California
Storm Drainage

Outline

- Storm Drainage Basics
- Traditional Storm Drainage
- Changes to Storm Drainage
- Examples

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Urban Drainage Basics

- Lot→Curb→Pipe→Creek→Sea
- Rainfall
  - ≈SF: 68 days, 22-inches
  - ≈LA: 35 days, 15-inches
- Concern = Damages
- Limited Regulations

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Traditional Storm Drainage

- **Storm Drain Master Plan**
- Design Storm
- Runoff
- Pipe Network
- Storage and Pumping
- Tides
- Operation and Maintenance
- Replacement

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Traditional Storm Drainage

- Storm Drain Master Plan
- **Design Storm**
  - ≈ Historical
  - ≈ Statistical
  - ≈ Duration & Frequency
- Runoff
- Pipe Network
- Storage and Pumping
- Tides
- Operation and Maintenance
- Replacement

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Traditional Storm Drainage

- Storm Drain Master Plan
- Design Storm
- **Runoff**
  - ≈ Q=CiA
  - ≈ Soil Losses
  - ≈ Land Use Factors
- Pipe Network
- Storage and Pumping
- Tides
- Operation and Maintenance
- Replacement

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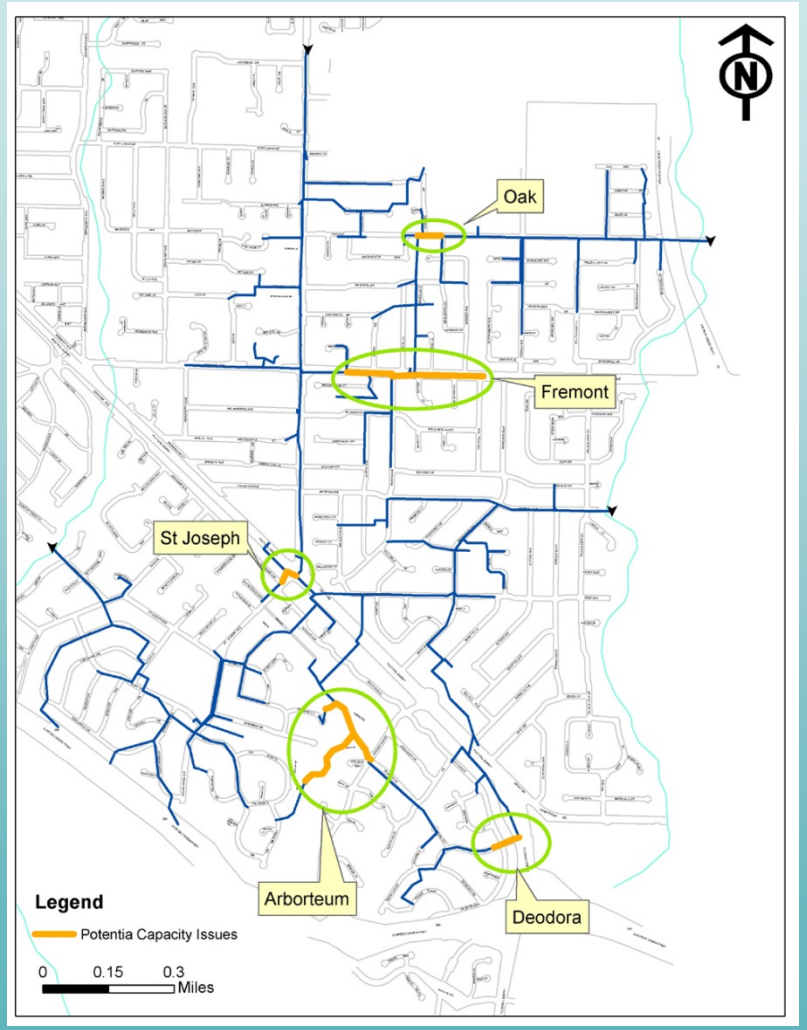
Traditional Storm Drainage

