Water Pollution Source Tracking

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SEAL OF THE CITY OF SANTA BARBARA CALIFORNIA

UCSB

Clean Creeks
HEALTHY BEACHES
CITY OF SANTA BARBARA

Partnerships & Acknowledgements

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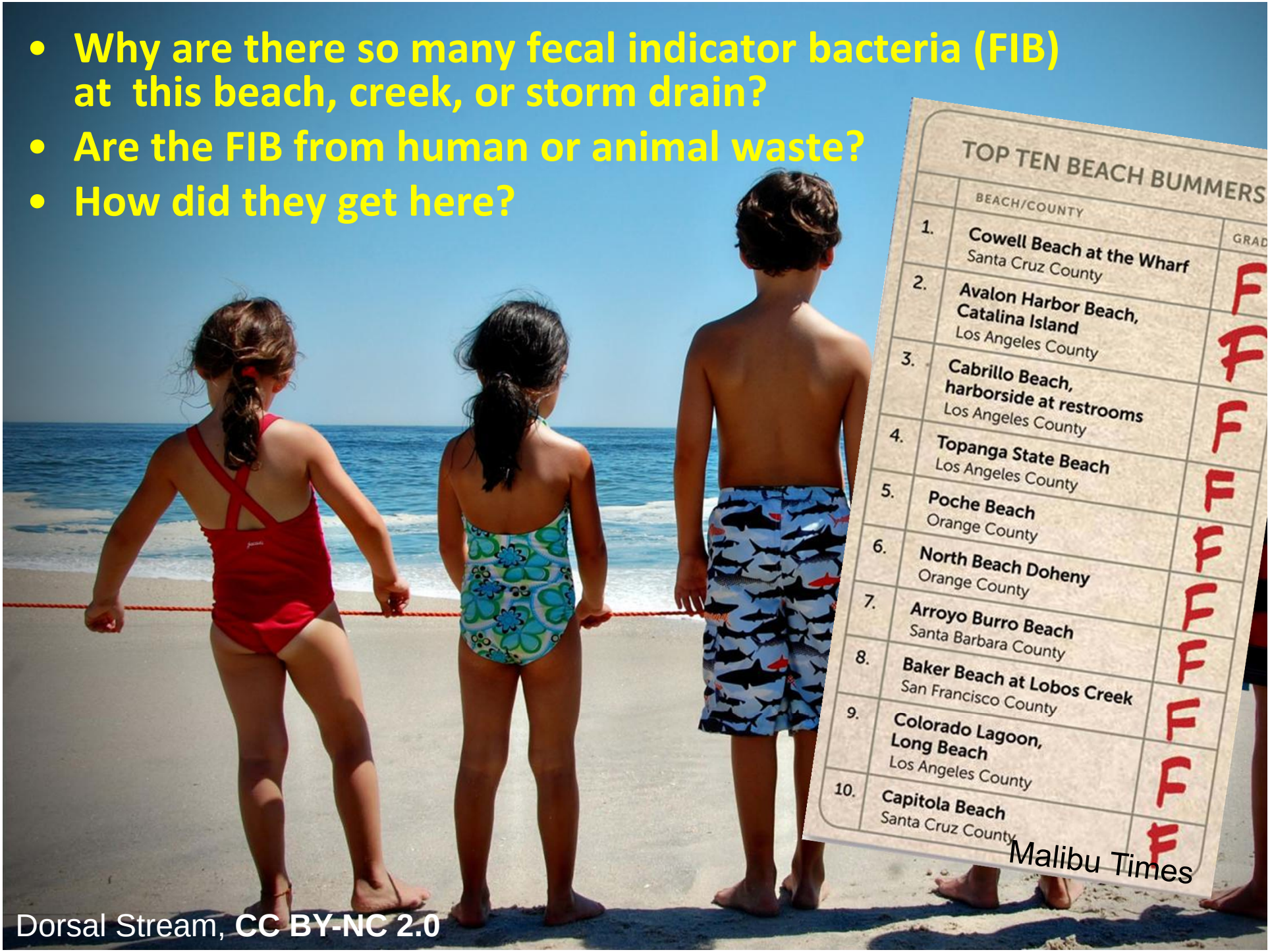
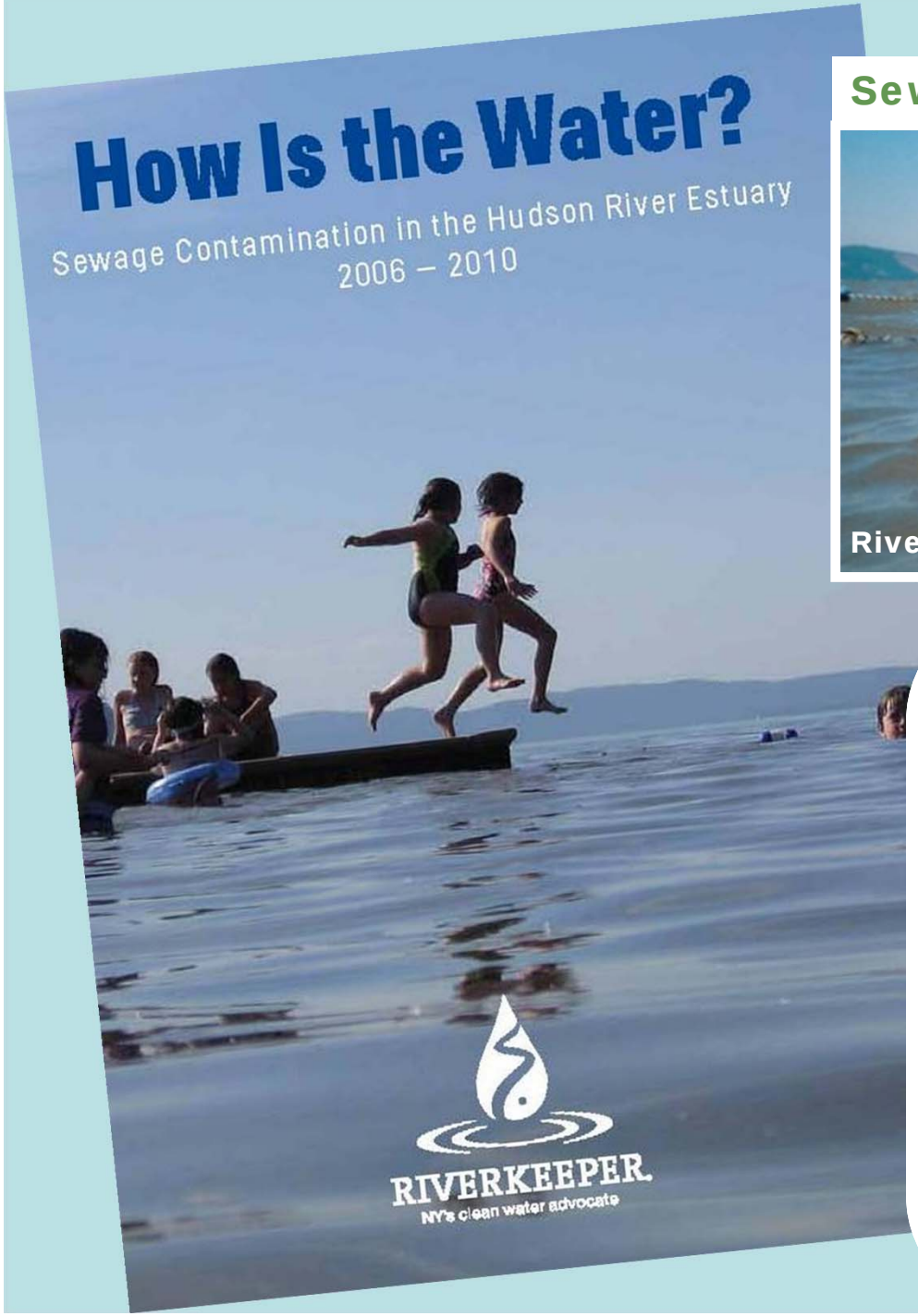
City of SB Wastewater: Rebecca Bjork (now with Water Resources), Chris Toth, Manuel Romero, Louis Chiourn, El Estero Wastewater Laboratory

