DRAFT

City of Newport Beach
Coastal/Bay Water Quality Citizens Advisory Committee Minutes

Date: August 12, 2010
Time: 3:00 p.m.
Location: Big Canyon Reservoir

1. **Welcome/Self Introductions**
   Committee Members present:
   Chairwoman/Council Member Nancy Gardner
   Council Member Mike Henn
   Dennis Baker
   George Drayton
   Tom Houston
   Janet Rappaport
   Randy Seton

   Guests present:
   Casey Clark
   Mrs. Drayton
   Monica Mazur, Newport Beach Resident
   Jack Skinner, SPON
   Ana Rothwell, Leaders of Environmental Action Films (L.E.A.F.)

   Staff present:
   Shane Burckle, Water Conservation Coordinator
   John Kappeler, Code and Water Quality Division Manager
   George Murdoch, Utilities Director
   Craig Justice, Deputy Utilities Director
   Steffen Catron, Water Production Supervisor
   Shirley Oborny, Administrative Assistant

2. **Approval of Previous Meeting's**
   The minutes from the June 10, 2010, meeting were approved.

3. **Old Business**
   (a) Bay and Ocean Bacteriological Test Results
   Monica Mazur reviewed the latest bacti reports.

4. **New Business**
   (a) Water Supply and Conservation Update
   Mr. Justice gave a PowerPoint presentation (attached). The committee discussed alternative methods of supplying southern California with water such as ground water replenishment and desalination. Mr. Houston raised his concern about whether the sanitation district is able to remove certain elements out of the sewage. Mr. Skinner

talked about using UV light and peroxide to treat water. He said it's very effective, including the treatment of pharmaceuticals.

In response to Chairwoman Gardner, Mr. Burckle said Newport Coast is 25-30% retrofitted with smart controllers.

Mr. Murdoch explained that using less water is "water conservation" while using water efficiently is "using water wisely." In other words, don't let the water hose run down the gutter, etc. He talked about State regulations that play a part in determining how much to charge for water.

Mr. Seton pointed out that more water is coming down the San Diego Creek than the entire City uses in a year. He hopes in the future somebody will figure out a way to reuse or recapture that water.

Mr. Baker suggested the water bills include a space to provide positive feedback to the consumer when they are doing a good job with their water consumption. Mr. Justice said there would be a place on the bill for messages to the consumer.

Mr. Burckle said the residents of Newport Beach are very interested in the literature we send them about using water efficiently. They frequently visit the *Watersmartnewport.org* website. He said the general public is just now starting to understand that water conservation and water quality go hand in hand. He talked about a landscape program funded through the Municipal Water District of Orange County (MWDOC) whereby MWDOC meets with an interested HOA to help them come up with an irrigation retrofit plan to save water/money, etc. He talked about other water conservation/water quality public outreach programs being used.

(b) Big Canyon Reservoir Tour

After public comments, Mr. Murdoch gave an overview of the reservoir's function, history, etc., and then led the committee on a tour.

5. Public Comments on Non-Agenda Items

Ms. Rothwell presented an informational handout about L.E.A.F. (attached). She talked about the Rob Machado PSA and various partners of the program. Chairwoman Gardner suggested her presentation be put on the agenda for a meeting in the future.

Mr. Burckle announced that the bacteria study done by Mr. Kappeler, Mr. Skinner, and Ms. Mazur was recently published in *Stormwater* (attached) entitled, "Regrowth of Enterococci & Fecal Coliform in Biofilm." The committee was very excited and congratulated them for their success.

6. Topics for Future Agendas

(a) Update on the Integrated Watershed Planning Efforts
(b) Bacteriological Dry-Weather Runoff Gutter Study (Phase III)
(c) NBTV – Waterwise
(d) OCTA Measure M
(e) Coastal Dolphin Research Program
(f) Regional General Dredging Permit (RGP)

(g) Proposition 84 ASBS Grant
(h) 2010 Urban Water Management Plan

7. **Set Next Meeting Date**
   The next meeting was set for September 9, 2010.

8. **Adjournment**
   The meeting was adjourned at approximately 5:00 p.m.

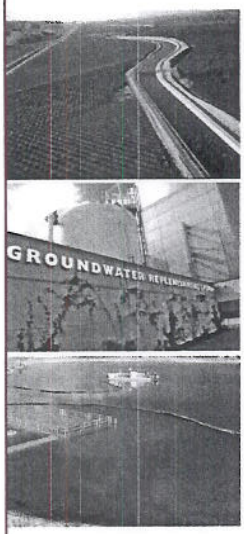
Water Supply and Conservation
CBWQC Meeting
Aug 12, 2010

Presented by: Craig Justice
Deputy Utilities Director
Shane Burckle
Water Conservation Coordinator

