# San Diego Investigative Order (IO): Quantifying Human Fecal Loading to the San Diego River

Project Update to San Diego Regional Board
May 11, 2022

# Technical Approach to the Investigative Order

- The IO names all of the human sources to be quantified

- The IO does not spell out many technical details
  - All the human source investigations will require new and unique research

- The IO desires relative proportions of human contributions on a watershed basis
  - Watershed-wide “pie chart” rather than identifying location-by-location inputs

# Which Human Source?

- Sanitary Sewer Exfiltration
- Homeless Populations
- Private Sewer Laterals
- Sanitary sewer overflows
- Onsite Wastewater Treatment Systems
- Illicit Connections/Illegal Discharges

# The Role of SCCWRP

- Asked by the named parties to create a workplan to satisfy the IO
- Asked to deliver the technical foundation to comply with the IO
  - SCCWRP is not addressing implementation actions
- Asked to facilitate a Steering Committee of named parties, regulators, and non-governmental organizations
  - Convene a Technical Review Committee comprised of national thought leaders

# Goals of the IO Conceptual Workplan

- Quantify loading of human fecal contamination from different sources to the San Diego River
  - Conducted in dry and wet weather with a focus on wet weather

- Use the loading estimates to compare relative contributions among the sources of human fecal inputs
  - Which is the greatest potential source of human fecal inputs?

- Identify the factors that might lead to the greatest risk of loading
  - Where and when does the greatest human fecal loading occur?

# Which Human Source?

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- Homeless Populations
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- Private Sewer Laterals
  - **Initiating sampling program**
- Onsite Wastewater Treatment Systems
  - **Sampling completed, starting data analysis**
- Sanitary sewer overflows
  - **Initial analysis completed**
- Illicit Connections/Illegal Discharges
  - **Completed**

# Three Key Milestones Thus Far

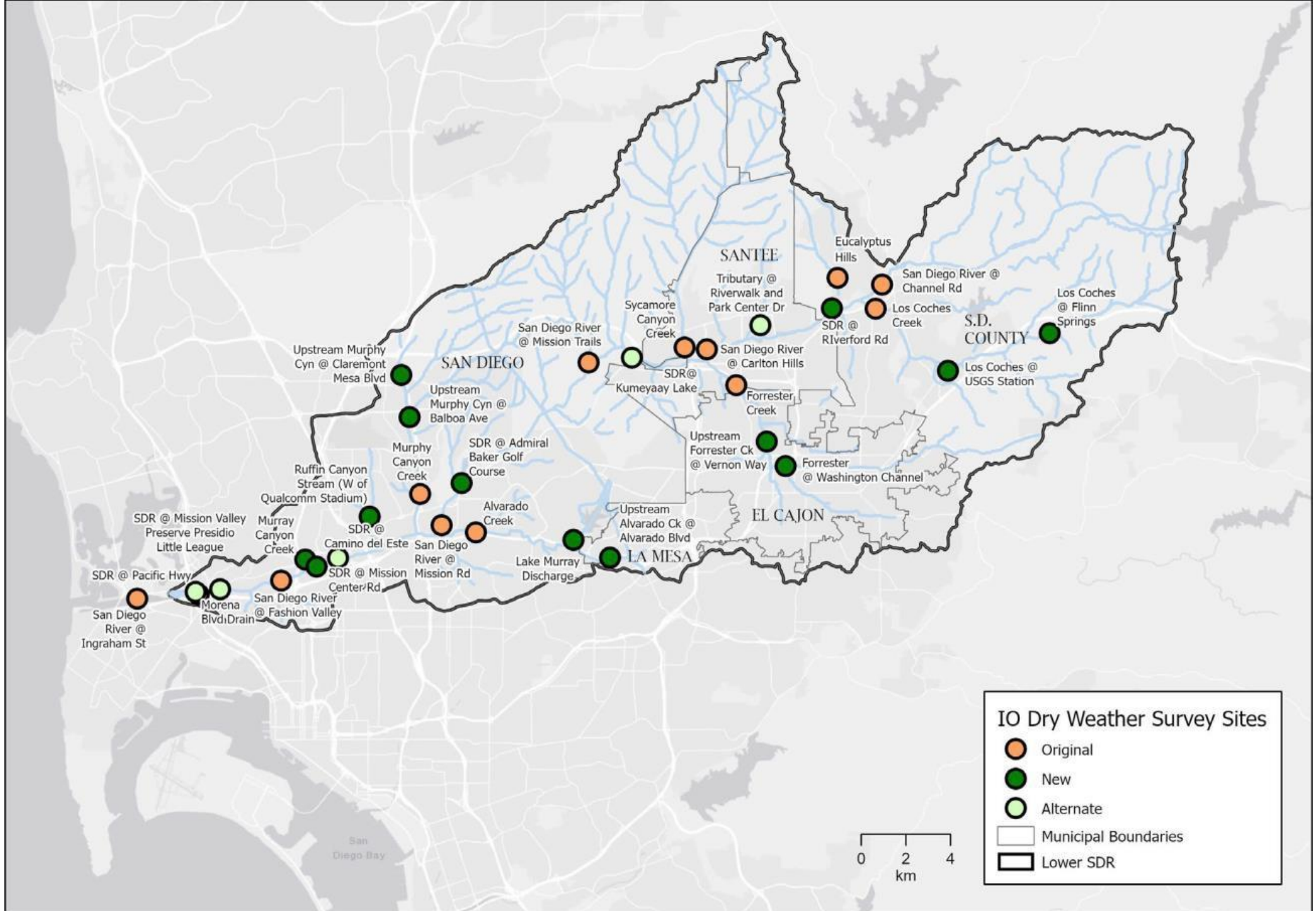
- Dry Weather was largely a non-problem for human sources
  - There are isolated locations that named parties are taking some action on

