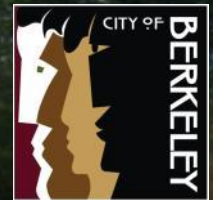
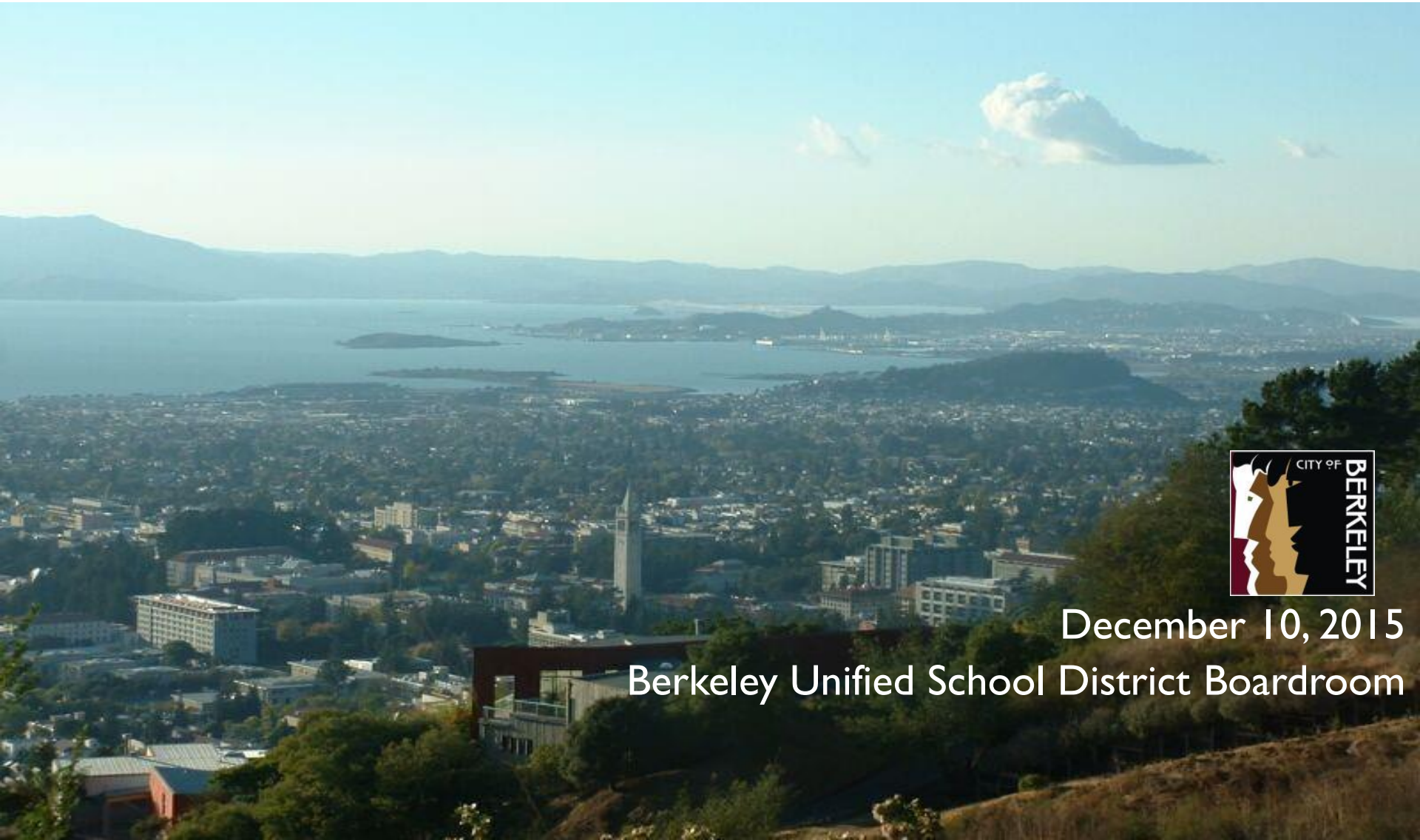