Clean Creeks
HEALTHY BEACHES
CITY OF SANTA BARBARA

- **Why are there so many fecal indicator bacteria (FIB) at this beach, creek, or storm drain?**
- **Are the FIB from human or animal waste?**
- **How did they get here?**



Dorsal Stream, **CC BY-NC 2.0**



Sewage in the Hudson: What You Can Do

Riverkeeper website

The New York Times

Sewage Frequently Fouls Hudson River, Report Says

To Swim Or Not To Swim?

Measure of sewage:

Enterococcus spp. measured by Enterolert

Caveats

- Not human/sewage specific
- Grow in the environment (e.g. on gutters)
- Overprotective in some cases
- Under protective in others
- Can lead WQ improvement strategies astray

The vast majority of indicator bacteria are not pathogens, and the vast majority of pathogens are not indicator bacteria.

Traditional tools:

FIB in creeks, storm drains

Microbial Source Tracking

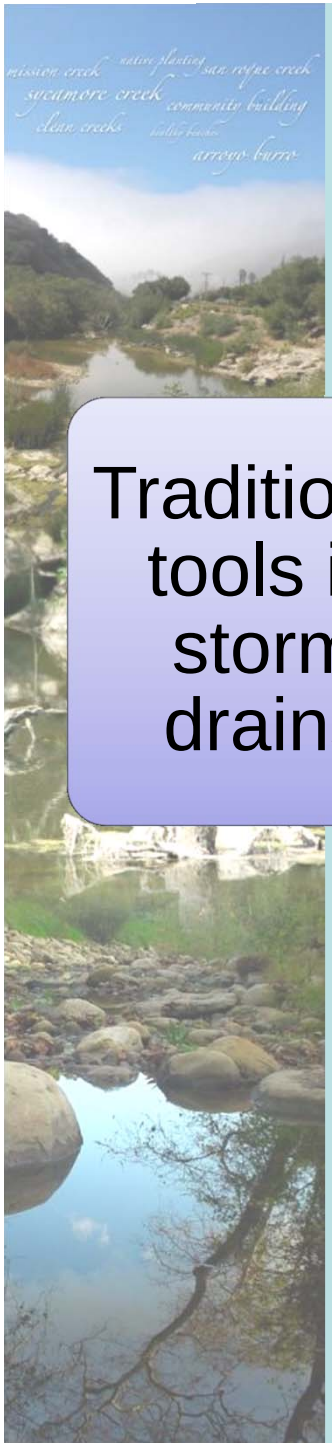
-molecular tools

Storm drains with consistent human waste markers

(Sercu et al. 2009, Geosyntec 2009)