Regional Water Supply Situation

- MWDSC is adjusting its 2010 SPW allocations from 40 to 50%
- 2010 MWDSC Integrated Water Resource Plan update
- Below average Colorado River basin water supply (69% of average)
- Continued State Project Water SF bay/delta environmental restrictions
- Possible postponement of $11 billion SPW Bond measure (Prop 18)
- State 20% water reductions by 2020 (SB 7 Steinberg, 2009)
- Development of local water supply projects (desalination, advanced treatment

City Water Supply Sources



- Groundwater pumping set at 62% of total City supply (OCWD)
- State Project Water makes up 38% (MWDOC)
- Recycled water makes up less than 5% of supply

Citywide Water Usage

FY Ending	Water Supply (ac-ft)	Service Area Population	Gallons per Person per Day (GPPD)
2000	19402	63179	266
2001	18774	64531	252
2002	18599	64938	247
2003	18489	63791	252
2004	18376	63903	251
2005	17892	64378	243
2006	17792	64428	242
2007	19026	64854	258
2008	18341	65317	237
2009	16200	66417	204

15% Decrease From the 10-year average

MWDOC 2010

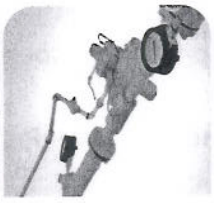
Residential Water Usage (indoor + outdoor)

FY Ending	Water Supply (ac-ft)	Service Area Population	Gallons per Person per Day (GPPD)
2005	10500	55235	170
2006	10450	55755	167
2007	9485	56357	150
2008	9290	56848	146
2009	8310	57212	130

15% Decrease From the 5-year average

2010 Water Supply Outlook

- Projecting 16,500 acre-feet of total water demand
- Groundwater pumping percentage stays at 62% to maintain the groundwater basin levels and water quality
- Recycled water supply will increase with the addition of Bonita Creek and East Bluff Parks. Other City projects being considered


Water Conservation Initiatives

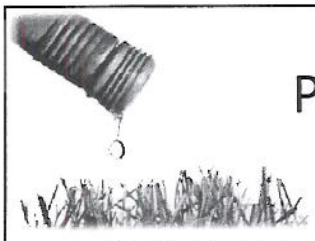
- 2005: UWMP updated to include required water conservation BMPs
- 2007: Hired Water Conservation Coordinator
- 2008: Adopted Resolution for 10% voluntary water conservation goal
- 2008: Responded to Grand Jury findings ("water budgets, not water rationing")
- 2009: Responded to Grand Jury findings ("paper water – does OC have a reliable future?")
- 2009: Adopted Water Conservation Ordinance, including permanent water conservation requirements

Water Conservation Initiatives

- 2010: Adopted Water-Efficient Landscaping Ordinance
- 2010: Adopted a water rate structure compliant with conservation BMPs
- 2010: Possible DWR Grant with MWDOC and members agencies to study Water Budget Based Rate structures
- City park ET irrigation controllers (208 installed over past 4-years)
- Participating with other agencies on developing local water supplies
- On-going water supply and resource planning – 2010 UWMP update
- Public Outreach and Education Program

Looking Ahead

- Council consideration of a Resolution declaring a "level one water supply shortage warning" and establishing a 5% water conservation goal
  - Another 5% citywide reduction would achieve the 20% by 2020 mandate
  - Includes level one mandatory water conservation requirements (number of irrigation days – summer 4 and winter 2)
  - Water Conservation Ordinance permanent BMP requirements in effect at all times
- With the level one declaration - Initiate the City's Water Conservation Implementation Plan
  - Establish a Water Supply Task Force to create water supply shortage response procedures
- Revise the customer utility bills to show the water usage conservation goal based on their 3-year average usage for a billing period. Include a bill statement message when customers achieve the 5% reduction.



Public Outreach

- Marketing Campaigns
  - WaterSmartNewport.org Logo and site
  - Smart Irrigation Month
  - Water - Do More With Less
    - PSA's NBTV; Newport Beach theaters and NB Film Festival
- Media and Direct Mail
  - Municipal Statement Inserts
  - NBTV – WaterWise
  - Facebook and Twitter
  - Newspapers and Local Magazines
    - Live OC; Newport Beach Magazine; Art Plantae
- Events
  - WaterMiser Workshop
  - Earth day
  - Coastal Cleanup Day
  - HOA's, Interest groups and clubs
- Education and Partnerships
  - MiOcean; Earth Resource; Zero Trash Newport; Oceana; Project Save our Surf etc.
- Commercial
  - Hotels
    - Table tents and door hangers; Appliance rebates and audits
  - Restaurants
    - Table tents; Appliance rebates and audits
  - HOA's
    - Rebates and landscape audits
- School Outreach
  - 1166 NB students – grade school
  - 500+ students - Ocean institute
  - Leaders in Environmental Action films (LEAF)
    - Over 150 submissions (City of Newport Hosted and sponsored)

Full details see 2010-2011 Water Conservation and Quality Marketing Outreach Plan

Questions?