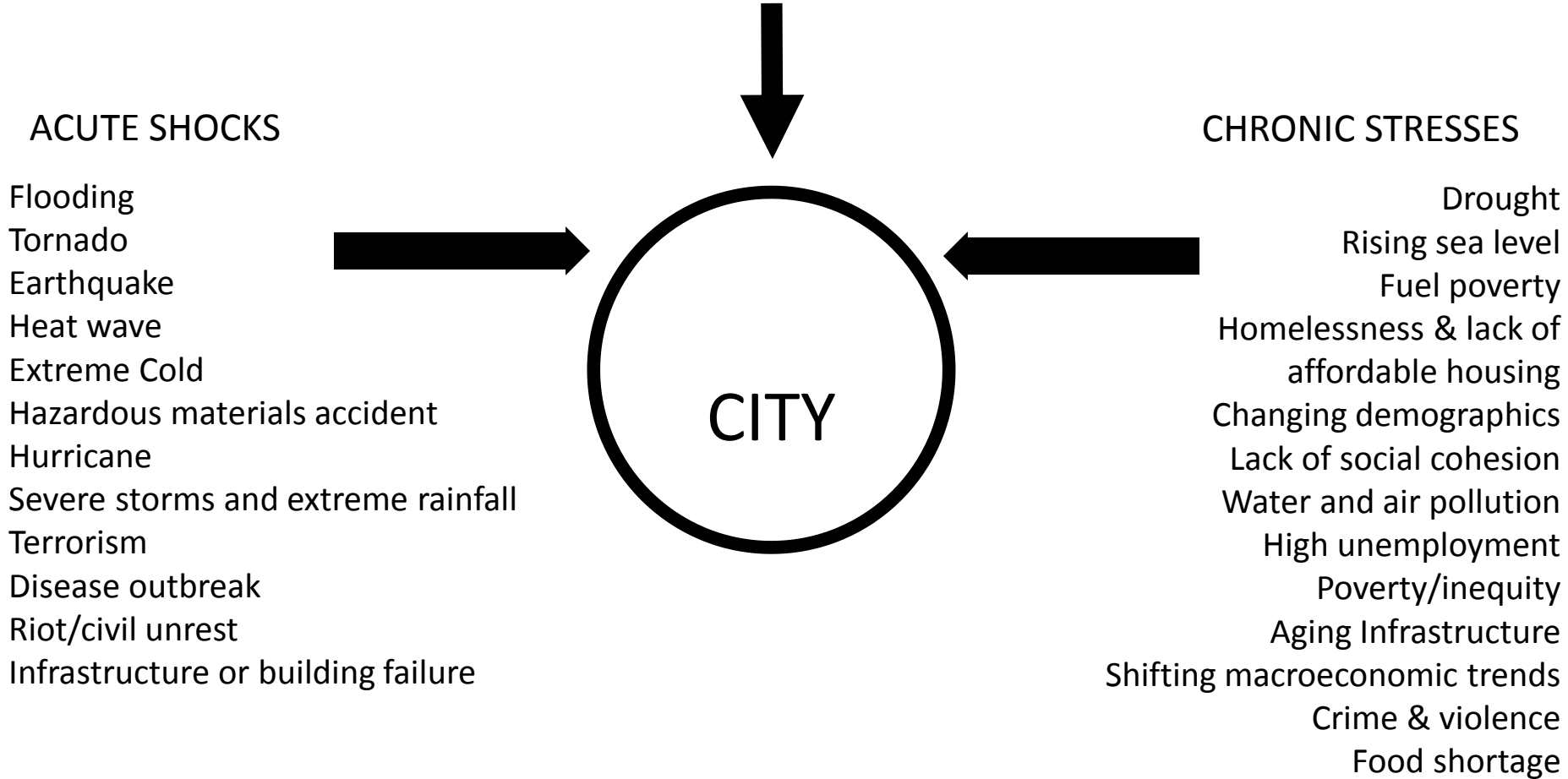
# Community Workshop: Get Prepared for El Niño



December 10, 2015

Berkeley Unified School District Boardroom

# A resilient community is prepared for a range of potential shocks and stresses.



# The City is advancing multi-benefit solutions to the challenge of flooding

- “Green infrastructure”
- Storm water capture and reuse
- Evaluating impacts of sea level rise and extreme precipitation



Bio-swale at California and Allston



# Berkeley Flooding

**High Tides, Heavy Rain, El Niño**

Kris May, Ph.D. P.E.  
AECOM

# What Makes Berkeley Vulnerable?

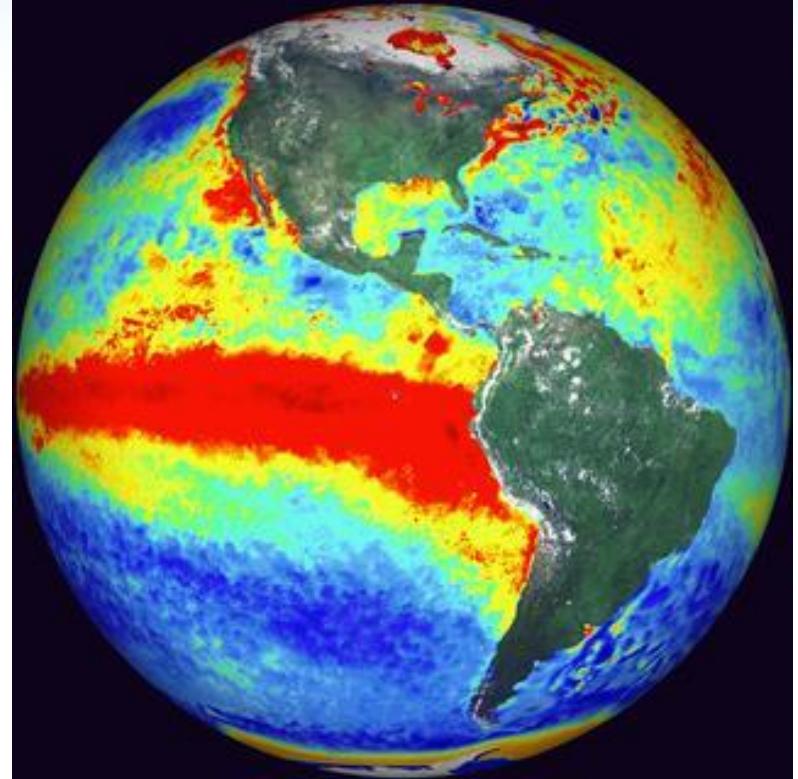
- Heavy Rainfall
- High Bay Tides
- Low-lying Topography
- Clogged Storm Drains
- Overwhelmed Infrastructure

