations along Mission Creek and found no toxicity to *Selenastrum*. High conductivity in Santa Barbara creeks may lead to false positives with test results, and Creeks Division staff will continue to investigate this possibility.

Sycamore Creek Sodium and Chloride

Sycamore Creek was listed recently under the Clean Water Act, based on potential agricultural use of creek water, as impaired for Sodium and Chloride. The Creeks Division conducted creek walks with associated conductivity tests and tested creek samples for sodium and chloride. Based on results obtained thus far, it appears that Sycamore Creek is high in sodium and chloride due to the natural process of groundwater movement through marine deposits into the creek. One tributary with the highest conductivity, sodium, and chloride ever observed in Creeks Division monitoring will be investigated more thoroughly in FY 13. If results show that the source of sodium and chloride in Sycamore Creek is natural, the Regional Board may de-list the Sycamore Creek from the 303(d) impaired list.

Source Tracking Protocol Development Project

Goals

The goals of the monitoring program are to:

1. Quantify the levels (concentration and flux, or load) of microbial contamination and chemical pollution in watersheds throughout the city.

2. Evaluate impacts of pollution on beneficial uses of creeks and beaches, including recreation and habitat for aquatic organisms.
3. Evaluate the effectiveness of the City's restoration and water quality treatment projects, which includes collecting baseline data for future projects.
4. Identify sources of contaminants and pollution in creeks and storm drains.
5. Evaluate long-term trends in water quality.

The underlying motivation behind the monitoring program is to obtain information that the City can use to:

1. Develop strategies for water quality improvement, including prioritization of capital projects and outreach/education programs.
2. Communicate effectively with the public about water quality.

Changes to Research Plan for Fiscal Year 2012

Several changes were made for the Fiscal Year 2012 Research and Monitoring Plan, including:

1. Adding creek sites to sediment sampling events, including sediment directly below storm drain outfalls.
2. Adding an investigation of salinity in Sycamore Creek, due a recent listing on the on the 303(d) list of impaired water bodies.
3. Addition of toxicity testing with algae species in Mission Creek during dry weather, to support the investigation of the 303(d) impairment for "Unknown Toxicity."
4. Addition of several water quality and restoration projects, including fish passage and parking lot retrofit projects, post-construction BMP assessment, and Mission Lagoon, to sampling efforts for evaluating project effectiveness.
5. Sampling of groundwater discharge (sump pumps) to storm drains for organic contaminants.
6. Preliminary testing for impacts of recycled water irrigation runoff on creeks, including nutrients, salts, and pharmaceutical products.
7. Developing a test kit for enforcement activities, including methods to test quickly for nutrients, hydrocarbons, chlorine, bromine, and some metals.

The sampling table is provided in the Appendix.

Program Elements and Research Questions

Watershed Assessment

Research questions:

1. Is overall water quality, in terms of indicator bacteria and field properties, getting better over time?
2. How contaminated and/or toxic is sediment at creek sites, particularly those below storm drain outfalls?
3. What is the impact of eutrophication on Santa Barbara creeks?
4. What is the impact of recycled water on water quality, including irrigation runoff and water line breaks?
5. What is the impact of groundwater pumping (sump discharge to storm drain) on water quality?
6. What is the source of the 303(d) impairment for Salinity on Sycamore Creek?
7. What is the source of the 303(d) impairment for Unknown Toxicity on Mission Creek?

Storm Monitoring

Research Questions:

1. What are the highest concentrations of pollutants of concern during storm events, particularly seasonal first flush storms? Do creeks and/or storm drains in Santa Barbara have problems with toxicity during storm events?
2. What are the loads of pollutants discharged from Santa Barbara creeks during storms?
3. What are the sources of toxicity and routes of pollutants to storm drains during storms?
4. How do concentrations and loads vary during storms and from site to site?
 - a. Fecal indicator bacteria
 - b. Slurry seal/PAHs/Foam
 - c. Metals
 - d. Nutrients
5. How do restoration/treatment projects impact water quality and restoration during storm events, including fish passages, the parking lot retrofit project, the Upper Las Positas Stormwater Management Project (Golf Course), and post-construction BMP assessment?

Restoration and Water Quality Project Assessment

The Creeks Division has completed several restoration and water quality improvement capital projects over the past several years. Project assessment is used to determine the success of projects in lowering microbial and chemical pollution levels and improving water quality for aquatic organisms. In some cases project monitoring is grant-required, and the remaining is for internal review of project success. Additional monitoring is conducted to ensure that the facility is performing as intended.

Research Questions:

1. Do Creeks Division projects result in improved water quality, as reflected in pre- and post-project, and/or, upstream to downstream, conditions?
2. What is the baseline water quality at future restoration/treatment sites?
3. What are the mechanisms of project success?
4. Are installed projects functioning correctly?

List of Projects

1. Westside SURF and Old Mission Creek Restoration.
2. Arroyo Burro Restoration, including Mesa Creek daylighting.
3. Hope and Haley Diversions.
4. Mission Lagoon Restoration and Laguna Channel Disinfection
5. Golf Course Project (Storm)
6. San Pascual Drain (Source Tracking)
7. Parking Lot LID Retrofit (Storm)
8. Debris Screens (Creek Walks)
9. Mission Creek Fish Passage (Eutrophication/Dissolved Oxygen)
10. Bird Refuge

Beach water quality

Research questions:

1. How do creeks and storm drains relate to beach water quality and warnings?
2. How do other factors (kelp, tides, temperature, and beach use) relate to beach warnings?
3. What are the causes of persistent beach warnings that occur?
4. What is the risk to human health from recreation in creeks and beaches in Santa Barbara?