- People experiencing homelessness ranged from 200-300 during the 2021-22 wet season
  - Open defecation appears widespread but direct deposition is rare

- Sanitary sewer biofilms have been quantified in wet weather runoff
  - Concentrations of sanitary sewer biofilm are consistently dilute

# Approach for Estimating Human Fecal Contributions From Illicit Connections/Illegal Dumping

- Sample receiving waters during dry weather for HF183 human marker
  - How widespread are human contributions?
- Multiple sampling campaigns across different flow regimes
  - Late summer, after first storm, at end of wet season
- Where “hits”” are found, conduct follow up to identify sources
  - Hits defined as 500 gene copies/100 mL based on raw sewage


SANTEE
SAN DIEGO
EL CAJON
LA MESA
S.D. COUNTY
Eucalyptus Hills
San Diego River @ Channel Rd
Tributary @ Riverwalk and Park Center Dr
Sycamore Canyon Creek
Los Coches @ Flinn Springs
Los Coches Creek
SDR @ RIverford Rd
San Diego River @ Mission Trails
San Diego River @ Carlton Hills
Upstream Murphy Cyn @ Claremont Mesa Blvd
SDR@ Kumeyaay Lake
Los Coches @ USGS Station
Forrester Creek
Upstream Murphy Cyn @ Balboa Ave
Upstream Forrester Ck @ Vernon Way
Forrester @ Washington Channel
Murphy Canyon Creek
SDR @ Admiral Baker Golf Course
Ruffin Canyon Stream (W of Qualcomm Stadium)
Alvarado Creek
Upstream Alvarado Ck @ Alvarado Blvd
SDR @ Mission Valley Preserve Presidio Little League
Murray Canyon Creek
SDR @ Camino del Este
San Diego River @ Mission Rd
Lake Murray Discharge
SDR @ Pacific Hwy
SDR @ Mission Center Rd
San Diego River @ Fashion Valley
San Diego River @ Ingraham St
Morena Blvd Drain
San Diego Bay
0 2 4
km
IO Dry Weather Survey Sites
Original
New
Alternate
Municipal Boundaries
Lower SDR

