APPENDIX D - Technical Advisory Committee

1. Topanga Source Identification Study TAC Meeting Minutes, December 12, 2012
2. Topanga Source Identification Study TAC Meeting Minutes, April 24, 2013
3. Topanga Source Identification Study TAC Meeting Minutes, October 30, 2013
4. Topanga Source Identification Study TAC Meeting Minutes, April 16, 2013

Topanga Source Id Study

TAC Meeting Minutes
12-12-12

See attached sign in sheet for participants. Steve Weisberg and Jed Fuhrman were not able to attend, but Jed sent in some comments regarding collecting virus samples.

Following introductions, Bruce Hamamoto from DPW provided a brief update on the MS4 permit and the potential for natural source exclusions. This is a way to demonstrate that no anthropogenic sources are contributing to the high bacterial counts. Lots of unknowns with this as a formal protocol to assess the risks of these non-anthropogenic sources is not well known or documented as yet. This may be a way to delist an impaired waterbody in the future. There are no precedents or procedural guidelines set as yet.

Eventually, the idea is to set site specific objectives that include human marker limits as part of a Quantitative Microbial Risk Assessment. Source Id such as that proposed with this study is an important first step. Bernard Franklin noted that the current MS4 permit uses the EPA REC-1 standards.

Rosi Dagit then outlined the project goals and objectives as well as reviewed the tasks. See the attached power point for main topics discussed. Sites were selected based on public access, safety and location representative of a subset of the watershed. The county study is starting sampling at the TC Blvd Bridge (MM2.02), which is where the stream gradient increases from 3-6% and it is located exactly half way between the town and beach. There is no development in this area of the state park, but it has had a few exceedances, possibly associated with transients, and/or the recently dismantled pot farm.

Jenny Jay gave an overview of the SIPP (Source Identification Protocol Project) which has been conducting investigations to calibrate and standardize the new molecular marker methods of source identification. Topanga was the site selected by the SIPP team because of a number of factors including, a history of poor water quality, significant prior data available, excellent network of stakeholders, and amenability of the watershed for new BMPs . The SIPP effort will continue to provide some sampling effort and the county funding will significantly enhance the development of a good picture of why the beach has exceedances.

Tim Riedel discussed the information in the attached power point to provide some background on the data gathered thus far. The SIPP project will continue to take samples just below the end of town at Owl Falls, if permission for access via private property is obtained. This will allow further examination of the currently observed pattern of high bacterial levels in town that decrease as they move downstream.

We discussed which thresholds to use (state or new EPA) and agreed to use the state standards for marine waters of total <10,000MPN, Fecal <400 MPN, Entero <104 MPN. There is no marine standard for *E. coli* but the fresh water limit is <235 MPN.

Rosi then requested input and review of the data sheets and sampling plan. Carlos Zimmerman suggested that we add some sampling dates to capture the conditions at the time the lagoon breaches, which we will do.

We discussed the problem of photo monitoring of the lagoon. The existing camera located on top of the lifeguard station does not capture the image of the lagoon connection very clearly. Bernard and Carlos were going to see if the camera could be adjusted to help. In the meantime, the county lifeguards have agreed to take a photo daily and note the condition of the connection.

Steve Braeband suggested that we add a sample blank collected at the first sampling site to calibrate our nutrient testing. He also recommended that we add a thermometer to the ice chest and record sample holding temperatures.

We discussed adding the sample holding temperatures to the chain of custody sheet as well.

Richard Sherman noted that there is not much documentation of the septic systems owned by State Parks along PCH. He is checking with the county on any information. Suzanne Goode noted that she learned that one or two of those systems might still be connected to leach fields/seepage pits. Richard will find out what the situation is and coordinate the testing of the systems with Rosi and State Parks in the spring.

Steve Braeband noted that the contractor who had been collecting the samples for the lifeguard station septic treatment system had been a bit lax, so he was happy to coordinate sample collections with our project. He will discuss logistics with Rosi to coordinate.

We also discussed:

- adding BOD (Biological Oxygen Demand) to the tests. Jenny noted that they could do that test in her lab.
- Checking with SCCWRP and Gary Cooper to discuss data management
- Tim will continue getting the city data by request
- Will also add a thermometer to the coolers to track temp during sample transport

Shirley Birosic suggested that we separate our field QA/QC from the lab QA/QC as they are different. Those changes have been made.

Lastly, Shirley noted that collection of this kind of data could result in scrutiny from the Regional Board and potential 303 d listing for the upper watershed. Susan Nissman explained why the county is taking a proactive approach to identify the sources and work with the community both via education/ outreach and implementation of county laws regarding violators. Shirley noted that this proactive approach is great, but that it may or may not affect a listing.

Rosi noted that monthly reports will be prepared and circulated among the TAC members. If anyone has any suggestions or recommendations, please send them along right away. Susan Nissman noted that this "virtual" TAC would be great, especially if everyone replies to all, so that the conversation can be followed. The next meeting will be held in late spring, after the wet weather data is compiled.

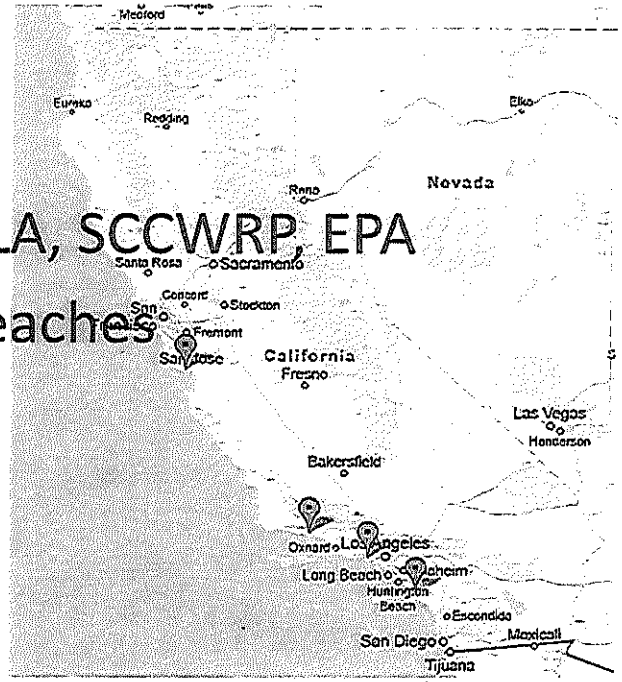
Post meeting Tim noted that there was a big elevation difference between Rodeo Grounds (0') and Shale Falls (200') and wondered if there was a closer site that might work. Upon further discussion, we agreed to use Brookside Drive (0') which is the same elevation and physically closer to Rodeo Grounds (500 meters) located at 1700 meters, and has a much safer access path.

Topanga Data Update

Dec 12th 2012

Presented by Tim Riedel,
UCLA Department of Civil and Environmental Engineering

- Source Identification Pilot Project (SIPP)
  - CA State Water Resources Control Board, Clean Beach Initiative, SCCWRP
  - 43 microbial source tracking methods across 27 Labs
    - human, cow, ruminant, dog, gull, pig, horse, and sheep
  - Core labs
    - Stanford, UCSB, UCLA, SCCWRP, EPA
    - Proof-of-concept beaches
      - UCLA
        - » Topanga



Data Introduction

- **FIB** – Fecal Indicating Bacteria
  - MPN/100ml ≈ Viable Cells/100ml

FIB	CA Standards	EPA Standards
Total Coliform	10,000	1,000
E. coli	400	?
Enterococcus	104	35

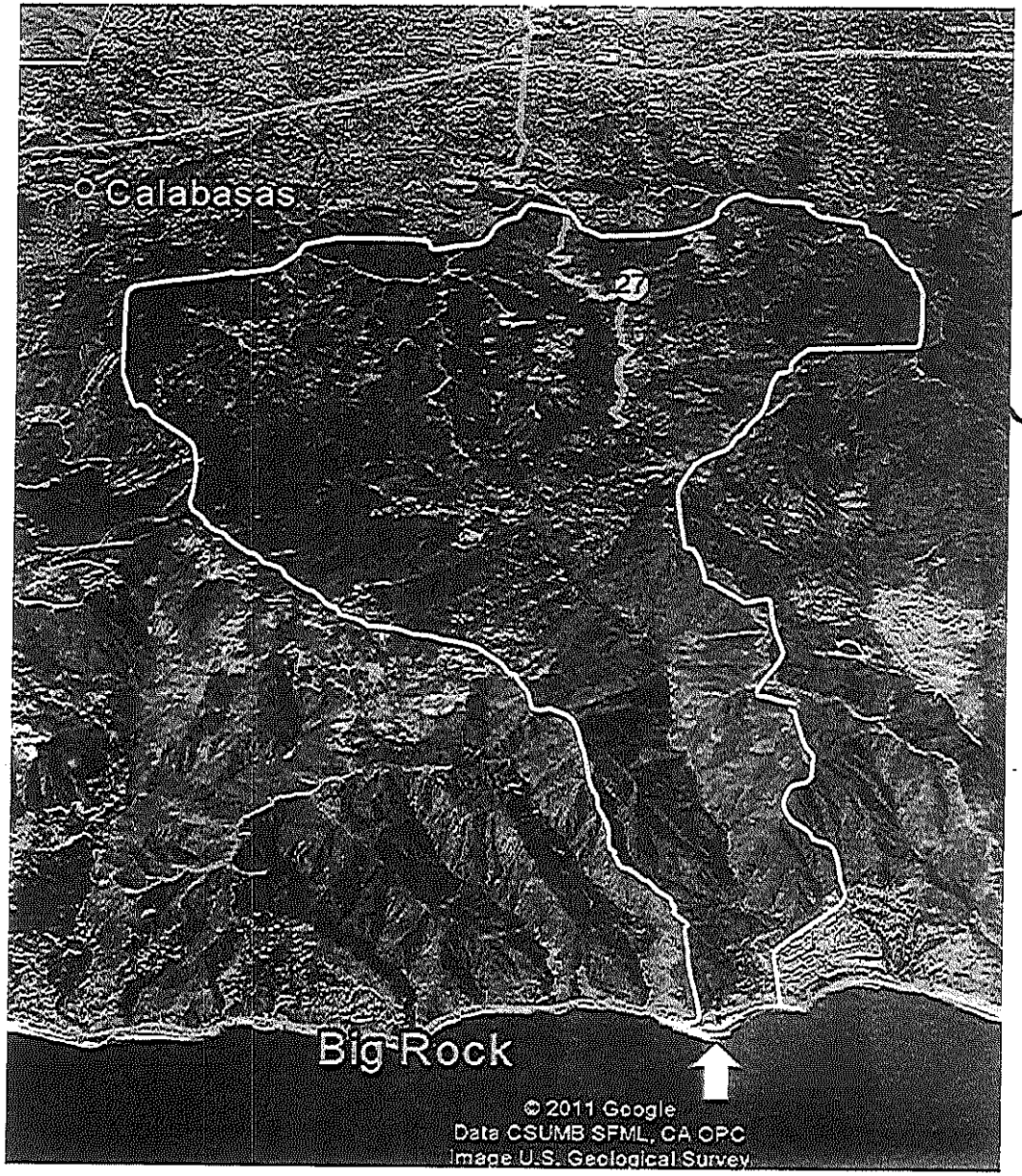
- Host Associated Markers (qPCR)
  - **Gene copies/100ml** – average of triplicate reps
  - **D** or **ND**

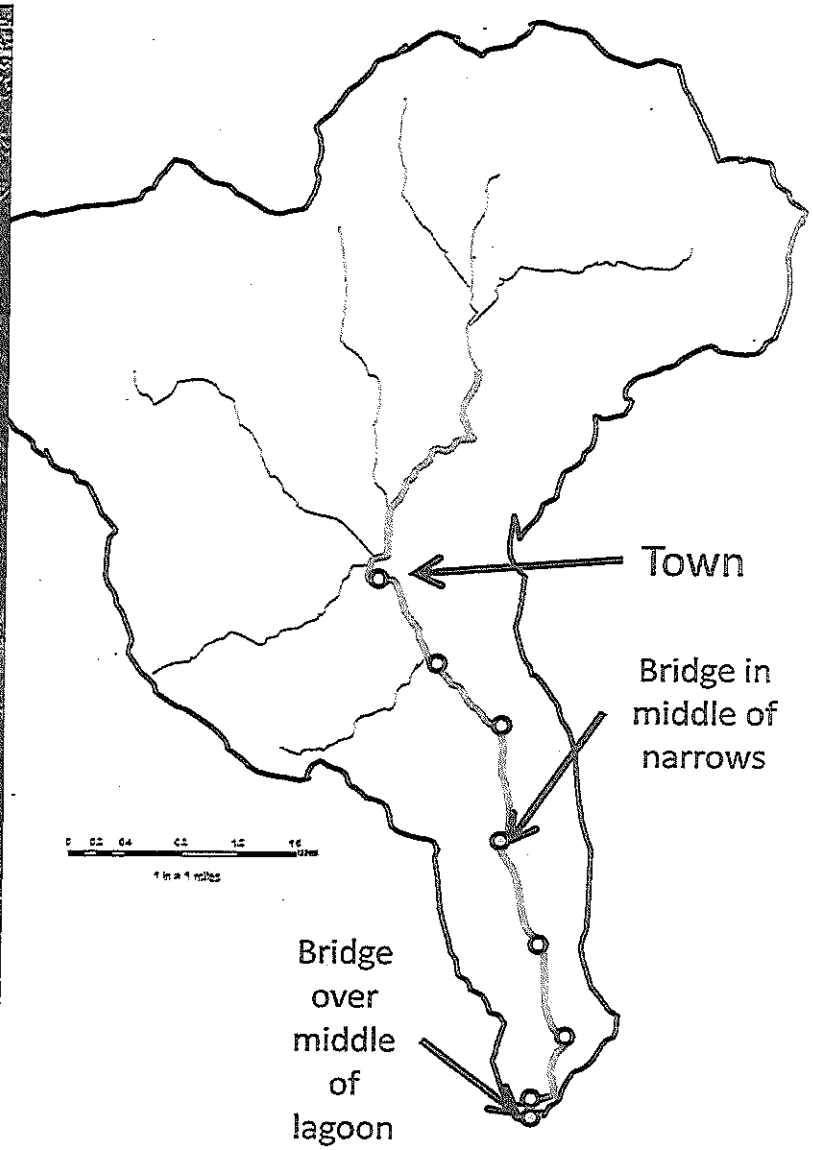
Target	Assay	LLOQ
Human	HF183Taqman	<80
Gull	Gull2Taqman	<200
Dog	DogBact	<1400

Topanga 2011-2012 SIPP Microbial Source Tracking Study

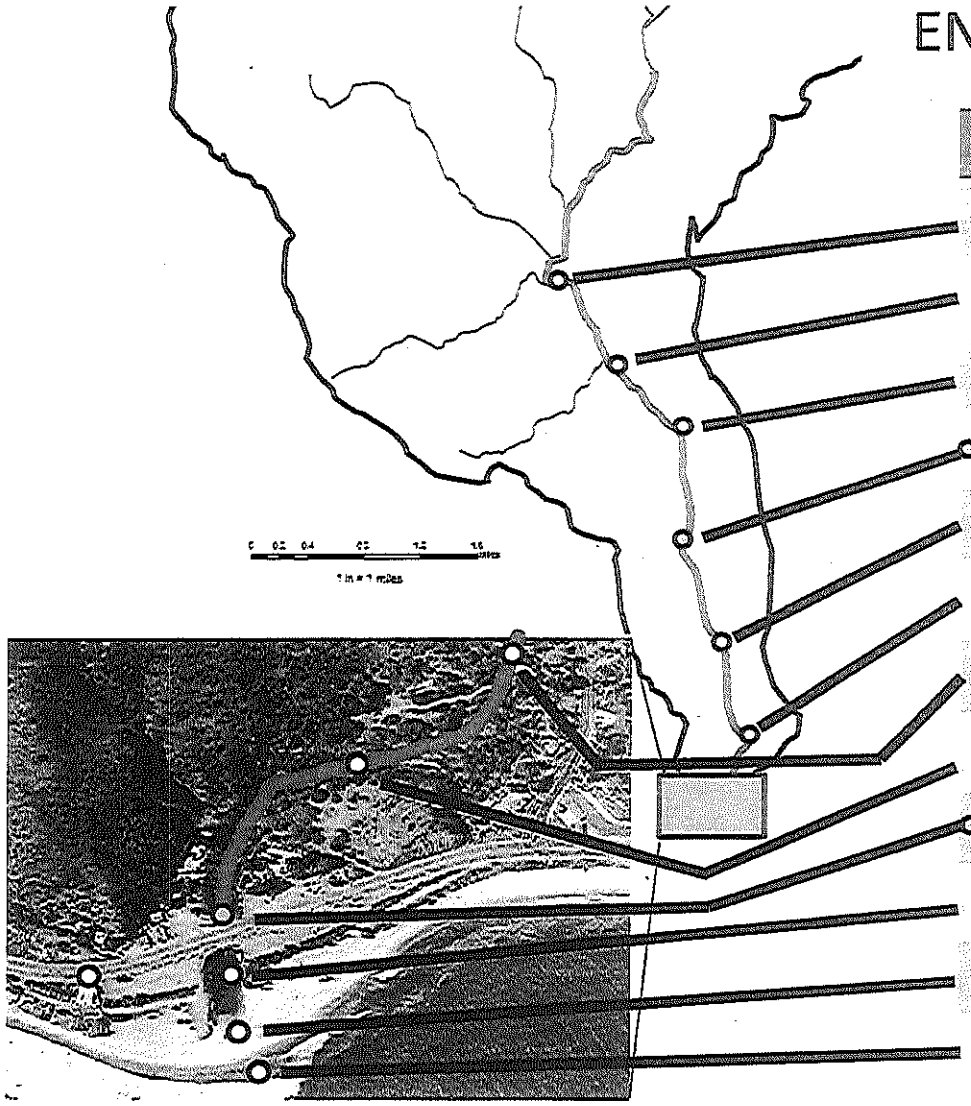
- Tiered Sampling Approach
  - Snapshot of Watershed
    - Investigate "hot spots" further

Topanga Canyon





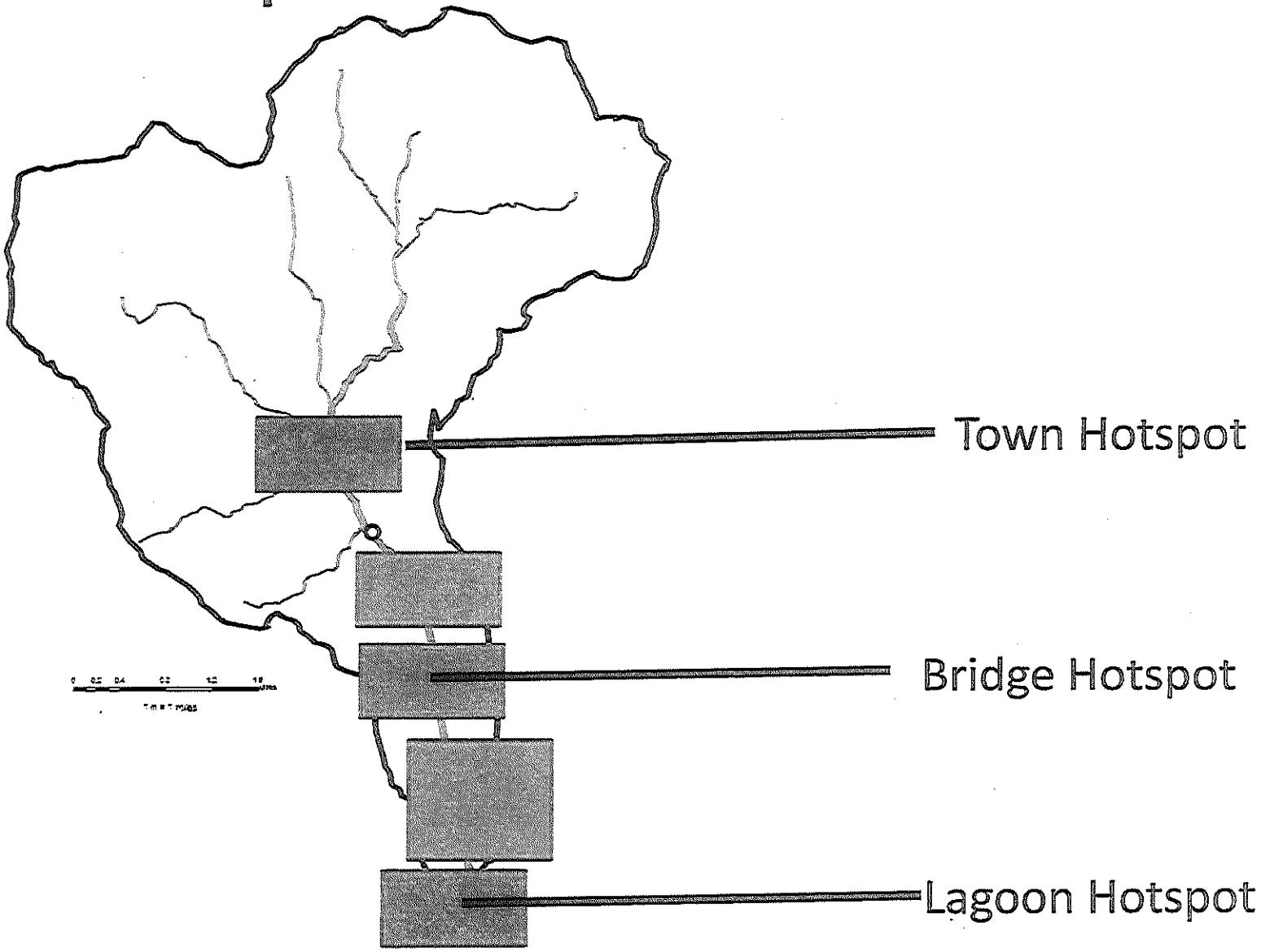
Snapshot May 10th, 2012



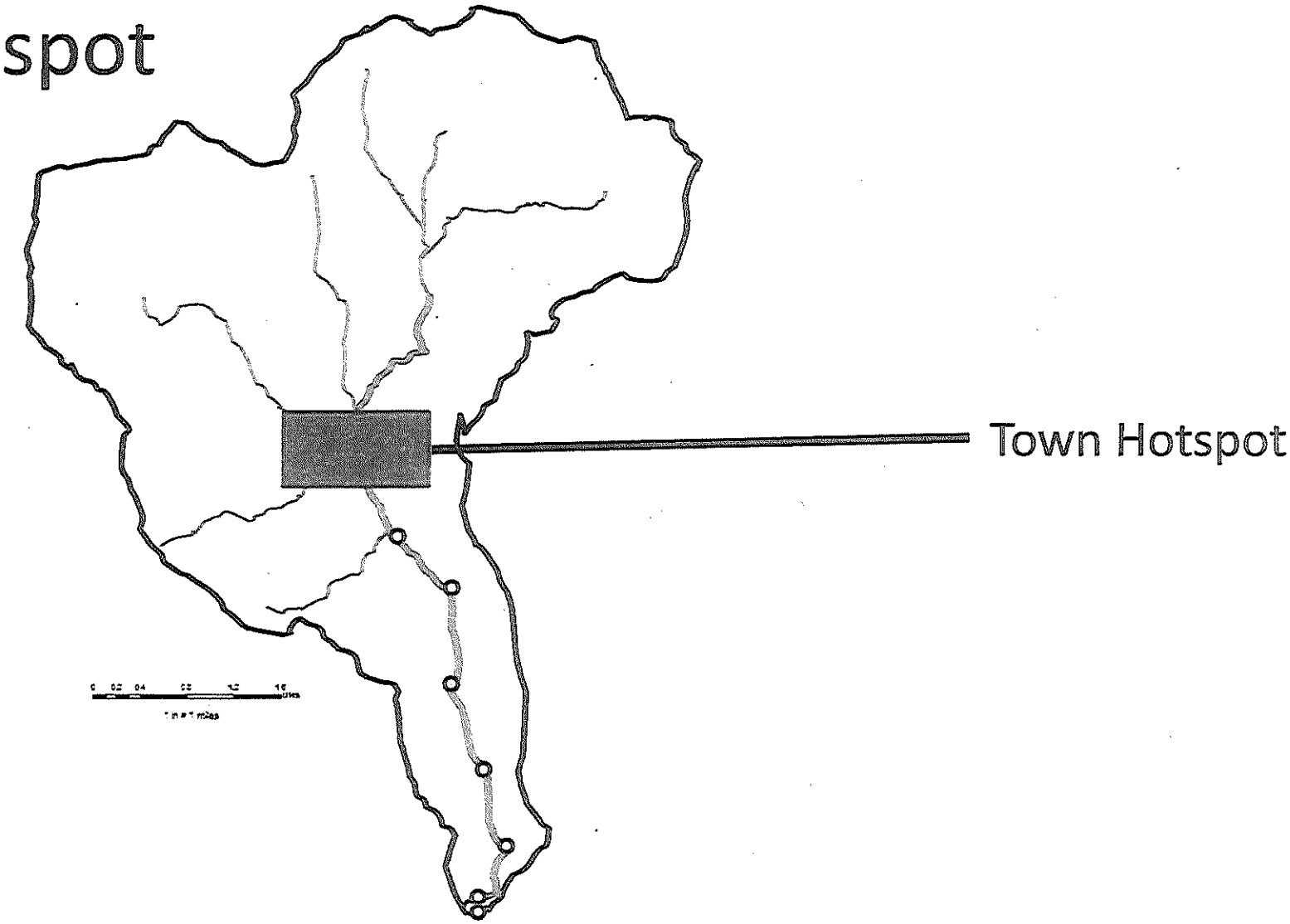
ENT MPN/100 ml, Copies/100 ml

ENT	Human	Gull	Dog
1200	5300	ND	ND
330	D	ND	ND
10	ND	ND	ND
320	D	ND	ND
30	D	ND	ND
40	ND	ND	ND
20	ND	ND	ND
10	ND	ND	ND
180	ND	6800	ND
130	D	11300	D
100	ND	34500	D
40	D	800	ND