Source Tracking/Illicit Discharge Detection

Research questions:

1. Which subdrainages and/or contribute the greatest loads of pollutants to creeks in Santa Barbara? (CBI).
2. Where, when and how is human waste and/or sewage entering storm drains and creeks?
 - a. What happens to the signals of human waste and indicator bacteria levels as water moves downstream away from the source?
 - b. How does presence of human waste relate to beach warnings?
3. Do rotting plant material and sediment contribute to high FIB levels in storm drains?
4. What are the impacts of reservoir flushing on metals?
5. Are new hot spots emerging?
6. Specific areas of concern: Barger Canyon, Las Positas Creek, Haley Drain

Creeks Walks/Clean ups

Research Questions:

1. Are there new problems in creeks that need to be addressed?
2. Is the amount of trash in creeks decreasing over time?
3. Were decreases in trash observed between 1999 and 2005 due to creek flow histories or the impact of City programs?
4. Will the installation of catch basin screens lead to decreased trash observed in creeks?
5. Can we see any impairment to San Roque Creek, leading to drop in bioassessment scores?

Bioassessment

The biological assessment element is used to assess and monitor the biological integrity of local creeks as they respond through time to natural and human influences.

Research Questions:

1. What is the baseline of biological integrity for benthic macroinvertebrates in creeks?
2. Are there differences between upper watershed and lower watershed sites?
3. Are there differences among watersheds?
4. How does the biological integrity in our creeks change over time?
5. How does the biological integrity respond to water quality and restoration projects?

Methods Development

1. Can we use the following potential new tools?
2. Can a chemical fingerprint be used to identify types of sources?
3. Can field kits be used for enforcement?

Recommendations for FY13

Several changes are included in the proposed Fiscal Year 2013 Research and Monitoring Plan (attached), including:

1. Test receiving waters for potential groundwater contaminants.
2. Further investigate potential RV dumping.
3. Conduct monitoring to assist with design decisions for the Mission Lagoon Restoration project.
4. Test for neonicotinoids, a group of pesticides that may be linked to colony collapse disorder in honeybees.
5. Test storm runoff from parking lots covered with coal-based parking lot sealcoat.
6. Conduct additional sampling at the Las Positas Golf Course to support management decisions during dry weather.
7. Collect baseline data for Storm Water Retrofit Projects.
8. Investigate high conductivity in a tributary of Sycamore Creek and also in Honda Creek.

Storm Monitoring

First Flush Monitoring: Chemistry and Toxicity

Each fall the Creeks Division samples the first storm of the season, as this “first flush” is known to produce the highest concentrations of contaminants in stormwater runoff. In most previous years, creek “integrator sites” (lowest sites on creeks, integrating water quality issues across the entire watershed) have been sampled during every first flush event. Following the changes to the FY11 Research Plan, storm drain and gutters were included in first flush sampling, which took place on October 5, 2011. Runoff was collected from street gutters and storm drains at Montecito/Olive Sts., Laguna/Cota Sts., Gutierrez/Quarantina Sts., and Salsipuedes/Cota. Sts., along with the integrator sites Laguna Channel at Chase Palm Park, Mission Creek at Montecito Street, Arroyo Burro at Cliff Drive, and Sycamore Creek at the railroad bridge.

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show that while Santa Barbara creeks are generally not toxic to aquatic organisms during storm events, due to large amounts of dilution with clean runoff, runoff that is sampled closer to the site of urban activities exhibits toxicity to sensitive species.

Table 1. First Flush Results at Integrator Creek Sites

Constituent	Arroyo Burro at Cliff Drive	Laguna Channel at Chase Palm Park	Mission Creek at Montecito St.	Sycamore Creek at Railroad Bridge	Reporting Level	Criteria (source)
<u>Metals (Total), mg/L</u>						
Arsenic	0.012	ND	ND	ND	0.01	0.15 (EPA CCC, old)
Cadmium	ND	ND	ND	ND	0.005	0.00027 (EPA CCC, old)
Chromium	0.018	0.0052	0.02	0.0063	0.005	0.086 (EPA CCC, old)
Copper	0.022	0.052	0.061	0.014	0.01	0.0094 (EPA CCC, old)
Lead	0.01	0.0087	0.042	ND	0.005	0.0053 (EPA CCC, old)
Mercury	ND	ND	ND	ND	0.0002	0.00091 (EPA CCC, old)
Nickel	0.023	0.011	0.021	ND	0.01	0.052 (EPA CCC, old)
Silver	ND	ND	ND	ND	0.01	
Zinc	0.086	0.19	0.22	0.052	0.02	0.12 (EPA CCC, old)
<u>Metals (Dissolved), mg/L</u>						
Copper	ND	0.034	0.017	ND	0.01	TBD
<u>Petroleum Hydrocarbons</u>						
EFH (C13-C40), mg/L	ND	0.89	0.76	ND	0.5	Uncertain
GRO (C6-C12) mg/L	ND	ND	ND	ND	0.5	Uncertain
PAHs (EPA 8270), µg/L	ND	ND	ND	ND	.5	
<u>Herbicides and Pesticides</u>						
Organochlorine Pesticides (EPA 8081A), µg/L	ND	ND	ND	ND	0.0095 – 0.005	No criteria
Organophosphorus Pesticides (EPA 8141A), µg/L	ND except 2,4-D= 2.2	ND except 2,4-D= 1.0 µg/L Pentachlorophenol= 0.32 µg/L	ND	ND except Pentachlorophenol= 0.73 µg/L	0.48 -120 µg/L	Limited criteria
Pyrethroids (GCMS-SIM), ng/L	ND	ND	ND, except bifenthrin = 120, cis-Permethrin=14, Cyfluthrin=10, Cypermethrin = 5.2, trans-Permethrin = 10	ND except Cyfluthrin = 6.3	5 ng/L	TBD
Carbaryl, µg/L	ND	ND	ND	ND	5	TBD
<u>Total Suspended Solids, mg/L</u>	430	45	57	44	10	TBD
<u>Surfactants (MBAS), mg/L</u>	0.88	1.3	0.71	0.54	0.5	TBD
<u>Toxicity</u>						
Ceriodaphnia, % Survival	100	95	100	85		
Fathead minnow, % Survival		10				
Selenastrum, % Cell Density	-70	-88	-8.32	-81		