- Storm Drain Master Plan
- Design Storm
- Runoff
- **Pipe Network**
- **Storage and Pumping**
  - ≈ **Energy**
  - ≈ **O&M**
  - ≈ **Replacement**
- Tides
- Operation and Maintenance
- Replacement



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Traditional Storm Drainage

- Storm Drain Master Plan
- Design Storm
- Runoff
- Pipe Network
- Storage and Pumping
- **Tides**
- **Operation and Maintenance**
- Replacement

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Traditional Storm Drainage

- Storm Drain Master Plan
- Design Storm
- Runoff
- Pipe Network
- Storage and Pumping
- Tides
- Operation and Maintenance
- **Replacement (Life Cycle)**

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Future of Storm Drainage

- **Population Changes**
  - ≈ Land Use Changes (A)
  - ≈ Increased Imperviousness (C)
- Climate Change
- NPDES Permit

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Future of Storm Drainage

- Population Changes
- **Climate Change**
  - ≈ Sea Level Rise
    - 18-inches in 2050
    - 55-inches in 2100
  - ≈ Storm Frequency Change (i)
  - ≈ Risk vs. Rise
- NPDES Permit

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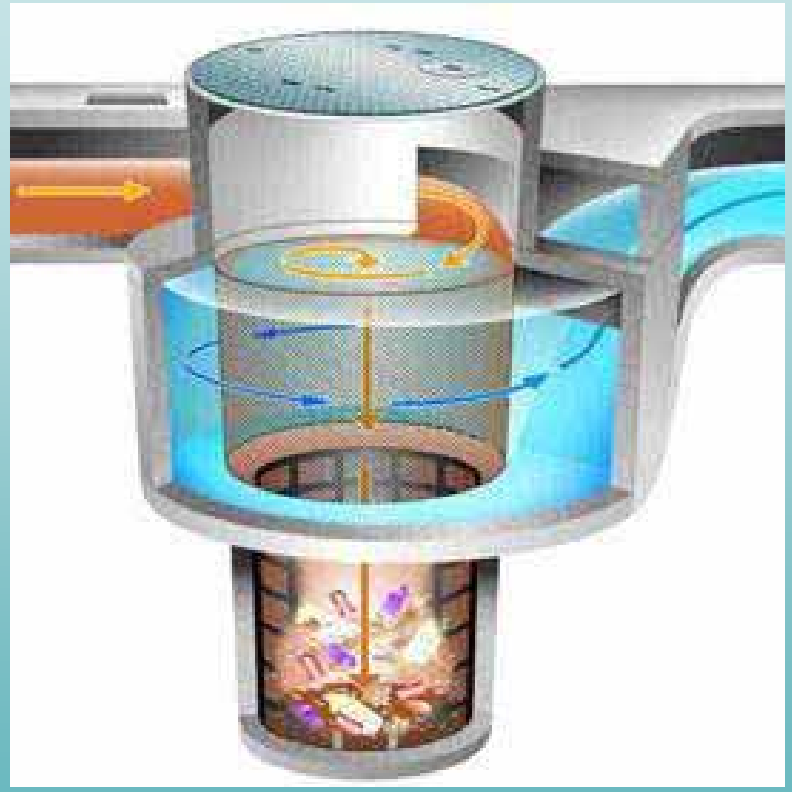
Future of Storm Drainage

- Population Changes
- Climate Change
- **NPDES Permit**
  - ≈ RWQCBs
  - ≈ HMP Basins (Creek Stability)
  - ≈ C3 (Water Quality)
    - Trash Capture
    - Sediment Capture
    - Metals & TMDLs



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Examples

- Trash Capture Required by RWQCB
  - ≈ 8% of 12-year CIP
  - ≈ $4 to $12 EDU
- Sea Level Rise
  - ≈ $15mil CIP (Existing)
  - ≈ +$2.7mil for 2050
  - ≈ +$?? for 2100

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Questions?