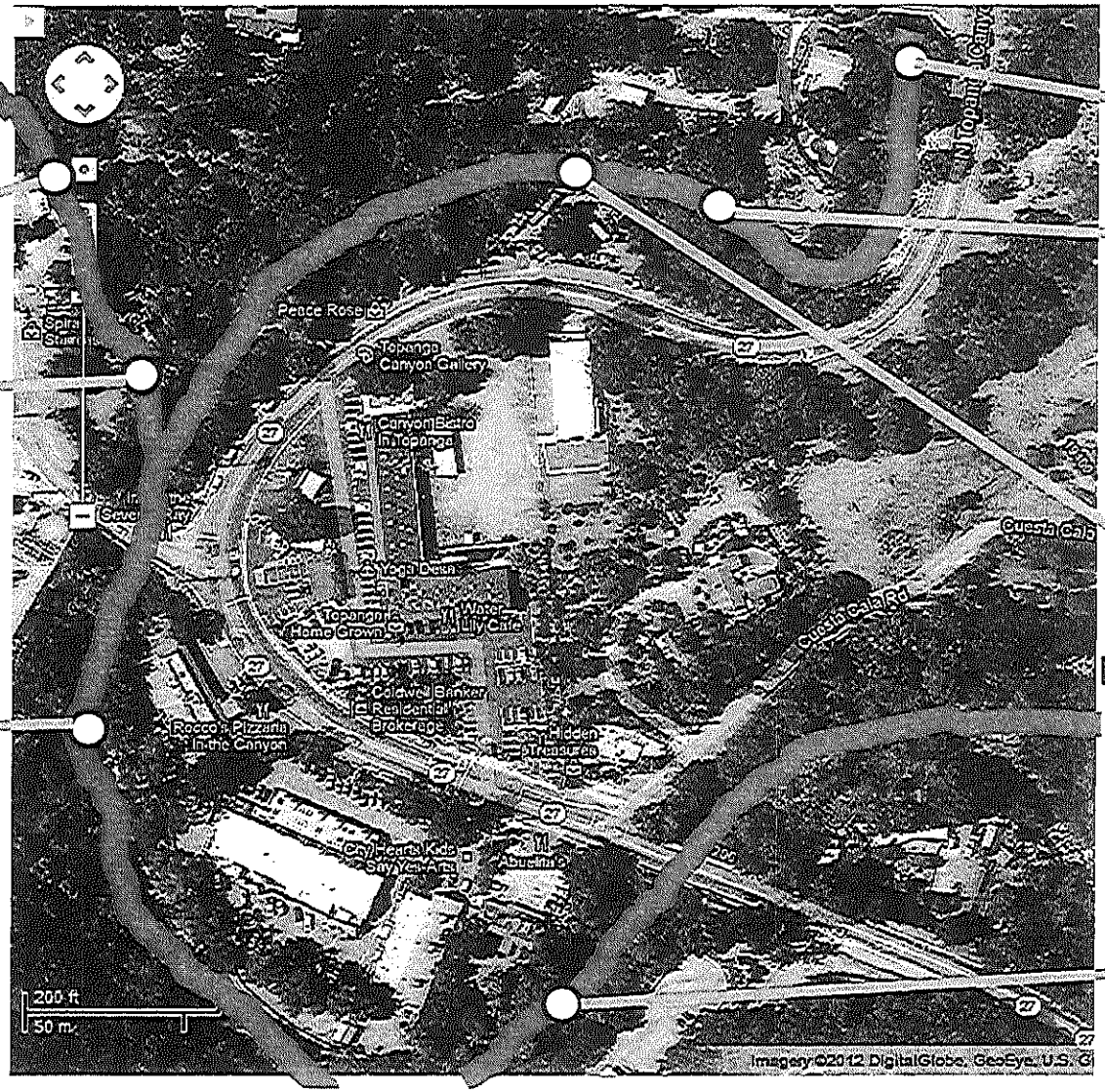
Snapshot Conclusions



Spatially Intensive Sampling of Town Hotspot



Sampled 3 times over two weeks
(May 23rd ,May 30th, June 7th 2012)



140

1200
280,400

ND
400, 190

D ND
260 ,220
150

ND ND
50, 75, 30

30

ND
780

ENT = MPN/100ml

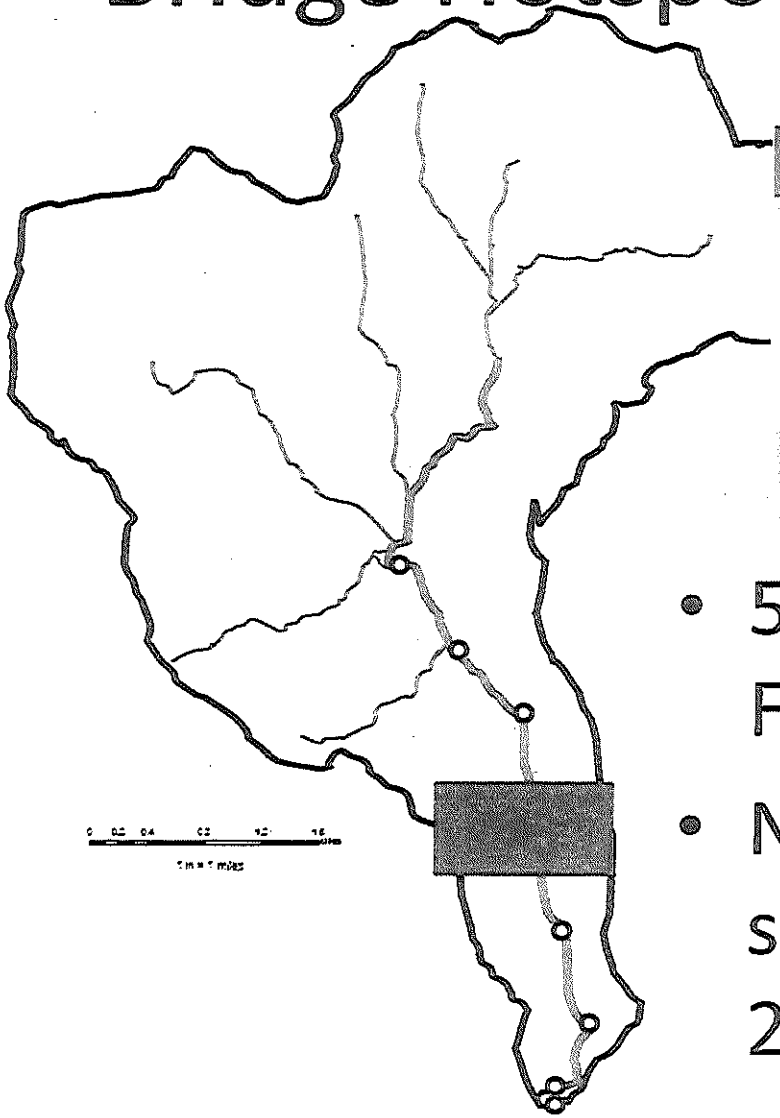
Human = copies/100ml

ND
230,130, 63

Town Hotspot Conclusions

- It is complicated!
- FIB hotspot
  - Main Stem
  - Old Topanga
- Human Markers
  - Only on Old Topanga Branch
- Additional markers and bacterial community analysis may help clarify
- IMS-ATP would be very usefull for faster turnaround

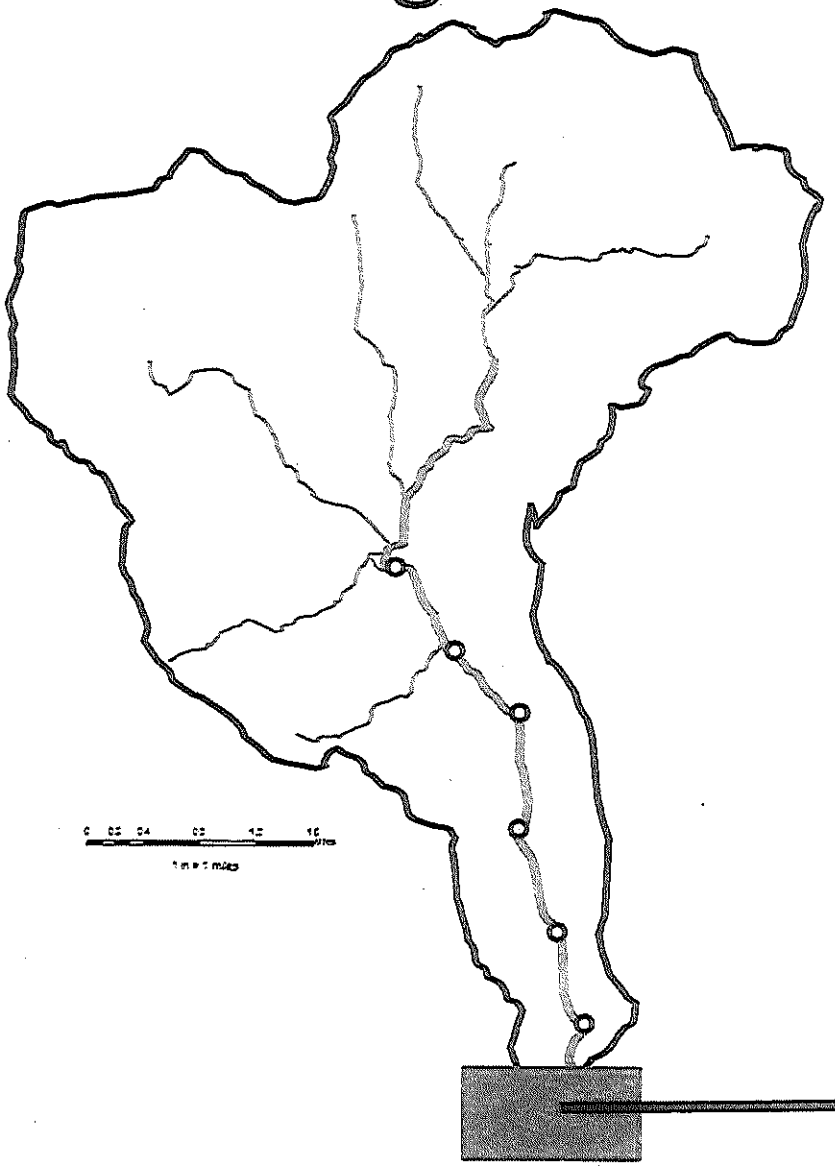
Bridge Hotspot



Date	ENT (MPN/100ml)	Human
5/10/2012 (s.s.)	320	D
5/23/2012	140 (above) 100 (below)	ND D
6/28/2012	(sampled 5X upcreek) **All <10**	

- 5/11/2012, Illegal *Cannabis* Farm Dismantled!
- Need more systematic sampling to determine if May 2012 results are isolated

Lagoon Hotspot

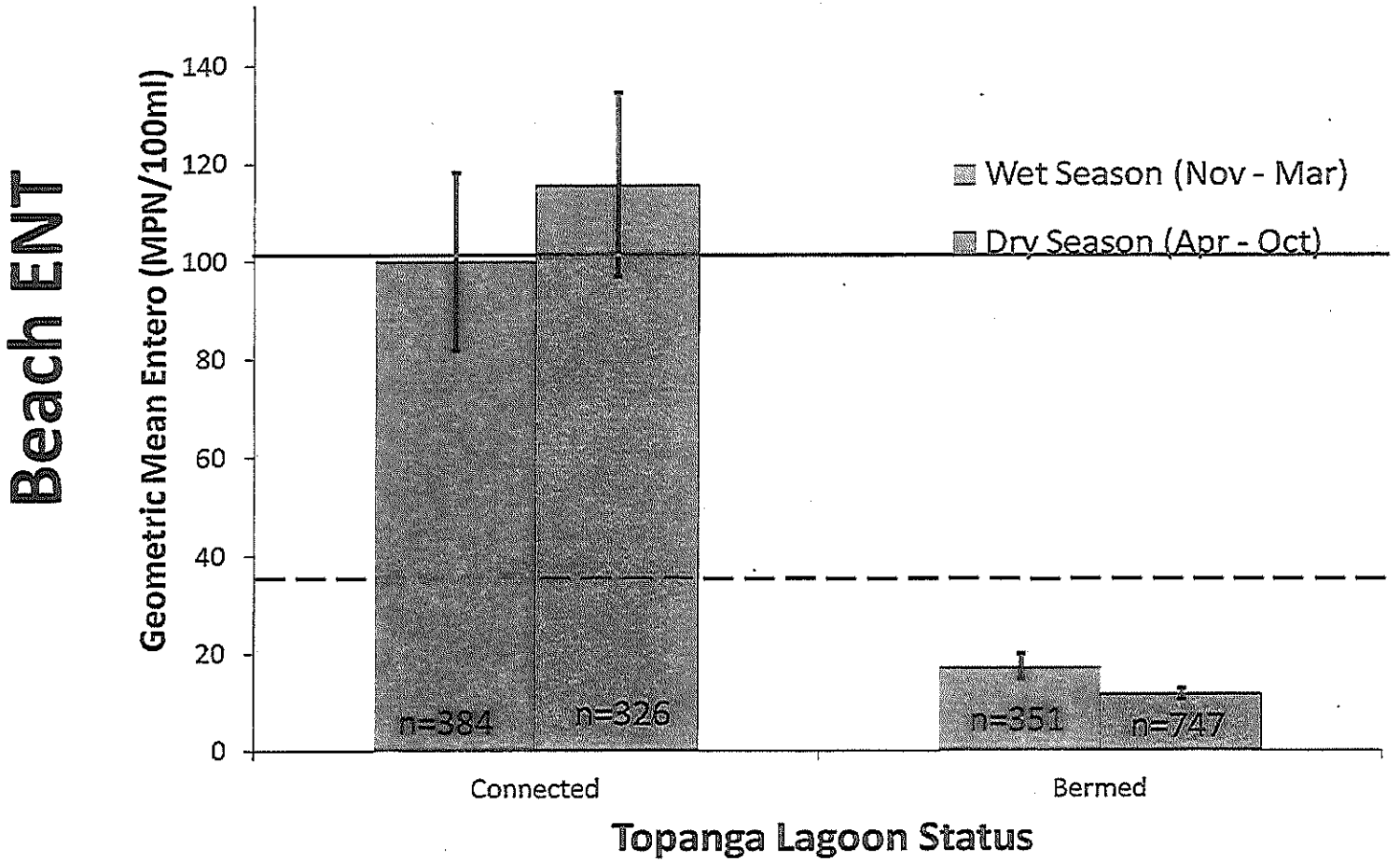


Lagoon Hotspot

Lagoon 7/24/12

ENT (MPN/100ml)	Human	Gull Copies/100ml
200	ND	2800
100	ND	6700
500	ND	8600
170	ND	5300
200	ND	8100
640	ND	6100
550	ND	23600
90	ND	D

Lagoon to Beach Connection

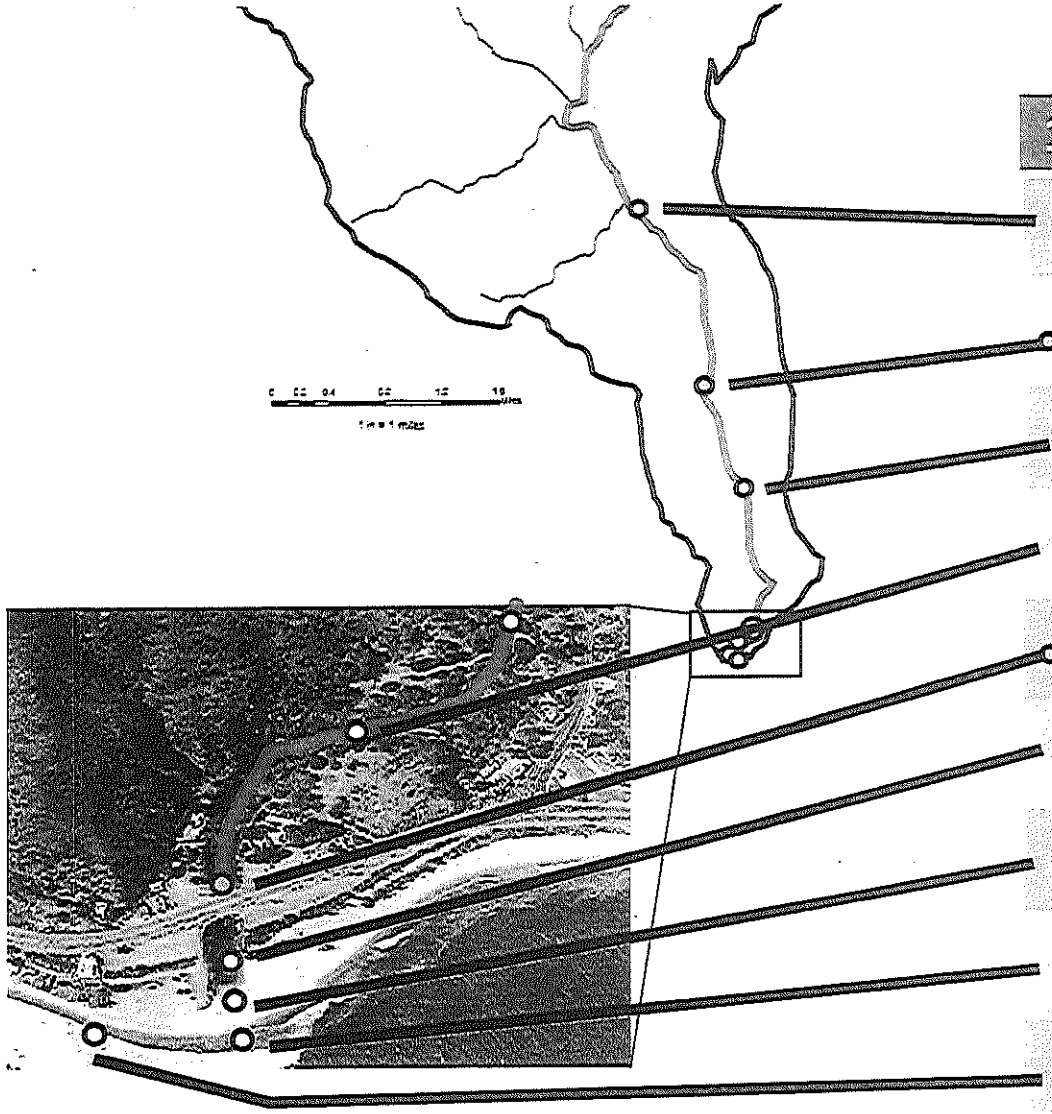


Data from Environmental Monitoring Division, Hyperion Wastewater Treatment Plant (Jan 2005 – Nov 2011)

Beach/Lagoon Hotspot Conclusions

- Lagoon main source of FIB to beach
- Human Markers have been detected in the lagoon and at beach
  - May be sourced from transient living under PCH bridge
- Large presence of Gull associated marker in the lagoon
  - Gulls may be dominant source of FIB in lagoon and at beach

Most Recent Data



ENT (MPN/100 ml)

11/17/12 (FF)	11/29/12
18500	
2359	313
459	63
512	275
1191	414
2014	495
2187	1439
121	10
	31

Recent Data Conclusions

- Large reduction in FIB down narrows
  - ~40 times reduced during first flush
  - ~5 times reduced two weeks later

- Important to sample Owl Falls and Scratchy Trails to understand Bridge Hotspot

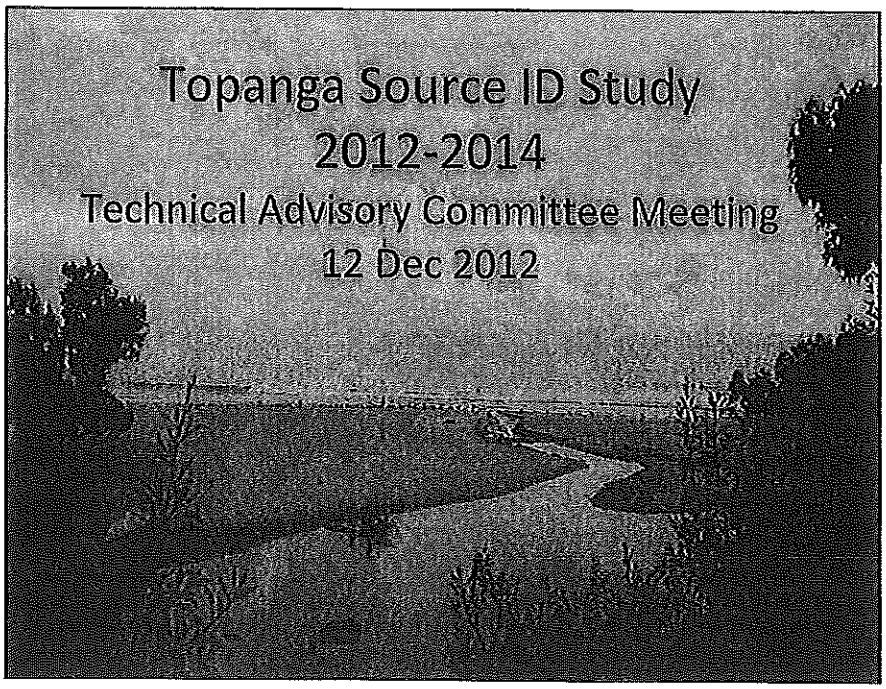
Acknowledgements

- Funded by Clean Beach Initiative Grant, CA State Water Resources Control Board, Source Identification Protocol Project (SIPP)

- It is a team effort!
  - Jenny Jay, PI, UCLA
  - Rosi Dagit, Senior Conservation Biologist, SMMRCD
  - Tim Riedel, Postdoc, UCLA
  - Amy Zimmer-Faust, Grad Student, UCLA
  - Vanessa Thulsiraj, Grad Student, UCLA
  - Darcy Ebentier, Grad Student, UCLA
  - Kaitlyn Hanley, Research Technician, UCLA
  - Jenna Krug, Conservation Biologist, SMMRCD
  - Ken Wheeland, Volunteer, Topanga Resident
  - Robert Torres, Undergraduate, UCLA
  - Chris Carandang, Undergraduate, UCLA
  - Ben Tanimoto, Undergraduate, UCLA
  - Maria Carvajal, Undergraduate, UCLA
  - Sofi Peterson, Summer High School Intern, Malibu High School
  - John Law, Summer High School Intern, James Logan High School

HTB most polluted beach rank

- Topanga
  - 2005-2006 = 9th
  - 2010-2011 = 4th
  - 2011-2012 = 10th



AGENDA

1-1:15 Welcome and Introduction of members

1:15- 1:20 MS4 Permit and Natural Source Exemption overview

1:20- 1:45 Overview of study goals, hypotheses and objectives

1:45-2:30 Presentation of data collected thus far
Dr. Jenny Jay and Tim Riedel

2:30- 2:50 Review of sampling plan and sites

2:50-3:00 Next Steps

How and why does Topanga Creek decline from an "A" grade to "F" grade at Topanga lagoon and beach?