Leaders of Environmental Action Films (L.E.A.F.)

Empowering youth to be the leaders of environmental solutions through the art of film!

Mission:

L.E.A.F.'s mission is to empower youth to become the environmental solutions within their own communities and beyond, through the powerful art of film.

L.E.A.F Project will include:

- High School Students are challenged to create a 30 or 60 second eco-commercial on any sustainable subject of their choice from energy efficiency, recycling, clean water, clean oceans, saving marine animals, healthy lifestyle, etc..
- Contest will be open to California High School Students
- Winning eco commercials will be utilized by L.E.A.F. non profit partners and municipalities for their community outreach campaigns
- Series of educational forums with leading experts - live webcasts connected to facebook
- Launch & press conference events
- Celebrity and Student awards events in conjunction with the Newport Beach Film Festival, Los Angeles Film Festival, and others (TBD)
- Showcasing L.E.A.F. winners at the Environmental Protection Agency national conference
-

L.E.A.F. Core Partners:

- Volcom
- Exclusively approved online video platform for the US school system reaching 27,000 schools nationally and internationally
- Environmental Protection Agency
- OC Department of Education's Inside The Outdoors Foundation (non profit umbrella) – representing 500,000 students, 27,000 teachers in OC
- Star Education/Eco Station (the leading educational foundation for state of California) reaching 250,000 students Sacramento to San Diego
- City Newport Beach
- Newport Beach Film Festival – 40,000 attendees -featuring 400 films from 30 countries
- ActivEmpire – leading action sports industry focused promotion and events company

L.E.A.F Community Partners

L.E.A.F. project will work with our LEAF Non Profit and Municipality partners to connect the students to their educational resources for the purpose of factual data for the students psas. In return, the students can submit specific LEAF psas that line up with our Community Partner's outreach campaigns. LEAF Community Partners include:

- Plastic Pollution Coalition
- Municipal Water District OC (MWDOC)
- Surfrider Foundation – 80,000 members globally
- Environmental Media Association
- OC Health Agency
- OC NPDES – Water Quality
- Algatia Marine Research Foundation founded by Charles Moore
- Project Save Our Surf – Founder and Co-Chair Tanna Frederick, Additional Co-Chairs are P.T. and Shaun Thompson

L.E.A.F. Celebrity Founding Partners:

- Tanna Fredrick- Actress, OCEANA member and leader of OCEANA Project Save our Surf
- Ed Begley Jr – Actor – Planet Green's "Living with Ed" tv show
- Charles Hambleton – Oscar winner "The Cove" and actor Pirates Caribbean
- Peter Townend "P.T." – first world champion surfer, Surfers Hall of Fame and leader in Surf/action sports industry

L.E.A.F. Student Contest Requirements:

Students will be challenged to develop a creative public outreach message that results in increased environmental awareness within their community.

Objective:

1. Integrate a creative message process to reach and influence their community

Contest - students would produce one of the following:

- 30 or 60 second PSA

Educational Forums presented in Live Webcasts - with environmental, academic, entertainment, marketing leaders

1. Environmental Forum – a panel of leading experts representing the major environmental topics: water, plastic pollution, energy, etc..
    - Purpose: To provide an insight on the topics for the students to choose from that matters most to them
2. Entertainment Forum – a panel of leading experts representing the entertainment industry: Directors, Writers, Editors, Actors, etc..
    - Purpose: How to create a story and film a documentary, from beginning to end? Producing, Editing, Writing a Script, Directing
3. Marketing and Social Media Forum – a panel of leading experts
    - Purpose: Once you have your product, how to reach your audiences and measure results

Winning Student Rewards:

- Award winning students will be featured in conjunction with the 2010 Newport Beach Film Festival (an international event – 40,000 attendees) showing videos from top winners to Newport Beach city leaders, action sports and Hollywood celebrities and national media exposure.
- Prizes from sponsoring industry leaders for students.
- Leading universities presenting certificates to winning students for accomplishments, benefiting students for future college applications.
- L.E.A.F. partners disseminate winners project nationally and globally.

2009/2010 RESULTS

Leaders of Environmental Action Films (L.E.A.F.)

RESULTS:

- **Students showcased and rewarded at the Newport Beach Film Festival in partnership with Newport Bay Naturalists, OC Parks' Earth Day event**
- **UCI recognized students with certificates of accomplishment**
- **Oscar winner for 2010 Best Documentary' producer personally gave awards to students**
- **City Councilwoman Leslie Daigle on behalf of the city recognized students**

Media exposure included for LEAF

- **Newport Coast Magazine, OC Metro, Fox Sports Fuel TV (reaching 80 million viewers), OC Register, Laguna Beach News**
- **Winning Student PSAs run on**
- **Cox Verb TV (Santa Barbara to San Diego)**
- **Social media exposure globally with Volcom and Nationally with partners, Wahoos, etc..**

Winning PSAs to be utilized by organzations:

- **Health Agency/Surfrider's campaign for anti cigarette butts (LEAF 3rd place winner)**
- **OC Public Works - OC Watersheds**

Testimonials:

Ed Begley Jr, Actor and Environmental Activist

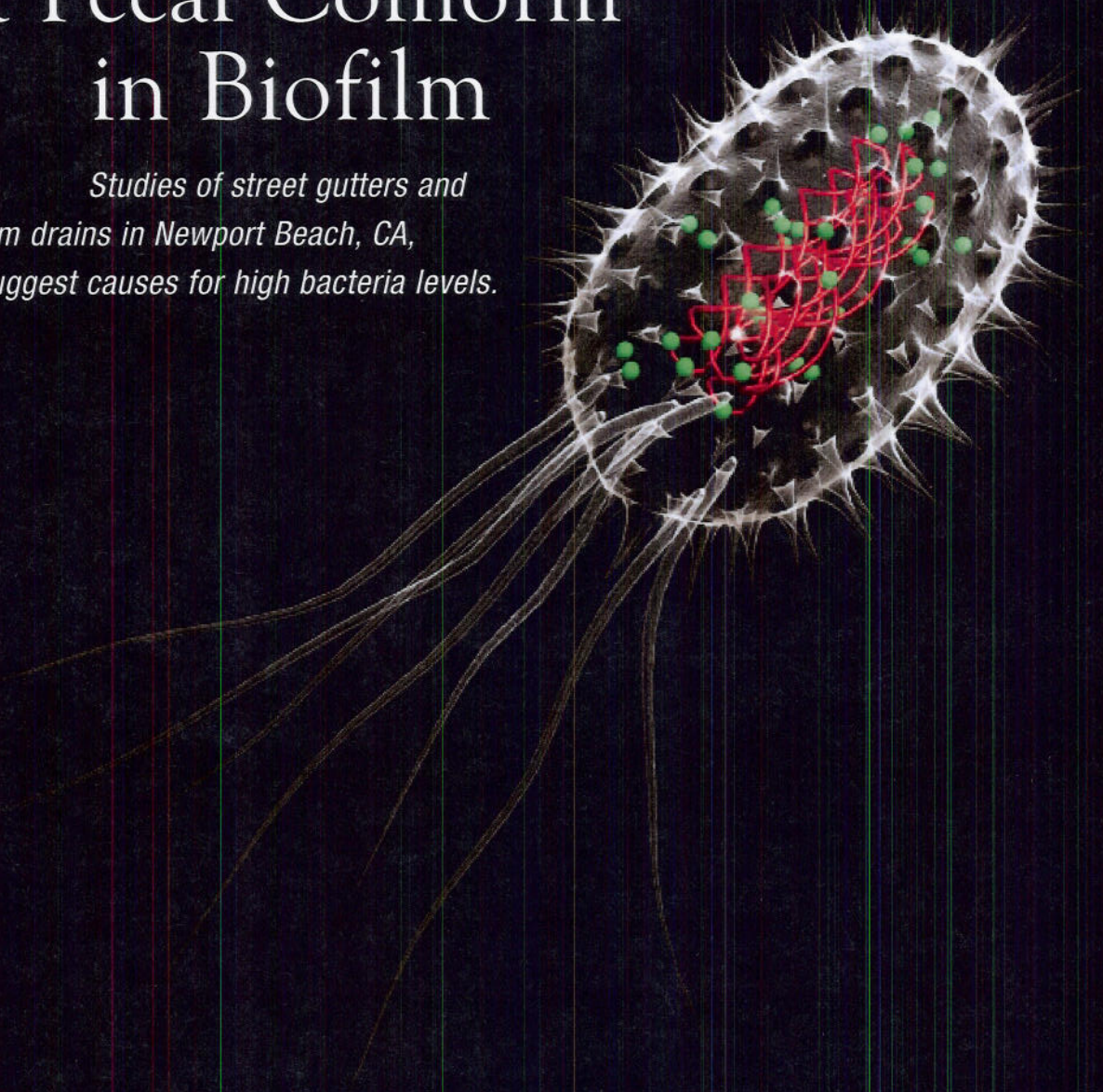
"I'm so proud to be a part of LEAF in their efforts to inspire and engage young people to try to make a difference. By involving them in LEAF's Ecomercial contest we can not only foster creativity in our youth, but also give them the tools to help tackle some of our larger environmental problems."

Louie Psihoyos, Director "The Cove" , 2010 Oscar Winner for Best Documentary

"Film is the most powerful medium in the world to to effect positive environmental change. We need legions of young filmmakers out there learning the craft and understanding that through their creativity the can indeed change the world."

Regrowth of Enterococci & Fecal Coliform in Biofilm

Studies of street gutters and storm drains in Newport Beach, CA, suggest causes for high bacteria levels.