... then add El Niño



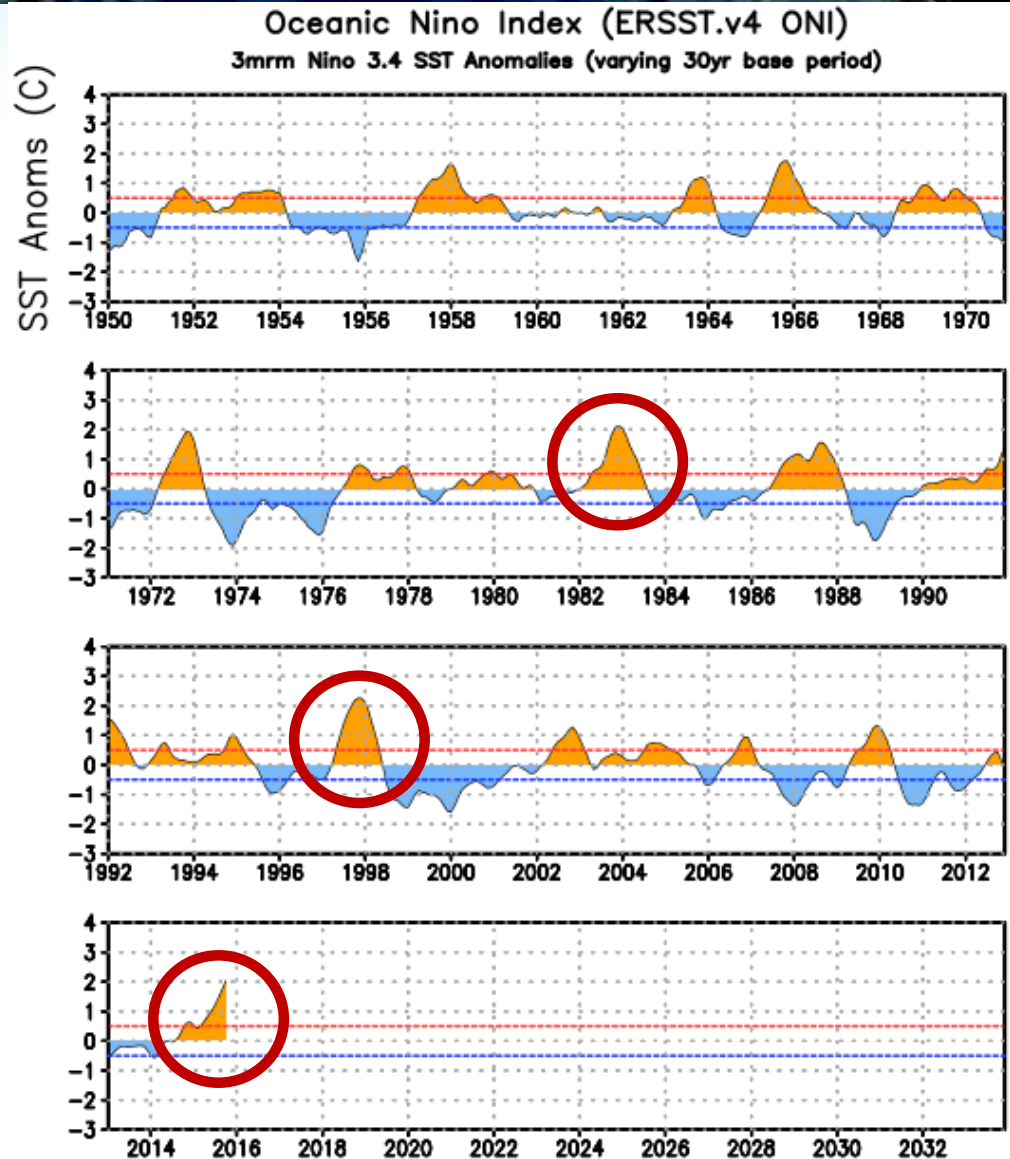
# What is El Niño

- Oscillation of ocean and atmospheric conditions in the Pacific (~3 to 7 years)
- Unusually warm water along the Equatorial Pacific
- Intense rainfall and higher Bay water levels along our coastline