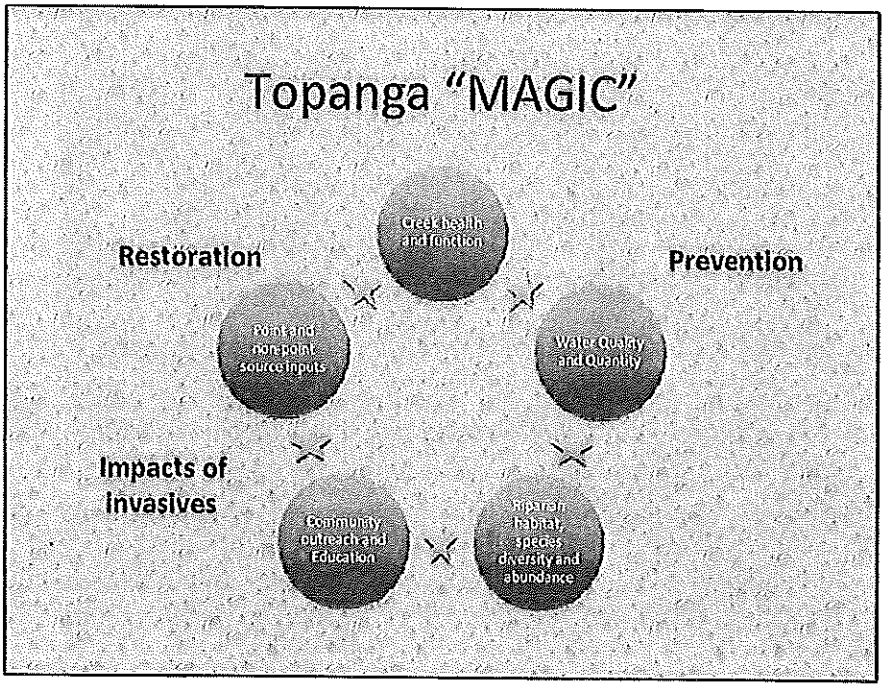
STUDY OBJECTIVES:

1. Identify the likely sources (both physical location and source, i.e., human, bird, dog, horse, etc.) of bacterial contamination at Topanga Beach. Testing will enable the completion of the SIPP sampling plan that will provide a conclusive picture of the sources and sinks in the creek and lagoon (current SIPP funding would only cover 12% of the proposed sampling plan;) and analyze the Index of Biological Integrity along the creek, which will allow a much greater understanding of the unusual sink observed.

2. Identify best practices or remedial actions that could reduce or eliminate human or animal bacterial sources.

3. Implement K-12 and community education and outreach to engage stakeholders in water quality problems and best management practices to solve them.

Topanga "MAGIC"



STUDY TASKS

TASK 1. Establish a Technical Advisory Committee to assist in fine tuning the sampling design, timing and analysis.

TASK 2. Sample collection and analysis

TASK 3. Community Outreach and K-12 Education

TASK 4. Prepare reports

TASK 1. TAC
2 meetings per year
Monthly email updates

Los Angeles County:
Beaches and Harbors, Public Health, Public Works, Supervisor Yaroslavsky staff

CA Department of Parks and Recreation

Caltrans

Regional Water Quality Control Board

SCCWRP

UCLA – Dr. Jenny Jay lab
USC – Dr. Jed Fuhrman lab

BioSolutions and Topanga Underground

RCDSMM Biologists and Topanga Creek Stream Team Volunteers

TASK 2. Sample collection and analysis

Sample collection will include:

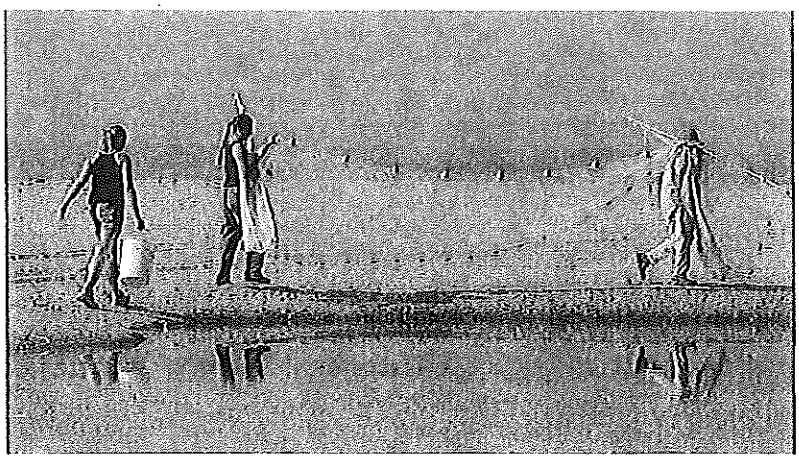
1. In-situ measurements of flow, algae cover, DO, water and air temperature, salinity, pH, conductivity. Observations will include weather conditions, date of last rain, moon phase, wind speed and direction, water clarity, color and odor, trash type and amount, birds at the lagoon and human or animal direct deposits.

2. FIB, nutrient grab samples will be collected at each event. If FIB exceedance is observed, then IMS-ATP follow up sampling will be done 2 days later, as will virus testing.

3. Benthic macro-invertebrate kick net samples will be collected every other month at the Bridge, Shale Falls or Radea Grounds, and Snake Pit. Additional kick net sampling using the Rapid Bioassessment method will be collected in Spring along with the amphibian surveys. 24 hour drift net sampling will be done the week prior to Fish round up events in March and November, and possibly in mid-summer as well.

****First Flush sample is done at the first ¾" storm event each fall.*

Lagoon-Ocean connection



Lower Watershed Potential Sources

- Septic systems along PCH in Topanga State Park
- Lifeguard station restrooms at Topanga Beach
- Wildlife
- Transients

Upper Watershed Potential Sources

-Septic systems and graywater from single family residences

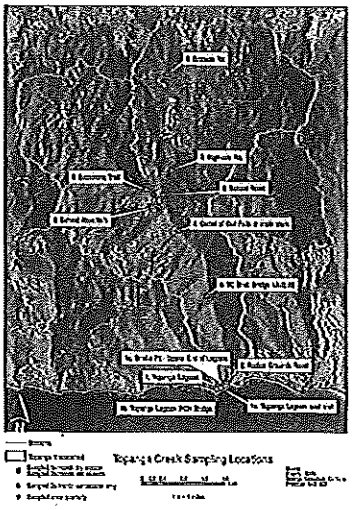
-Transient encampments

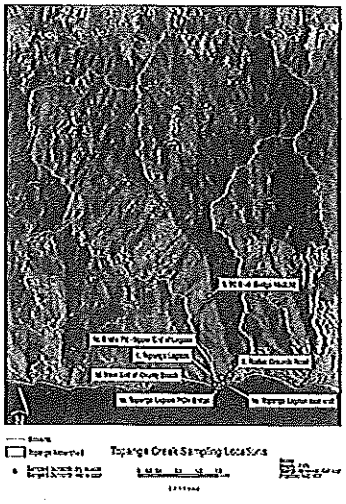
-Horses

-Dogs

-Wildlife

HYPOTHESIS 1 : *Upper watershed sources of FIB are not conveyed to the beach via the creek.*





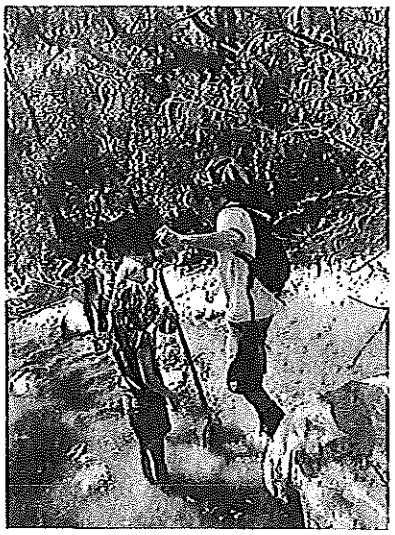
HYPOTHESIS 2.
Concentrations of FIB and/or pathogens and nutrients decrease as the creek flows downstream from town through the Narrows. Benthic macro-invertebrate community species diversity, sensitivity, and abundance increases as the creek flows downstream.

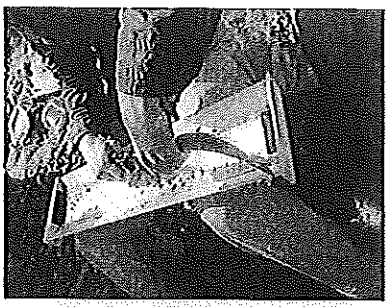
Source Identification

- FIB- Total coliform, fecal E. coli, Enterococcus
- Specific markers- bacterial DNA(qPCR), viral DNA and human specific markers, host-associated markers for gull, dog, horse (PCR)
- Virus
- Bacterial Community – septic, graywater, direct deposit

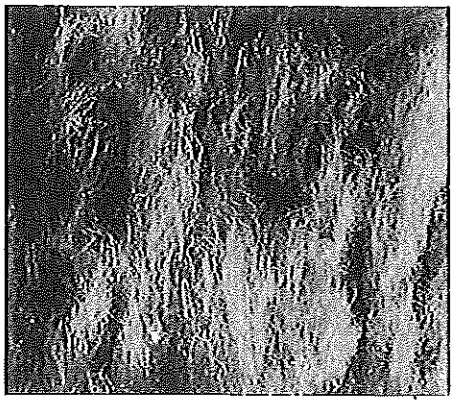
Iterative testing trying to hone in on areas of concentration.

Role of Benthic Macro-invertebrates



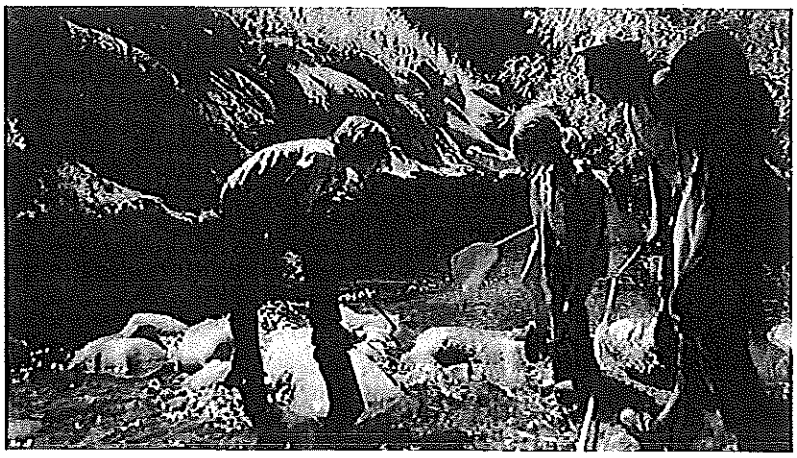


Role of Diatoms



Data from Malibu Creek suggests that diatoms might be good indicator species for water quallty. We will collect samples at 4 locations within the watershed each spring and send them off for testing. Along wlth the algae sampling this will provide insight into the role of primary producers.

Training volunteers to help



HYPOTHESIS 3. ***FIB and/or pathogens are not leaking from faulty septic systems in the lower watershed, from septic systems along Pacific Coast Highway in Topanga State Park or from the County Lifeguard facility.***

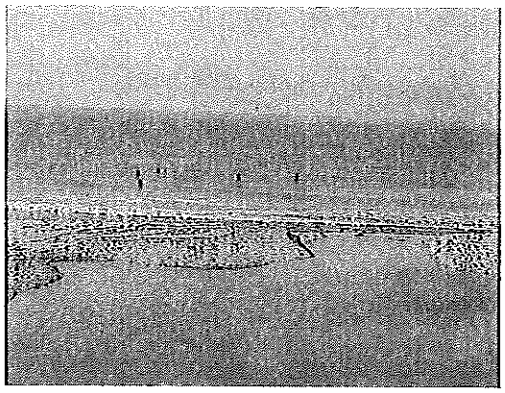
Topanga Underground will test State Park facilities for leaks in Spring 2013 including:

Cholada's, Ranch Motel ranger residence, Winery, Reel Inn, Malibu Feed Bin

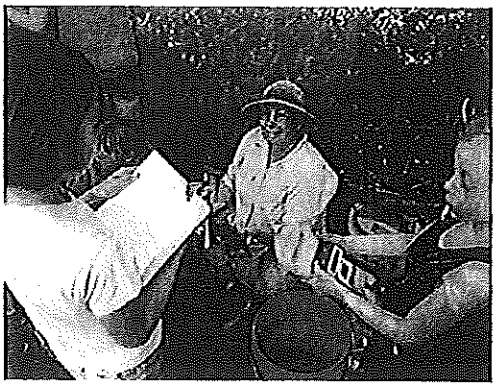
BioSolutions will collect 2 liter samples monthly from the UV disinfection system and distribution box. Samples will be tested for FIB, BOD, TSS, pH, NH^4, Organic N, NO^2, NO^3, DO and alkalinity.

HYPOTHESIS 4. ***Lower watershed and/or lagoon sources of FIB (human and non-human inputs such as gull, dog, etc.) are correlated with exceedances at Topanga Beach.***

HYPOTHESIS 5. ***IMS/ATP can be used to adaptively track sources of FIB in the watershed furthering our understanding of concentration and dispersal.***



TASK 3. Community Outreach and Education



- Field classes with local schools
- UCLA undergraduates help with field classes
- Watershed Stewards work with CSC magnet school students
- CSC High school and UCLA interns assist with bug id

TASK 4. Project Reports
Education, Prevention and Restoration

A. Annual and Final Reports would include, but not be limited to:

- Documentation of present water quality conditions in the main stem of the creek, along Topanga Beach and Lagoon.
- Identification of sources of bacterial contamination.
- Description of the existing bacterial community composition in the context of both ecosystem and human health.
- Identification of potential remedial actions and BMP's.
- Examination of changes in macro-invertebrates, aquatic species of special concern and endangered fishes in relation to water quality conditions.
- Documentation of community participation.

B. Community outreach will include:

- Yearly watershed field class and UCLA mentoring for 5th and 6th grades at Topanga Elementary School.
- Yearly community meetings to highlight care and maintenance of septic systems and graywater systems and discuss potential BMP's.
- Yearly neighborhood meeting to discuss "hot spots" and brainstorm solutions.
- Two articles per year in the local newspaper and relevant web sites updating the community on results of the study.
- Twice yearly training of Stream Team volunteers.

Sampling Locations and Schedule

Site Name	7 Wet Months (Nov – May)	5 Dry Months (Jun – Oct)
West end of the county beach (W of groin) (BU)	2/mo + first flush	1x/month
Beach – city sampling site (BO)	2/mo + first flush	1x/month
Topanga Lagoon outlet (LO)	2/mo + first flush	1x/month
Topanga Lagoon east wall (TL)	2/mo + first flush	1x/month
Topanga lagoon – PCH bridge (HB) (0m)	2/mo + first flush	1x/month
Snake Pit (SP) (300m)	2/mo + first flush	1x/month
Rodeo Grounds (RG) (600m)	2/mo + first flush	
Shale Falls (SF)2700m)		1x/month
TC Blvd. Bridge MM2.02 (TB) (3600m)	2/mo + first flush	1x/month
Scratchy Trail (ST) (4900m)	SIPP 1x/month	SIPP 1x/month
Owl Falls (OF) (6000m)	SIPP 1x/month	SIPP 1x/month

NOTE: IMS-ATP testing will be triggered by FIB exceedance
Virus Sampling will be triggered by FIB exceedance

Sampling Calendar

WET SEASON	Dry Season
First Flush – Nov 17	June
Nov 28- Bugs	July - Bugs
Dec 19	August
Jan 9	September
Jan 27	October
Feb 8	
Feb 24	
Mar 10	Fish Round Up and Bugs
Mar 27	
Apr 10	
April 28	Earth Day Crayfish roundup
May 8	

QA/QC

- Calibrate all probes for each event
- Collect samples in same sequence each event to keep times similar
- Collect samples before direct sunlight
- Collect data in a consistent way – 1 team for flow/algae, 1 team for FIB samples and WQ
- Adhere to strict holding times
- FIB samples go to UCLA to be processed within 6 hours of first sample collected
- Virus samples go to USC
- Nutrients tested at RCDSMM
- Data entry done at each event
- QA/QC of data entry done at each event
- Chain of Custody records completed for each event
- Monthly review of samples collected, results posted, other activities provided to the TAC

Next Steps

- Coordinate classes with local schools for spring
- Set up community outreach meetings
- Schedule septic testing along PCH
- Set up Lifeguard station septic monitoring
- Get volunteers scheduled
- AND??????

RESOURCE
CONSERVATION DISTRICT
OF THE
SANTA MONICA MOUNTAINS

818.597.8627
818.597.8630
info@rcdsmm.org

30000 Mulholland Highway, Agoura Hills, CA 91301
Mail: PO Box 638, Agoura Hills, CA 91376-0638

TOPANGA SOURCE ID STUDY

TECHNICAL ADVISORY COMMITTEE MEETING

Wednesday, 24 April 2013
Topanga Library
122 N. Topanga Canyon Blvd., Topanga, CA
10 am – 12 pm

10:-10:15	Welcome and Introductions
10:15 – 10:30	Update on work accomplished to date – Rosi Dagit, RCDSMM
10:30-10:45	Presentation on the Lifeguard Septic System – Steve Braeband, David Tufto, BioSolutions
10:45-11:00	Presentation on State Park septic system test results – Richard Sherman, Topanga Underground
11:00 – 11:15	QA/QC Plan update, Nutrient data update – Rosi Dagit, Jenna Krug, RCDSMM
11:15-11:45	Source ID Data update – Dr. Tim Riedel, Dr. Jenny Jay, UCLA
11:45- 12:00	Questions and Next Steps

NOTE:

Next TAC meeting will be in September/October 2013.

Thursday, 30 May 2013
6:30- 8 pm
Topanga Library

Community Meeting on Best Management Practices for Septics and Graywater
Students from Topanga Elementary School and Topanga Mountain School will present posters of their experiments.