| Site Name | Location | HF183 (copies per 100ml) | | |
|---|---|---|---|---|
| **ORIGINAL SITES** | | Summer | First Rain | End Wet Season |
| San Diego River @ Ingraham St | Mainstem | BD | BD | BD |
| Morena Blvd Drain | Tributary | BD | BLOQ | BLOQ |
| San Diego River @ Fashion Valley | Mainstem | BD | BLOQ | BD |
| Murphy Canyon Creek | Tributary | BD | 72 | BD |
| Alvarado Creek | Tributary | BLOQ | BLOQ | BD |
| San Diego River @ Mission Rd | Mainstem | BLOQ | BD | BD |
| San Diego River @ Mission Trails | Mainstem | BD | BLOQ | BD |
| Sycamore Canyon Creek | Tributary | - | BD | BD |
| Forrester Creek | Tributary | BLOQ | 1160 | 124 |
| San Diego River @ Carlton Hills | Mainstem | BD | BD | BD |
| Los Coches Creek | Tributary | BLOQ | 412 | BD |
| Eucalyptus Hills | Tributary | - | - | BD |
| San Diego River @ Channel Rd | Mainstem | - | BD | BD |
| **NEW SITES** | | | | |
| Murray Canyon Creek | Tributary | BLOQ | 162 | BD |
| San Diego River @ Mission Center Rd | Mainstem | BD | BD | BD |
| Ruffin Canyon (W of Qualcomm Stadium) | Tributary | - | N/A | - |
| Upstream Murphy Cyn @ Balboa Ave | Tributary | BLOQ | BD | BLOQ |
| Upstream Murphy Cyn @ Claremont Mesa Blvd | Tributary | - | BD | - |
| Upstream Alvarado Ck @ Alvarado Blvd | Tributary | BD | BD | BD |
| Lake Murray Discharge | Tributary | BD | BD | 57 |
| SDR @ Admiral Baker Golf Course | Mainstem | BD | BLOQ | BLOQ |
| Upstream Forrester Ck @ Vernon Way | Tributary | BD | 4840 | 594 |
| Upstream Forrester Ck @ Washington Channel | Tributary | 100 | 480 | 196 |
| SDR @ RIverford Rd | Mainstem | BD | BD | BD |
| Los Coches @ USGS Station* | Tributary | BLOQ | 1020 (BD) | BD |
| Los Coches @ Flinn Springs | Tributary | BLOQ | 660 | BD |
| **ALTERNATE SITES** | | | | |
| SDR @ PCH Bridge | Mainstem | BD | BD | BD |
| SDR @ Mission Valley Preserve Presidio Little League | Mainstem | BD | BD | BD |
| SDR @ Camino del Este | Mainstem | BD | - | BD |
| SDR upstream from Kumeyaay Lake | Mainstem | BD | - | - |
| Tributary @ Riverwalk and Park Center Dr | Tributary | BD | BLOQ | BLOQ |
| Upstream Forrester Ck @ Terra Ln | Tributary | - | - | - |

- no flow
- BD: Below detection
- BLOQ: Below limit of Quantification (~20 gc/100 mL)
- <500 gc/100 mL
- >500 gc/100 mL

Homeless Encampment

Sewage Spill

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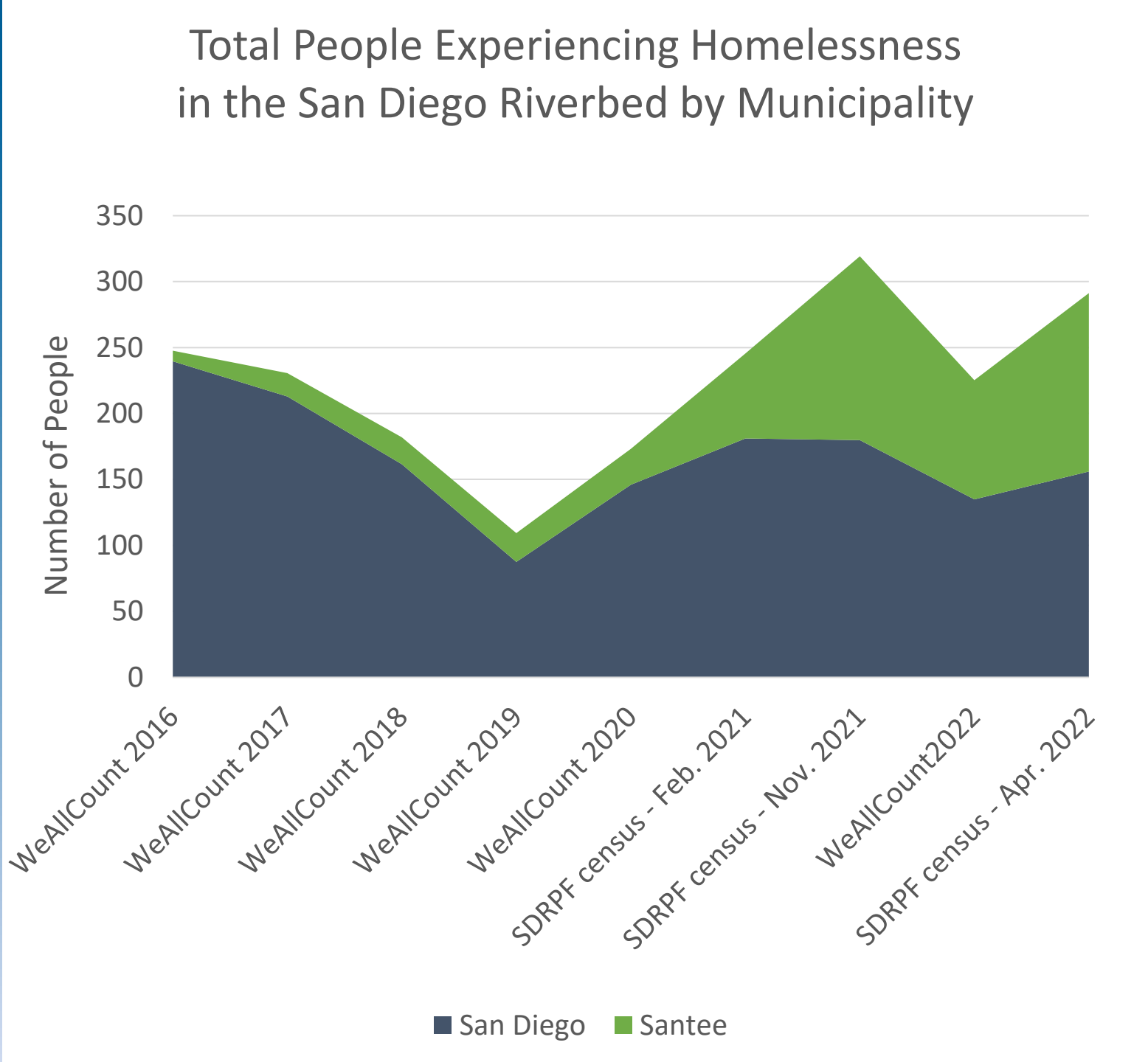
# Approach for Estimating Human Fecal Contributions from People Experiencing Homelessness