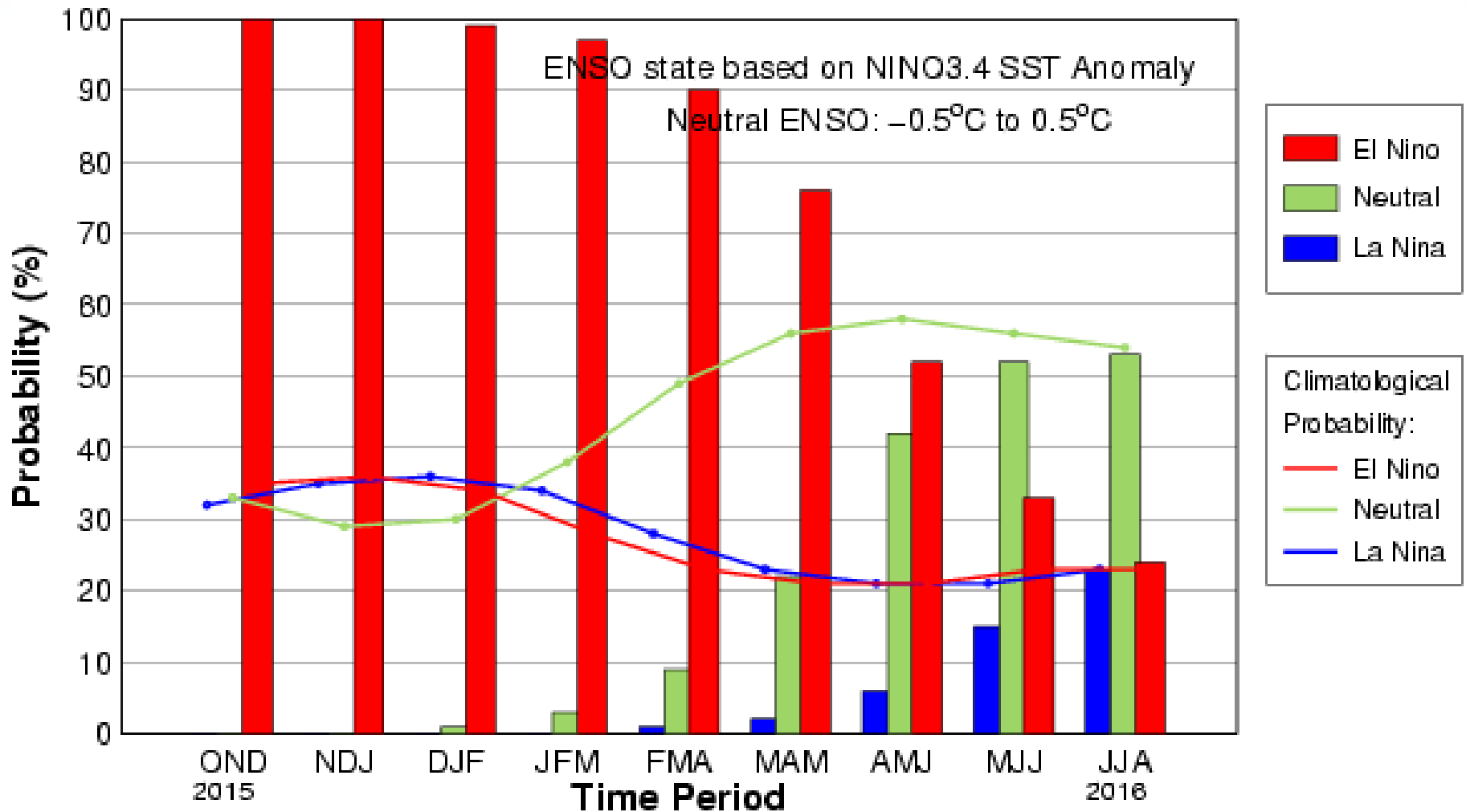
# Ocean Niño Index

- Strongest El Niños on Record
  - 1982/1983
  - 1997/1998
- 2015 – 2016 may break the record



# How long will El Niño last?

Early–Nov CPC/IRI Consensus Probabilistic ENSO Forecast



# 2015 – 2016 El Niño



- NOAA predicts 95% chance El Niño will continue through the Winter (~March)
- El Niño will gradually weaken through Spring/Summer (~May/June)
- El Niño conditions bring heavy rainfall coupled with elevated Bay water levels

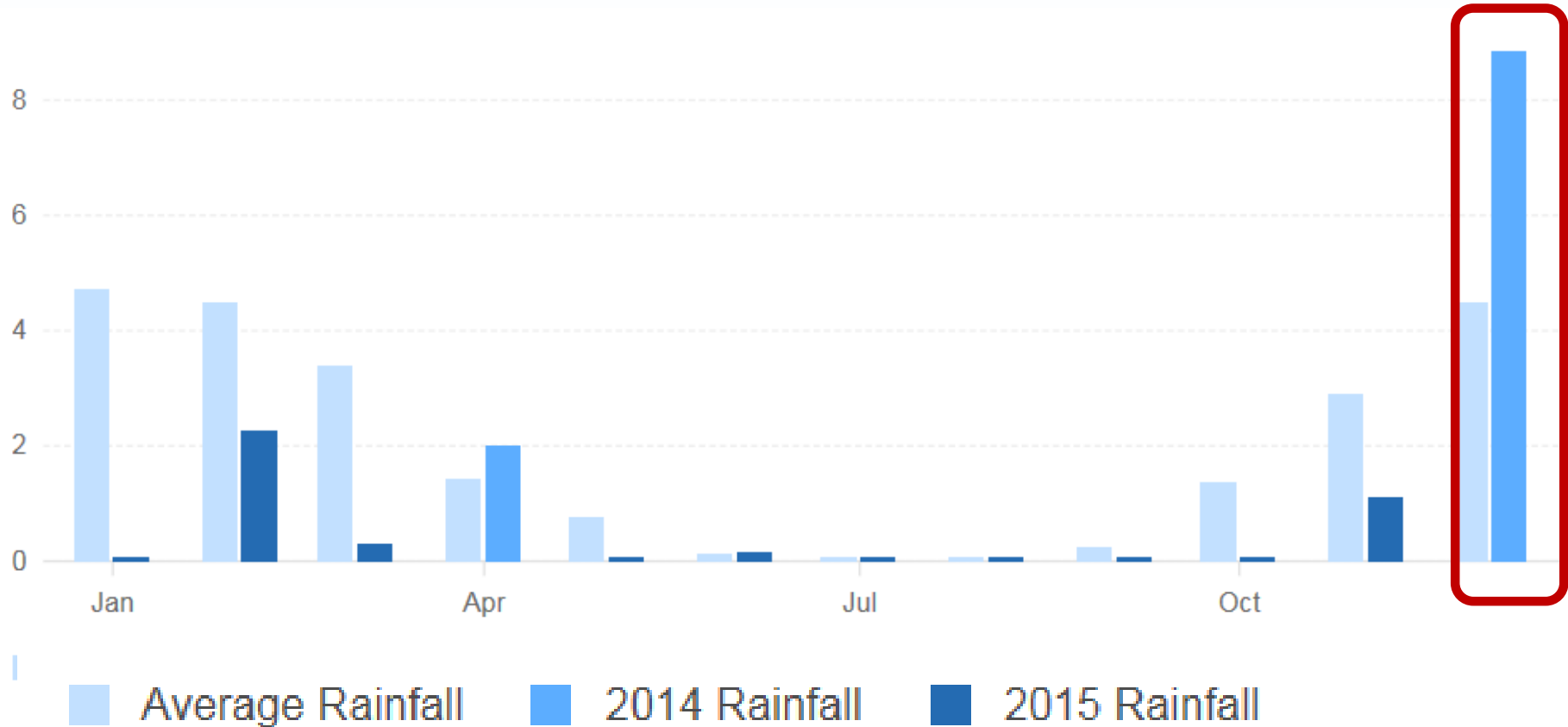
# December 11, 2014

- Heavy rainfall (i.e., 25-year)
- 18" inches of storm surge (i.e., 5-year)
- Baywide flooding in low-lying areas