- Did not correlate with FIB

-Could not find inputs



Microbial Source Tracking

GIS

Traditional tools in storm drains

Canine Scent Tracking

Source Tracking Protocol

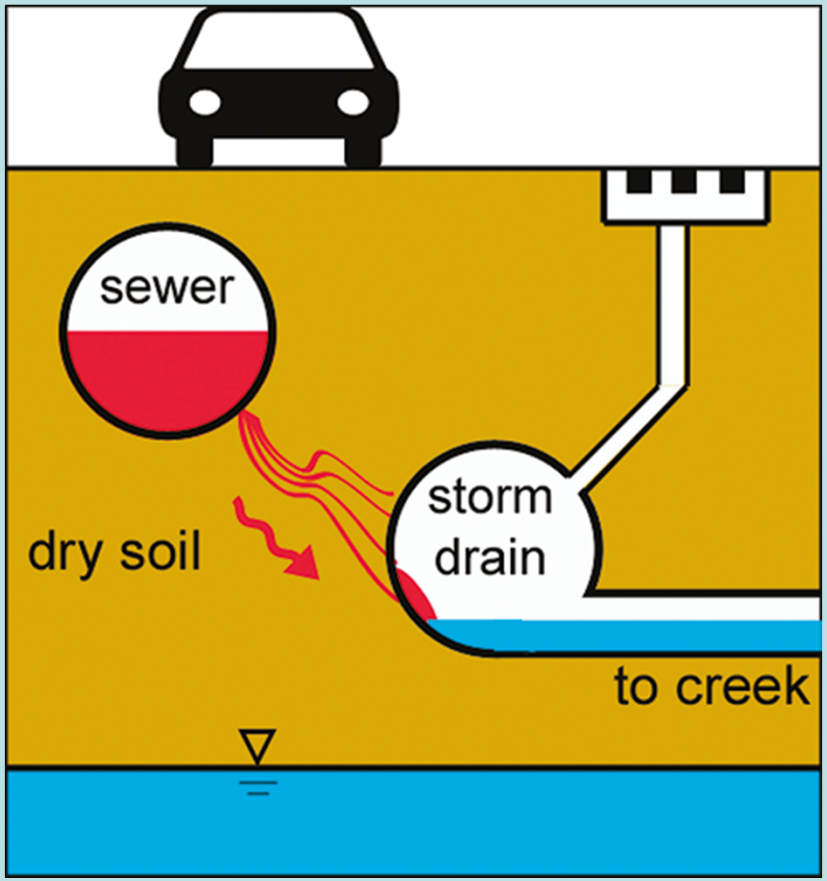
- human waste

Funded by Proposition 50 Clean Beaches Initiative Grant Program

Objectives

- Test tools for identifying and locating human waste in storm drains
- Share with coastal managers, watershed groups and researchers.
- Decrease risk to swimmers
- Focus on finding illicit connections:
  - Direct connections (plumber accident)
  - Indirect connections (sewage leaks)
    - Parallel lines?

Macaulay, 1976, *Underground.*



(Sercu et al. 2011, ES&T)

Source Methods

Human Specific

Bacteroidales qPCR (Van De Werfhorst et al. 2011, *AEM*)