Table 2. First Flush Results at Gutter and Drain Sites in Laguna Watershed

Constituent	CB-H08-13	JS-H08-01	MH-H08-01	MH-H08-10	MH-H09-06	Reporting Level	Criteria (source)
<u>Metals (Total), mg/L</u>							
Arsenic	ND	ND	ND	0.032	ND	0.01	0.15 (EPA CCC, old)
Cadmium	ND	ND	ND	ND	ND	0.005	0.00027 (EPA CCC, old)
Chromium	0.0071	0.0067	0.0086	ND	0.0084	0.005	0.086 (EPA CCC, old)
Copper	0.078	0.25	0.69	0.03	0.049	0.01	0.0094 (EPA CCC, old)
Lead	0.013	0.039	0.087	0.0051	0.017	0.005	0.0053 (EPA CCC, old)
Mercury	ND	ND	ND	ND	ND	0.0002	0.00091 (EPA CCC, old)
Nickel	0.017	0.016	0.024	ND	0.01	0.01	0.052 (EPA CCC, old)
Silver	ND	ND	ND	ND	ND	0.01	
Zinc	0.27	0.5	0.72	0.15	0.33	0.01	0.12 (EPA CCC, old)
<u>Metals (Dissolved), mg/L</u>							
Copper	0.043	0.16	0.54	0.024	0.021	0.01	TBD
<u>Petroleum</u>							
<u>Hydrocarbons</u>							
EFH (C13-C40), mg/L	1.4	2.4	3.4	0.59	1.4	0.5	Uncertain
GRO (C6-C12) mg/L	ND	ND	ND	ND	ND	1	Uncertain
PAHs (EPA 8270), µg/L	ND	ND	ND	ND		.5	
<u>Herbicides and Pesticides</u>							
Organochlorine Pesticides (EPA 8081A), µg/L	ND	ND	ND	ND		0.0095 – 0.005	No criteria
Organophosphorus Pesticides (EPA 8141A), µg/L	ND, except Penta-chlorophenol = 0.4 µg/L	ND, except 2,4-D=2.3 µg/L Penta-chlorophenol= 0.64 µg/L	ND, except 2,4,D=0.68 µg/L	ND, except 2,4,D=1.3 µg/L	ND, except Penta-chlorophenol= 2 µg/L	0.48 -10 µg/L	Limited criteria
Pyrethroids (GCMS-SIM), ng/L	ND, except Bifenthrin=27, cis-Permethrin = 14 ng/L, trans-Permethrin = 12	ND, , except Bifenthrin=33 ng/L	ND, except	ND except	ND, except Bifenthrin=83 ng/L, cis-Permethrin = 11, Cyfluthrin=12, trans-Permethrin = 13 ng/L	5 ng/L	TBD
Carbaryl, µg/L	ND	ND	ND	ND		5	TBD
Total Suspended Solids, mg/L	160	150	87	67	130	10	TBD
Surfactants (MBAS), mg/L	1.7	2.5	2.1	0.9	0.57	0.5	TBD
<u>Toxicity</u>							
Fathead minnow, % Survival	25	90	0	85	90		

Beach water quality

Beach Warnings

Table 3. Beach Warnings for 2011 AB411 Season and 2011-2012 Rainy Season.

Date	Arroyo Burro Beach	E. Beach at Mission Creek	Leadbetter Beach	East Beach at Sycamore Creek	Notes
3/28/2011					
4/4/2011					
4/11/2011		Warning			
4/18/2011					
4/25/2011		Warning			
5/2/2011		Warning			initiated Rapid Response on May 4th
5/9/2011	Warning				lagoon open
5/11/2011		#N/A	#N/A	#N/A	
5/16/2011	Warning	Warning			.14 inches of rain on May 15
5/18/2011	Warning	Warning	#N/A	#N/A	.52" of rain on May 17-18
5/23/2011					
5/31/2011					
6/6/2011	Warning	Warning		Warning	.76" of rain on June 5-6.
6/13/2011					
6/20/2011	Warning				lagoon open
6/22/2011		#N/A	#N/A	#N/A	
6/27/2011	Warning				lagoon open
7/5/2011					
7/11/2011					Carrillo Drain repaired
7/18/2011		Warning			
7/25/2011					
8/1/2011	Warning				lagoon open
8/3/2011		#N/A	#N/A	#N/A	
8/8/2011	Warning				lagoon open
8/15/2011					
8/22/2011					
8/29/2011	Warning				lagoon open
8/31/2011		#N/A	#N/A	#N/A	
9/6/2011	Warning	Warning			AB lagoon open
9/12/2011					
9/19/2011		Warning			
10/3/2011					
10/10/2011					
10/17/2011					
10/24/2011	Warning		Warning	Warning	AB lagoon open
10/26/2011		#N/A			
10/31/2011		Warning		Warning	
11/8/2011		Warning			
11/14/2011					
11/21/2011	Warning	Warning	Warning		1.14" rain on Oct. 20 and 21
11/28/2011	Warning				

12/5/2011					
12/12/2011	Warning	Warning	Warning	.44" of rain on Dec. 12th	
12/19/2011					
1/9/2012					
1/17/2012					
1/23/2012	Warning	Warning	Warning	Warning	1.28" of rain on Jan. 21 and .35" rain on Jan. 23
1/25/2012				Warning	.65" of rain on Jan 23-24
1/30/2012		Warning			lagoon open
2/6/2012					
2/13/2012		Warning			lagoon open
2/15/2012	#N/A		#N/A	#N/A	
2/21/2012					
2/27/2012					
3/5/2012					
3/12/2012					
3/19/2012		Warning			1.69" of rain on March 17-18
3/26/2012	Warning				lagoon open
3/29/2012		#N/A	#N/A	#N/A	
4/2/2012					
4/9/2012					
4/16/2012	Warning				.72" of rain on April 13-14
4/18/2012		#N/A	#N/A	#N/A	
4/23/2012		Warning	0		MC lagoon open
4/30/2012			Warning		.22" of rain on April 26 and SC lagoon open
5/7/2012					
5/14/2012					
5/21/2012					
5/29/2012					
6/4/2012					
6/18/2012					
6/25/2012					

Beach Warnings – Kelp, Tides, Temperature and Beach Use

No work was conducted by the City in this area. The UCSB Source Identification Protocol Project (SIPP), which the City has supported with sampling assistance, will be addressing beach conditions and the connection to beach warnings at Arroyo Burro Beach. A camera was installed to record numbers of people, dogs, and lagoon status.