By John F. Skinner, Joseph Guzman, and John Kappeler

Recently the city of Newport Beach, CA, and the Orange County (CA) Health Care Agency Water Quality Laboratory have completed studies presenting evidence that biofilm regrowth of enterococci and fecal coliform bacteria is occurring in street gutters and storm drains. This may explain the occasional high levels of these bacteria in runoff water flowing from residential areas into nearby Newport Bay. If these findings of regrowth are duplicated by others, the health threat to recreational swimmers resulting from nonpoint sources may be overestimated (Colford et al. 2007).

The city of Newport Beach has implemented a number of measures to be certain that raw sewage is not entering the city's urban runoff system, including a comprehensive fiber-optic scoping program to check for sewage/storm drain cross-connects, and to identify any breaks in the integrity of the city's sewer system.

Previous studies indicate that biofilms provide a safe environment for enhanced bacterial replication; supply nutrients and water for biofilm bacteria; and offer protection against microbial predators, ultraviolet (UV) light, drying, and disinfectants (Coghlan 1996, Costerton et al. 1995, Donlan and Costerton 2002, Donlan 2002).

Bacteria have been observed detaching

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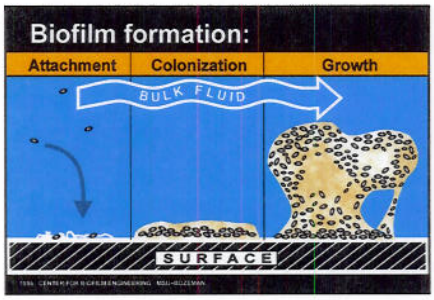
from the surface of biofilms and entering the overlying water column as single planktonic bacteria or small clumps of bacteria attached to fragments of biofilm (Figure 1). The rate of detachment of these bacteria is related to factors such as water flow velocity, shear forces, nutrient availability, and aging of biofilm.

In 2006, the Orange County Health Care Agency's Water Quality Laboratory staff performed studies that determined that enterococci and fecal coliform were multiplying in bacterial biofilms in the Dover Drive storm drain located in Newport Beach (Ferguson 2006).



P. Dirckx, MSU Center for Biofilm Engineering

Figure 1. Process of biofilm formation

In the 2006 study, biofilm in the Dover Drive storm drain contained up to 4.6 million enterococci and 1.8 million fecal coliform/100 grams or 100 milliliters of biofilm. Enterococci and *E. coli* were grown in the laboratory under simulated natural conditions using filtered stormwater. These bacteria grew on the glass slides as microcolonies and secreted extracellular polymeric substances (EPS), a marker of biofilm formation. The presence of this EPS was validated using Calcofluor stain (Polysciences Inc., Warrington, PA). The multiplication of enterococci and *E. coli* in biofilm was documented by using PNA FISH (peptide nucleic acid probes and fluorescence in situ hybridization) (AdvanDx Inc., Woburn, MA) and visualized using fluorescent microscopy.

Subsequently, sections of PVC pipe and concrete coupons were placed in the Dover Drive storm drain for two weeks before removal. Some of the enterococci and fecal coliform were adherent to the pipe and coupons and could not be removed by vigorous rinsing or washing. However, sonication freed up these adherent bacteria. These findings are consistent with biofilm formation.

In 2009, the city of Newport Beach and the staff of the Orange County Health Care Agency Water Quality Laboratory performed water-quality studies in a residential neighborhood where street gutters flow directly into the Dover Drive storm drain just upstream from the site where the earlier 2006 study was performed.

The goal of the current studies was to determine the sources of high numbers of enterococci and fecal coliform found in street gutter runoff flowing from residential areas.

Initially, studies were performed to determine the levels of fecal indicator bacteria entering street gutters from a nearby residence. Bacteria-free hose water was used to wash down a driveway and a sidewalk for testing. Runoff water from flooding a residential front lawn was also

