Stanley B. Grant’s Research Group
Chemical Engineering and Materials Science Science
University of California, Irvine
Grant Lab Research Effort

Utilize the tools of modern engineering-science to:

(1) Identify the ecological and transport factors that contribute to urban coastal pollution (focus on pathogens, particles and nutrients).

(2) Design optimal best management practices for pollution mitigation.
Motivation: recreational water quality

Sewage or urban runoff

mixing

exposure

Human illness (GI and respiratory)
Sewage/runoff

Fecal/oral pathogens + “other stuff”

“Fecal indicator bacteria (FIB)”
(total coliform, fecal coliform, enterococci bacteria)

Human illness

Regulatory Focus
Top five causes of water quality impairment in the US
(EPA 303(d) listings, 1996-2006)

<table>
<thead>
<tr>
<th>Reason for impairment</th>
<th>Number of Total Maximum Daily Loads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy metal pollution</td>
<td>3936</td>
</tr>
<tr>
<td>Microbial pollutants and pathogens</td>
<td>3603</td>
</tr>
<tr>
<td>Nutrients</td>
<td>2198</td>
</tr>
<tr>
<td>Sediments/siltation</td>
<td>1709</td>
</tr>
<tr>
<td>Organic enrichment, dissolved oxygen</td>
<td>1264</td>
</tr>
</tbody>
</table>

Source: http://oaspub.epa.gov/waters/national_rept.control
Conceptual Model: Beach Boundary Layer Model (BBLM)

Beach boundary layer: Where water quality monitoring and most recreation occurs. FIB from dry & wet weather runoff, shallow groundwater, bather shedding, bird droppings, growth in intertidal sediments & vegetation, and exchange with main stem of tidal channel.

Main stem of tidal channel: FIB from point/non-point sources located up and downstream, growth in subtidal sediments, and exchange with the beach boundary layer.

Dry and wet weather runoff

Leaks from storm sewer (top layer) and sanitary sewer (bottom layer)

Tidal exchange of shallow groundwater

FIB growth in intertidal and subtidal sediments

Tide range

Nearshore exchange

Horizontal and vertical mixing

Flood ebb transport

S. Grant, UCI, 5/17/08
One of our field sites in southern California.
Former graduate Students and Post-docs

- Harold Walker (now Professor CEE, Ohio State U.)
- Alexandria Boehm (now Professor CEE, Stanford)
- Jeremy Redman (now Professor CEE, CSULB)
- Joon Ha Kim (now Professor CEE, KGIST)
- Younsul Jeong (now Consultant, Everest)
- Cris Surbeck (now Professor CEE, U of Mississippi)
- Karen McLaughlin (now Researcher, SCCWRP)
- Abhishek Pednekar (now Consultant, Worley Parsons)
- Jong Ho Ahn (now Researcher, Korea Environment Institute)
Current graduate students and post-docs

- Rachel Litton
- Lin Ho
- Morgan Bailey
- Janice Lin
Funding

• California State Water Resources Control Board
• State of California Clean Beaches Initiative
• County of Orange
• County of Riverside
• County of San Bernadino
• City of Avalon
• National Science Foundation (Cyberinfrastructure)
• National Water Research Institute