Persistent Beach Warnings and Rapid Responses

One Rapid Response was initiated due to persistent dry weather warnings at East Beach at Mission Creek in April and May, 2011.

First, results at the integrator stations were compared to see if Mission Creek or Laguna Channel was unusually high in FIB.

Table 4. Integrator Station FIB levels during persistent beach warnings.

Site	Date	Parameter	Result
LC CPP	11/Apr/2011	E. coli	63 MPN/100ml
LC CPP	11/Apr/2011	Enterococcus	85 MPN/100ml
LC CPP	11/Apr/2011	Total Coliform	15531 MPN/100ml
LC CPP	27/Apr/2011	E. coli	213 MPN/100ml
LC CPP	27/Apr/2011	Enterococcus	1126 MPN/100ml
LC CPP	27/Apr/2011	Total Coliform	8664 MPN/100ml
MC Monteci	11/Apr/2011	E. coli	419 MPN/100ml
MC Monteci	11/Apr/2011	Enterococcus	98 MPN/100ml
MC Monteci	11/Apr/2011	Total Coliform	7701 MPN/100ml
MC Monteci	27/Apr/2011	E. coli	3448 MPN/100ml
MC Monteci	27/Apr/2011	Enterococcus	160 MPN/100ml
MC Monteci	27/Apr/2011	Total Coliform	>24192 MPN/100ml

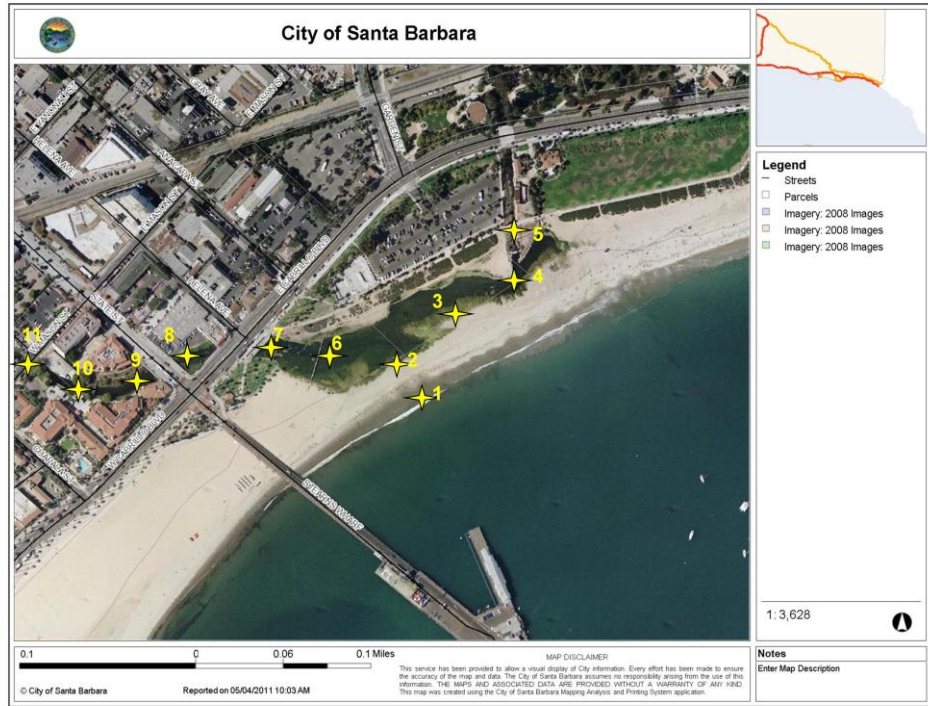
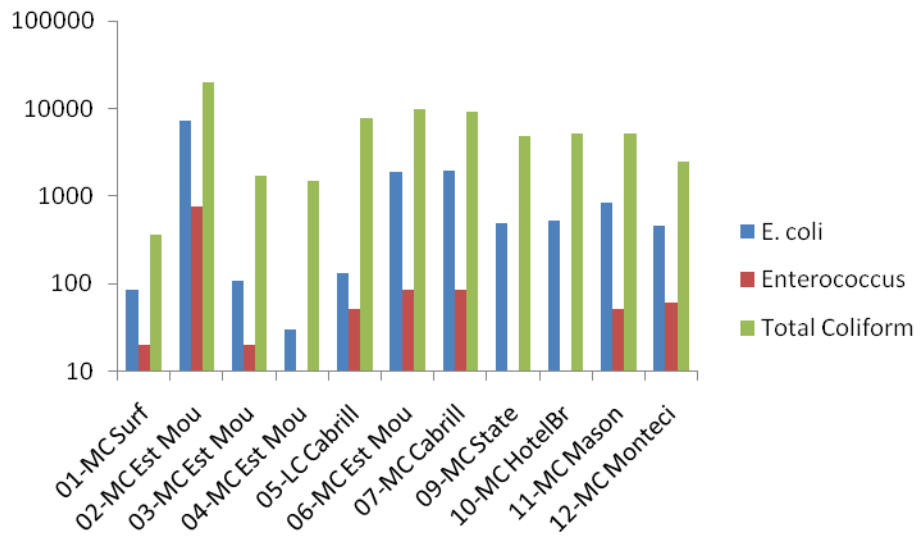