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Figure 4. Street sweeper

Figure 2. Sprinklers overshooting lawn onto street

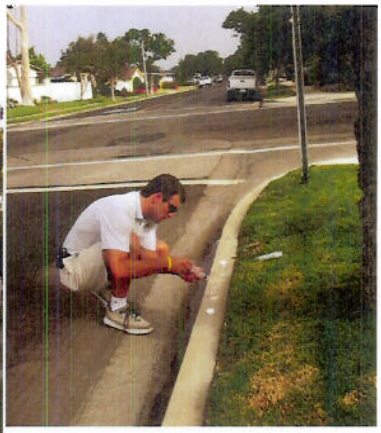


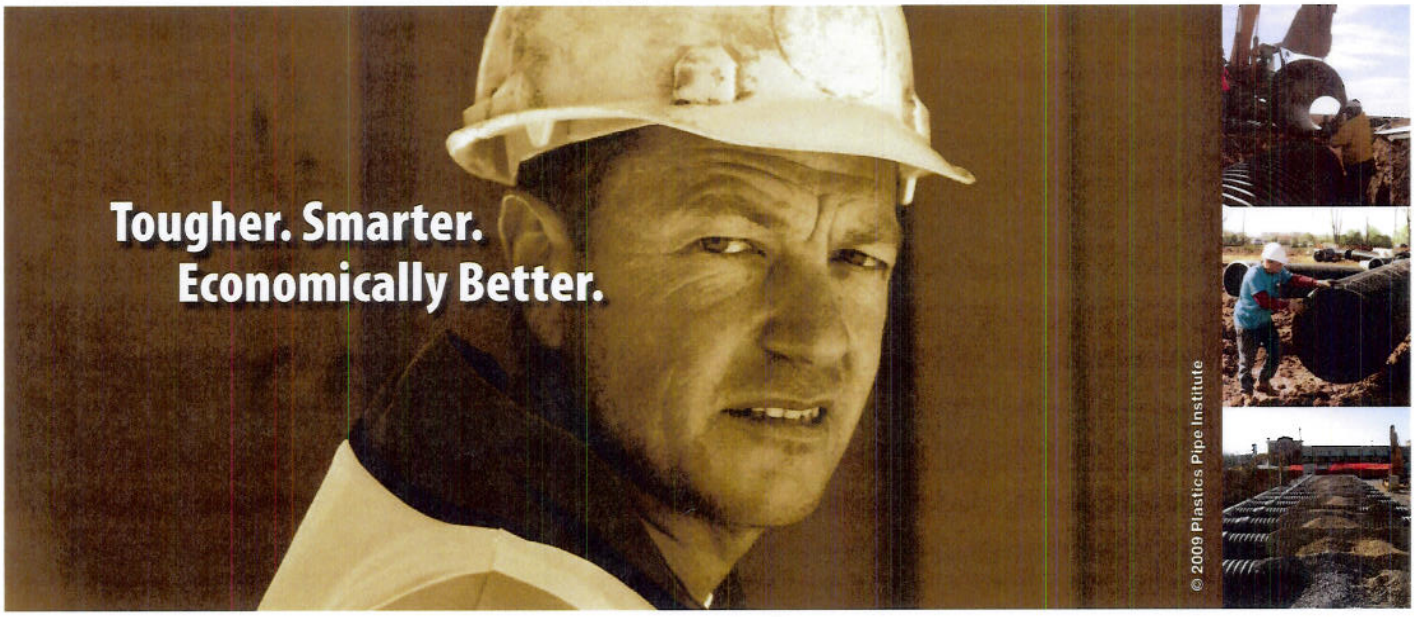
Figure 3. Sample collection 100 meters downstream

analyzed. Runoff from a front yard garden where the runoff water exited through a hole cut through the curb and drained directly into the gutter was studied. Finally, a water sample from lawn sprinklers was tested to be certain it was bacteria free.

The following results were obtained: Bacteria counts in runoff from washing the sidewalk were 220 enterococci/100 ml and 180 fecal coliform/100 ml. Washoff water from the driveway was 160 enterococci/100 ml and 9 fecal coliform/100 ml. Runoff from flooding the grass contained 1,250 enterococci/100 ml and 2,000 fecal coliform/100 ml. Water draining directly into the gutter through a hole cut through the curb grew out 70 enterococci/100 ml and 100 fecal coliform/100 ml.

Most of the water entering the street gutters originated from misdirected sprinklers that sprayed directly onto the streets (Figure 2). Surprisingly, it was rare to see water entering the gutters from overwatering lawns. The amount of water in the usual sprinkler cycle apparently did not oversaturate lawns and cause runoff.

Flows from holes in the curb directly into the gutter usually



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indicate drainage either from backyard and side yard patios or from roof gutter drains plumbed to flow directly into the street gutter. Repeated checks of these curb holes during the summer and fall study period did not identify any other than the one measurable flow described above. There is need to gather more information to determine if these occasional flows contain high levels of enterococci or fecal coliform bacteria.

No dog excrement was observed during the time that the bacterial samples were obtained. However, a number of dog walkers were observed bagging their dogs' fecal material for proper disposal.

Table 1. Results of Wet Biofilm Samples

Date	Enterococci/100 ml	Fecal coliform/100 ml	Comments
10/8	9,000,000	6,000,000	Before rain
10/8	1,410,000	1,230,000	Before rain
10/14	Rainy day—all biofilm flushed from gutter		
10/16	41,000	1,330,000	Two days after rain
10/16	All biofilm manually scraped from stretch of gutter		
10/20	120,000	10,000	Biofilm patches a.m.
10/20	870,000	460,000	Biofilm patches p.m.
10/21	2,060,000	10,000	Diffuse patches
10/27	200,000	100,000	
11/19	670,000	24,000	

Further studies were performed to determine if enterococci and fecal coliform bacteria were growing in the street gutters and could be responsible for high indicator bacteria counts found in gutter water.