- Census and survey of homelessness
  - How many potential contributors? Where? When?
  - What are their sanitary habits (direct vs indirect deposit)?

- Confirming homelessness contribution estimates
  - Upstream-downstream sampling design

- Washoff experiments for boosting empirical confidence (optional)
  - Contribution from streambank latrines during wet weather




# Population Counts 2016 - 2022

Performed by San Diego River Park Foundation

Variability from weather, enforcement

Counts fall within a range of 100 - 320 individuals

# **Defecation patterns:** Occurrence is widespread

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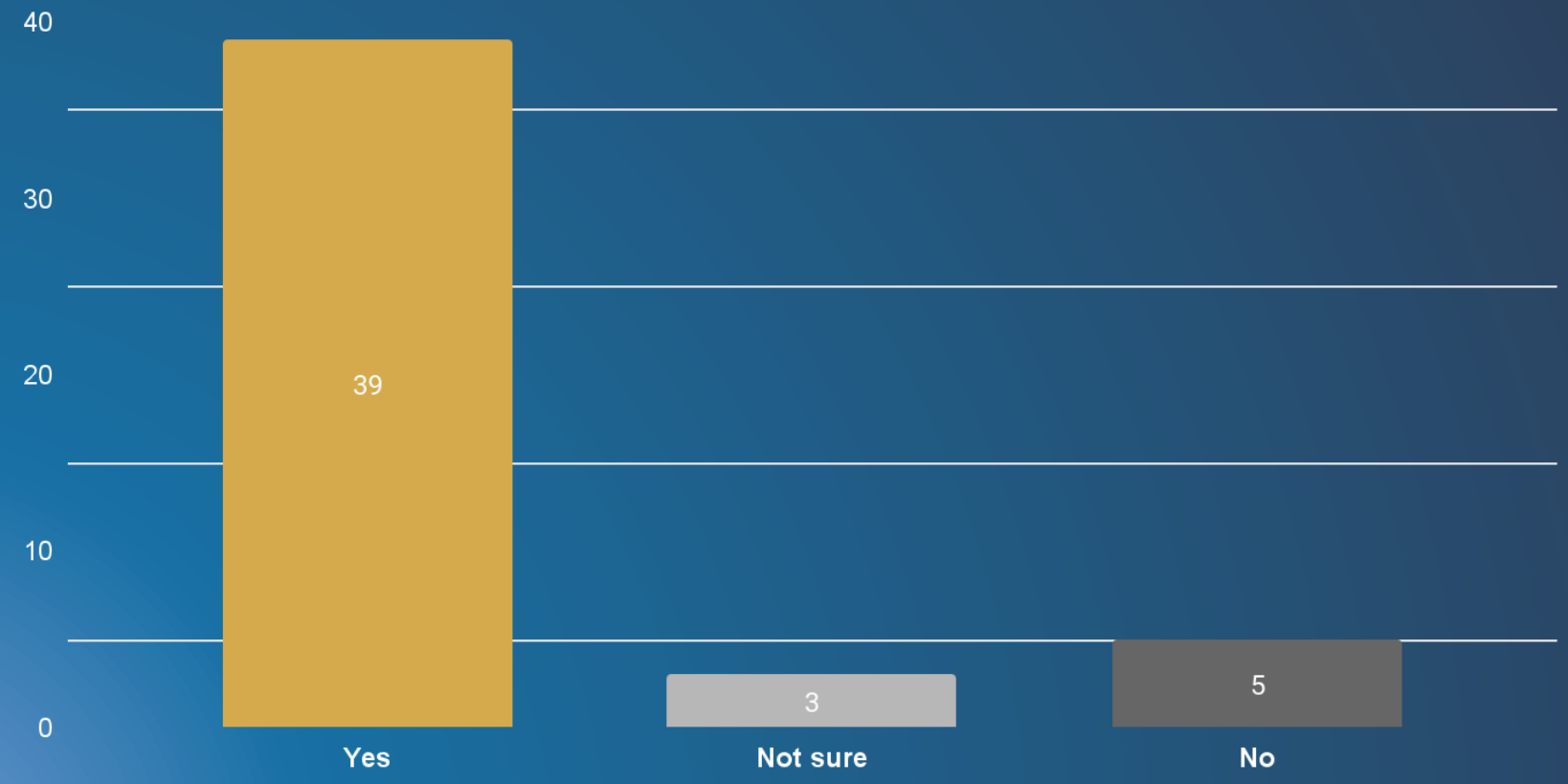
**Q: Do you or do you know of people living nearby who defecate/poop within the river corridor?** (n = 49)