Figure 1. Map of Rapid Response Samples Collected



4. Figure 2. Fecal indicator levels at Rapid Response sites on May 5, 2011.

Appendix 1: FY 12 Sampling Table

DRAFT – PENDING COST ESTIMATES FROM LABORATORY BIDS

PROGRAM ELEMENT and QUESTIONS	CONSTITUENTS/METHODS	SITES	FREQUENCY
A. Watershed Assessment			
1. Is overall water quality, in terms of indicator bacteria and field properties, getting better over time?	FIB, field parameters, flow	Integrator Sites Honda and Lighthouse	Biweekly (26 x 4) Quarterly (4 x 2)
2. How contaminated and/or toxic is sediment at creek sites?	Metals, PAHs, Toxicity, Pyrethroids	8 creeks sites TBD	Yearly, in late summer
3. What is the impact of eutrophication on Santa Barbara creeks?	Nutrients, DO, Bioassessment, Algae cover	TBD 20 nutrient suites	Weekly to Monthly
4. What is the impact of groundwater pumping?	Semivolatile organics	TBD 4 sump pump discharges located near LUST sites	
5. What is the impact of recycled water on water quality?	Salinity and PPCPs	2 discharges and 4 creek sites.	One time.
6. What is the source of the impairment for Salinity on Sycamore Creek?	Salinity	Creek walk	Monthly
7. What is the source of the impairment for toxicity on Mission Creek?	Toxicity Tests, especially algae	Quarterly sampling sites plus Mission Canyon	Quarterly (3x's during dry weather)
B. Storm Monitoring			
1. What are the highest concentrations of pollutants of concern during storm events, particularly seasonal first flush storms, in creeks? Do storm drains in Santa Barbara have problems with toxicity during storm events?	Metals, Herbicides, Pesticides, Nutrients, Hydrocarbons, MBAS, Toxicity (Vert, invert, algae)	Integrator Sites and eight storm drains, full suite on all	Yearly, first flush. Collect creek samples early during runoff event. Collect drain samples second.
2. What are the loads of pollutants discharged from Santa Barbara creeks during storms?	Metals, MBAS, FIB	Arroyo Burro at Cliff (location of flow gauge and autosampler)	Conduct composite sampling according to Caltrans (2008) during a 1"

PROGRAM ELEMENT and QUESTIONS	CONSTITUENTS/METHODS	SITES	FREQUENCY
			forecasted storm.
3. What are the sources and routes of pollutants during storms?	Fecal indicator bacteria, Sediment, MBAS (or cationic surfactants), PAHs. Visual observation for foam during storm event.	Arroyo Burro at Cliff Simulated rain and runoff from recently sealed parking lots and/or streets.	Conduct composite sampling according to Caltrans (2008) during a 1" forecasted storm.
4. Slurry seal	PAHs, toxicity	8 sites	One early storm
5. How do restoration/treatment projects impact water quality during storm events?	Bacteria, nutrients, metals, sediment Rainfall, Flow, Two sites for full storm suite. Post-construction BMP Fish passages	Seven sites at Golf Course MacKenzie park TBD Flow rate	Three storms for Golf Course. First flush One later storm. Several storms of varying intensities.
C. Restoration and Water Quality Project Assessment			
1. Westside SURF and Old Mission Creek Restoration (see annual report for details)	Indicator bacteria and field parameters.	SURF up, SURF down, Westside Drain, OMC at W. Anapamu, 10 sites between Westside Drain and W. Anapamu	Weekly for SURF operation, biweekly for downstream impacts, and quarterly for regrowth study
2. Arroyo Burro Restoration, including Mesa Creek daylighting (Suspension of quarterly testing until results from biweekly testing warrant a change).	Indicator bacteria and field parameters	AB at Cliff, Mesa upper, Mesa lower, AB Estuary upper, AB Estuary Mouth, AB Surf	Biweekly
3. Hope and Haley Diversions	Indicator bacteria and field parameters	Hope Diversions, Haley Pump	Biannual
4. Laguna Channel Disinfection (Source Tracking)	Indicator bacteria and field parameters	Laguna at Chase Palm (already covered by routine)	Biweekly
5. Golf Course Project (Storm)	See storm monitoring. Also sample discharge for management information. DO, Temp, Nutrients, Sediment, Chlorophylla	See storm monitoring. East basin discharge.	Biweekly.
6. Parking Lot LID (Storm)	See storm monitoring		
7. Debris Screens (Creek Walks)	See creek walks		
8. Mission Creek Fish Passage (Eutrophication/Dissolved Oxygen)	Dissolved Oxygen, pH, temperature, conductivity (nutrients as part of above study)	MC Lagoon, MC upper reaches	Install probes for summer months, collect data continuously

PROGRAM ELEMENT and QUESTIONS	CONSTITUENTS/METHODS	SITES	FREQUENCY
9. Bird Refuge	Indicator bacteria, chlorophyll a, nutrients, and field parameters ON HOLD	Bird Refuge Inflow, Landing and Outlet	Monthly
D. Beach water quality			
1. Is growth on sediment and/or kelp responsible for beach warnings?	Sample plan to be determined. FIB only.		
2. What are the causes of persistent beach warnings that occur?	Conduct additional surveillance and sampling (indicator bacteria and/or DNA techniques) up creek and within estuaries when persistent warnings occur.		
3. What is the risk to human health from recreation in creeks and beaches in Santa Barbara?	Use forthcoming epidemiology studies in Southern California to conduct simple model of illness rates at Santa Barbara beaches.		
E. Source Tracking/Illicit Discharge Detection			
1. Which subdrainages and/or contribute the greatest loads of pollutants to creeks in Santa Barbara? (CBI)	Source Tracking Grant		
2. Where, when and how is human waste and/or sewage entering storm drains and creeks?	Source Tracking Grant		
3. What happens to the signals of human waste and indicator bacteria levels as water moves downstream away from the source?	Source Tracking Grant		
4. How does presence of human waste relate to beach warnings?	Source Tracking Grant		
5. Do rotting plant material and sediment contribute to high FIB levels in storm drains?	Work with Streets Division to conduct pilot study on catch basin and storm drain cleaning on indicator bacteria levels. And TSS.	Possible site: Montecito St. in Laguna Channel Watershed. Ideal sites are located at terminal upstream end of storm drain, with easy access for	Monthly.

PROGRAM ELEMENT and QUESTIONS	CONSTITUENTS/METHODS	SITES	FREQUENCY
		cleaning and sampling.	
6. What are the impacts of reservoir flushing on metals?	Metals, sediment.	Rattlesnake Creek and Reservoir outlet.	Single event.
7. Are new hot spots emerging?	Observation, enforcement.	Serena Drain and others	
F. Creeks Walks/Clean ups			
1. Are there new problems in creeks that need to be addressed?	Creek clean ups		
2. Is the amount of trash in creeks decreasing over time?	Weight of trash removed each year.		
3. Were decreases in trash observed between 1999 and 2005 due to creek flow histories or the impact of City programs?	Continue measuring and marking GPS coordinates of trash in Old Mission Creek and Lower Mission Creek (Oak Park to beach).		
4. Will the installation of catch basin screens lead to decreased trash observed in creeks?	See 3.		
G. Bioassessment	See Bioassessment Proposal and Reports.		
H. Methods Development			
1. Can a chemical fingerprint be used to identify types of sources?	No sampling, just data analysis.		
2. Investigate field screening kits.	Investigate costs and options.		

