

Sea Level Rise

2014 City Council Update

City of Olympia | Public Works, Water Resources
March 2014



Sea Level Rise in Olympia

PRELIMINARY ASSESSMENT OF
SEA LEVEL RISE IN
OLYMPIA, WASHINGTON:
TECHNICAL AND POLICY IMPLICATIONS

June, 1993

City of Olympia
Public Works Department
Policy and Program Development Division
Olympia, Washington

Olympia's Response to
The Challenge of Climate Change



Background Report and
Preliminary Recommendations



September 2007

CITY OF OLYMPIA
ENGINEERED RESPONSE TO SEA LEVEL RISE



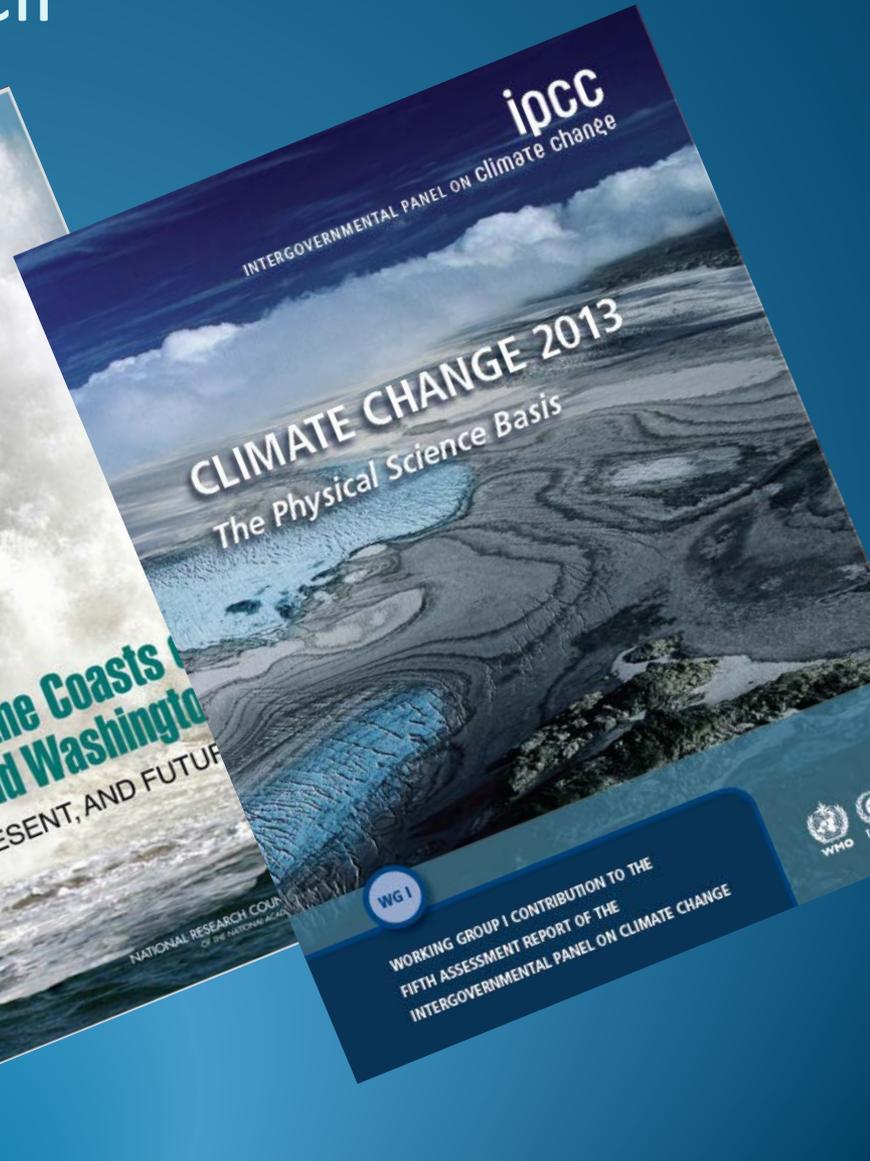
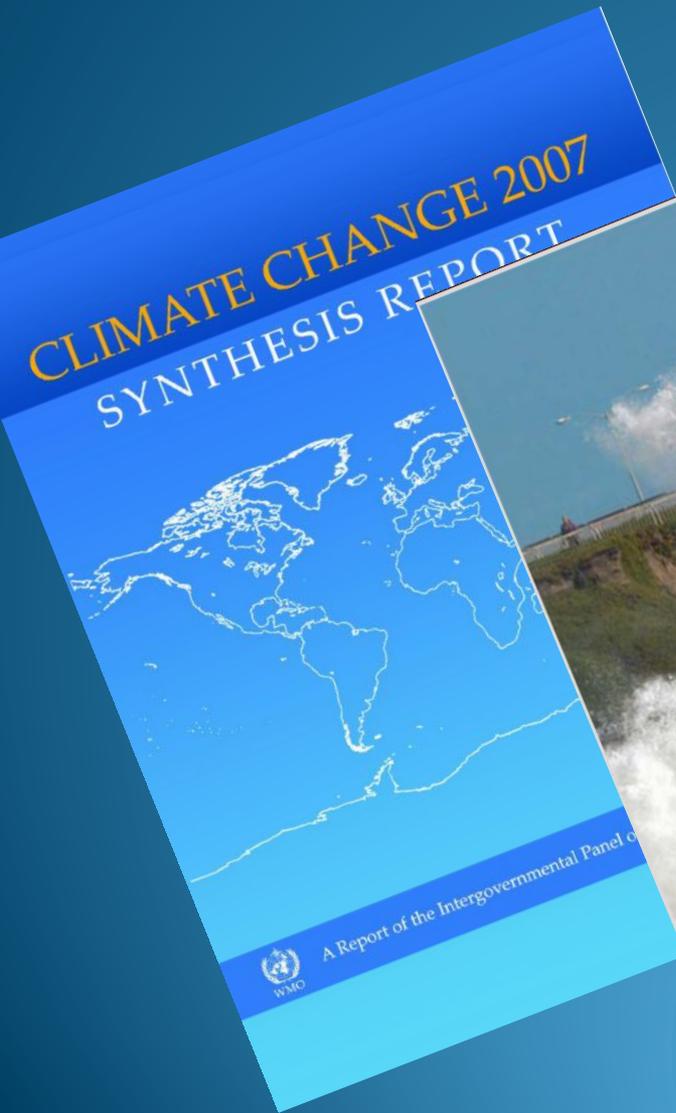
Existing Flooding Extents – 10-year event