Bacterial Community Approach

Phylochip Microarray

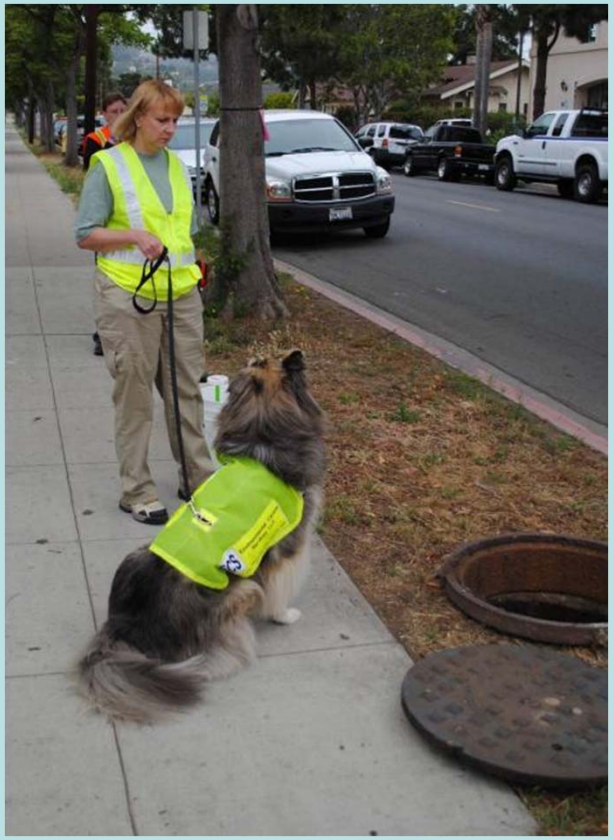
T-RFLP Community Analysis

Chemistry

Wastewater tracers, including surfactants and ammonia

Caffeine, cotinine

Tracking Methods: Sewage Sniffing Dogs

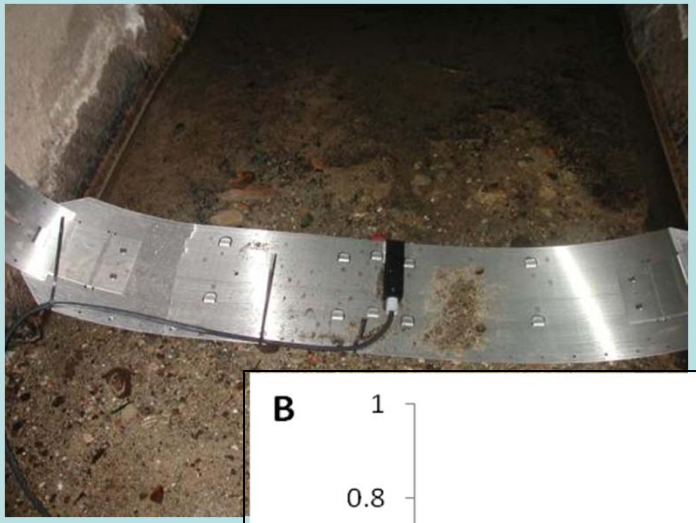


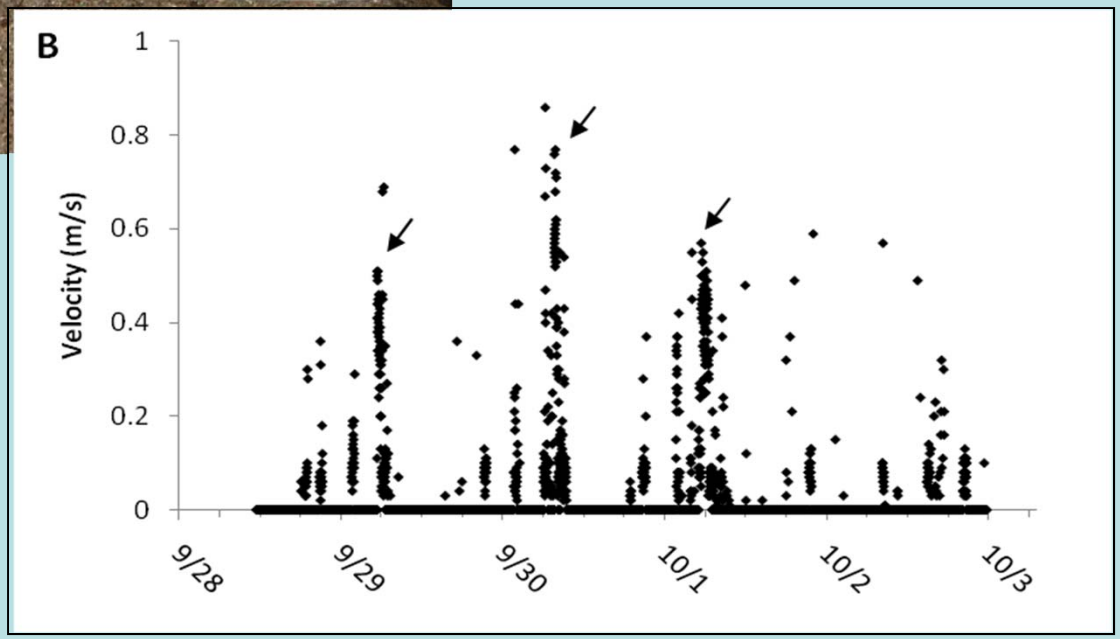
Environmental Canine Services, LLC

UCSB