Survey answers ±2% confidence

# Defecation patterns: Frequency

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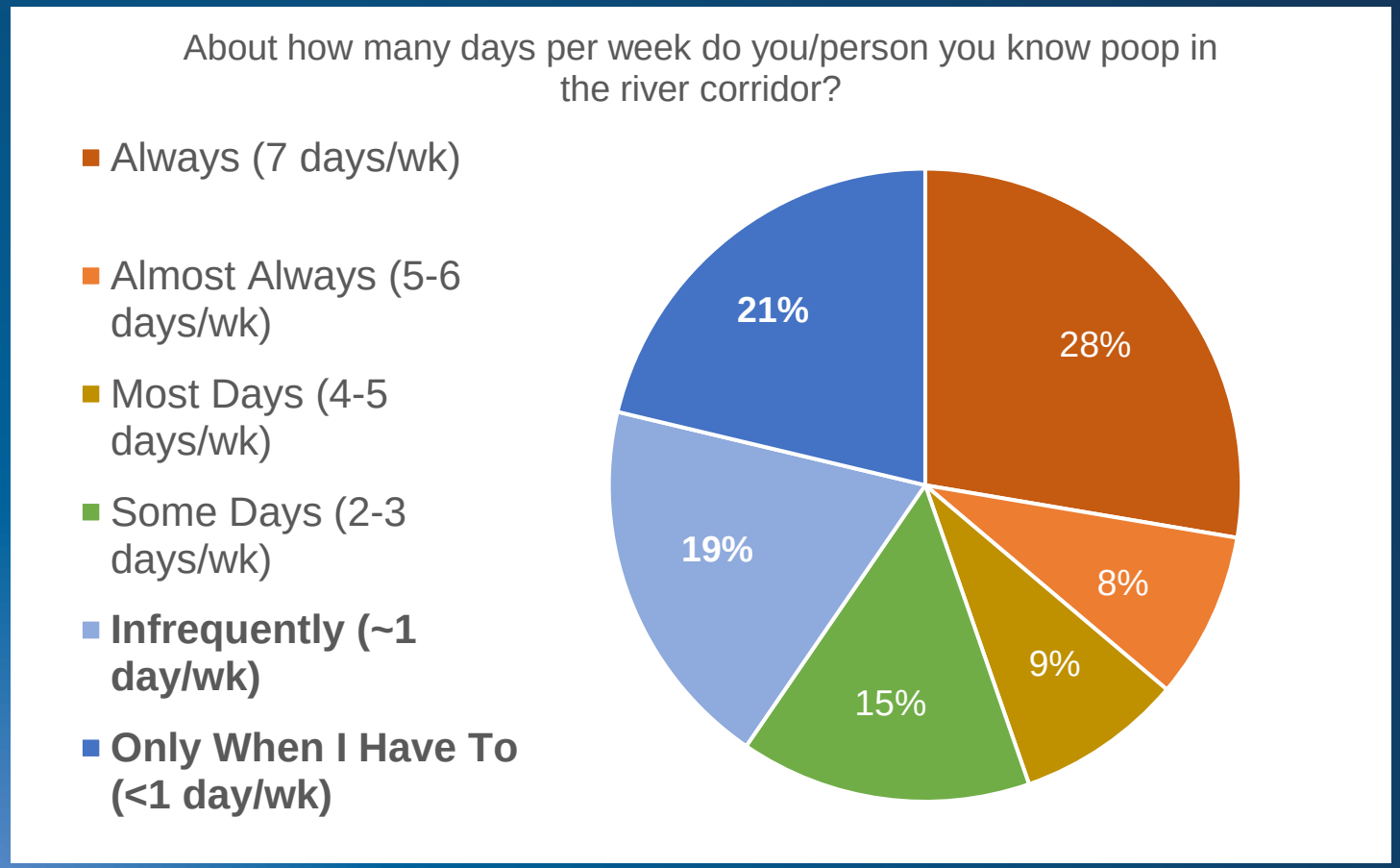
**Q: Frequency of outdoor defecation** (n = 47)