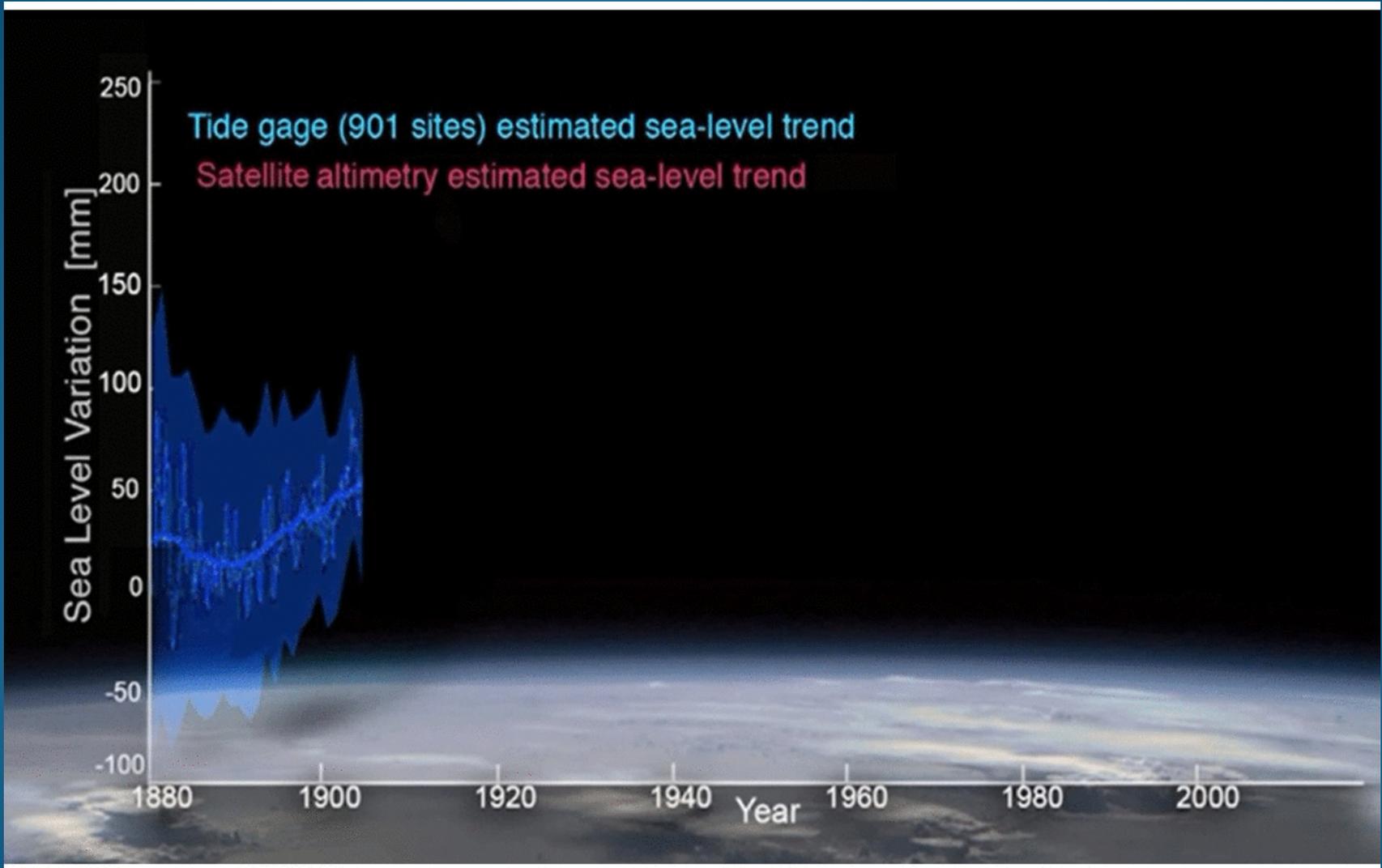
City Policy - 2010

- Protect downtown.
- Understand the implications of 50 inches of sea level rise.
- Use opportunities for new public and private investments to prepare for sea rise.