Funded by WERF

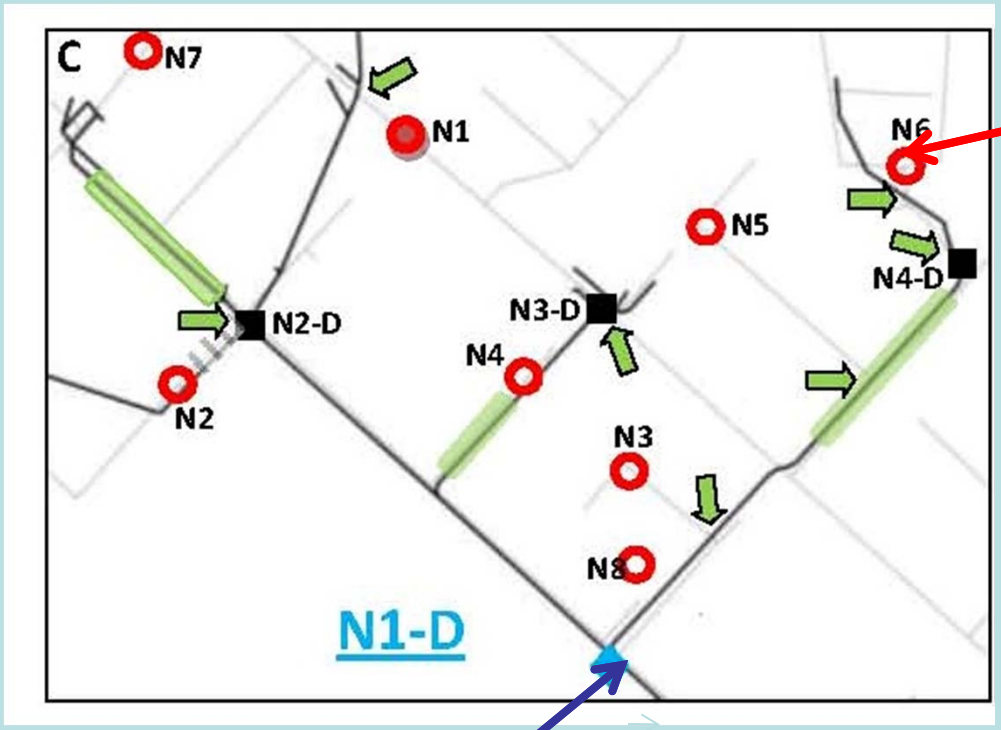
Tracking Methods – Flow gauges and autosamplers





Tracking Methods – Rhodamine WT Probe

Case Study
Nopal St. Storm Drain



Dye in Sanitary Sewer

Probe in
Storm Drain

Sercu et al. 2011 ES&T

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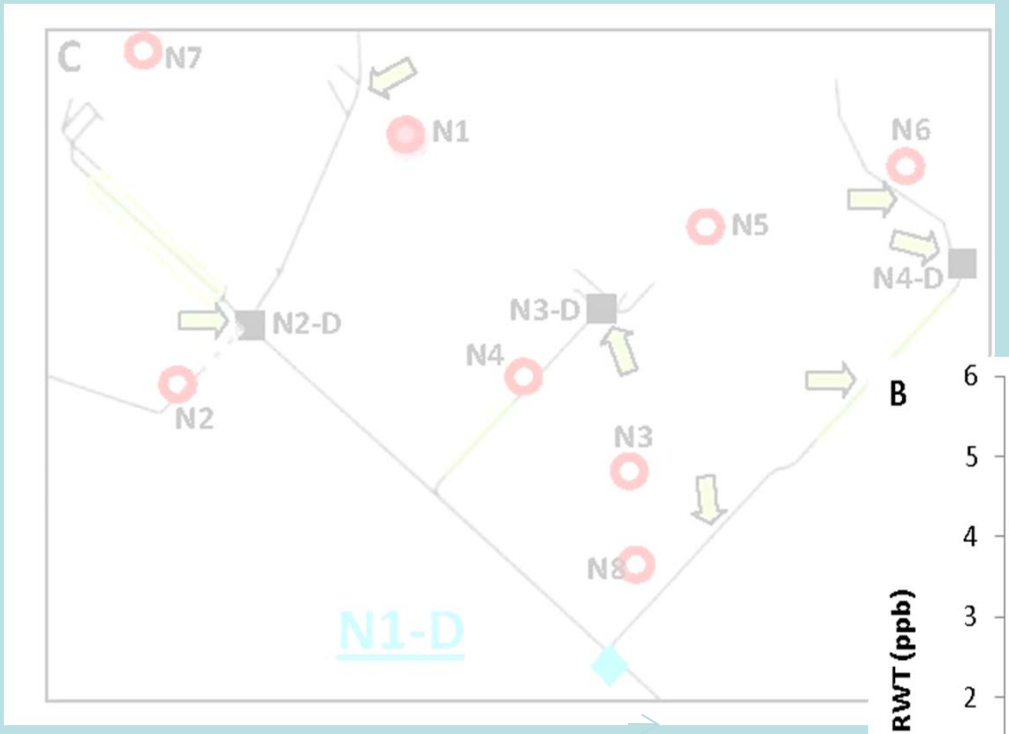
Nopal St. Storm Drain