Results of Nutrients in Topanga Creek Dec 2012 – April 2013
Exceedances are highlighted in yellow

Nitrate-N mg/l Numeric Water Quality Criteria - 1 mg/l

Site	12-19	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	-	0.02	-	-	0	-	0.01	-	-
Owl Falls	0	-	-	-	-	-	0.21	-	0.15
Scratchy Trail	0	0.05	-	-	0	-	0.07	-	0
Topanga Bridge	0	0.03	0.09	0	0	0	0	0.02	0
Brookside Dr	0	0.11	-	0	0	0.02	0	0.06	0
Snake Pit	0	0.08	0.01/0.11	0.01	0	0	0.07	0.02	0
PCH Hwy Bridge	-	-	-	-	-	-	-	0.03	-
Top Lagoon East	0	0.02	0.10	0.01	0	0	0	0.04	0
Lagoon Outlet	-	-	-	0.05	-	-	-	-	-
Lifeguard Station	-	11.66	-	-	o/r	-	46	-	62

Nitrite-N mg/l Numeric Water Quality Criteria - 1 mg/l

Site	12-19	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	-	0.07	-	-	0.05	-	0	-	-
Owl Falls	0	-	-	-	-	-	0	-	0.05
Scratchy Trail	0	0.04	-	-	0.06	-	0	-	0.09
Topanga Bridge	0	0	0.03	0.01	0.05	0.01	0	0.03	0.03
Brookside Dr	0	0	-	0.03	0.04	0	0	0.04	0.02
Snake Pit	0	0	0.04/0.02	0.03	0.04	0	0.01	0.01	0.17
PCH Hwy Bridge		-	-	-	-	-	-	0.05	-
Top Lagoon East	0	0	0.03	0	0	0	0	0.04	0.05
Lagoon Outlet		-	-	0.03	-	-	-	-	-
Lifeguard Station	-	0.12	-	-	0.09	-	0.10	-	28

Phosphate mg/l Numeric Water Quality Criteria 0.1 mg/l

Site	12-19	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	-	0.1	-	-	0.11	-	0.03	-	-
Owl Falls	0.19	-	-	-	-	-	0	-	0.18
Scratchy Trail	0.09	0.02	-	-	0.07	-	0.04	-	0.14
Topanga Bridge	0.05	0.01	0.01	0.06	0.08	0.04	0.06	0.02	0.08
Brookside Dr	0.02	0.27	-	0.04	0.04	0.04	0.09	0.10	0.04
Snake Pit	0.07	0.06	0.08/0.19	0.10	0.06	0.08	0.02	0.16	0.11
PCH Hwy Bridge	-	-	-	-	-	-	-	0.08	-
Top Lagoon East	0.05	0	0.11	0.16	0.03	0.16	0.04	0.12	0.01
Lagoon Outlet	-	-	-	0.06	-	-	-	-	-
Lifeguard Station	-	9.8	-	-	33	-	25.4	-	33

Ammonia-N mg/l *Numeric Water Quality Criteria - relationship between pH, temperature and ammonia collected at the same time, toxicity increases with increasing pH and temperature, limit based on 30-day average and 4 day average shall not exceed 2.5 times the 30-day average

Site	12-19	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	-	2.66	-	-	0.05	-	0	-	-
Owl Falls	0.22	-	-	-	-	-	0.07	-	0.16
Scratchy Trail	0.5	0.01	-	-	0.07	-	0.02	-	0.14
Topanga Bridge	0.12	0	0.13	0.03	0.04	0.13	0.09	0.34/ 2.06	0.10
Brookside Dr	0.76	0.03	-	0.02	0.02	0.02	0	0.35/ 1.29	0.27
Snake Pit	1.95	0.12	0.14/0	0.20	0.04	0.08	0.01	0.12	0.10
PCH Hwy Bridge	-	-	-	-	-	-	-	0.45	-
Top Lagoon East	0.13	0.03	0	0.12	0	0.02	0	0.02	0.10
Lagoon Outlet	-	-	-	0	-	-	-	-	-
Lifeguard Station	-	12.33	-	-	15.8	-	29.8	-	33.6

pH Numeric Water Quality Criteria *Defined for waste discharge as between 6.5-8.5. No target for non-waste water systems

Site	12-19	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	-	7.6	-	-	8.1	-	7.7	-	-
Owl Falls	8.03	-	-	-	-	-	8	-	8.04
Scratchy Trail	8.36	8.25	-	-	7.7	-	8.3	-	8.27
Topanga Bridge	8.26	8.12	8.43	8.28	8.18	8.3	8.25	8.32	8.23
Brookside Dr	8.36	8.27	-	8.4	8.31	8.41	8.36	8.14	8.36
Snake Pit	7.69	7.75	7.94	7.48	7.41	7.56	7.52	7.55	7.49
PCH Hwy Bridge	-	-	-	-	-	-	-		-
Top Lagoon East	7.99	8.09	8	7.65	7.95	8.22	8.16	8.44	8.35
Lagoon Outlet	7.97	-	-	7.65	7.91	8.18	7.93	8.17	8.25
Lifeguard Station	-	-	-	-	-	-	-	-	-

Water Temperature ^{0}C Numeric Water Quality Criteria *WARM=<80^{0}F (26.6^{0}C)

Site	12-19	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	-	6.2	-	-	10.3	-	10.2	-	-
Owl Falls	8.4	-	-	-	-	-	10.1	-	10.5
Scratchy Trail	9.2	7.2	-	-	10.3	-	10.7	-	11.3
Topanga Bridge	9.8	8.5	10.4	12.3	11	8.4	10.1	11.7	12.8
Brookside Dr	10	9.1	-	12.7	11.5	9	11.7	11.9	12.9
Snake Pit	11.3	14.9	14.3	15.7	15.9	14.5	15.1	15.3	15
PCH Hwy Bridge	-	-	-	-	-	-	-		-
Top Lagoon East	11.3	11.3	14.2	14.4	13.9	12.7	14.7	14	16.5
Lagoon Outlet	10.9	-	14.3	13.8	12.7	12.4	13	12.1	15.8
Lifeguard Station	-	-	-	-	-	-	-	-	-

Dissolved Oxygen mg/l Numeric Water Quality Criteria >5 mg/l

Site	12-19	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	-	7.76	-	-	9.8	-	7.35	-	-
Owl Falls	9.33	-	-	-	-	-	8.92	-	7.22
Scratchy Trail	10.41	10.87	-	-	7.17	-	8.59	-	8.49
Topanga Bridge	10.49	9.09	11.03	9.22	9.15	9.63	8.82	8.59	7.53
Brookside Dr	11.19	9.97	-	9.85	9.77	10.2	9.6	9.76	8.73
Snake Pit	6.97	5.28	8.51	4.85	4.05	4.43	4.16	3.67	4.12
PCH Hwy Bridge	-	-	-	-	-	-	-		-
Top Lagoon East	8.38	9.84	10.2	4.55	9.31	10.3	9.48	8.68	9.57
Lagoon Outlet	9.1	10.16	8.7	8.55	8.65	10.42	8.23	9.14	9.34
Lifeguard Station	-		-	-	8.3	-		-	10

Salinity ppm

Site	12-19	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	-	3	-	-	2	-	0.25	-	-
Owl Falls	3	-	-	-	-	-	0	-	0
Scratchy Trail	2	3	-	-	2	-	0	-	0
Topanga Bridge	1	2	0.5	0.5	0	0	0	0.5	0
Brookside Dr	1	2	-	0.5	0	0	0	0	0.5
Snake Pit	2	3	0.5	1	0	1	0	0	0
PCH Hwy Bridge	-	-	-	-	-	-	-	-	-
Top Lagoon East	5	4	2	1	1	1	0	2	2
Lagoon Outlet	6	-	32.5	7	1	1.5	0.5	2	1
Lifeguard Station	-	-	-	-	-	-	-	-	-

Conductivity mS/cm

Site	12-19	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	-	2.39	-	-	-	-	2800	-	-
Owl Falls	1508	-	-	-	-	-	1730	-	1740
Scratchy Trail	1374	1407	-	-	2.38	-	1610	-	1690
Topanga Bridge	1333	1319	1317	1368	1456	1383	1473	1520	1508
Brookside Dr	1435	1405	-	1311	1501	1445	1552	1560	1592
Snake Pit	1.95	1893	1305	1806	1784	1721	1810	1750	1784
PCH Hwy Bridge	-	-	-	-	-	-	-	-	-
Top Lagoon East	8.52	3.1	1805	10250	2.77	2860	4170	4.5	3660
Lagoon Outlet	8.27	-	-	1763	2.68	2880	2880	3.9	3650
Lifeguard Station	-	-	-	-	-	-		-	-

Turbidity NTU

Site	1-9	1-24	1-27	2-6	2-24	3-6	3-24	4-10
Behind Abuelitas	0.63	-	-	0.88	-	1.41	-	-
Owl Falls	-	-	-	-	-	5.14	-	0.31
Scratchy Trail	0.16	-	-	0.13	-	0.36	-	1.00
Topanga Bridge	0.2	1.03	0.06	0.05	0.89	2.31	0.44	0.54
Brookside Dr	0.14	-	0	0.28	0.12	0.07	0.49	0.13
Snake Pit	0.18	0.13/1.59	0	0.07	0.15	0.28	-	0.08
PCH Hwy Bridge	-	-	-	-	-	-	-	-
Top Lagoon East	0.97	5.72	0.36	0.13	0.59	3.86	-	8.42
Lagoon Outlet	-	-	1.22	-	-	-	-	-
Lifeguard Station	2.16	-	-	0.97	-	44.9	-	8.97

LIFEGUARD SEPTIC

Pat-Chem Lab- Biosolutions

Parameter	9 Jan 13	6 Feb 13	6 Mar 13	8 Mar 13	10 April 13
Biological Oxygen Demand (mg/l)	28	18	40	.	29
Dissolved Oxygen (mg/l)	7.8	8.3	6.8	.	7.6
pH	3.3	3	4.1	.	7.6
total Alkalinity (mg/l)	1	1	1	.	54
Carbonate Alkalinity (mg/l)	1	1	1	.	1
Bicarbonate Alkalinity (mg/l)	1	1	1	.	54
Hydroxide Alkalinity (mg/l)	1	1	1	.	1
Total Suspended Solids (mg/l)	13	7	180	.	28
Turbidity (NTU)	4.3	1.5	103	.	10

— low due to circulation to lower ammonia

UCLA lab

Total coliform	<10	nd	2400	<10	794
E. coli	<10	nd	<10	<10	<10
entero	<10	nd	50	<10	30

RCDSMM lab

Nitrate - N	11.66	overrange	46	.	62
Nitrite - N	0.12	0.09	0.1	.	28
Ammonia - N	12.33	15.8	29.8	.	33.6
Phosphate	9.8	33	25.4	.	33
Turbidity	2.16	0.97	44.9	.	8.97

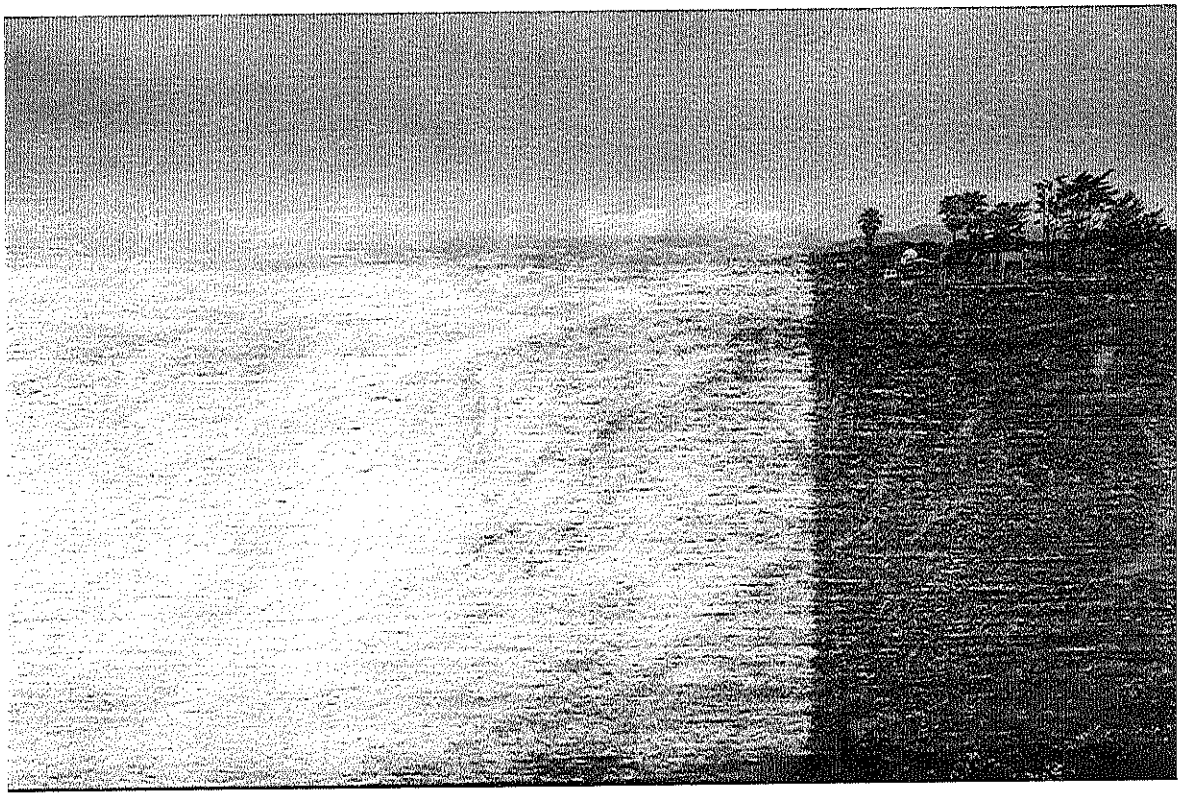
Topanga Source ID Study

April 24, 2013

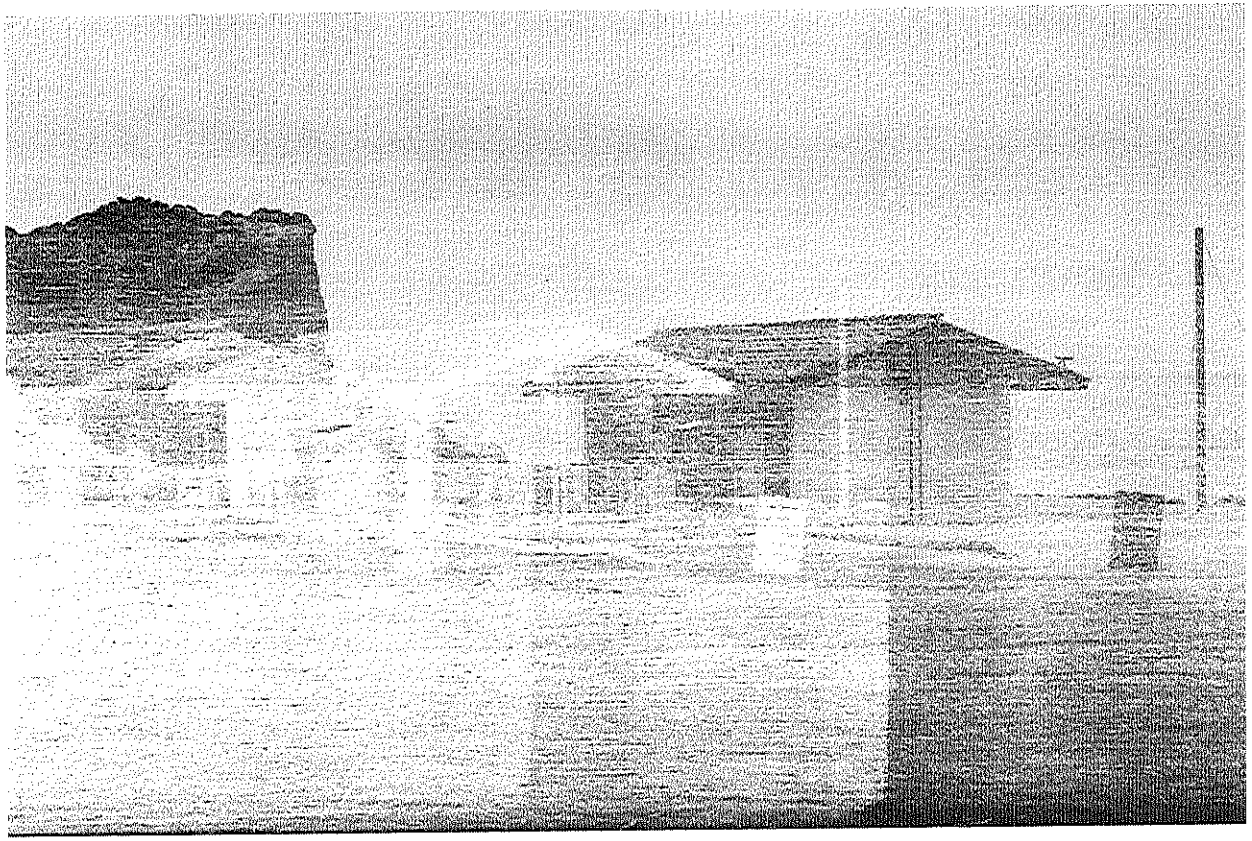
David Tufto

BioSolutions, inc.

Malibu Beaches Project



Malibu Beaches Project



Malibu Beaches Project

- Topanga Beach to Zuma Beach
- Some with Food Facilities
- Maintenance Yard
- Ocean Plan
- High TKN
- Low B( )

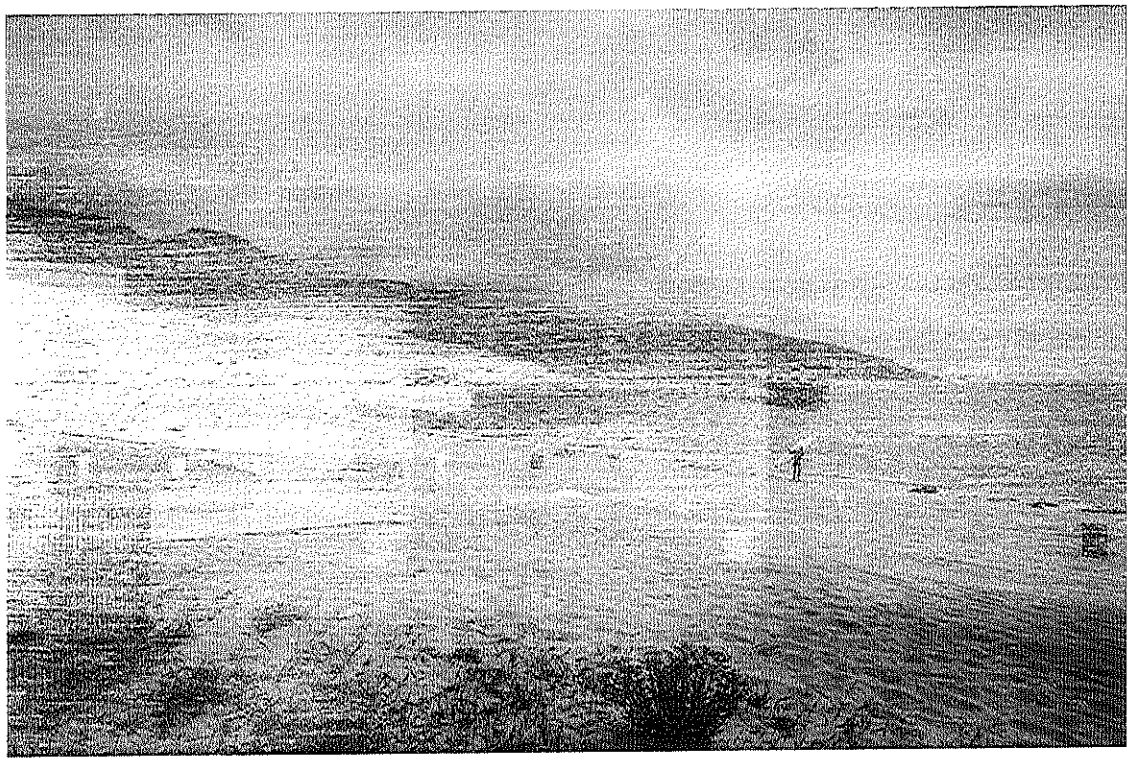
Malibu Beaches Project

Ocean Plan

Parameters	Influent Results	Requirements
Fecal Coliform		400 MPN/100ml
Enterococcus		104 MPN/100ml
Ammonia	70-121 mg/L	2.4 mg/L
Total Chorine Residual		8.0 ug/L
TKN	101-132 mg/L	