- Seek opportunities to maintain control of valuable shoreline.

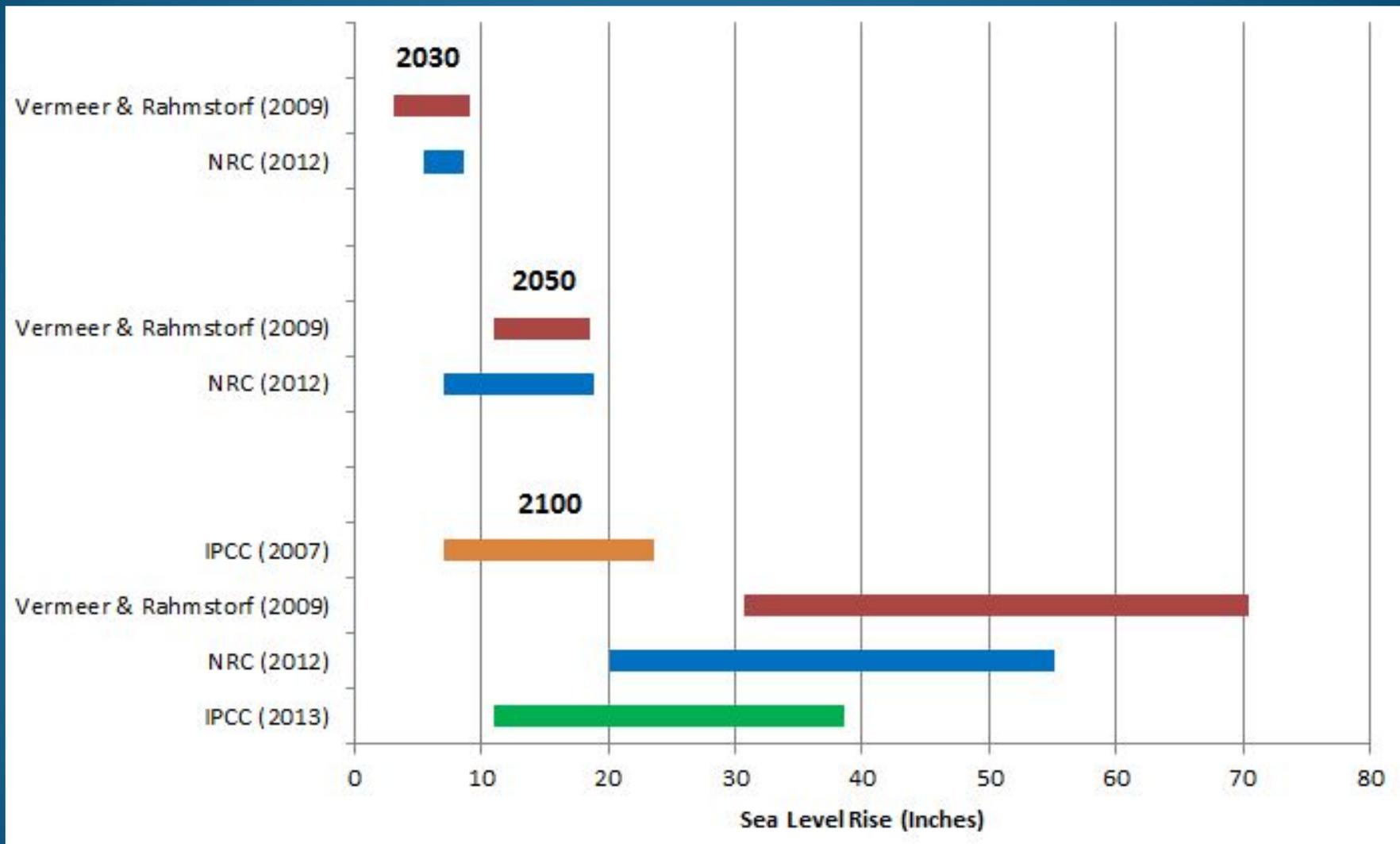
International Panel on Climate Change National Research Council