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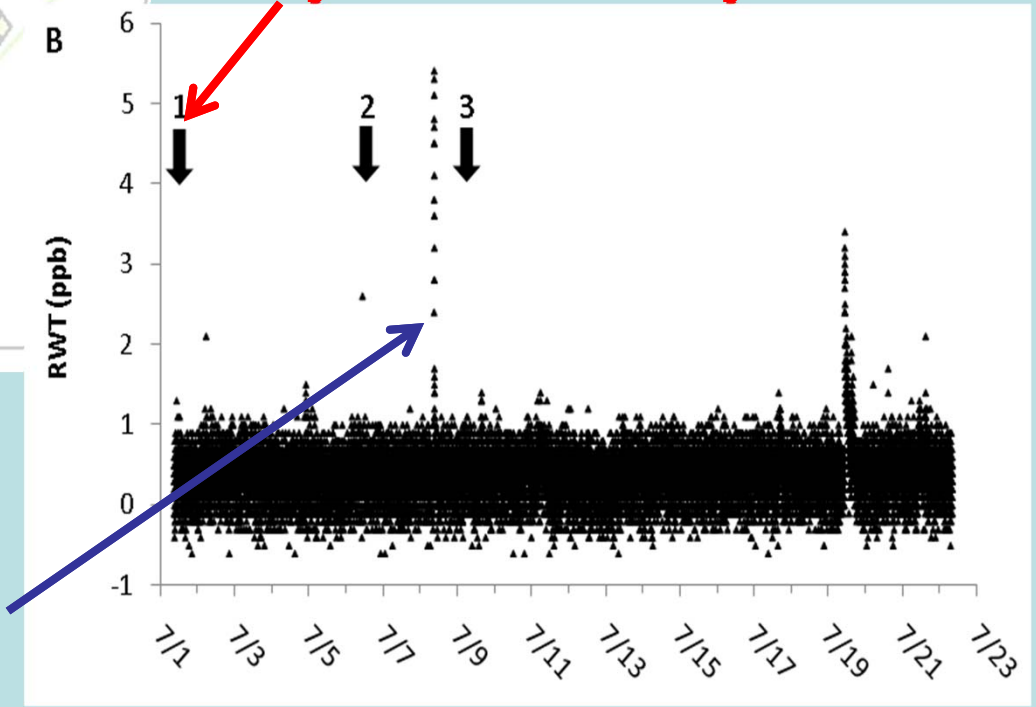