Appendix 2: FY 12 CAC Reports



City of Santa Barbara
Parks and Recreation Department

Memorandum

DATE: June 20, 2012

TO: Creeks Restoration/Water Quality Improvement Program
Citizen Advisory Committee

FROM: Jill Murray, Water Quality Research Coordinator

SUBJECT: **WATER QUALITY RESEARCH AND MONITORING PROGRAM
UPDATE AND FISCAL YEAR 2013 RESEARCH PLAN**

COMMITTEE DIRECTION – FOR ACTION

That the Committee receive an update on the Water Quality Research and Monitoring Program and concur with the staff recommendation to implement the proposed Research Plan for Fiscal Year 2013.

DISCUSSION

Background

In June 2011, the Committee concurred with the staff recommendation to implement the Research Plan for Fiscal Year 2012 (FY12). In December 2011 the Committee received an update on the Source Tracking Protocol Development Project and concurred with the staff recommendation to postpone some portions of the FY12 Research Plan. At this time, the Committee will receive a mid-year update on FY12 sampling, with a focus on first flush storm monitoring results, parking lot sealcoat, toxicity testing in Mission Creek, and high sodium and chloride in Sycamore Creek, along with recommended changes for the Fiscal Year 2013 (FY13) Research Plan. The proposed FY13 Research Plan is attached.

The goals of the research and monitoring program are to:

1. Quantify the levels (concentration and flux, or load) of microbial contamination and chemical pollution in watersheds throughout the City.
2. Evaluate impacts of pollution on beneficial uses of creeks and beaches, including recreation and habitat for aquatic organisms.
3. Evaluate the effectiveness of the City's restoration and water quality treatment projects, which includes collecting baseline data for future projects.

4. Identify sources of contaminants and pollution in creeks and storm drains.
5. Evaluate long-term trends in water quality.

The underlying motivation behind the research and monitoring program is to obtain information that the City can use to:

1. Develop strategies for water quality improvement, including prioritization of capital projects and outreach/education programs; and
2. Communicate effectively with the public about water quality.

In support of the program goals, the Research Plan consists of six key elements and associated research questions (questions are listed in the attached Research Plan) :

1. Watershed Assessment
2. Storm Monitoring
3. Restoration and Water Quality Project Assessment
4. Source Tracking/Illicit Discharge Detection
5. Creeks Walks/Clean ups
6. Bioassessment

Selected updates from several elements are presented below. Additional results will be presented in the Annual Water Quality Report, to be presented in January 2013.

First Flush Storm Sampling

Each fall the Creeks Division samples the first storm of the season, as this “first flush” is known to lead to the highest concentrations of contaminants in stormwater runoff. In most previous years, creek “integrator sites” (lowest sites on creeks, integrating water quality issues across the entire watershed) have been sampled during every first flush event. Following the changes to the FY11 Research Plan, storm drain and gutters were included in first flush sampling, which took place on October 5, 2011. Runoff was collected from gutters and storm drains at Montecito/Olive Sts., Laguna/Cota Sts., Gutierrez/Quarantina Sts., and Salsipueds/Cota. Sts., along with the integrator sites Laguna Channel at Chase Palm Park, Mission Creek at Montecito Street, Arroyo Burro at Cliff Drive, and Sycamore Creek at the railroad bridge.

These sites were sampled between 5:15 AM and 9:15 AM, when 0.02” to 0.68” of rain had fallen. Water was tested for metals, pesticides, hydrocarbons, surfactants, and toxicity. Metals and hydrocarbons were not detected at elevated concentrations; however some other results were concerning.

In previous years, very few detections of pesticides have been found in creek samples, during both dry and wet weather. Based on a recommendation by the State-funded UP3 Priority Pesticide list, several pesticides were added to the testing suite in FY11. The wood preservative pentachlorophenol was found in almost every sample the first flush of fall 2010, albeit at low levels. This result was corroborated in first flush 2011 samples,

when pentachlorophenol was found in five of nine samples. In addition, 2,4-D, an ingredient in some weed killers, was detected for the first time, and in several samples. The detection limit for this compound was ten times lower than in previous years, which is likely the reason behind the sudden detections. Pyrethroids were also detected, with bifenthrin found at elevated levels in four of nine samples. Unlike 2010, organochlorine pesticides, including DCPA (dacthal), were not detected in drain samples.

Continuing a change made in FY11, storm water toxicity in creeks was tested using invertebrates and algae, which are thought to be more sensitive to some constituents than the vertebrate fathead minnow, which had been used in most previous tests. No toxicity was observed in creek sites. Storm drain and catch basin sites were tested with fathead minnows. Results showed high toxicity in some drain samples. These results show that while Santa Barbara creeks are generally not toxic to aquatic organisms during storm events, due to large amounts of dilution with clean runoff, runoff that is sampled closer to the site of urban activities exhibits toxicity to sensitive species.

Coal-based Parking Lot Sealcoat

Research around the country has raised concerns about the high toxicity of runoff from parking lots sealed with coal-based sealcoat as compared to runoff from asphalt-based sealcoat. According to industry leaders, coal tar is not used in California, but the Creeks Division sought to test this assumption by testing parking lots located in Santa Barbara. A field test was conducted on 50 parking lots throughout the City. Results suggest that approximately 30% of parking lots in the City may contain coal-based sealants. Recently a State Bill banning coal-based parking lot sealcoat was proposed but did not reach a vote in the State Assembly. Work in FY 13 will include a comparison of the toxicity of runoff from the two different types of parking lot sealcoats.