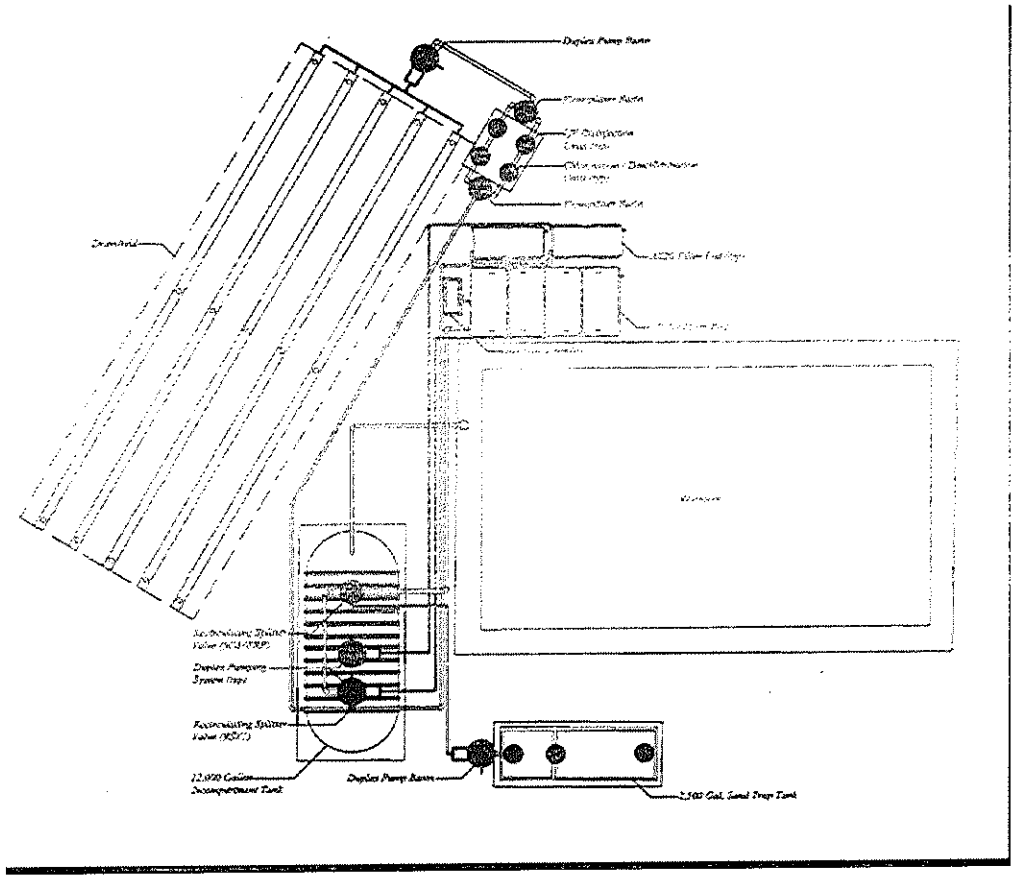
Malibu Beaches Project

Surfrider Beach



Surfrider Beach

System Layout



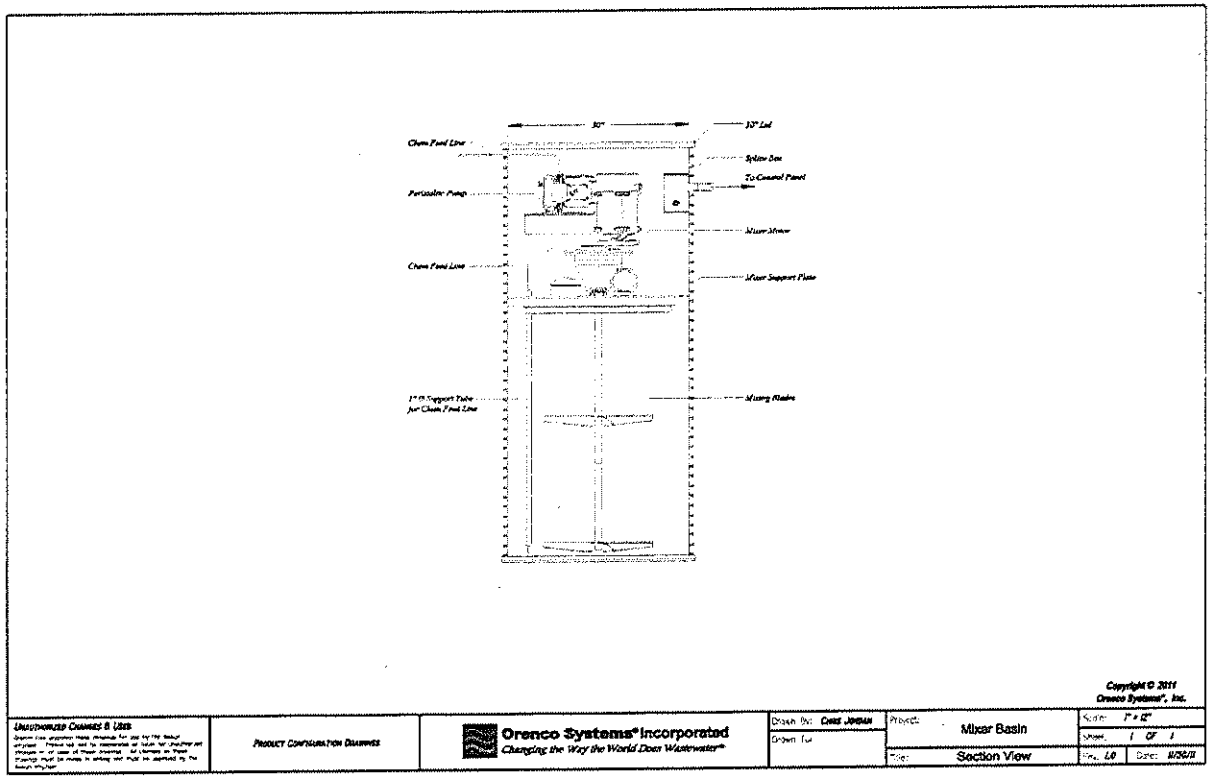
Surfrider Beach

Ocean Plan

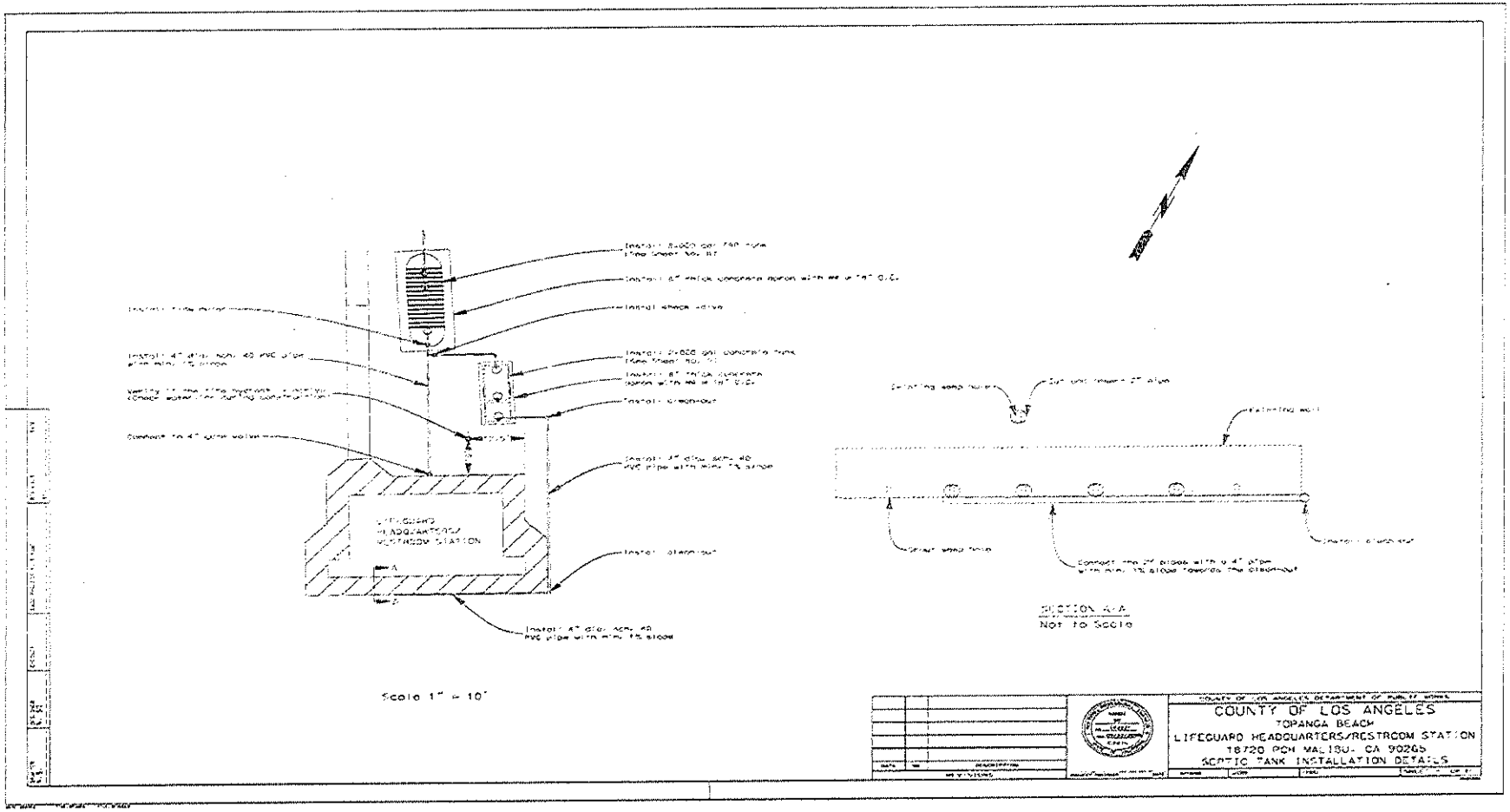
Parameters	Requirements	Sampling Results
Fecal Coliform	400 MPN/100ml	ND
Enterococcus	104 MPN/100ml	ND
Ammonia	2.4 mg/L	0.218 mg/L
Total Chorine Residual	8.0 ug/L	ND
Turbidity		1.05 NTU

Alkalinity/Carbon Feed Systems

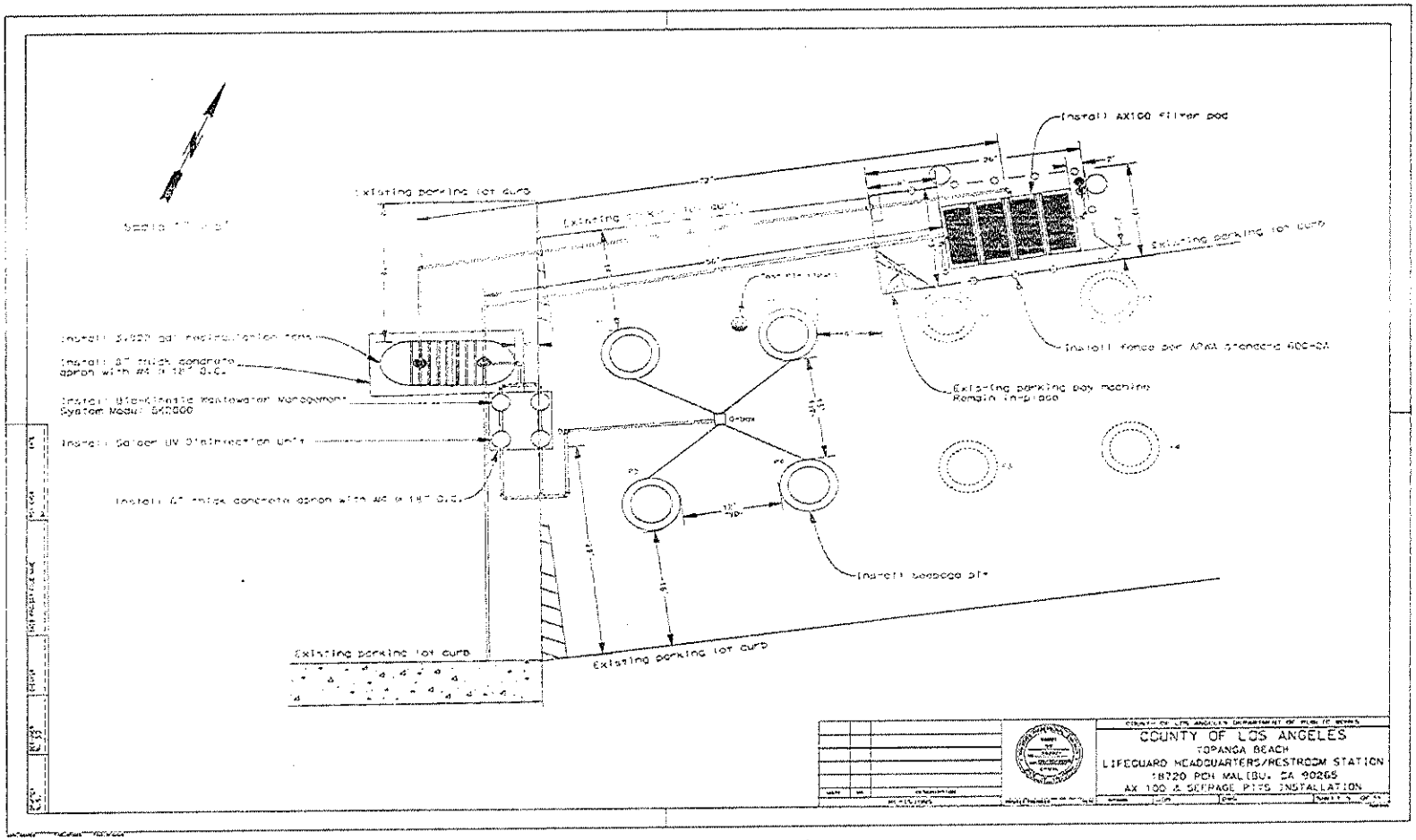
- One part Ammonia to Seven parts Alkalinity



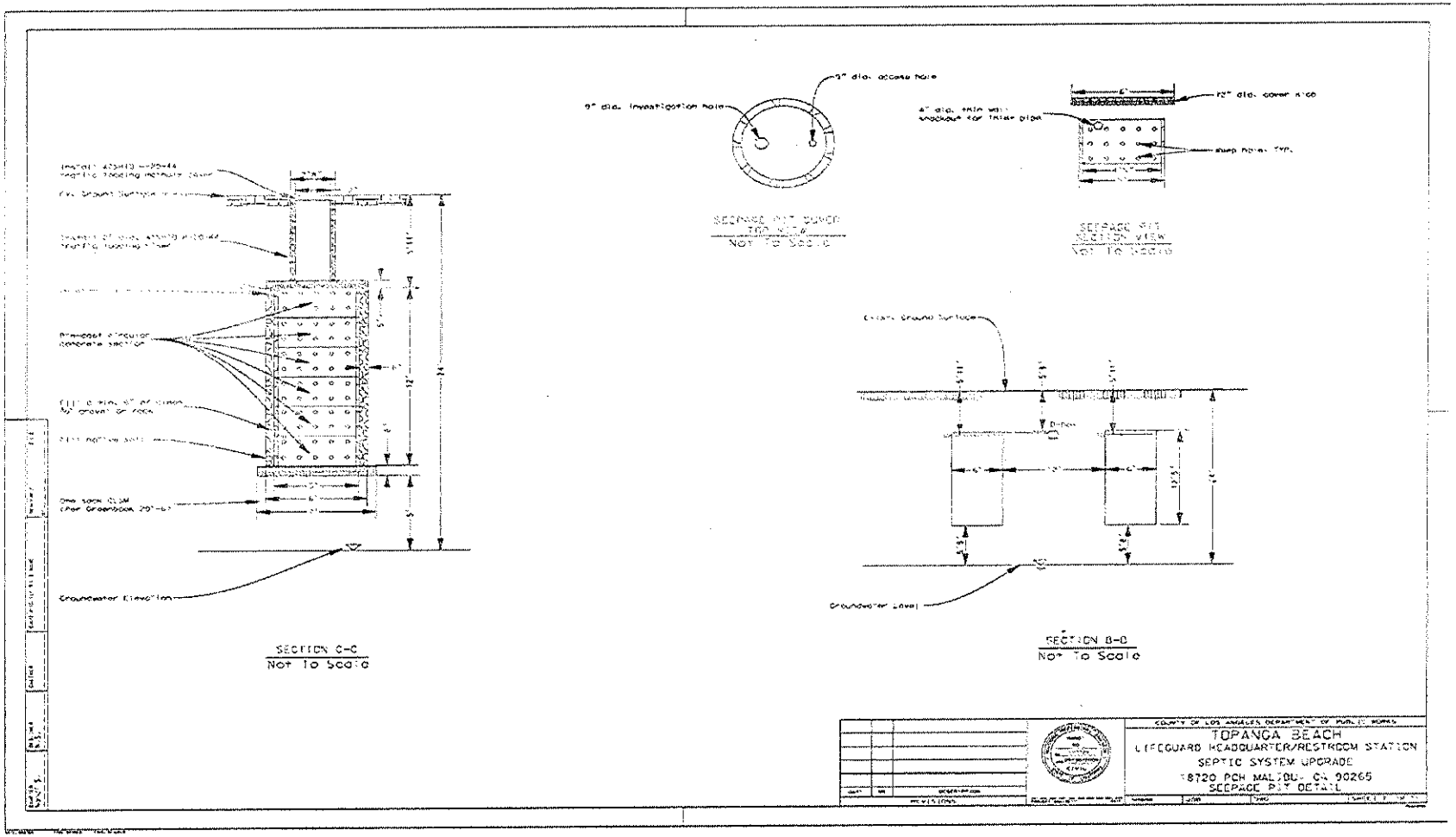
Lower System Layout



Upper System Layout



Seepage Pit Detail



Questions?

Topanga Source ID
TAC minutes
10.30.13

Following introductions, Rosi started the summary presentation by thanking all our collaborators and volunteers, especially our funders Sup Yaroslavsky and SIPP! We also introduced Lizzy and Crystal, our Watershed Steward members, who will be working on both the water quality and benthic macro-invertebrate studies while they are working on the project.

All of the information presented in the power point is attached. Please refer to the slides for details.

After a brief review of the project hypotheses, goals, sampling site characteristics, data management and QA/QC, Vanessa Thulsiraj (UCLA graduate student) took over to summarize the results of the FIB and molecular marker tests. She briefly reviewed historical data that indicates that when the lagoon is connected to the ocean, Beach Entero levels are much higher. The seasonal trends indicate that Beach Entero levels are lowest in mid-July when the berm is closed, and begin to increase starting mid-September.

She also reviewed the process of employing source markers to trace inputs, which was done on 23 May, 30 May and 7 June 2012. Susan asked for clarification of the results, which indicate that both human marker and dog markers were observed in both the Old Topanga sub-drainage and along the main stem of the creek across from the library. Bernard asked if we had used any optical brightener tests, which Vanessa said have some problems that made it not feasible to implement at this time. Bernard also inquired as to whether the watershed level geomeans were at all associated with sites known for high dog walking. Vanessa indicated that they were not that specific and provided indication of the levels throughout the watershed, rather than for a particular site.

The seasonal pattern of both gull and dog levels being substantially higher during the winter months was observed at both the watershed and lagoon-ocean levels. Susan asked if this data provided actual amounts, and Jenny Jay noted that it is still not clear how markers behave in the environment and their rate of degradation. Unfortunately the science is not yet able to provide source-apportioning information, but this is being looked into in the second part of the SIPP study. The samples were also not tested to see if they were septic, graywater or direct deposit as this work was done prior to the start of the County study.

In discussing the result that a single direct deposit into the lagoon would be sufficient to cause an exceedance. Giles noted that the mass balance calculation assumed uniform mixing, but that if the deposit was dumped close to the sampling site, it could be substantially higher.

The results thus far confirm that hypothesis 1 (that the inputs in the town are not associated with the exceedances at the beach) is correct, as is hypothesis 2 (FIB and nutrient levels decrease from the town to the ocean). Total coliform remained under 10,000 MPN at all times, but E. coli and Entero did exceed FIB targets in both the ocean and lagoon. We discussed the sampling protocol of the City, and they are supposed to be collecting samples in the "active" wave zone, especially at low tide to avoid collecting samples from the tidal pools or seepage through the berm. Susan asked if there any beaches adjacent to lagoons or culverts that would not show evidence of human markers. Jenny noted that the SIPP project had conducted a reconnaissance survey prior to selecting beaches for testing and that human marker was not found everywhere, but she was not

sure of which ones had sources or not. Shirley wondered if a lagoon/culvert source would make a difference and Bernard noted that several sites in Manhattan Beach have consistently low FIB, but no marker data was available.

Vanessa described the Cov-IMS/ATP method which uses a portable and fast process to allow quantification of specific ATP which is equivalent to the level of Entero. They have tested this and will be using it when we get the next exceedance at the beach to see if it is possible to further isolate a source.

The lessons learned from the FIB and marker data indicates that dogs and gulls are important sources and since gulls are natural beach denizens, a focused effort to educate dog owners about the impacts is needed. A discussion of this came up again at the end of the meeting, and Jenny will think about ways we can focus the student projects in the spring to get more info and enlist them in helping spread the word. Susan suggested we talk to Beaches and Harbors about a poster contest and ways to use the winning poster on the beaches.

Lizzy and Crystal summarized their literature search on the relationship between FIB and human health risk in the ocean. Early studies suggested a correlation between FIB and GI symptoms, etc, but this seems to be not as strong in more recent studies. They described the work at Mission Bay, and Susan asked whether the study compared results before and after the installation of a bioswale/berm. Bernard noted that DPW has also conducted a thorough literature review of stormwater and healtb risks, which he offered to share. He noted that studies done in the mid-2000's suffered from low rainfall and that might affect the results. There does not appear to be a consensus at this time on this issue.
We will continue to explore more information during Year 2.

Richard Sherman (Topanga Underground) then described how each of the septic systems in the state park were examined and tested for leaks. The only sites with problems were the Feed Bin, where a small tank is still connected to a failing seepage pit that is located about 75' from the creek. They pumped the tank and added risers to make access easier, as well as added red fluorescent dye that they will monitor for the next several months to see if there is any leakage into the creek. He recommended that the seepage pit be sealed and the tank capped. This would require more frequent pumping and perhaps the addition of an additional holding tank, but would eliminate any potential threat to the creek.

They also repaired the septic tank at the Ranger residence, where they found a crack at the bottom. Yellow fluorescent dye was used here and will be monitored to see if there is any leaking. This system is also quite close to the creek and while it appears fixed, should be monitored.

The other septic systems at the Reel Inn and Cholada's are already capped and the tanks pumped regularly. He did caution that it is not known how long it might take for effluent to work its way through the fill material. In some places in Malibu, they estimate that it takes almost 75 years.

Rosi reported on the lifeguard treatment system, which does a great job removing all bacteria, but remains extremely high in nutrients. Steve noted that the system was not designed to accommodate the waterless urinals which were installed. He is working with Beacbes and Harbors to install an additional step that would increase alkalinity and bopefully reduce nutrient loading. There were a few odd results, but after Beaches and Harbors maintained the traps and lines, readings have gone back to normal. No one is sure why dog marker showed up in April!

Krista summarized the in-situ qualitative observations, as well as highlighted the problems with direct deposits, and discharges from RV's into the culvert at the lagoon and along the road shoulder near Brookside Drive. The removal of 2 pot farms as well as the continual impacts and removals of transient encampments does seem to affect our results.

Jenna noted that other in-situ measurements of dissolved oxygen, pH, water temperature, conductivity and salinity are all within the limits to support aquatic life, although due to the low rainfall (9.9") some very low DO levels have been observed. Nitrates, Nitrites, orthophosphates and ammonia levels were low overall, but orthophosphates showed the most consistent trend for higher levels at a variety of sampling locations. This appears to be related to transient use primarily. Algae is measured both quantitatively using the random point count method, and qualitatively. Due to the low flows this year, there was very little observed.

Krista then introduced the physical habitat results collected according to the SWAMP 2007 protocol. Basically the two study reaches are both in good shape, but Susan noted that we need to explain why the tree/sapling layer is considered scarce in the upper reach! This is actually related to the more rocky nature and natural topography of that area, not due to any anthropogenic effects. We will be sure to add that into the report!

Amy described the hypotheses and preliminary results of the BMI study. Processing began in July, with volunteer assistance from NPS, Watershed Stewards, and UCLA interns. Lizzy and Crystal will be digging in to continue analysis. Thus far it does appear that Greenleaf in the upper watershed has a lower IBI than the lower Topanga Creek reach, but stay tuned for more details.

Rosi quickly noted that as part of the SWAMP bioassessment we also collected diatoms, soft-bodied algae, chlorophyll a and ash free dry weights to begin to document those elements. As we only have a single data point at this time there is not much more to say. We anticipate collaborating with LVMWD and Aquatic Bioassay to compare the results in Topanga to those observed in Malibu. We also will be working with SCCWRP to examine a more regional context. Shirley noted that she was glad to see us using these methods, as the movement is towards developing future water quality objectives based on local conditions and response indicators like chlorophyll a.

We briefly touched on our outline for examining the trophic levels in Topanga Creek, including a more lab based approach as well as potential modeling. Stay tuned for year 2, but if any of the TAC have information to help with us, please let us know.

The development of BMP's will build on those already outlined in the report and depend on further understanding of the contributions of gulls and dogs, as well as human bacteria at the beach. For the moment, efforts will focus on reducing the amount of dog waste at the beach.

Karen McLaughlin and Carly Beck took a few moments to talk about the project SCCWRP is working on to develop a better understanding of the normal, seasonal eutrophic levels in estuaries. Topanga has been selected as a reference site for southern CA. They will be deploying a data sonde in the lagoon starting in Nov and also measuring macroalgae levels. A copy of their work plan is attached. This is a fantastic opportunity to expand the information available about lagoon conditions and their relationship to FIB. Also, we connected with Kevin O'Connor of Moss Landing and they are finalizing a study they did of 37 bar built estuaries along the coast, including Topanga. They have graciously shared their data sonde data with us as well.

This will enable us to implement one of our ideas for year 2 to really focus on the uniqueness of these small coastal estuaries and how they work.

We discussed our proposed sampling plan for the coming year, which has a better balance of events with incoming vs outgoing tidal stages. We also noted that the testing of the lifeguard treatment system effluent will end in Nov and we will rely upon the usual quarterly reports until the augmented treatment is installed.

Since we were running out of time, we had a very short discussion of BMP's and next steps. Finding a way to reduce the dog inputs is top of the list at present. We will definitely find a way to get the kids involved.

Shirley and Jed kindly emailed some suggestions that we will implement as we move forward in the development of the final report.

Please review the attached excerpts from the report and give us your thoughts on priorities. Shirley and Susan are keen on us adding wrack sampling into the program to get a better handle on recolonization and contributions from that source.

Our next TAC meeting will be in April 2014. We will be contacting you soon regarding a date.

Topanga Source Identification Study 2012-2013 Report

Technical Advisory Committee Meeting
Presentation
30 October 2013

Thank you to the team!!

Our Funders: Supervisor Zev Yaroslavsky and SIPP

Los Angeles County Departments

State Parks Angeles District

Our TAC and SIPP Collaborators for advice along the way

BioSolutions and Topanga Underground

UCLA Team: Dr. Jenny Jay's Lab Group

Former Postdoc: Dr. Tim Riedel

Current Grad Students: Vanessa Thulsiraj, Amy Zimmer-Faust, and Uriel Cobian

Undergrads: Robert Torres, Ian Davies

Past Help: Darcy Ebersole, Kathryn Hendy, Maria Carvajo, Soli Peterson, John Un, Lynn Rice, Ben Tachiiri, Chris Canadang, Raven LeGharde

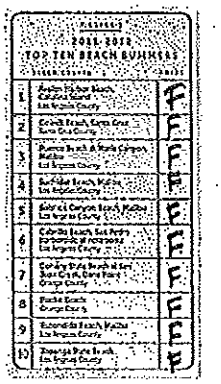
RCDSMM Team: Rosi Dagit, Jenna Krug, Steve Williams, Krista Adamek, Gabriel Stoggy, Ken Wheeland, Steve Harrison

WSP Members Lizzy Montgomery and Crystal Garcia

Heal the Bay- microscope loan

Topanga Beach Problem

- Beach Bummer List
  - # 9 in 2005/06
  - # 4 in 2010/11
  - # 10 in 2011/12
- 35 exceedances in 2012
- 5 exceedances so far in 2013
- Required to achieve 25% reduction in 2013
- Popular beach for recreation
- Home to endangered populations of Southern Steelhead Trout and Tidewater Gobies.



Hypotheses examined:

1. Upper watershed sources of FIB are not conveyed to the beach via the creek.
2. Concentration of FIB and/or pathogens and nutrients decrease as the creek flows downstream.

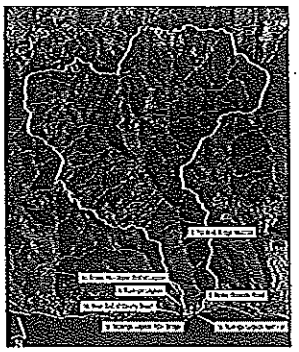
Benthic macroinvertebrate community species, diversity, sensitivity and abundance increase as the creek flows downstream from the town.

Hypotheses examined continued...