Probe in Storm Drain

Sercu et al. 2011 ES&T

Case Study
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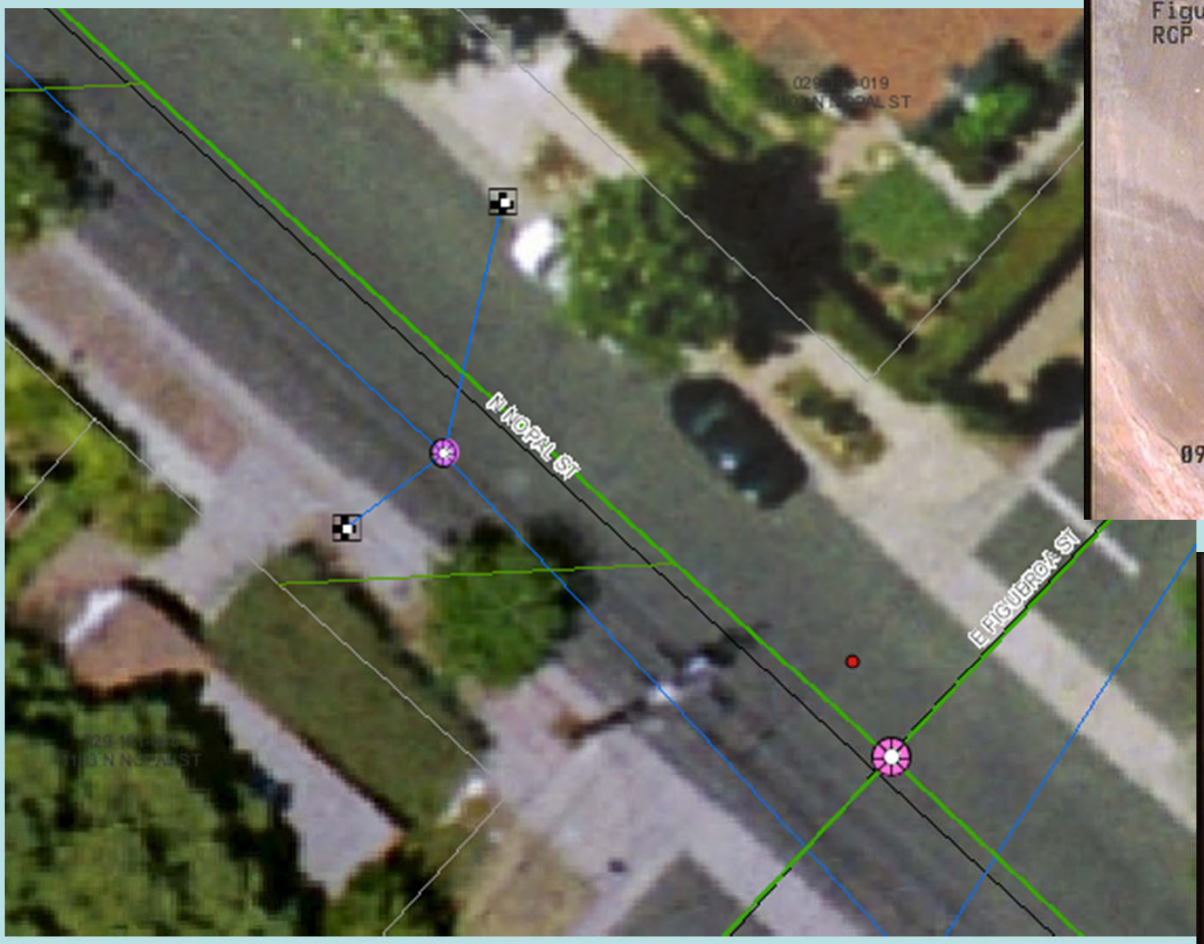
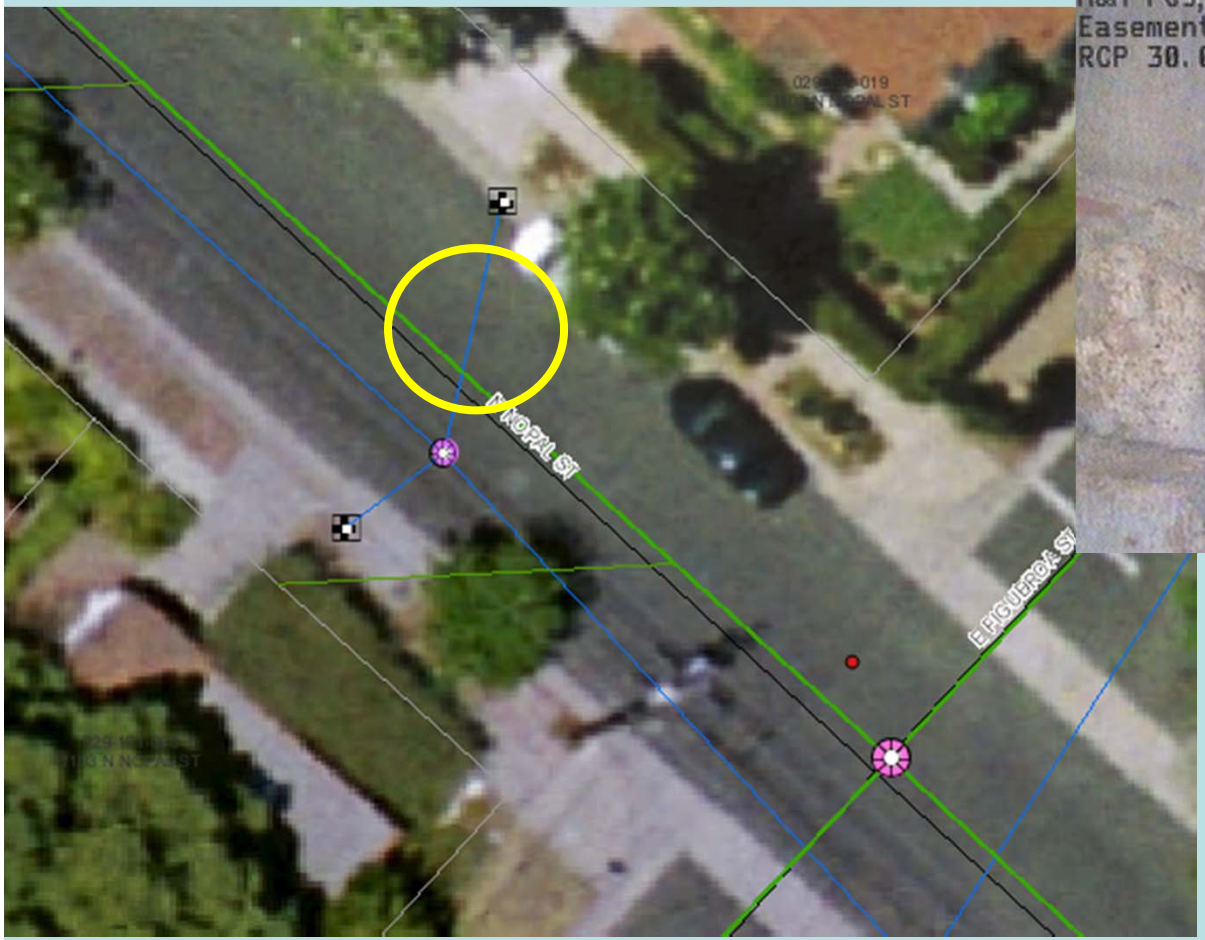
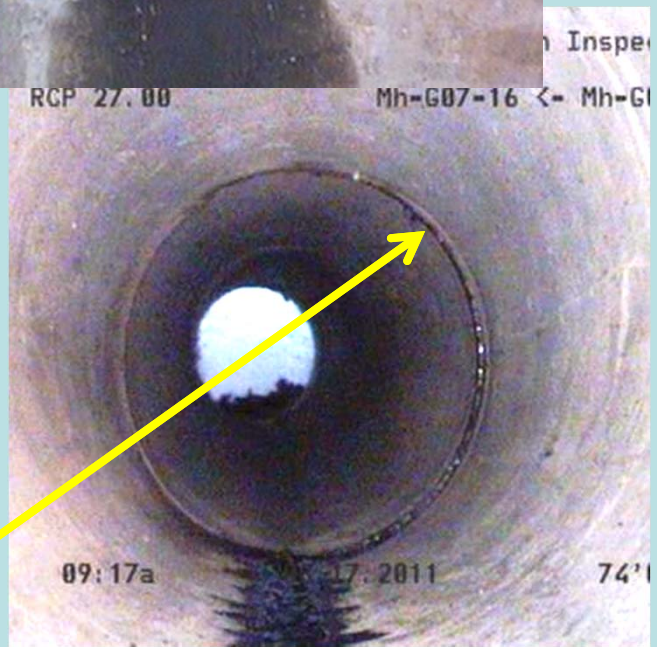