Mission Creek Toxicity

Mission Creek is listed under the Clean Water Act as impaired for "Unknown Toxicity." The Creeks Division has worked to understand the original basis for the listing, and any potential current toxicity problems in Mission Creek. After conducting many toxicity tests with fathead minnows and invertebrates, the City found no signs of toxicity in Mission Creek. However, the Regional Water Board conducted tests at Mission Creek at Montecito Street which showed toxicity to the algae *Selenastrum*, suggesting the presence of herbicides in creek water. In Fiscal Year 2012, the Creeks Division collected samples from several locations along Mission Creek and found no toxicity to *Selenastrum*. High conductivity in Santa Barbara creeks may lead to false positives with test results, and Creeks Division staff will continue to investigate this possibility.

Sycamore Creek Sodium and Chloride

Sycamore Creek was listed recently under the Clean Water Act, based on potential agricultural use of creek water, as impaired for Sodium and Chloride. The Creeks Division conducted creek walks with associated conductivity tests and tested creek

samples for sodium and chloride. Based on results obtained thus far, it appears that Sycamore Creek is high in sodium and chloride due to the natural process of groundwater movement through marine deposits into the creek. One tributary with the highest conductivity, sodium, and chloride ever observed in Creeks Division monitoring will be investigated more thoroughly in FY 13. If results show that the source of sodium and chloride in Sycamore Creek is natural, the Regional Board may de-list the Sycamore Creek from the 303(d) impaired list.

Recommendations for FY13

Several changes are included in the proposed Fiscal Year 2013 Research and Monitoring Plan (attached), including:

1. Tests receiving waters for potential groundwater contaminants.
2. Further investigate potential RV dumping.
3. Conduct monitoring to assist with design decisions for the Mission Lagoon Restoration project.
4. Test for neonicotinoids, a group of pesticides that may be linked to colony collapse disorder in honeybees.
5. Test storm runoff from parking lots covered with coal-based parking lot sealcoat.
6. Conduct additional sampling at the Las Positas Golf Course to support management decisions during dry weather.
7. Collect baseline data for Storm Water Retrofit Projects.
8. Investigate high conductivity in a tributary of Sycamore Creek and also in Honda Creek.

Next Steps

Staff will begin implementing the FY13 Research Plan and perform scheduled monitoring beginning July 2012. The Fiscal Year 2012 Annual Report will be completed and quarterly reporting will resume.

cc: Cameron Benson, Creeks Restoration/Clean Water Manager
Jill E. Zachary, Assistant Parks and Recreation Director



City of Santa Barbara
Parks and Recreation Department

Memorandum

DATE: December 12, 2012

TO: Creeks Restoration/Water Quality Improvement Program
Citizen Advisory Committee

FROM: Jill Murray, Water Quality Research Coordinator

SUBJECT: **Water Quality Monitoring and Research Program Fiscal Year 2012 Report and Source Tracking Protocol Project**

COMMITTEE DIRECTION – FOR ACTION

That the Committee receive a presentation and discuss the results from the Water Quality Monitoring and Research Program Fiscal Year 2012 Report and the Source Tracking Protocol Development Project.

DISCUSSION

Background

In June 2011, the Committee concurred with the staff recommendation to implement the Research Plan for Fiscal Year 2012 (FY12). In December 2011 the Committee received an update on the Source Tracking Protocol Development Project and concurred with the staff recommendation to postpone some portions of the FY12 Research Plan due to a focus on the Source Tracking Protocol Development Project. In June 2012, the Committee received a mid-year update on FY12 sampling, along with recommended changes for the Fiscal Year 2013 (FY13) Research Plan. The Committee concurred with staff recommendation to implement the Research Plan. At this time, the Committee will receive an update on the FY12 Annual Report, focusing on the completion of the Source Tracking Protocol Development Project.

The goals of the monitoring program are to:

1. Quantify the levels (concentration and flux, or load) of microbial contamination and chemical pollution in watersheds throughout the city.
2. Evaluate impacts of pollution on beneficial uses of creeks and beaches, including recreation and habitat for aquatic organisms.
3. Evaluate the effectiveness of the City's restoration and water quality treatment projects, which includes collecting baseline data for future projects.

4. Identify sources of contaminants and pollution in creeks and storm drains.
5. Evaluate long-term trends in water quality.

The underlying motivation behind the monitoring program is to obtain information that the City can use to:

1. Develop strategies for water quality improvement, including prioritization of capital projects and outreach/education programs.
2. Communicate effectively with the public about water quality.

The monitoring program consists of eight key elements, with associated research questions. City staff, Committee members, and community members provide input to shape the questions. In addition, some monitoring is required by grants the City has received. All sample collection and monitoring partnerships are geared toward answering these questions.

Watershed Assessment

1. Is overall water quality, in terms of indicator bacteria and field properties, getting better over time?
2. How contaminated and/or toxic is sediment at creek sites, particularly those below storm drain outfalls?
3. What is the impact of eutrophication on Santa Barbara creeks?
4. What is the impact of recycled water on water quality, including irrigation runoff and water line breaks?
5. What is the impact of groundwater pumping (sump discharge to storm drain) on water quality?
6. What is the source of the 303(d) impairment for Salinity on Sycamore Creek?
7. What is the source of the 303(d) impairment for Unknown Toxicity on Mission Creek?

Storm Monitoring

1. What are the highest concentrations of pollutants of concern during storm events, particularly seasonal first flush storms? Do creeks and/or storm drains in Santa Barbara have problems with toxicity during storm events?
2. What are the loads of pollutants discharged from Santa Barbara creeks during storms?
3. What are the sources of toxicity and routes of pollutants to storm drains during storms?
4. How do concentrations and loads vary during storms and from site to site?
5. How do restoration/treatment projects impact water quality and restoration during storm events?

Restoration and Water Quality Project Assessment

1. Do Creeks Division projects result in improved water quality, as reflected in pre- and post-project, and/or, upstream to downstream, conditions?
2. What is the baseline water quality at future restoration/treatment sites?
3. What are the mechanisms of project success?

4. Are installed projects functioning correctly?

Beach water quality

1. How do creeks and storm drains relate to beach water quality and warnings?
2. How do other factors (kelp, tides, temperature, and beach use) relate to beach warnings?
3. What are the causes of persistent beach warnings that occur?
4. What is the risk to human health from recreation in creeks and beaches in Santa Barbara?