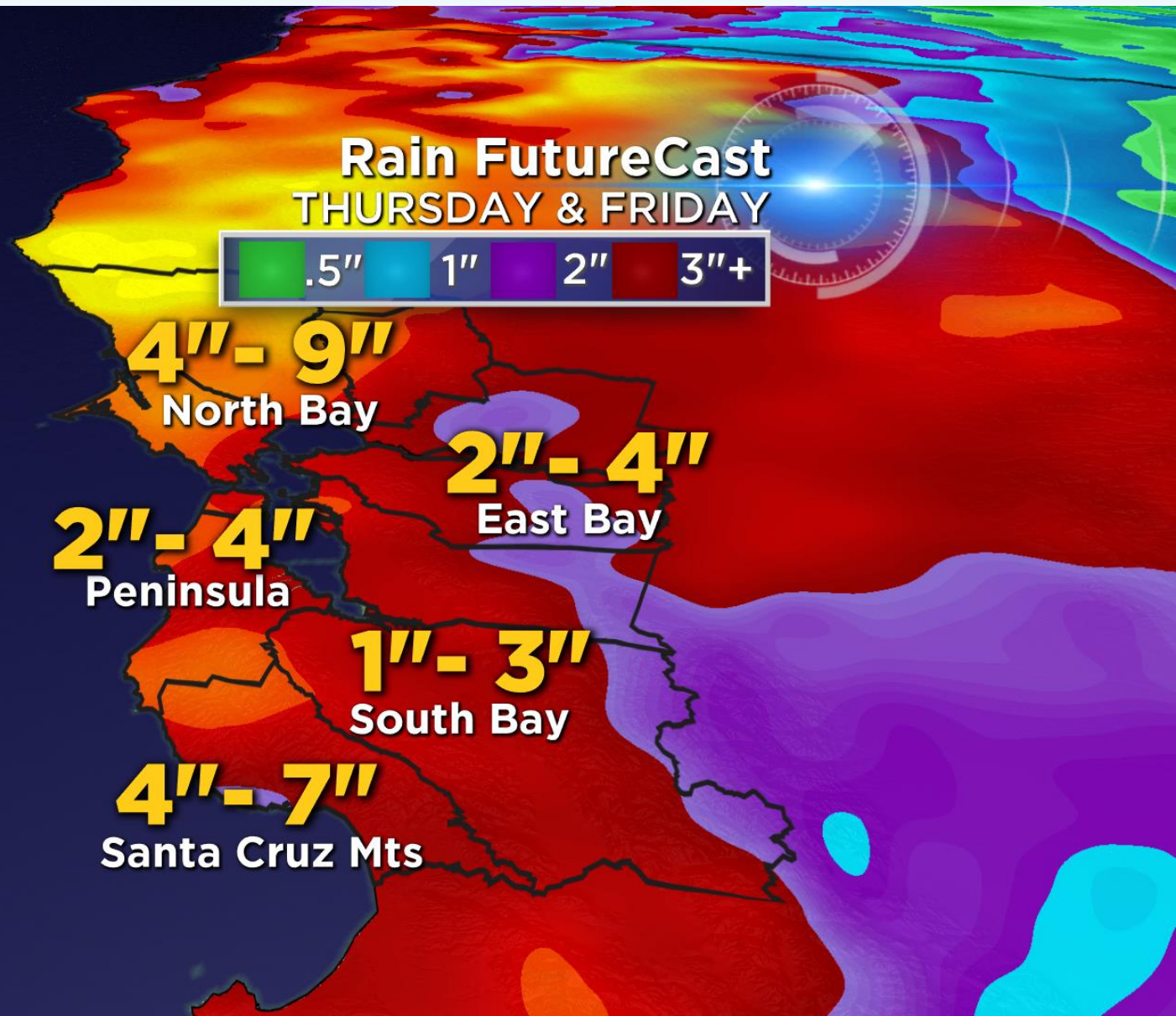


# Monthly Berkeley Rainfall

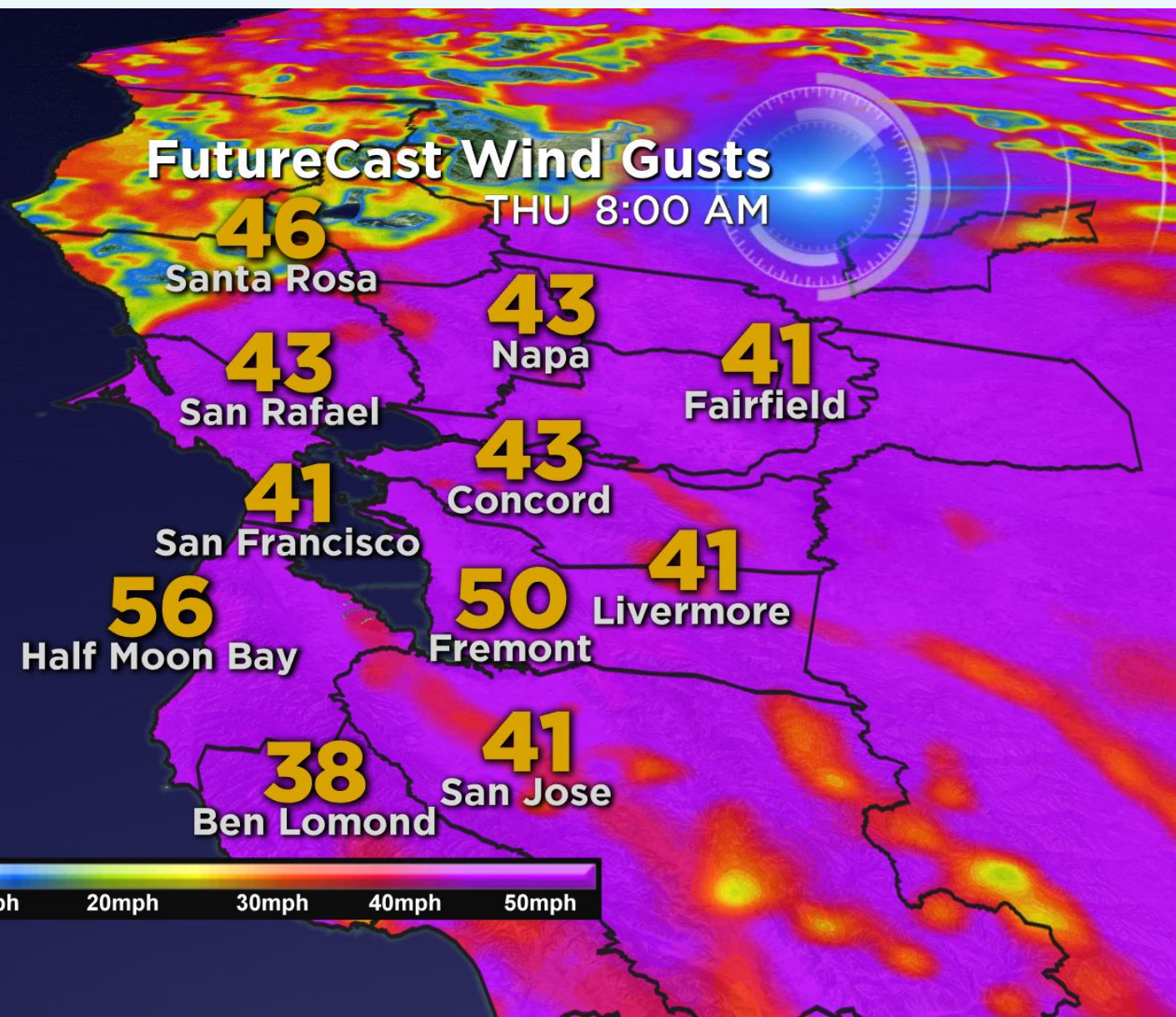
December 2014



# December 2014 Rainfall



# December 2014 Wind Gusts



# Water flows into Storm Drains



# Storm Drains flow out to the Bay



# When Storm Drains Can't Drain

- Storm drain outlets **submerged** at high tides
- Storm drain inlets are **clogged**
- Flooding occurs in low-lying areas

# When Storm Drains Can't Drain



Most infrastructure was designed and constructed to past conditions with lower Bay water levels

# Bay Tide Levels



- High Tides have risen by **8 inches** over the past ~100 years
- High Tides may rise by **12 to 24 inches** by 2050
- *December 11<sup>th</sup> storm had **18 inches** of storm surge (18 inches above normal tide levels!)*
- High tides could rise by **36 to 66 inches** by 2100

# High Tide (King Tide) Flooding



# December 11, 2014

- Heavy Rainfall ✓
- High Bay Tides ✓
- Low-lying Topography ✓
- Clogged Storm Drains ✓
- Overwhelmed Infrastructure ✓