36% answered "Always" or "Almost Always"

40% answered "Infrequently" or "Only When I Have to"

# **Defecation patterns:** Proximity to Surface Water

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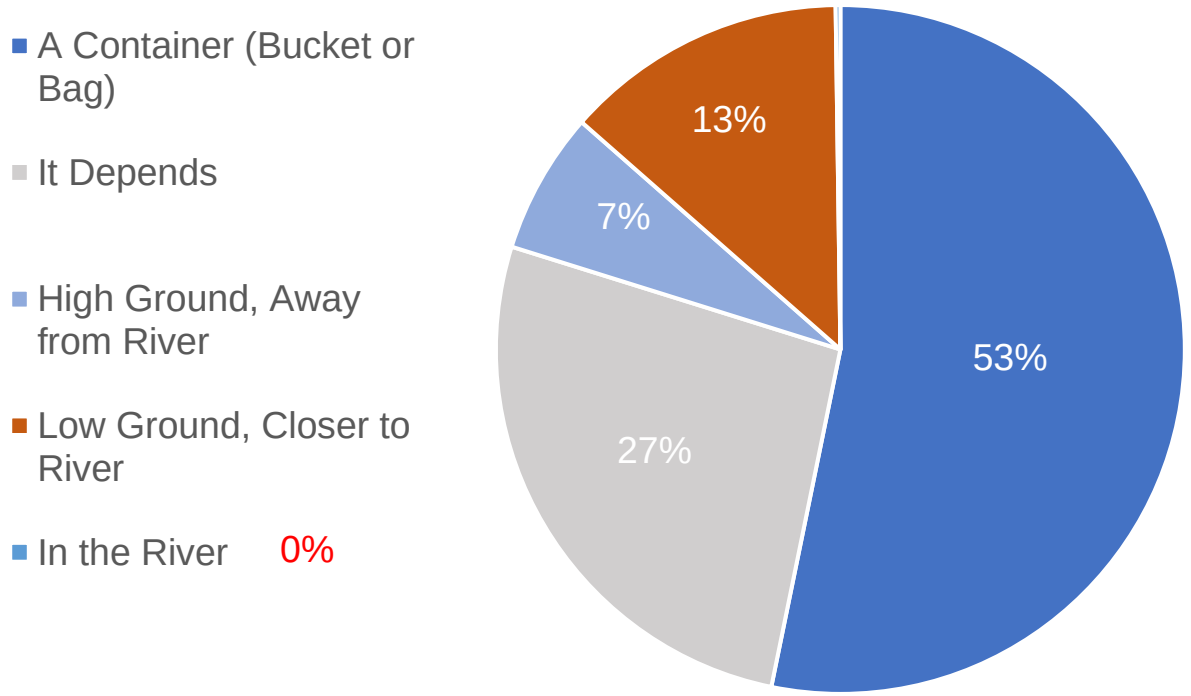
**Q: Proximity to Surface Water** (n = 45)

When you/person you know go near your [tent/camp/site], do you/they typically go here or is the designated spot:




- Over 50% report using a bucket or bag to contain waste
- 40% report using a designated latrining site
- No respondents indicated they defecate in the water

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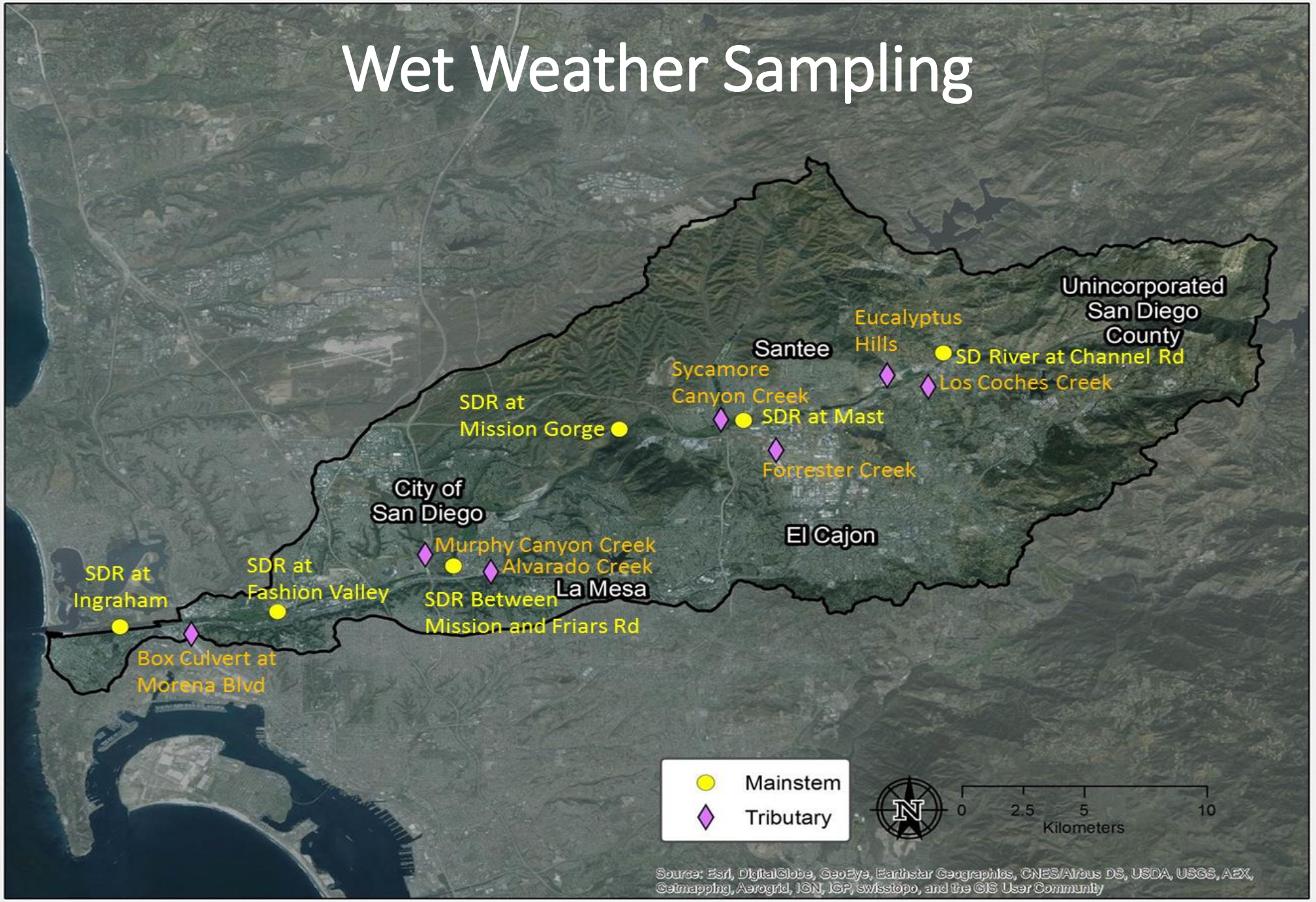
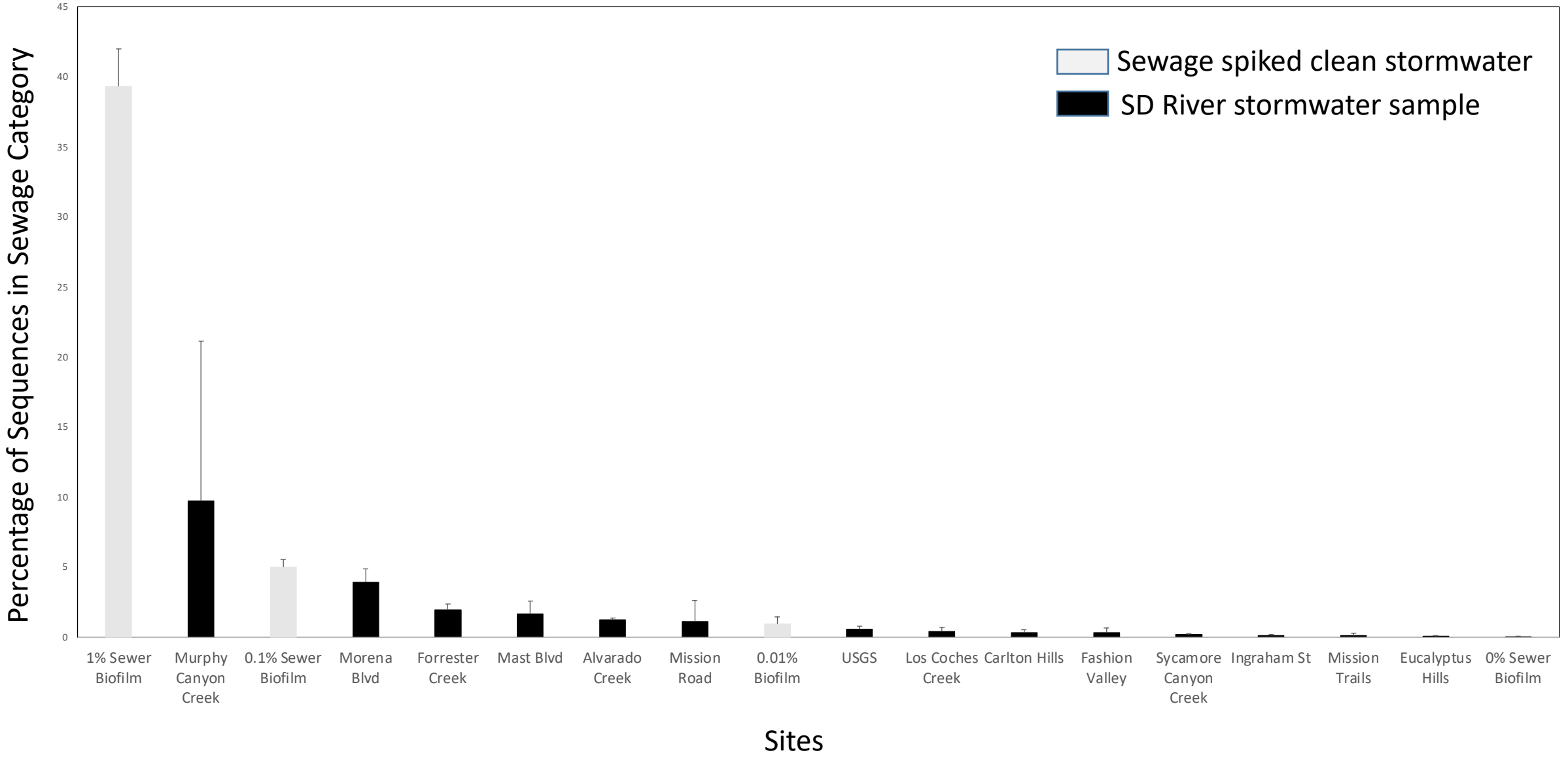
# Approach for Estimating Fecal Contributions from Sanitary Sewers

- Unique microbial communities grow in the biofilms lining sanitary sewage pipes
  - New DNA technology allows us to quantify these microbial communities
- Ensure sanitary biofilms are different from storm drain biofilms
  - Measure dozens of sites over different seasons and years across San Diego
- If you quantify sanitary sewer biofilm in wet weather, then you can confirm raw sewage inputs
  - Triggers increased effort to investigate sanitary sewer overflows and subsurface exfiltration

# Wet Weather Sampling



# Strength of Sewer Biofilm Signal



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# Project Progression

- Workplan approved May 2020
  - Semi-Annual compliance updates

- Assembled a Steering Committee
  - City, County, RWQCB
  - Other named parties
  - Coastkeeper and Riverpark Foundation

- Assembled a Technical Review Committee of national experts
  - We encourage independent technical oversight

- Final project completion December 2024
  - Learn, revise, and publish results as we progress