Source Tracking/Illicit Discharge Detection

1. Which drainages and/or subdrainages contribute the greatest loads of pollutants to creeks in Santa Barbara?
2. Where, when and how is human waste and/or sewage entering storm drains and creeks?
 - a. What happens to the signals of human waste and indicator bacteria levels as water moves downstream away from the source?
 - b. How does presence of human waste relate to beach warnings?
3. Do rotting plant material and sediment contribute to high FIB levels in storm drains?
4. What are the impacts of reservoir flushing on metals?
5. Are new hot spots emerging?

Creeks Walks/Clean ups

1. Are there new problems in creeks that need to be addressed?
2. Is the amount of trash in creeks decreasing over time?
3. Were decreases in trash observed between 1999 and 2005 due to creek flow histories or the impact of City programs?
4. Will the installation of catch basin screens lead to decreased trash observed in creeks?
5. Can we see any impairment to San Roque Creek, leading to drop in bioassessment scores?

Bioassessment

1. What is the baseline of biological integrity for benthic macroinvertebrates in creeks?
2. Are there differences between upper watershed and lower watershed sites?
3. Are there differences among watersheds?
4. How does the biological integrity in our creeks change over time?
5. How does the biological integrity respond to water quality and restoration projects?

Methods Development

1. Can we use the following potential new tools?
2. Can a chemical fingerprint be used to identify types of sources?
3. Can field kits be used for enforcement?

Fiscal Year 2012 Annual Water Quality Monitoring Report

The Annual Report describes sampling and results that were based on the FY 12 Research and Monitoring Plan. Compared to previous years, the FY 12 report is reduced in scale due to the focus on completing the Source Tracking Protocol Development Project. A summary of water quality sampling and data analysis in FY 12 includes:

First Flush Monitoring: Chemistry and Toxicity

Each fall the Creeks Division samples the first storm of the season, as this “first flush” is known to produce the highest concentrations of contaminants in stormwater runoff. In most previous years, creek “integrator sites” (lowest sites on creeks, integrating water quality issues across the entire watershed) have been sampled during every first flush event. Following the changes to the FY11 Research Plan, storm drains and gutters were included in first flush sampling, which took place on October 5, 2011. Runoff was collected from street gutters and storm drains at Montecito/Olive Sts., Laguna/Cota Sts., Gutierrez/Quarantina Sts., and Salsipueds/Cota. Sts., along with the integrator sites Laguna Channel at Chase Palm Park, Mission Creek at Montecito Street, Arroyo Burro at Cliff Drive, and Sycamore Creek at the railroad bridge.

These sites were sampled early in the morning, when 0.02” to 0.68” of rain had fallen. Water was tested for metals, pesticides, hydrocarbons, surfactants, and toxicity. Metals and hydrocarbons were not detected at elevated concentrations; however some other results were concerning.

In previous years, very few detections of pesticides have been found in creek samples, during both dry and wet weather. Based on a recommendation by the State-funded UP3 Priority Pesticide list, several pesticides were added to the testing suite in FY11. The wood preservative pentachlorophenol was found in almost every sample the first flush of fall 2010, albeit at low levels. This result was corroborated in first flush 2011 samples, when pentachlorophenol was found in five of nine samples. In addition, 2,4-D, an ingredient in some weed killers, was detected for the first time, and in several samples. The detection limit for this compound was ten times lower than in previous years, which is the likely reason behind the sudden detections. Pyrethroids were also detected, with bifenthrin found at elevated levels in four of nine samples. Unlike in 2010, organochlorine pesticides, including DCPA (dacthal), were not detected in drain samples. It is thought that faulty laboratory procedures led to false positives of dacthal in previous samples.

Continuing a change made in FY11, storm water toxicity in creeks was tested using invertebrates and algae, which are thought to be more sensitive to some constituents than the vertebrate fathead minnow, which had been used in most previous tests. No toxicity was observed in creek sites. Storm drain and catch basin sites were tested with fathead minnows. Results showed high toxicity in some drain samples. These results

show that while Santa Barbara creeks are generally not toxic to aquatic organisms during storm events, due to large amounts of dilution with clean runoff, runoff that is sampled closer to the site of urban activities exhibits toxicity to sensitive species.

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Source Tracking Protocol Development Project

In July 2012 the Creeks Division completed work on the Source Tracking Protocol Development Project. The project was funded by a grant from the State Water Board’s Prop 50 Clean Beaches Initiative Grant Program, and the work was conducted in partnership with Dr. Patricia Holden at the University of California Santa Barbara.

The Creeks Division proposed and completed the project because there was a gap in available guidance on how to find sources of human fecal pollution entering storm drains, creeks and beaches. In previous years, the City has taken an aggressive approach to eliminating fecal indicator bacteria by installing capital projects such as low-flow storm drain diversions and a storm drain UV disinfection project. Concurrent with the capital program, the City partnered with Dr. Patricia Holden at the University of California, Santa Barbara (UCSB), whose research group recruited and tested cutting edge microbial markers, and developed other approaches, to investigate sources of indicator bacteria. Results from this research showed that some storm drain outfalls in

Santa Barbara discharged water with consistent DNA-based signals of human waste. The City of Santa Barbara, with support of the Committee, decided to prioritize the goal of locating and eliminating human waste contributions to fecal indicator bacteria loads due to the potential associated health risks. However, despite substantial effort, tracking human-waste specific signals up storm drain networks to the points of input remained impossible for several years.

The City and UCSB developed and tested tools to locate inputs of human waste to storm drains. As part of the grant agreement, the City and UCSB produced a non-technical guide for coastal managers and a more detailed, technical report to communicate the information to other coastal communities facing similar challenges. The Committee will receive a presentation on the coastal managers guide. Both documents, and the Final Grant Report, are available on the Creeks Division website (www.sbcreeks.com).

During the course of the work, four sites with persistently leaking sewage were identified and repaired immediately. A set of potentially high-risk locations for sewage leaking into storm drains has also been slated for preventative rehabilitation by the Wastewater Division.

cc: Cameron Benson, Creeks Restoration/Clean Water Manager
Jill E. Zachary, Assistant Parks and Recreation Director