The first study was performed on July 8, 2009, and was designed to measure fecal indicator bacteria concentrations in a street gutter draining from 10 residential homes. Bacteria-free hose water was introduced into a dry street gutter and tested for enterococci and fecal coliform at 10 meters, 45 meters, and 100 meters downstream when the flow from the hose water reached those locations. There was a progressive rise of both enterococci and fecal coliform bacteria with the increased distance of flow. The levels of fecal indicator bacteria were 26,000 enterococci/100 ml and 14,000 fecal coliform/100 ml when the water reached the 100-meter test site, the last testing station (Figure 3). The source of these high numbers of bacteria is suspected to be coming from regrowth in the street gutters.

The EPA's single sample standard is 104 enterococci/100 ml.

The second study was performed on September 18, 2009, and utilized the same protocol as the first study to determine the impact of street sweeping on these high fecal indicator bacteria counts. Street sweeping of the 100-meter stretch of street gutter was performed by the city of Newport Beach using a street sweeper equipped with rotating brushes and vacuum cleaning equipment to pick up particulates in the gutter (Figure 4). Again, bacteria-free

Figure 5. Slime or biofilm in street gutter

hose water was introduced into the same street gutter. Water samples collected at the 100-meter sampling station revealed markedly reduced fecal indicator levels of 1,550 enterococci/100 ml and 870 fecal coliform/100 ml.

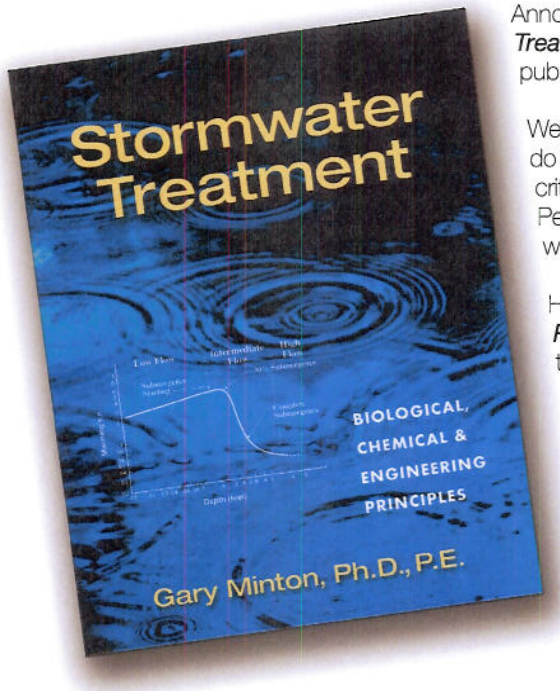
The third study took place between October 5, 2009, and October 27, 2009, and was designed to determine if the high fecal bacterial counts found in the street gutter water were due to replication of these bacteria growing in street gutter biofilm.

It was noted that the street gutter across the street from the previous testing site had a more abundant growth of slime or suspected biofilm (Figure 5), because street sweepers had not been able to clean that street gutter for weeks. This street gutter drains a separate watershed of 30 homes, with all runoff flowing four blocks before emptying into the Dover Drive storm drain near the site of the 2006 biofilm study.

Sampling of this suspected biofilm identified up to 9 million enterococci and 6 million fecal coliform per 100 grams (equivalent to 100 ml) of biofilm. These biofilm samples were sonicated to release entrapped bacteria, and the levels were validated with split sampling. Gutter water samples flowing over the biofilm contained 5,500 enterococci and 3,600 fecal coliform/100 ml.

To determine if this biofilm, or slime, was contributing bacteria to the runoff in the gutter, bacteria-free hose water was introduced into the dry gutter and was sampled 60 feet downstream. This test was performed to determine if the biofilm-like material was shedding enterococci or fecal coliform as the bacteria-free hose water flowed over the moist biofilm. Enterococci and fecal coliform levels in the water sampled 60 feet downstream were reported to contain 3,200 enterococci/100 ml and 230 fecal coliform/100 ml. It is suspected that these bacteria were free-floating planktonic forms of

STORMWATER TREATMENT



Announcing the 3rd edition of Gary's widely acclaimed book: ***Stormwater Treatment, Biological, Chemical, and Engineering Principles*** to be published October 1st. A special price offer if ordered by October 1st.

Wet ponds, sand filters, bioretention, infiltration basins, swirl concentrators. How do these things work? What is the relationship between first principles, design criteria, and performance? How can we make these systems smaller, but meet Performance Goals. What are the lowest likely median effluent concentrations we can expect for each system, including manufactured systems.

Here are some of the major changes. Four new chapters: ***Gross Solids Removal, Advanced Treatment, Source Control,*** and ***Maintenance***. thirty pages on bioretention. An increase in text by over 50%. Many new figures and tables. Summations of field studies on several different treatment systems, with a focus on effluent concentration, discussions of reuse, roof gardens, roof treatment, over 2,700 references, and more. Go to *www.stormwaterbook.com* to learn more.

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bacteria that were shed from the underlying biofilm.