# Ashby Avenue, Berkeley



# Ashby Avenue, Berkeley



# Mill Valley, CA



# High Street, Oakland



# Turn Around Don't Drown

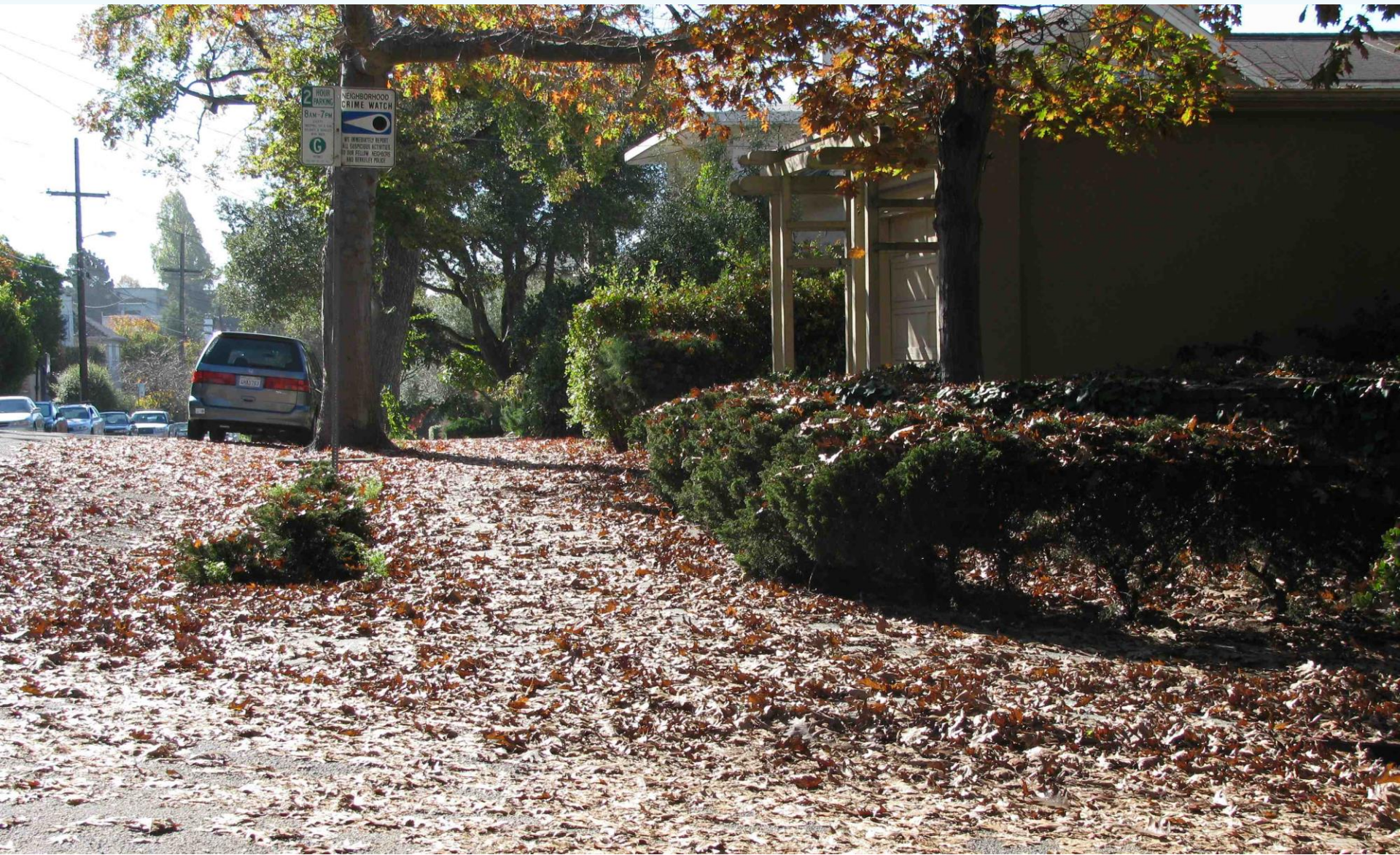


# What Makes Berkeley Vulnerable?

- Heavy Rainfall
  - Clogged Storm Drains
  - Overwhelmed Infrastructure
  - High Bay Tides
  - Low-lying Topography
- ... then add El Niño



# Clogged Storm Drains



# Clear Drains BEFORE it Rains



Copyright © Victoria Sheridan

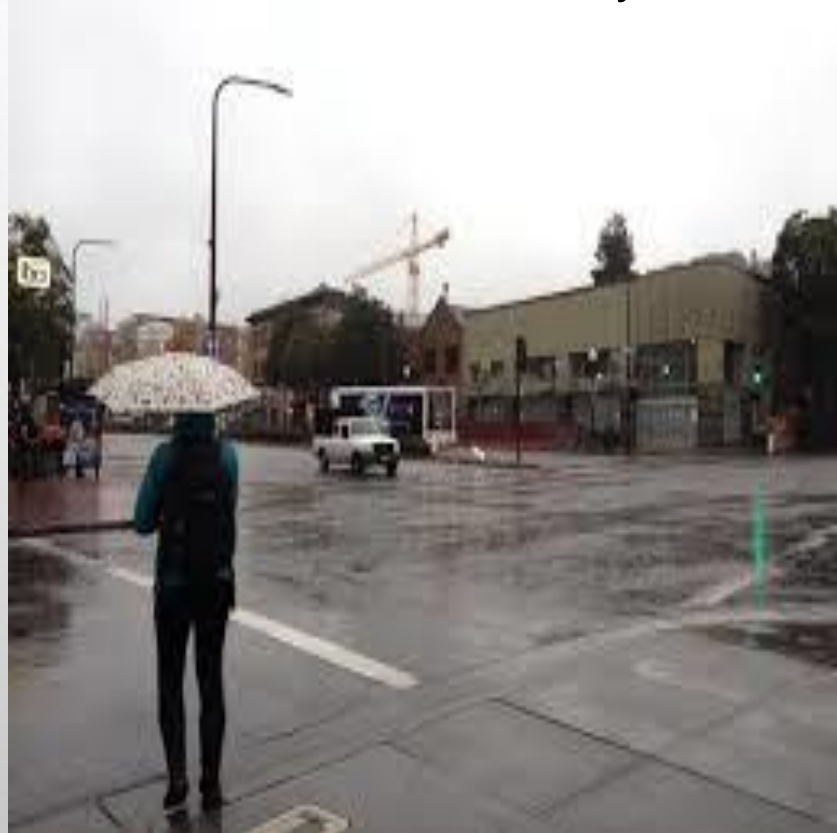
# Urban Flooding

- Urban flooding is already a problem in Berkeley
- Urban flooding may be **severe** during El Niño with winter storm conditions
- Its going to get **worse** with **climate change**
- Our response this winter will better prepare us for the future



# PUBLIC WORKS STORM PREPAREDNESS

Phil Harrington & Kem Loong  
Department of Public Works, City of Berkeley



# STORM DRAIN MAINTENANCE PROGRAM

STREET  
SWEEPING AND  
LEAF REMOVAL



STORM DRAIN  
INLET CLEANING



STORM DRAIN  
CULVERT  
CLEANING



# STORM DRAIN MAINTENANCE PROGRAM

7,000 STORM DRAINS  
CLEANED ANNUALLY



6,400 MILES SWEEPED AND  
2,000 TONS OF DEBRIS  
REMOVED FROM CITY  
STREETS



# GREEN INFRASTRUCTURE MAINTENANCE

VINE AND SPRUCE



ALLSTON WAY AND CALIFORNIA



# AQUATIC PARK LAGOON TIDE GATES

Measures and regulates water releases through tidal gates to minimize flooding of Bolivar Street while maintaining depth for recreational boating uses.