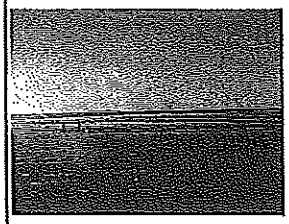
3. FIB and/or pathogens are not leaking from faulty septic systems along PCH
4. Lower watershed end/or lagoon sources of FIB (human and non-human inputs such as gull, dog, etc.) are correlated with exceedances at Topanga Beach
5. IMS/ATP methods can be used adaptively to track sources of FIB.

What we hope to achieve...

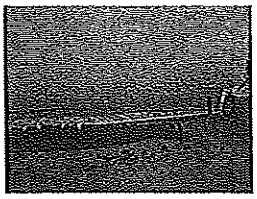
1. Identify the sources of bacterial contamination at Topanga Beach
2. Identify BMP's that can reduce exceedances
3. Examine the sources and sinks, as well as trophic level interactions in Topanga Creek and lagoon to understand the Topanga "Magic"
4. Provide outreach to the local community and schools



Beach sites

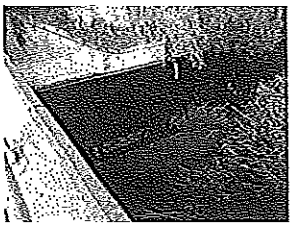


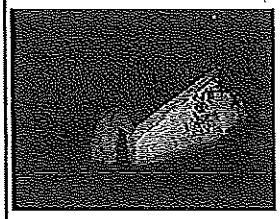
BO-beach outlet



BU- beach upcoast

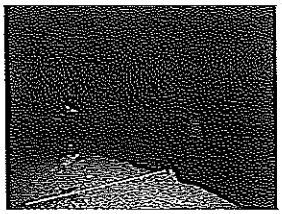
HB- PCH Highway Bridge





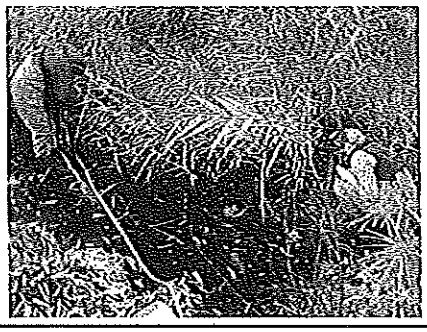
Lagoon sites

TL- lagoon east wall



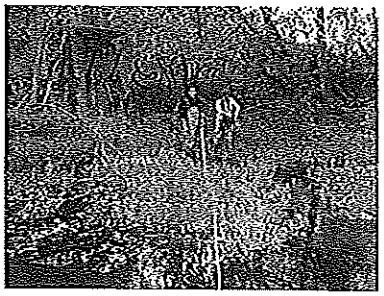
LO-lagoon outlet

SP- Snake Pit

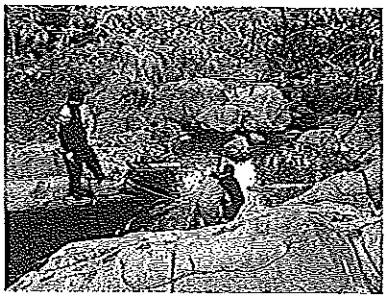


BR- Brookside Dr.

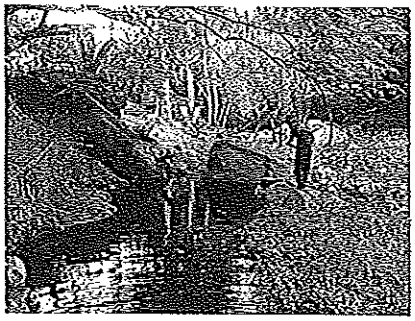
TB-Topanga Bridge MM 2.02



ST-Scratchy Trail

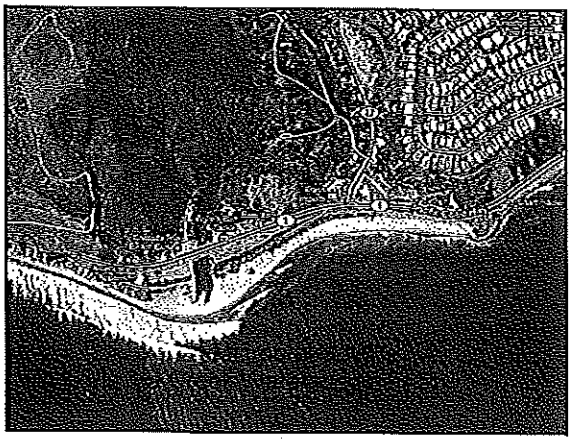


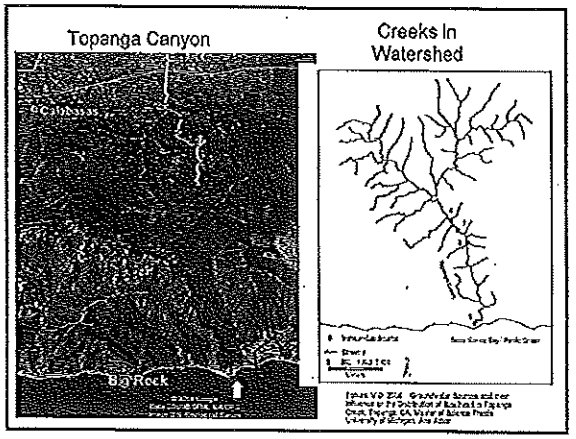
OF- Owl Falls



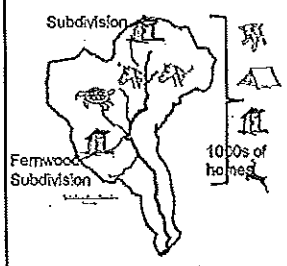
Data management and QA/QC

- Access and Excel both utilized
- QA/QC includes all steps of the process
  - calibration, sample collection, holding and testing, data entry and anelysis





Step 1a: Gathered info on Upper Sources:



Homes on septic systems throughout watershed
- About 6,000 homes on septics
- Many homes built in the 1920's and 1930's
- condition of septic system is not known

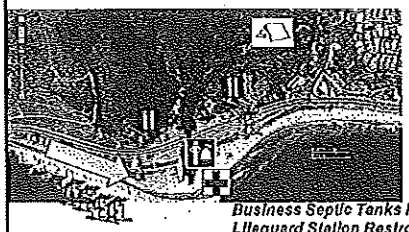
Transient encampments
- previous encampments dispersed
- Possible new encampments exist

Horses
- Several horse farms
- many residents have one or two horses on small parcels

Dogs
- diffuse source of FIB

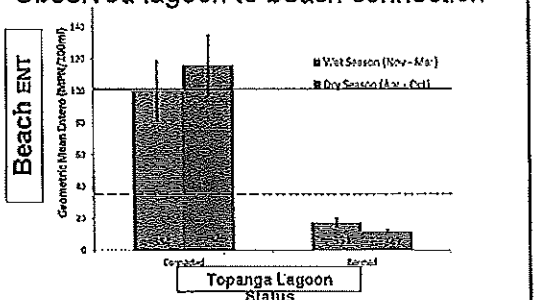
Wildlife (deer, birds, turtles, etc)
- 70% of the watershed undeveloped

Step 1b: Gathered info on Lower Sources:



Business Septic Tanks in State Park
Lifeguard Station Restroom
Stand alone treatment facility
Homeless encampments
Gulls
Bogs
Upcoast Residences Septics

Step 2: Historical FIB data analysis. Observed lagoon to beach connection



Data from Environmental Monitoring Division, Hyperion Wastewater Treatment Plant (Jan 2006 – Nov 2011)

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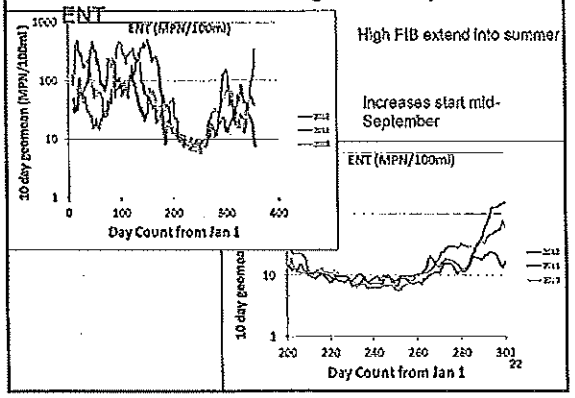
Historical data show strong seasonality in beach



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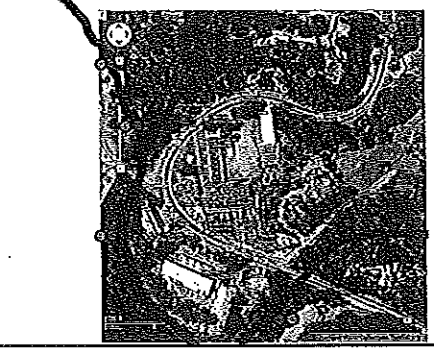
Step 3: Employ source markers (May 23rd ,May 30th, June 7th 2012)



23

ENT	HF183	BacHu	Dog
135	ND		
275	414	2400	4700	ND
		3		
393	185	ND	D	910
		ND		

(N) N = number of times sampled over 2 week period

May 23rd ,May 30th, June 7th 2012

ENT	HF183	BacHu	Dog
5265	30	ND ND ND	ND D	ND ND
	30	14		
	780	ND	ND	ND
	256	223	146	8 9 ND	50 ND	590	135
	233	13	63	ND ND ND	ND 220	ND ND
	2			

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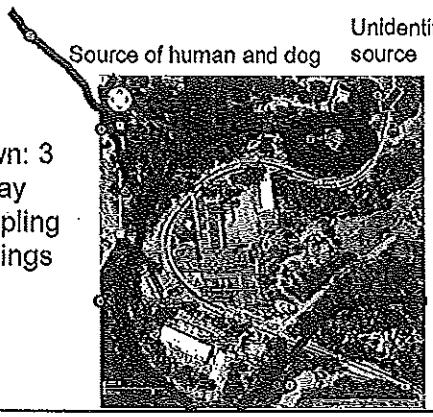
Town: 3 day sampling findings



Geometric means of FIB for wet and dry sampling events for watershed

	TC MPN/100ml	EC MPN/100ml	ENT MPN/100ml	HF gene copies/100ml	BacHum gene copies/100ml	Dog gene copies/100ml
Raining	1566 (27)	755 (27)	663 (27)	28 (23)	56 (22)	68 (20)	668 (19)
Dry Raining	640 (154)	51 (134)	54 (211)	2 (133)	5 (152)	129 (153)	25 (203)

Raining – samples collected during active rainfall on 10/5/11, 11/17/12, 1/24/13, and 3/8/13

Data collected for 5 Oct 2011 to 1 July 2013

(n) – indicates number of data points

- Values are 10 to 15 times higher in rain events
- Dog marker is 35 times higher in rain events
- Gull is only marker with lower levels in rain events

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Geometric means of FIB for winter and recreation season for watershed

	TC MPN/100ml	EC MPN/100ml	ENT MPN/100ml	HF gene copies/100ml	BacHum gene copies/100ml	Dog gene copies/100ml
Winter	615 (89)	61 (96)	41 (96)	2 (96)	6 (56)	290 (85)	169 (56)
Recreation	1427 (93)	50 (38)	55 (121)	2 (102)	5 (102)	52 (80)	6 (103)

Winter Season – Nov 1 to May 31
Recreation Season – April 1 to Oct 31

Analysis excludes rain data
Data collected for 5 Oct 2011 to 1 July 2013

- TC winter season values two times higher dry seasons
- Gull marker six times higher in winter
- Dog marker 28 times higher in winter

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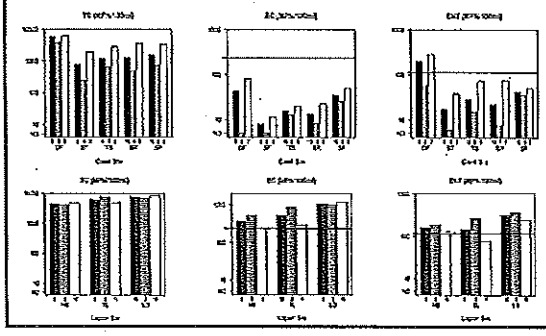
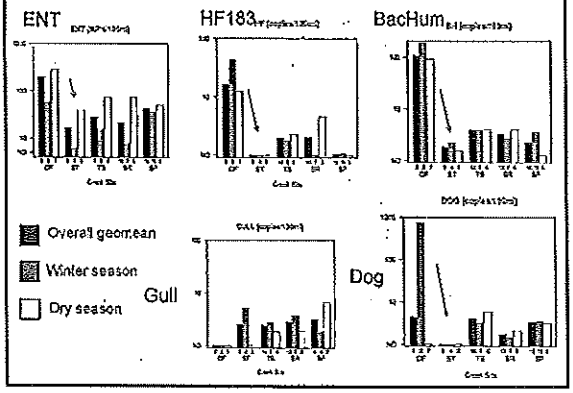
Hypothesis 1: Upper watershed sources of FIB are not conveyed to the beach via the creek

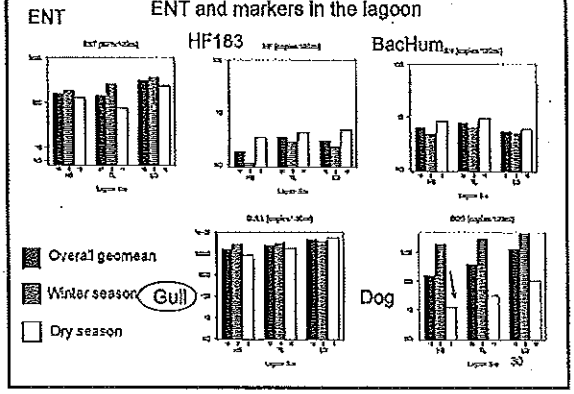


Hypothesis 2: ENT and markers decrease through the Narrows



Hypothesis 3: FIB are not leaking from faulty septic systems

ENT and markers in the lagoon



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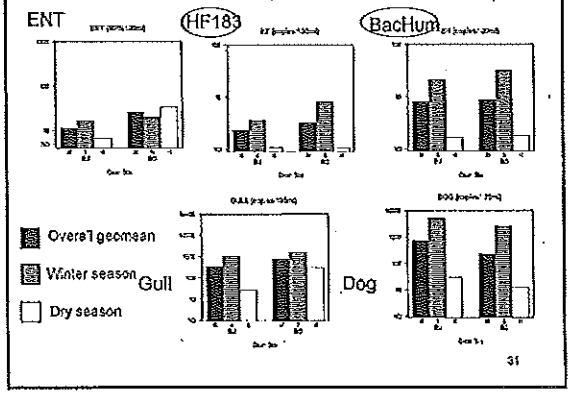
ENT and markers in the ocean



Human-associated marker values

Range of values seen when marker is detected

Site ID	HF183 (Copies/100 ml)	BacHum (Copies/100 ml)
OF	2.0 - 9992	15.09 - 29120 ←
ST	0.18	7.82 - 22
TB	0.18 - 934	2.12 – 4803 ←
BR	69.36 - 124	4.98 - 171
SP	1.77	1.73 - 289
HB	0.18 - 803	6.53 - 1851
TL	0.18 - 1327	2.54 - 4159 ←
LO	1.6 - 2196	2.15 - 6306 ←
BO	0. 18 - 619	6.65 - 2533 ←
BU	0.18 - 672	3.34 - 2777 ←

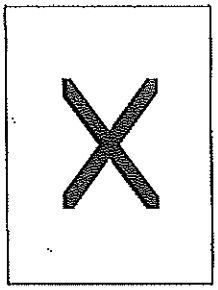
Mass balance on direct deposits

Assumptions:
200 g of waste per day enter the lagoon
Human waste contains 10^7 CFU/g ENT
Steady state, well-mixed
No decay or growth
Flow = 17 L/s = 1.6×10^6 L/day

Mass Balance

0 = CFU/day deposited – C_{lagoon} * Q
2×10^9 CFU/day = C_{lagoon} * 1.6×10^6 L/day
C_{lagoon} = 133 CFU/100 mL

Result: One direct deposit per day is enough to result in an exceedance



FIB Exceedances in lagoon and ocean

- 14% (6/43) samples exceeded at ocean for ENT
  - 10/5/11 for BO: gull only
  - 11/17/12 for BO: all markers detected (FF)
  - 1/27/12 for BO: human only
  - 3/6/13 for BU: gull and high dog
  - 5/8/13 for BO: dog only
  - 6/5/13 for BO: HF183, dog and gull
- 76% (47/62) samples exceeded at the lagoon for ENT
  - 21 samples positive for HF183 (45%)
  - 23 samples positive for BacHum (49%)
  - 39 samples positive for Gull marker (83%)
  - 35 samples positive for Dog marker (74%)

ENT exceedance and human-associated marker presence in the ocean

- 53% (22/42) ocean samples positive for the human marker
- ENT exceeded once at BU, but the human marker was not detected

Sample Site	Number of observations (n)	Positive for human (n)	Positive for HF183 (n)	Positive for BacHum (n)	Positive for both markers
BO	24	13	11	10	8
% detection		54%	46%	42%	33%

BO	Positive for human	HF183 detect	BacHum detect	Both markers
ENT exceedance	3	3	2	2
% detection	13%	13%	8%	8%
ENT compliance	10	8	8	6
% detection	42%	33%	33%	25%

Sample Site	Number of observations (n)	Positive for human (n)	Positive for HF183 (n)	Positive for BacHum (n)	Positive for both markers
BU	18	9	7	7	5
% detection		50%	39%	39%	28%

Summary of Marker Results

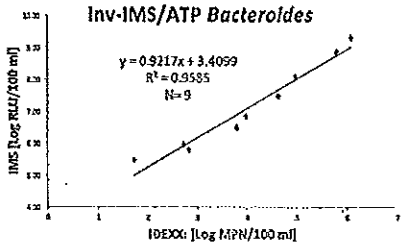
Upper Watershed

1) Human-associated merker mey be important near the town.
2) Concentretions of FIB end/or human-associated merker decrease through the narrows.

Lower Watershed

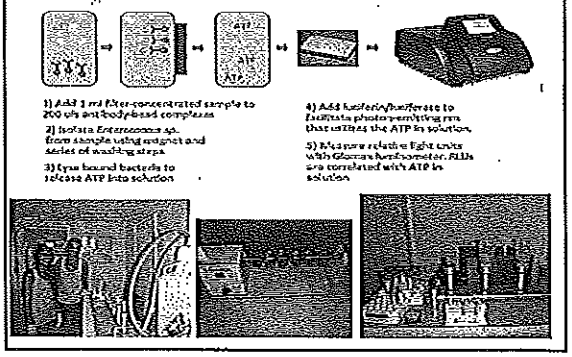
3) Transient populations near the lagoon contribute by direct deposit.
4) Dogs may be en important source of FIB to the legoon and beach
5) Gulls mey be en important source of FIB to the legoon and beach.
6) FIB and/or markers may be leaking from faulty septic systems in the lower watershed at beach establishments.

Hypothesis 5: IMS/ATP can be used to adaptively track sources of FIB in the watershed

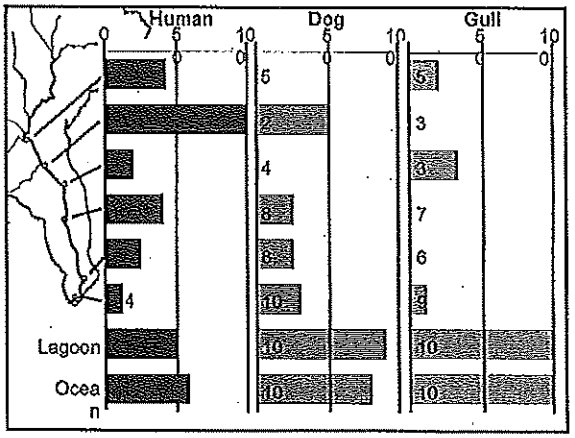


Calibration curve for Topanga lagoon and marine samples (N=21)
Samples collected between 10/23/12 to 7/31/2013

Cov-IMS/ATP Method

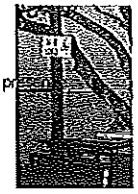


1) Add 1 ml filter-concentrated sample to 200 uls antibody-bead complexes
2) Isolate *Enterococcus* sp. from sample using magnet and series of washing steps
3) Lyse bound bacteria to release ATP into solution
4) Add luciferin/luciferase to facilitate photo-emitting rxn that utilizes the ATP in solution
5) Measure relative light units with Glomax luminometer. RLUs are correlated with ATP in solution



Lessons learned/actions taken

1) Human marker sources in lagoon and ocean
   - Encampments seen near sampling locations.
   - Adaptive IMS/ATP will be done to help find locations.
2) Transient populations are contributors at the lagoon and possibly upstream
   - Direct deposits observed and marker observed consistently in lagoon
   - Person was relocated.
3) FIB and marker levels appear to consistently decrease downstream from town.
   - Further work on ecological controls
4) Dogs appear to be a source
   - Seasonal source may be associated with life guard pr
   - Additional signs regarding dogs posted.
5) Gulls appear to be a source
   - Consistent and high levels of gull marker in lagoon
6) Septics may have been a source
   - All systems tested, two systems found faulty
   - Faulty septics repaired



Relationship between FIB and health risk in ocean

Changing Tides

1953-1968 Compiling a literature review of 22 studies, Arnoldi Prinse points to a correlation between fecal bacteria and gastro-intestinal symptoms, eye infections, skin complaints, ear, nose and throat infections and respiratory illness.)

1969 Hata et al. studied health effects of swimming in Santa Monica Bay waters affected by storm drain runoff. They found a higher risk of upper respiratory and GI symptoms when subjects swam near storm drains, and where fecal coliform or enterio viruses were detected.

And then...

2007 A study at 8 Mission Bay beaches found *no relationship* between fecal indicator bacteria and rates of swimmer illness.

- The authors pointed out this contradiction, citing a literature review of 27 relevant marine recreational water epidemiology studies that showed increased risk with increased fecal indicators.
- The explanation...
- "In essentially all of these studies, there were known sources of human fecal contamination. There appears to be little human fecal contamination in Mission Bay, as evidenced by a recent source tracking study showing that the predominant source of fecal contamination was avian."

And so... *New research suggests that human health outcomes may vary depending on the source of fecal indicator bacteria.*

Chlorophyl a and ash free dry weight

- Provide a direct link between nutrient levels and eutrophication
- Estimating algal biomass measured by
  1. quantifying chlorophyl- a
  2. measuring carbon biomass as ash-free dry mass
  3. measuring particulat organic carbon (DOC)
- >6 chlorophyll characteristic of either nutrient poor water w/ hi temp, OR cold water with excessive nutrient inputs

Preliminary Results

Matrix	Method	Unit	TC4500 6000m	TC3200 3700m
Ash free dry Mass	SM 2540	mg/cm²	7.81	10.85
Chlorophyl-a	SM10200 H	ug/cm²	8.63	13.26

The ratio between AFDM and *Chl a* diagnostic tool.
Higher the ratio, greater amount of biomass, lower water quality

Trophic Levels

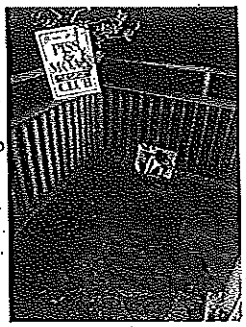
- Will be assessing fate and transport of FIB inputs from the upper watershed
  - Photoinactivation, dilution, and predation → possible mechanisms
- Wanjugi and Harwood (2013):
  - Studied influence of indigenous microbiota on FIB
  - Treatments: no predation or competition, competition only, predation only
- Korajkic et al. (2013):
  - Influence of predation versus photo inactivation on *E.coli* survival
  - Predation more strongly affected *E. coli* concentrations than photoinactivation
  - Treatments: presence/absence of indigenous microbiota with and without predation from protozoa in covered/uncovered mesocosms
- Surbeck et al. (2010):
  - FIB concentration strongly dependent on DOC and phosphorus
  - Treatments: Microcosms spiked with treated wastewater, surface water, surface water runoff

Trophic levels ????