At the time of testing, the biofilm-like slime had formed a coalescent film covering virtually the entire gutter surface.

On October 23, 2009, a gardener was seen washing off large paved areas at a home located 100 feet upstream from the gutter testing site. This water was seen flowing in the gutter for four blocks before entering the Dover Drive storm drain. There was no other water input from the side streets at that time. The bacterial counts in the gutter water just prior to entering the Dover Drive storm drain contained 38,000 enterococci/100 ml and 5,200 fecal coliform/100 ml, indicating that the gutter water apparently picked up more bacteria from the street gutter along the four-block flow path.

On October 14, 2009, there was a significant rain event that washed away nearly all of the slime/biofilm in the gutter. Subsequently, an 8-foot stretch of gutter was vigorously scraped with a putty knife to remove any remaining visible slime/biofilm from that section of gutter, and the gutter was observed over the next month (Figure 6).

Figure 6. Photo looking down at street gutter. The dark patches show biofilm re-forming in the gutter after it was scraped clean of biofilm two weeks earlier.

Four days after scraping the gutter, small patches of slime/biofilm were seen reforming on the scraped areas. Two small samples of biofilm were obtained and tested. The first contained 120,000 enterococci/100 grams and 10,000 fecal coliform/100 grams. The second sample contained 870,000 enterococci/100 grams and 460,000 fecal coliform/100 grams.

By five days after the slime removal, patches of the suspected biofilm growing in the gutter were larger and contained 2,060,000 enterococci/100 grams and 10,000 fecal coliform/100 grams. The last sample of new growth of biofilm was tested at one month after slime removal, and bacterial levels were 670,000 enterococci/100grams and 24,000 fecal coliform bacteria (Table 1).

The findings of these studies provide evidence that regrowth of both enterococci and fecal coliform bacteria are occurring in biofilm located in residential street gutters and storm drains in Newport Beach. It is suspected that these biofilm bacteria may be responsible for some of the high levels of enterococci and fecal coliform bacteria reaching Newport Bay from residential neighborhood runoff.

These findings raise important questions as to whether enterococci and fecal coliform bacteria replicating in biofilm located in street gutters and storm drains confound testing for fecal contamination and potential health issues. Health officials agree that enterococci and fecal coliform bacteria originating from human fecal sources indicate a health risk to swimmers not because of the presence

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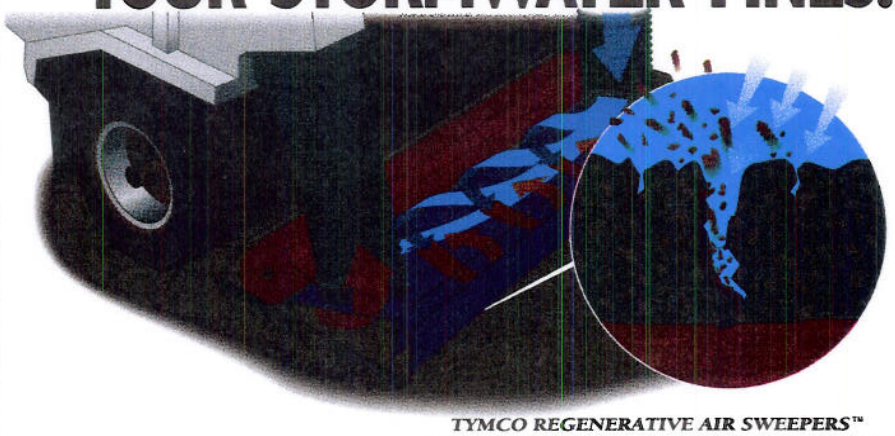

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of *E. coli* and enterococci but because of the presumed presence of human enteric viruses. It is the enteric viruses, including Enterovirus, Adenovirus, and Norovirus, that are believed to be the primary cause of swimmer-related gastrointestinal illnesses (Glass et al. 2009). These enteric viruses multiply in the human gut but not in the environmental biofilms such as those found in street gutters or storm drains.

If these study findings are substantiated by others, the focus of remediation should be on best management practices to reduce the bacterial biofilms in street gutters, catch basins, and storm drains.

Frequent street sweeping, cleaning out the catch basins of biofilm material, using storm drain filters to remove debris, reducing water usage for landscape irrigation, filling in pooling locations in residential street gutters where replication can occur, and focusing on proper placement of sprinklers to prevent water from being sprayed directly into street gutters all play an important role in reducing gutter biofilm growth.

The findings of these gutter studies provide a logical explanation for elevations of fecal coliform and enterococci found in urban runoff in the absence of human fecal contamination.

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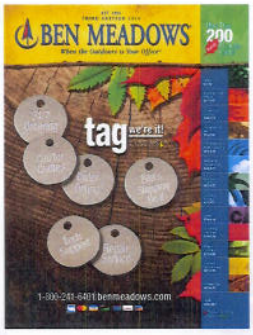

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