Typical Groundwater Infiltration

Case Study
Nopal St. Storm Drain





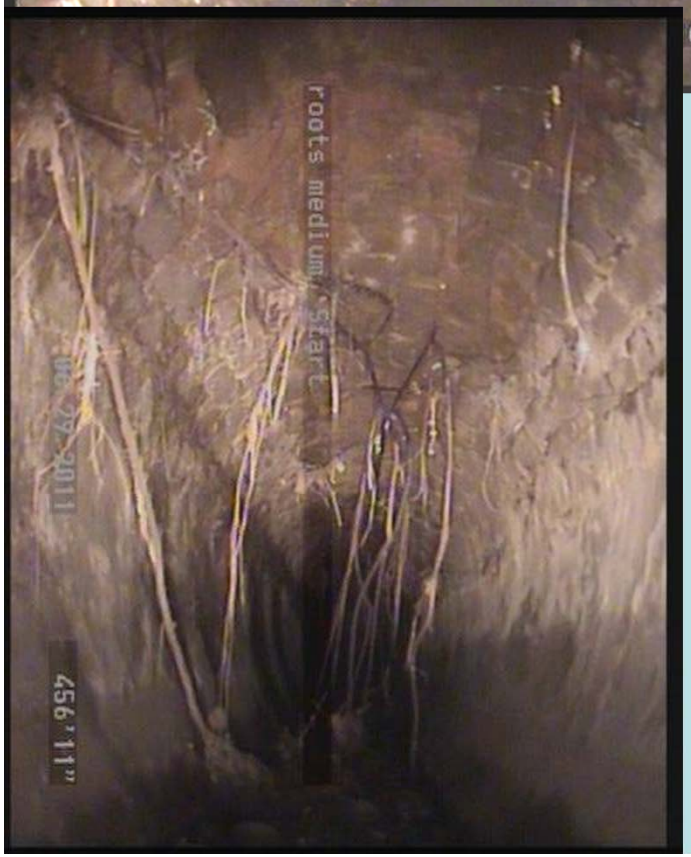
Sewage Infiltration

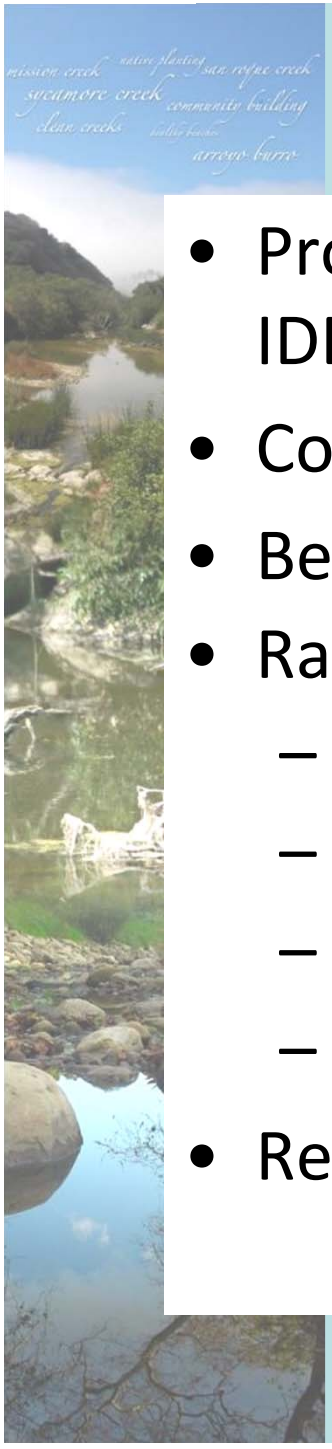
Case Study
Carrillo St. Storm Drain

- Many years of high FIB, smell.
- Sporadic hits for human waste markers.
- Early CCTV work inconclusive.
- Recent CCTV showed water dripping into storm drain.
- Crack did not appear large.
- Dye testing of toilets in nearby businesses,

camera in storm drain.

Two private laterals to 6 businesses





Results

- Proof of concept for combining of MST, GIS, and IDDE, new approaches.
- Confirmed four locations with sewage infiltration.
- Beach warnings not correlated.
- Rational plan can be developed:
  - Broad brush tools
  - Narrow and confirm
  - Pinpoint inputs
  - Repair and eliminate sources
- Report for Coastal Managers

Additional Information

sbcreeks.com

- Sign up for our monthly e-newsletter
- Link to City TV segment on sewage sniffing dogs
- Water Quality reports

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