- Water quality controlling factor for biological communities
- Not yet sure how all this interacts to provide the Topanga Magic
- How is creek able to absorb the nutrient inputs from upper watershed?
- What are the processes involved in that?
- Do groundwater inputs play a role? Dilution?
- What are the trophic levels and how are they defined/affected by water quality?
- NEED TO INVESTIGATE AND IMPLEMENT SUITABLE MODEL

BMP'S

- BASIN PLAN RECOMMENDATIONS (pg. 122)
- Community outreach needed – best way to reduce inputs in upper watershed
- Community meeting update on info gathered – when?
- Pet and corralled animal inputs- formal outreach? How? When? Target audience?
- Trailhead notification of dog inputs?



NEXT STEPS

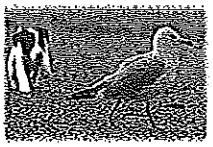
Discuss focus/refinements for Year 2

- Sampling Schedule by tide/moon
- Year 2 sampling plan (pg. 125)
- Opportunities for collaboration
- SCCWRP/ Moss Landing study
- SIPP results and papers
- Isotopes with Doug Hammond?
- IMS/ATP for adaptive hot spot sampling and tracking human sources
- Virus sampling at lagoon, how far upstream?

Not All Feces Are Created Equal

The degree to which fecal contamination from animals leads to human health varies (Cox et al, 2005; Hardwood et al,2013; Jang et al, 2007; Schoen and Ashbolt, 2010; Soller et al, 2010; and Wright et al, 2009).

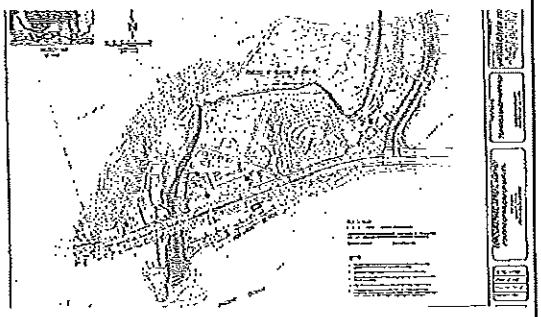
Fecal contamination from cattle can be as high a risk to human health as human feces (Soller et al, 2010).



The risks associated with exposure to recreational waters impacted by fresh gull, chicken, or pig feces appear substantially lower than waters impacted by human sources. (Soller et al, 2010).

Some waterborne zoonotic infections such as salmonella, campylobacter jejuni, giardia, cryptosporidium, and hepatitis E are still a concern (Soller et al, 2010).

Existing septic systems tested

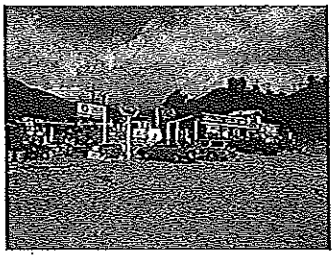


**Still need to track down remaining soil data

Red= septic system locations

Feed Bin- Oasis

MALFUNCTIONING AND POTENTIAL CONTRIBUTOR TO CREEK

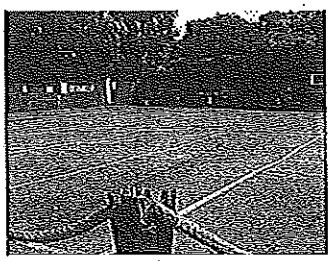


- 800 gallon tank
- 4' x 26' seepage pit

Recommendation:

- Cap and seal pit.
- Add holding tank.

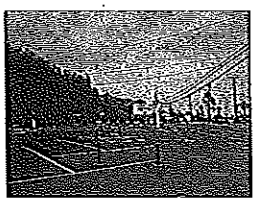
Reel Inn



- Tank is sealed and pumped regularly
- Could benefit from better pumping plan

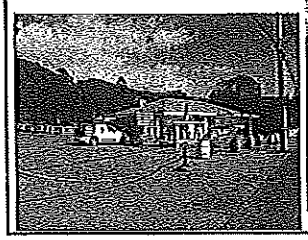
Ranger residence

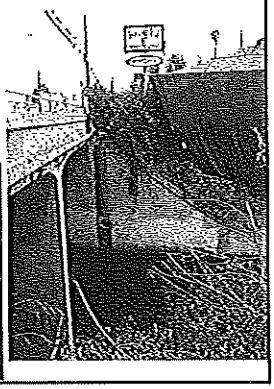
- First tank: Leak detected and repaired
- Second tank: Empty but lid cracked and needing repair



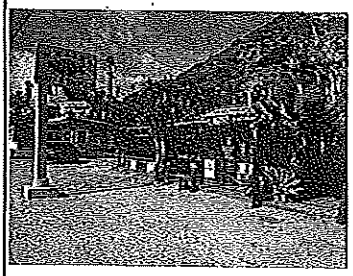
Winery

- No septic system remaining
- Using port-o-potties
- Runoff from irrigation may be a problem



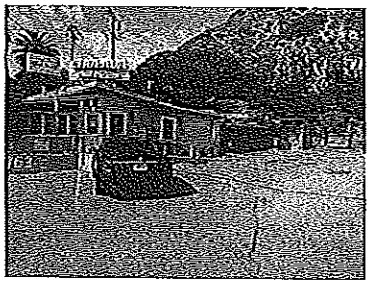


Wylie's



- No septic system on site
- Sink drains into French drain

Cholada's



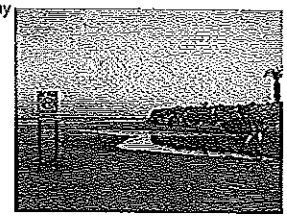
- Tank is sealed and pumped regularly

Topanga Lifeguard Station Restroom Treatment Facility

Function could be improved with addition of de-nitrifying equipment such as that at Surfrider

Lifeguard Station Results

- Total coliform always low or non-detect
- E coli always low or non-detect
- Enterococcus high June, July 2013
- Human marker observed but may be measuring DNA from dead bacteria cells
- Dog marker April 2013?



Lifeguard station-nutrients

Nitrate (ppm)
1:100 dilution
- Range: 12 – 74
- Average: 44

Nitrite (ppm)
- Range: 0.00 – 0.61
- Average: 0.23

Orthophosphate (ppm)
1:100 dilution
- Range: 9.9 – 68
- Average: 31

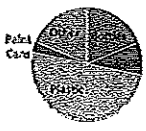
Ammonia (ppm)
1:100 dilution
- Range: 11 – 71
- Average: 30

In-situ Data Results

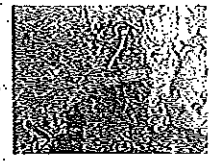
SITE	Water Conditions: Not Clear?	Color?	Odor?	Oil?	Foam?	% Not CompSent	Feces: Trash	Transient	Human	Dog	Bird
Topanga Lagoon	1	2	0	0	0	15%	12	2	7	1	11
PCH Bridge	1	2	0	0	0	25%	1	6	4		
Snake Pit	4	3	0	2	0	31%					
Brooksida Dr	1	1	0	0	0	8%	2		1		
Topanga Bridge	1	1	0	1	0	15%	8	1			
Scratchy Trail	3	4	0	0	2	67%	2				
Owl Falls	0	2	0	0	1	29%					

SITE	Flow (ft^3/s) min	Flow (ft^3/s) max	Depth (in) min	Depth (in) max
Topanga Lagoon	*ND	*ND	7	27
Snake Pit	0	0.78	3	12
Brooksida Dr	0.04	0.71	3	6
Topanga Bridge	0.07	4.35	7	9
Scratchy Trail	0.01	0.69	6	9
Owl Falls	0.05	0.31	3	9

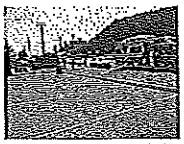
*None Detected



Direct deposits under PCH Bridge



Direct deposits Topanga Creek

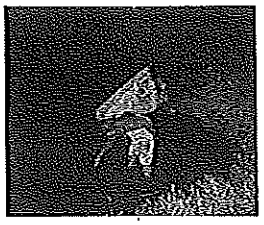


RV near culvert at PCH Bridge

RV discharge on shoulder of TCB

In-situ water quality parameters

- Dissolved Oxygen (mg/L)
- Dissolved Oxygen (%sat)
- pH
- Water Temperature (°C)
- Conductivity (µS/cm)
- Salinity (ppt)



RCD Biologist Steve Williams using a refractometer to test salinity at TL, February 2013

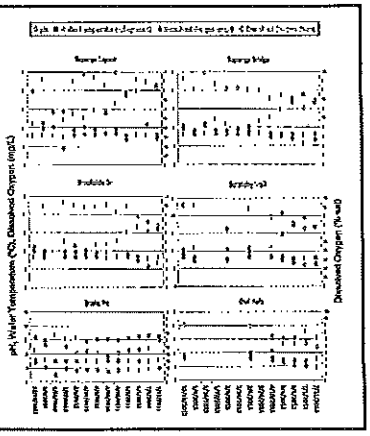
Sites: TL, SP, BR, TB, ST, OF

pH
- Range:
7.1 (OF) – 8.44 (TL)
Highest mean: BR (8.3)
Lowest mean: SP (7.6)

Water Temperature (°C)
- Range:
7.2°C (ST) – 22.3°C (TL)
Highest mean: TL (15.9°C)
Lowest mean: TB (12.5°C)

Dissolved Oxygen (mg/L)
- Range:
2.6 (SP) – 11.19 (BR)
Highest mean: BR (9.0)
Lowest mean: SP (4.5)

Dissolved Oxygen (%sat)
- Range:
38.6% (SP) – 127.7% (TL)
Highest mean: TL (89.5)
Lowest mean: SP (47.8)



Nutrients, Turbidity & Algae

- Nitrate-N (ppm) >0.1
- Nitrite-N (ppm) >1
- Orthophosphate (ppm) >0.1
- Ammonia (ppm) >0.4
- Turbidity (NTU) >5
- Algae (% cover)

RCD Stream Team member, Gabe Stoggy, testing for nutrients, February 2013

Sites: TL, SP, BR, TB, ST, OF

# of Exceedances:

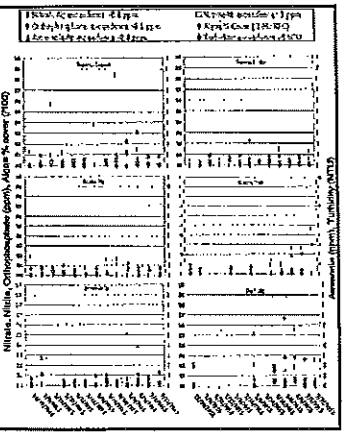
Nitrate (ppm)
TL – 1/13 (8%)
BR – 1/12 (8%)
OF – 2/7 (29%)

Nitrite (ppm)
None

Orthophosphate (ppm)
TL – 3/13 (23%)
SP – 3/13 (23%)
BR – 3/12 (25%)
TB – 2/13 (15%)
ST – 4/9 (44%)
OF – 6/7 (86%)

Ammonia (ppm)
SP – 2/13 (15%)
BR – 2/12 (17%)
TB – 1/13 (8%)
ST – 1/9 (11%)

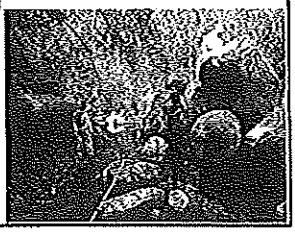
Turbidity (NTU)
TL – 2/11 (18%)
OF – 1/6 (17%)



Physical Habitat results

Lower reach 3200-3700m

Upper reach 4500-5000m



Physical Habitat Results

PHYSICAL HABITAT		UPPER REACH 4500-4650m	LOWER REACH 3200-3350m
Bank Stability	% Stable	91%	82%
Instream Habitat Complexity	Frequency Channel Feature*	28%	62%
Riparian Vegetation	Trees and saplings >5 m high	scarce	heavy
	Alt vegetation 0.5 m to 5 m	moderate	moderate
	Woody shrubs & saplings <0.5m	absent	absent
	Herbs/grasses	moderate	moderate
	Barren, bare soil/duff	moderate	heavy

*Count of Instream Habitat Complexity Channel Features (CH)
Channel Feature
Filamentous Algae
Aquatic macrophytes
Boulders
Woody debris ≥0.3
Woody debris <0.3
Undercut banks
Overhanging vegetation
Live tree roots
Artificial structures

Benthic Macroinvertebrate (BMI)

- Presence/absence of specific BMIs provides insight into the health of an ecosystem
- BMIs will help to quantify differences in ecosystem health between sites
- Also help provide insight on potential stressors on biological health
  - Physical impairment found to impact biological condition (e.g. Rogers et al. 2002)
  - Addition of sediment fines found to affect BMIs (Wagenhoff et al. 2012)

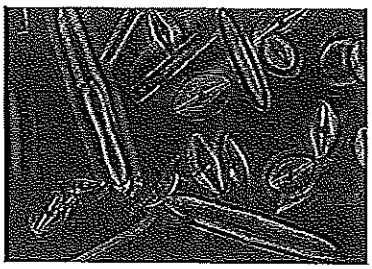
Hypotheses Examined:

- *Benthic macroinvertebrate species diversity and sensitivity increases as the creek flows downstream.*
- *Biological condition is effected by physical habitat quality.*

BMI Results

- Processing:
  - Completed samples assessed according to the Southern California Index of Biological Integrity (Ode et al. 2005)
- Preliminary Results: Processing has begun as of July, 2013
  - Greenleaf site (upper watershed) had a much lower IBI score than Topanga Creek 3200-3350 m as hypothesized.
  - Samples collected in May, 2013 and July, 2013 contained too few individuals to apply IBI metric

	Site	Sampling Dates 2013	Sampling Dates 2014	Sampling Procedure
1	Backbone Trail	*Insuff. Flow	4/X/2014	SWAMP 2007
2	Greenleaf	4/29/2013	4/X/2014	SWAMP 2007
3	MM2.02 Above	*Insuff. Flow	4/X/2014	SWAMP 2007
4	MM2.02 Below	5/2/2013	4/X/2014	SWAMP 2007
5	Out Falls	5/8, 7/1, 9/21	4/X, 6/X, 8/X	CDFG 2005
6	Sunshine Trail	5/8, 7/1, 9/21	4/X, 6/X, 8/X	CDFG 2005
7	Topanga Bridge	5/8, 7/1, 9/21	4/X, 6/X, 8/X	CDFG 2005
8	Brookside Drive	5/8, 7/1, 9/21	4/X, 6/X, 8/X	CDFG 2005



Diatoms

- Single cell algae
- Frustule shell
- Sensitive to changes in DO, pH, nitrogen and conductivity

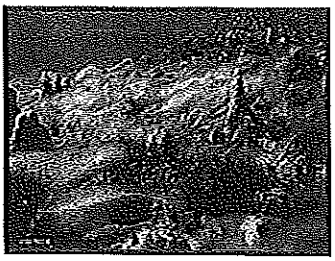
Diatoms – Preliminary results

- 61 species in upper reach, 64 in lower reach
- Shared 38 species
- 23 unique to upper, 26 unique to lower
- Most very pollution and disturbance tolerant
- Shell shape rapidly responds to changes in water quality
- Year 2 will examine relationship to regional context – collaboration with LVMWD and Aquatic BioAssay

Soft-bodied algae:

Includes green, red and cyanobacteria

- Dominant species *Cladaphora*.
- Lower reach had 3 additional species (13) upper reach had (10)
- *Cladophora* as eutrophication indicator? Maybe not?
- Cyanobacteria are nitrogen fixers found mostly in stream with low N levels



Suggested sampling days for Topanga Coun	2013-14					
Sample Trip ID	Month in 2013	Day	Suggested Date	Tide	Time/Tide height (ft)	Samples Trip type
25 TQ	November	Thursday	7	low	4:52 AM PST / 2.50 ft	big trip
26 TQ	November	Monday	18	high	8:46 AM PST / 6.06 ft	small trip
27 TQ	December	Monday	9	low	9:14 AM PST / 2.01 ft	big trip
28TQ	December	Thursday	19	high	9:30 AM PST / 5.65 ft	small trip
Sample Trip ID	Month in 2014	Day	Suggested Date	Tide	Time/Tide height (ft)	Samples Trip type
29TQ	January	Monday	6	low	7:11 AM PST / 1.79 ft	big trip
30 TQ	January	Wednesday	29	high	7:33 AM PST / 6.70 ft	small trip
31 TQ	February	Monday	10	high	6:23 AM PST / 5.20 ft	big trip
32 TQ	February	Thursday	20	low	6:40 AM PST / 1.32 ft	small trip
33 TQ	March	Monday	10	high	6:07 AM PDT / 4.40 ft	big trip
34 TQ	March	Thursday	20	low	6:25 AM PDT / 0.39 ft	small trip
35 TQ	April	Thursday	24	high	6:16 AM PDT / 4.40 ft	big trip
36 TQ	May	Thursday	29	low	4:45 AM PDT / -0.83 ft	big trip
37 TQ	June	Thursday	19	high	4:25 PM PDT / 4.96 ft	big trip
38 TQ	July	Monday	14	low	5:35 AM PDT / -1.14 ft	big trip
39 TQ	August	Tuesday	19	high	7:18 AM PDT / 3.60 ft	big trip
40 TQ	September	Thursday	11	low	5:10 AM PDT / 0.56 ft	big trip
Tides taken from http://tides.mobilegeographics.com/calendar/year/3446.html						
*Sample trip type: big = includes SIPP (OF and ST), small = only county samples (up to TB)						
**we assume tide will not affect upstream creek samples						

Best Management Practices (BMP's)

11.1 Evaluation of BMP's

The Los Angeles Region Sub-watershed Specific Implementation Plan (NSMR 11/4 Bacterial TMDP Implementation Plan 2005) identified target exceedance day reductions for creeks within the Santa Monica Bay watershed as a way of examining watershed specific compliance milestones. Topanga Creek is allowed 17 exceedance days, with a total required day reduction of 9 exceedance days. To achieve the target reduction, the Plan recommends the following Best Management Practices, benefits and performance evaluation measures and methods.

One of the main efforts of this study is to collect data to monitor current water quality conditions, compare the current levels to previous studies, and identify sources and recommend specific Best Management Practices to reduce, and eliminate if possible, identified contributions to bacteria and nutrient exceedances. Further evaluation and investigation of potential BMP's will continue in Year 2.

Table Error! No text of specified style in document..1 Summary of BMP's Benefits and Performance Evaluation Measures for Topanga Lagoon and Creek (excerpted from: NSMR 11/4 Bacterial TMDP Implementation Plan 2005)

BMP's and Activities	Water Quality Benefits	Integrated Water Resources Benefits	Performance Evaluation Measure and Method
TMDL Monitoring and studies:	Monitor bacteria, nutrients, metals and organics	N/A	Monitoring results (Note: metals and organics are not being monitored by this study)
Hydrologic Loading Estimates	N/A	Hydrology/ Geomorphology	Study results
Id most relevant Human Health Indicators Study	Bacteria and pathogens	N/A	Study results from this and SIPP
Hydrology vs. Bacteria loading	Bacteria	N/A	Study results from this and SIPP
Bacterial Seasonal Variation Study	Bacteria	N/A	Study results from this and SIPP
Non-Structural Measures:			
Outreach to pet owners (especially dogs on the beach) concerning link between animal wastes and health issues	Bacteria, nutrients and pathogens	N/A	Study results from this and SIPP

Locate areas with corralled animals and educate property owners on bacteria TMDL's	Bacteria and pathogens	N/A	Study results from this and SIPP, Community meetings
Identify horse stables and implement pilot program for manure management	Bacteria and pathogens	N/A	Study results from this and SIPP
Outreach at trailheads encouraging hikers to use restroom facilities	Bacteria and pathogens	N/A	Study results from this and SIPP
Commercial Facilities Control Programs:			
Provide outreach to all commercial facilities with corralled animals	Bacteria and pathogens	N/A	Study results from this and SIPP
Development Planning and Construction Programs:			
Further emphasize applicable existing BMP's in development planning and construction programs	Bacteria, nutrients, metals, organics, pathogens, trash	Water conservation, reuse/recycling, habitat, geomorphology, hydrology, flood volumes	Community meetings to highlight County recommendations
Structural Measures:			
Encourage residential cisterns	Bacteria, nutrients, metals, pathogens,	Water conservation, reuse/recycling, habitat, geomorphology, hydrology, flood volumes	Community meetings to highlight County recommendations
On-site storage and reuse projects	Bacteria, nutrients, metals, organics, pathogens, trash	Water conservation, reuse/recycling, habitat, geomorphology, hydrology, flood volumes	Community meetings to highlight County recommendations
Small scale Infiltration projects	Bacteria, nutrients, metals, organics, pathogens, trash	Water conservation, reuse/recycling, habitat, geomorphology, hydrology, flood volumes	Community meetings to highlight County recommendations

A number of BMP's could be implemented throughout the watershed in order to address the identified problems. Funding sources to assist property owners in implementing these recommendations should be identified and made available to all watershed residents.

These include, but are not limited to:

- Installation of effluent-filters in septic system outlets to reduce particulates into leach fields or seepage pits, thus reducing bacterial and nutrient contamination potential.
- Installation of a variety of filters to capture sub-surface graywater discharges.
- Installation of additional trash receptacles behind Topanga Market and Abuelita's.
- Increased availability of public restrooms in Topanga Center.
- Consistent removal of transient encampments located adjacent to the creek.
- Installation of green berm filter strips on the downslope edges of corrals to prevent manure spills and contaminated stormwater run-off.
- Use of manure composting with runoff control.
- Installation of culvert filters along PCH at Topanga Beach to prevent direct road surface run-off spills into Topanga Lagoon.
- Upgrade as needed the septic systems at the Topanga State Park and other commercial and residential structures along PCH.

11.2 References Cited

LARWQCB. 2005. Los Angeles Region Sub-watershed Specific Implementation Plan NSMR 11/4 Bacterial TMDP Implementation Plan.

NEXT STEPS FOR YEAR 2

12.1 Next Steps

The intention of this study is to utilize the data obtained thus far to help direct our sampling strategy, identify gaps and additional information needed to enable the county to best understand the sources of bacterial contamination at Topanga Beach, and identify possible ways to eliminate, reduce or mitigate those sources.

Based on the preliminary results, we have identified several questions and actions that could help us achieve those results. We anticipate additional recommendations and suggestions on how to refine this effort from the TAC. Their input will be incorporated into this section prior to release of the document to the public.