# STORM PROJECTS

HILGARD CULVERT  
TRASH RACK



PARK HILLS  
CULVERT



4<sup>th</sup> STREET



# STORM PROJECTS

WOODHAVEN



9<sup>th</sup> AND ALLSTON WAY



# STORM PREPARATION

TRIM TREES



CHECK ROOF  
AND DRAINS



MOVE CARS FOR  
STREET

SWEEPING AND  
REMOVE LEAVES  
UNDER WHEELS



# STORM PREPARATION

BACK-UP SUMP  
PUMP SYSTEM



GET YOUR  
SANDBAGS EARLY



VOLUNTEER



# RAIN GUTTERS OR ROOF DRAINS

- Drain roof drains away from property to street gutter or storm drain.
- Do not drain roof drains directly onto neighbors property or sanitary sewer system.

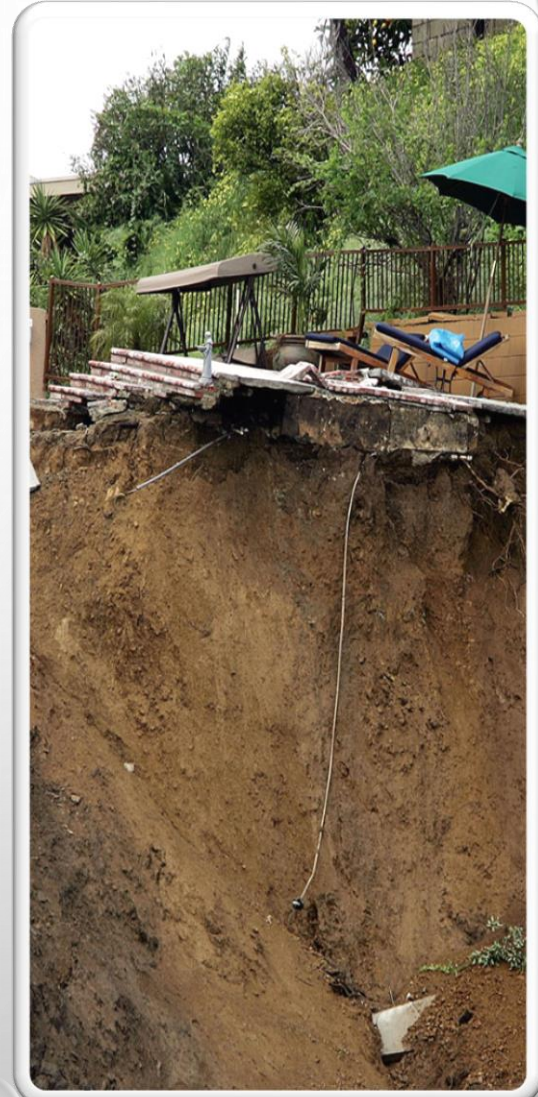


# SANDBAGGING



# HILL SLIDE PREPAREDNESS AND AWARENESS

- Build an emergency kit and family communications plan
- Learn if you are in a debris flow zone ([http://landslides.usgs.gov/state\\_local/sanfrancisco.php](http://landslides.usgs.gov/state_local/sanfrancisco.php))
- Consult a professional for advice on appropriate measures for your hillside
- Protect your property by planting ground cover on slopes.
- Look for changes in landscape, changes in water runoff, land movement, small slides, or leaning trees
- Take notice if doors or windows jam for the first time.



# Better Safe than Soggy

Khin Chin, Office of Emergency Services, City of Berkeley



# Prepare your family

- Prepare to shelter in place
  - Don't get bored
  - Phone chargers
- Your neighbors
  - Who has special needs? / Buddy System
  - Children, elderly, pets
- Copies of important documents
- Emergency Notification
  - BENS, Radio 1610am, City website



Photo:  
Petattack.com

# Prepare your home

- Sandbags
- Plywood
- Clear rain gutters
- Keep rake handy
- Check homeowners insurance policy
  
- Use extreme caution entering flood damaged buildings
  - Hidden damage, electrical systems, undermine foundation



# Getting to work



Photo:  
cragmont.org

- Safe Driving
- Pay attention to school announcements
  - Alternative childcare
- Prepare your family and home



Photo:  
abc7news.com

# Driving safely

- Wet driving conditions – debris, mud, downpours
- Windshield wipers
- Flashlight in Car
- Safety Kits in Car
- Fill up the gas



# Turn Around, Don't Drown

- Do not drive around barricades
- NEVER drive through flooded roadways
- 12-24 in of water can move vehicle.
- Stay out of flood waters,
  - 6 inches of water can knock you off your feet
  - Contamination
- Downed powerlines



Photo: Jennifer Lazo

# Power Outage

- Disaster preparedness kit
- Battery-powered radio
- Store extra batteries, lights (not candles), power banks for phones
- Operate generators outdoors, never inside
- Keep freezer and refrigerator closed
  - Before the storm, fill up any open spaces in freezer with sturdy water bottles
- Know signs of hypothermia

# 311 Not 911

- 311 – Non-Emergency City Services
  - Access City Services
  - Report Problems
  - Request Information
- 911 – Emergency Services
  - Current or imminent threat to life or property
  - Non-Emergency Police or Fire calls – 981-5900

# Community-wide effort

- Take care of debris on your property
  - Leaves
  - Tree trimming
  - Household Hazardous Waste
- Volunteers
  - Adopt a Drain
  - CERT



Please share your questions and ideas.



Timothy Burroughs

Asst. to City Manager/Chief Resilience Officer

City of Berkeley

[tburroughs@cityofberkeley.info](mailto:tburroughs@cityofberkeley.info)

510.981.7437