FIB and host associated markers:

- Cov- IMS/ATP methods can be used to adaptively track sources of FIB in the watershed, furthering our understanding of concentration and dispersal.
- Inv-IMS/ATP Bacteroides method will be used to adaptively to track potential sources of human associated fecal pollution
- Additional sampling needs or location changes based on preliminary results
- Add sampling location between 3600 and 1700 to see if we can narrow down the "sink" location? Shale Falls?
- Add sampling location between 3600 and 1700 to see if we can narrow down the "sink" location? Shale Falls?
- Examine the buoy data to look at the patterns of nearshore flow along Topanga Beach
- What more, if anything, do we need to know in order to identify sources of bacterial contamination?
- Examine the relationship between FIB, markers and potential impacts to human health risks via literature search.
- Should extracts be tested for inhibition using spiked serial dilutions?
- What impacts might Sea Level Rise have on the movement and dilution of FIB between the lagoon and the ocean?
- In collaboration with Dr. Doug Hammond at USC, examine the isotope signatures of water leaching through the sand berm from the lagoon to the ocean to get a better idea of the time lag and potential for filtration.
- Expand the data analysis to examine how TC and EC increase through the lagoon, even though there is little input from Snake Pit.
- Expand the data analysis to examine the patterns of gull and dog markers as they travel from the lagoon to the ocean.
- Why does enterococci survive the transition from the lagoon to the ocean in higher concentrations?
- Identify types of bacterial colonies marketed to homeowners to improve their septic function and examine their potential contributions or impacts on FIB found in the creek and lagoon.

Ecological interactions:

- Develop an ecosystem process model and examine ecological controls such as nutrient cycling and predation on FIB, benthic macroinvertebrates, diatoms and soft-bodied algae dynamics.
- Investigate appropriate conceptual model and analyses to examine the role of periphyton in both trophic levels and in response to environmental stressors.
- Compare BMI results between reaches within Topanga Creek and between Topanga Creek and other creeks in the Santa Monica Bay.
- Compare diatom and soft-bodied algae species abundance, growth patterns and ecological tolerances between Malibu and Topanga, and within a southern California region context (work with Las Virgenes Municipal Water District, Aquatic Bioassay and Consulting Inc., and SCCWRP).
- Examine data collected with parameters identified in the Reference Condition Management Plan (RCMP) for California Streams (Ode and Schiff 2008) and the central coast statistical model built using the River Invertebrate Prediction and Classification System (RIVPACS) (Ritz 2010, Wright 1995).
- What are the seasonal patterns of algal cover and species diversity?
- Does density and duration of algal cover affect benthic infauna species composition or abundance?
- Systematically survey fish populations in relation to algae cover and water quality in Topanga lagoon.
- Track the presence and abundance of beach wrack (kelp) over time, which could be harboring bacteria and/or attracting birds, on the berm between Topanga lagoon and the ocean

Best Management Practices and Community Outreach:

- Develop a survey for the community regarding how pet wastes are handled to encourage active management. (This could be a Watershed Steward member project)
- Conduct active outreach effort to provide information on the effects of dog waste on water quality.
- Conduct community meeting on rainwater harvesting, cisterns and reducing run off from your property.
- Set up volunteer training and community meeting schedule.
- Establish volunteer bird monitoring at Topanga lagoon and Beach to obtain more information on numbers of birds and use/roosting patterns.
- Find funding to repair the Feed Bin OWTS.
- Set up a time-lapse camera on the PCH bridge to document lagoon/ocean connectivity patterns.
- Clean the lens on the existing camera on top of the lifeguard station.
- Refine the school field program to have students focus their microbial investigations more closely on the inputs from dogs and gulls.
- Investigate correlation between marijuana farms and water quality in Topanga Creek.

Estuary Reference Study Workplan -- DRAFT
Topanga Canyon Lagoon
2013-2014

Background and Conceptual Approach

The general conceptual approach involves the measurement of eutrophication indicators and nutrient loads at minimally disturbed estuary "reference" sites in southern California. Minimally disturbed is defined as best available, since no watersheds are without some form of human disturbance. Natural abundance of algae and concentrations of dissolved oxygen can be highly variable, therefore replication in space (many sites) over multiple seasons is required to adequately characterize median values and estimate variability. This study consists of multiple phases. What is currently drafted below is for Phase 1 only. One study site has been selected for this field year (2013-2014) in southern California (Phase 1). An additional 5 sites will be selected using the same criteria from northern and central California next year (2014-2015) for Phase 2.

The core monitoring question of this study is:

"What is the natural condition of closed estuaries with respect to the indicators of eutrophication?"

Estuaries that are subject to seasonal closure of their ocean inlet due to the formation of a sandbar are expected to experience stratification of their waters and longer water residence times, which can ultimately result in a naturally eutrophic state. This study attempts to evaluate the natural spatial and temporal extent of eutrophic condition in minimally disturbed closed estuaries. The indicators of interest are: dissolved oxygen, macroalgal biomass and cover, and phytoplankton biomass.

A previous study assessed extent and magnitude of eutrophication indicators in 27 sites in 23 southern California Bight estuaries, 6 of which experienced seasonal closure of their ocean inlets (McLaughlin et al. 2012). Our approach is to use the lessons learned from this study to develop appropriate monitoring protocols for closed estuaries and build on this data set. Site selection was driven by a need to evaluate estuaries with minimal anthropogenic, watershed nutrient inputs. Only one estuary was found to satisfy the criteria in southern California (Topanga Canyon Lagoon).

Sampling for Indicators of Eutrophication

Sampling frequency will consist of monthly sampling at 15 stations within the estuary between November 2013 and November 2014. Measurements will include macroalgae and phytoplankton biomass (as biovolume), nutrient concentrations, and microcystin, as well as hypoxic volume and water column stratification.

Sampling for hypoxic volume and phytoplankton abundance will be conducted using two techniques: a continuous monitoring at a fixed location in the estuary and spatial mapping. Continuous monitoring data will be collected using a YSI 6600 data sonde outfitted with optical dissolved oxygen probe (ROX), optical chlorophyll fluorescence probe, conductivity/temperature probe, and water level sensor. Three dimensional maps of dissolved oxygen and chlorophyll fluorescence will be collected using the sonde to profile the water column at a grid of evenly distributed points throughout the estuary. Points along the grid will be 10 - 50 meters apart, with a minimum of 15 profiles collected monthly, for a total of 180

profiles for the year (15 profiles x 12 sampling months). Chlorophyll fluorescence will be converted to phytoplankton biomass (g m^{-3}) by calibration to discrete water column chlorophyll *a* concentrations collected as a composite water sample from the estuary and processed using standard methods (EPA 440), replicates will be conducted at one of the sites for a total of 36 chlorophyll a samples (3 samples x 12 sampling months).

Sampling for macroalgae abundance will be conducted with depth integrated measurements of total biomass. Fifteen grab samples will be collected at each estuary per month for a total of 180 samples, using the same grid as described for water column profiling (12 sampling periods x 15 samples). This should allow for spatial representation of biomass for each estuary. Macroalgae abundance will be collected as a biovolume (grams per cubic meter of water) using a specially designed sampler which comprehensively collects all biomass in the water column above a prescribed surface area of estuary sediment. Water column depth at each sampling location will be recorded and multiplied by the surface area to generate water column volume. Macroalgae samples will be rinsed lightly in the field to eliminate excess sediment and organisms, stored in plastic bags on ice, and transported to the laboratory for processing within 24 hours of collection. Samples will be washed of sediment and debris and excess water will be rung out. Wet and dry weights will be collected. Biovolume will be calculated from the dry weight and volume of water at each sampling site. Plots of mean biovolume of macroalgae and spatial maps of biovolume will be generated for each sampling period.

Linking Eutrophication Indicators and Nutrients

The relationship between the indicators of eutrophication and nutrients will be determined by comparing observed indicator abundance/concentration and watershed nutrient loads and estuarine ambient concentrations.

Nutrient loading into the estuary will be estimated monthly from flow data and stream nutrient concentrations. Topanga Creek water level will be measured continuously using a water level sensor (HOBO instruments) at a site above tidal influence. Water level will be converted to flow using a rating curve derived from channel measurements of flow and channel topography collected every other month for one year (consistent with indicator monitoring described above). A total of 12 flow measurements will be collected (12 sampling events). Nutrient loads into the estuary will be calculated from the channel flow and nutrient concentration measurements from grab samples at the creek site. A total of 14 grab samples will be collected for nutrient concentrations (12 sampling periods + 10% QA/QC) using standard methods. Nutrient samples will be analyzed for a suite of nutrient parameters (Table 1).

Ambient nutrient concentrations in the estuary will be collected every month for one year (consistent with indicator monitoring and nutrient loading described above). Nutrient concentrations will be collected as a composite at a minimum of three sites in the estuary (located coincident with the chlorophyll a measurements) for a total of 14 samples (12 sampling periods x 10% QA/QC). The composite sample will be analyzed for a suite of nutrient and carbon parameters as well as the toxin microsystin (Table 1).

The relationship between indicators of eutrophication (dissolved oxygen, macroalgae biovolume, phytoplankton biomass) will be explored using least squares regression analysis and plots of relationships will be generated.

Constituents

Table 1. Constituents to be measured in estuarine reference study.

Type	Constituent	Creek	Estuary
In Situ	Flow	X	
	Water Level	X	X
	Temperature	X	X
	Conductivity/Salinity	X	X
	Dissolved oxygen		X
	Chlorophyll fluorescence		X
Discrete	Nitrate	X	X
	Nitrite	X	X
	Ammonia	X	X
	Phosphate	X	X
	Total Nitrogen	X	X
	Total Phosphorus	X	X
	Dissolved Organic Carbon	X	X
	Chlorophyll *a*		X
	Macroalgae biovolume		X

Table 2. Summary of Sampling Effort by Type of Sampling and Indicator Group

Type of Sampling	Minimum # of In Situ Measurements	Minimum # of Discrete Samples
Hypoxic Volume	180	
Phytoplankton Biomass	36	14
Macroalgae Biomass	180	
Dissolved Inorganic nutrients		14
Flow measurements	12	

RESOURCE
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SANTA MONICA MOUNTAINS

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TOPANGA SOURCE ID STUDY
TAC MEETING
16 APRIL 2014

Topanga Library 10AM – Noon

ATTENDEES introduced themselves.

NAME	ORGANIZATION
Amy Zimmer- Faust	UCLA
Vanessa Thulsiraj	UCLA
Catalina Marambio	UCLA
Stephen Bylin	CDPR
Suzanne Goode	CDPR
Becky Valenti	LAC DPW
Nick Brakband	LAC DPW
Eric Edwards	LAC DPW
Armando D'Angelo	LAC DPW
Steve Braband	BioSolutions Inc
John Giles	LAC BH
Shirley Birosik	RWQCB
Richard Sherman	Topanga Underground
Zuhey Espinosa	Supervisor Yaroslavsky
Alisa katz	Supervisor Yaroslavsky
Susan Nissman	Supervisor Yaroslavsky
Rosi Dagit	RCDSMM
Jenna Krug	RCDSMM
Sandra Albers	RCDSMM
Lizzy Montgomery	RCDSMM - WSP
Crystal Garcia	RCDSMM - WSP

Rosi started off meeting with powerpoint presentation.
Noted that this is the last chance for the TAC to provide guidance on the study.
Final TAC meeting will be held on Wed. 17 Sept. A draft report will be provided to the TAC for their review by early Sept. Final revisions and the completed project ends on 31 October 2014.

At beginning of study, took 1800 FIB values and compared when lagoon bermed vs breeched. Regardless of winter/recreation season, it appears that the lagoon is a major source of FIB's to the ocean.

Results –higher FIB levels at the beach and lagoon means there's an independent source there, and that the FIB's are not coming from the creek. This included higher levels of Ec and ENT, as well as dog and gull markers present. Some human hits were found on most upstream creek site (Owl Falls) and periodic hits in lagoon and in ocean. Noted that one single human feces "direct deposit" would be sufficient to cause an exceedance, based on mass loading calculations.

Fib levels were elevated during rainfall- dog hits were much higher than during dry period.

Conducted two sample t tests – to test for significance. Showed that there are significant differences in values taken in winter vs. recreational season – more prevalence of dog marker in winter season. Could be related to reduced lifeguard hours on beach and people take advantage of this. In summer people would complain about dogs vs. winter time.

Locations of dog hits are highest at lagoon and ocean.

Year 1 (10/11 –thru 7/13)
Half of ocean samples (22 samples) were positive for human marker. Found that 10 samples with human marker occurred when beach was within compliance of TC, EC and ENT health standard, which suggests that other sources were responsible for exceedance levels of bacteria. During year 2, only 7 of 45 samples were positive for human marker, which is more representative. During Year 2, the transient living under the PCH bridge also moved away and fewer direct deposits were observed.

Human markers were detected during rain. Beach outlet –is where city health collecting samples. BU – upcoast is where houses are located upcoast to west of lagoon

More sample events lumped into year 1 vs year 2. Lagoon tends to be high for FIB – IN BOTH year 1 and 2. Data is not broken up to show when lagoon is breeched or not.

At end of study there will be enough data to compare from year to year. It will be well weighted. At the moment sample N is small.

Amy then described the proposed dog marker survey that will be conducted on 2 May at Topanga lagoon and beach. The plan is to collect data that can be compared to samples collected on the same day at other reference sites (beach with little dog activity such as Dockweiler and Santa Monica, Long Beach dog beach) to identify background levels. Topanga middle and high school students will help collect data.

She showed the proposed sample location map for dog marker survey. Far west location (BU) is just out of eyesight of lifeguard. If time and resources allow, we hope to also test the samples for gull markers.

Rosi asked if anyone had input on what other locations to sample from?
Shirley asked if there's a webcam on Topanga beach. Yes there is, but that lens only sees as far as the beach outlet. An additional Webcam would be good to confirm where hits are found.

John Giles suggested that dog activity at Dockweiler and Santa Monica beaches are not strictly enforced. Malibu Surfrider at 3rd point by contrast is heavily watched and might be a better site. He also suggested that Broad Beach –might have high dog also Leo Carillo on upper end allows dogs. Zuma or Point Dume might also be good sites that don't get too many dogs.

Amy then described the Microcosm Experiments she is setting up. (Her summary appended at the end.)

Hypothesis is that the natural community can better assimilate low concentrations of sewage (raw sewage). Low concentration of input took the longest to decay, which was surprising. 0.1% is representative of human marker found in Topanga. It took 3.5 days for smallest level to decay in ocean. By contrast, marker in the creek water decayed faster, especially at higher concentrations.

Second experiment will examine the effects of sediment on FIB/marker decay. The point is to identify site characteristics that affect decay rates. How do sediment characteristics and natural community affect decay rates at different sites? Why is Scratchy Trail special in that it absorbs inputs? Could be due to different geology of creek substrate at that location. It is the only sampling site with siltstone bedrock.

Amy and Jenny thought of taking a sample from an impacted channelized control site for comparison, such as at Ballona Creek (above Jefferson maybe?), or should we use Greenleaf in Topanga since its heavily impacted? Greenleaf is one of few locations where

lavage (make trout vomit) and have observed that trout are switching their diet to include more crayfish. Crayfish are found throughout the creek including in pools with trout. Trout prefer native macroinvertebratess due to their high caloric value/gram. The growth rates of trout doesn't seem to be decreasing even though they are changing diet. In sites with high crayfish presence, there is a decrease in BMI, species richness, etc.

Susan asked if there are studies in other systems that have looked at crayfish impacts? Dr. Lee Katz has done work in Trancas and Cold Creek. Due to the presence of trout in Topanga Creek, we can only catch crayfish by hand and not set traps. Currently there is no estimate of crayfish population abundance but we are working on it. Crayfish are reproducing at least two times a year in southern California and have become a non-native problem in many areas. They thrive in low flow warm conditions such as those presently provided by the drought and don't like high flows. Crayfish were almost completely taken out of removal site but recolonized after the Feb-March rain event.

Next steps

- Collaborating with Dr. Scott Cooper to develop the model for trophic level interactions. A few possible experiments are being considered, such as exclusionary experiments but will need permission from permitting agencies. On May 5 and 6 we will be repeating the SWAMP stream surveys done previously and have more data to compare.
- Collaborating with LVMWD to compare diatoms between Malibu and Topanga Creeks.
- Topanga Elementary 5th graders and Topanga Mountain School middle school will collect data on 2 May and on 5/16 will present hypothesis, results and posters at UCLA on a field trip there.
- The Poster contest campaign is in progress and winners will be decided at the 28 May community meeting by judges from the Supervisors office, Topanga Canyon Town Council and LA County Dept of Beaches and Harbors. The winning poster will become official sign at Topanga Beach and the student winner will get a dolphin pillow pet!

Rosi requested that the TAC think about the End Goal –
What is the single most important piece of info/BMP/recommendation the County would like to gain from the study?
Please let us know!
There are only a few months left to tailor experiments for report that will give County effective tool to reduce exceedences at Topanga Beach.

understanding of some of the mechanisms playing a role in decay of FIB throughout the watershed.

Methods

Concentration Microcosms

Microcosms were constructed with 2 L of ambient or filter-sterilized creek or ocean water. Water was inoculated with varied concentrations of sewage (0.1, 1, 5, and 10%) collected from Orange County Sanitation District within 24 hours of first time point. Oxygen content of beakers was maintained by using an airstone in each beaker. Light and temperature were monitored continuously by Hobo data logger deployed in at least one beaker per treatment. Dissolved organic carbon content and nutrients were measured on initial water and samples were preserved for enumeration of protist abundance. Microcosms were run in triplicate for each concentration and sampled for FIB and molecular markers at day 0, day 1, day 2, day 4, day 6, and day 8.

Sediment Microcosms

Sediment will be collected from several sites within the Topanga Creek Watershed- (Topanga bridge (TB), Scratchy trail (ST), Owl falls (OF), and GL. Microcosms will be constructed in beakers with a 1:1 sediment: water ratio by weight using homogenized sediment from each site and environmental water and maintained at ambient conditions. Dissolved oxygen content in beakers will be maintained by using an airstone in each beaker. Light and temperature will be monitored continuously by Hobo data logger deployed in at least one beaker per treatment. The overlying water will be filter-sterilized but the sediment will contain either natural microbial populations or will be sterilized to control for effects of natural populations. Water will be collected from Scratchy Trail and same source water will be used in all microcosms (sediment will vary by site). Sewage will be seeded into the water column and sediment in order to address how presence of sediment affects decay/persistence of markers in the water column and sediment. Control microcosms without sediment will also be included to account for changes that occur strictly in the associated water.

At each of the five time points, water and sediment will be sampled and monitored for decay of FIB and DNA-based markers. Additionally, organic carbon content, chla, nutrients, and predator abundance will be measured on initial sediment samples taken from each site.

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Report on Microbial Contamination of samples from Topanga Creek Enterovirus Contamination Study

Report date: 28 May 2014

Measurements performed by Erin Fichot, (213-740-5759), Laboratory of Jed Fuhrman, USC Department of Biological Sciences (fuhrman@usc.edu, 213-740-5757)

Study Aim

To determine the presence and quantity of enteroviruses from human fecal contamination in water samples, by genetic testing.

Methods

Sample Preparation

Samples were collected onto plastic sample bottles by the sampling team in February 2014, and sent to our lab in coolers. The same day we filtered them onto Millipore HA (mixed ester) filters (1 liter on 7 Feb, 250 ml on 27 Feb when there was much dark suspended material that colored the filters brown), then froze the filters. Filters remained frozen at -80 C until extraction. RNA was extracted using the Qiagen RNeasy Mini Kit (tissue protocol) with the QIAvac Manifold. Final extract volume was 50 ul, split into two 25 ul portions so that a second analysis could be done without thawing and refreezing the extract (which can lose RNA).

Reverse-Transcription and Quantitative PCR

Reverse Transcription and the QPCR were performed in a single reaction as described in Fuhrman et al. (*Appl. Environ. Microbiol.* 2005). All samples were run in duplicate with 5 ul of RNA extract, each representing 1/10 of the original sample, with an additional duplicate 5 ul of sample spiked with vaccine-type poliovirus to test for inhibition. A standard curve was run simultaneously with vaccine-type poliovirus, each done in duplicate. Negative controls contained water instead of RNA extract, or extract from a blank filter (27 Feb). Samples for which the spike did not amplify were diluted 10-fold (from the second frozen 25 ul tube), in an attempt to dilute out inhibiting substances, and re-run.

Results

Enteroviruses were not detected in any of the 11 samples (see Table below). Four of the 11, all from 7 February, showed amplification of the spike on the first round, hence were conclusive negatives. The remaining (from 27 February) were diluted and re-analyzed. Of these, none had positive amplification and only 2 showed some amplification of the spike. This suggested relatively high inhibition of the assay for that entire sampling date. The negative controls worked properly (nothing detected) and the standard curve was linear as expected. The calculated minimum detection limit was ~33 pfu (plaque forming units, an estimate of live viral particle abundance) per ml of original water sample when 1 liter was filtered and 132 pfu/ml when 250 ml was filtered.

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Conclusions

All of the samples were negative (7 February), likely negative (Ocean and TL on 27 February) or inconclusive negative (all others, 27 February), indicating little detectable enterovirus contamination. Unfortunately there was significant inhibition on 27 February, probably due to soil humics and other materials leached into the creek by the rain after the long drought. Lack of enteroviruses is not necessarily an indication of the lack of fecal contamination in a given sample because not all fecal material comes from people shedding enteroviruses.

Sample	Date	amplification?	spiked amplifcation?	volume filtered	conclusion
Topanga Bridge	7-Feb	no	yes	1 L	conclusive negative (2 of 2 spiked replicates amplified)
Beach Opening	7-Feb	no	yes	1 L	conclusive negative (2 of 2 spiked replicates amplified)
Topanga Lagoon	7-Feb	no	yes	1 L	conclusive negative (2 of 2 spiked replicates amplified)
Owl Falls	7-Feb	no	yes	1 L	conclusive negative (2 of 2 spiked replicates amplified)
Ocean	27-Feb	no	yes	250 mL	likely negative though inhibited (1 of 4 spiked replicates amplified)
Owl Falls	27-Feb	no	no	250 mL	inconclusive negative (0 of 4 spiked replicates amplified)
DIX	27-Feb	no	no	250 mL	inconclusive negative (0 of 4 spiked replicates amplified)
TL	27-Feb	no	yes	250 mL	likely negative though inhibited (2 of 4 spiked replicates amplified)
TB	27-Feb	no	no	250 mL	inconclusive negative (0 of 4 spiked replicates amplified)
BR	27-Feb	no	no	250 mL	inconclusive negative (0 of 4 spiked replicates amplified)
ST	27-Feb	no	no	250 mL	inconclusive negative (0 of 4 spiked replicates amplified)
blank	27-Feb	no	yes	none	conclusive negative (2 of 2 spiked replicates amplified)

*based upon the lowest standard at which both replicate shad detectible material, this assay could detect >33 copies per milliliter of sample when 1 L was sampled or >132 copies per milliliter of sample when 250 mL was sampled.

Estuary Reference Study Workplon -- DRAFT
Tapanga Conyan Lagaan
2013-2014

Backgraund ond Canceptual Approoch

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Constituents

Table 1. Constituents to be measured in estuarine reference study.

Type	Constituent	Creek	Estuary
In Situ	Flow	X	
	Water Level	X	X
	Temperature	X	X
	Conductivity/Salinity	X	X
	Dissolved oxygen		X
	Chlorophyll fluorescence		X
Discrete	Nitrate	X	X
	Nitrite	X	X
	Ammonia	X	X
	Phosphate	X	X
	Total Nitrogen	X	X
	Total Phosphorus	X	X
	Dissolved Organic Carbon	X	X
	Chlorophyll *a*		X
	Macroalgae biovolume		X

Table 2. Summary of Sampling Effort by Type of Sampling and Indicator Group

Type of Sampling	Minimum # of In Situ Measurements	Minimum # of Discrete Samples
Hypoxic Volume	180	
Phytoplankton Biomass	36	14
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