Sea Level Trends

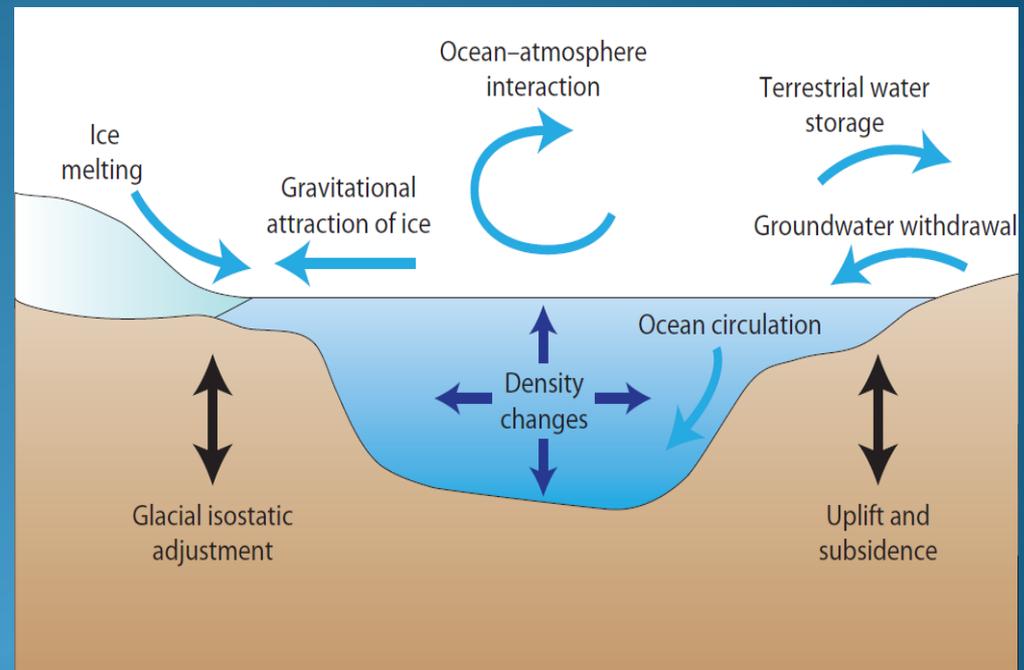


Global Sea Level Rise Projections

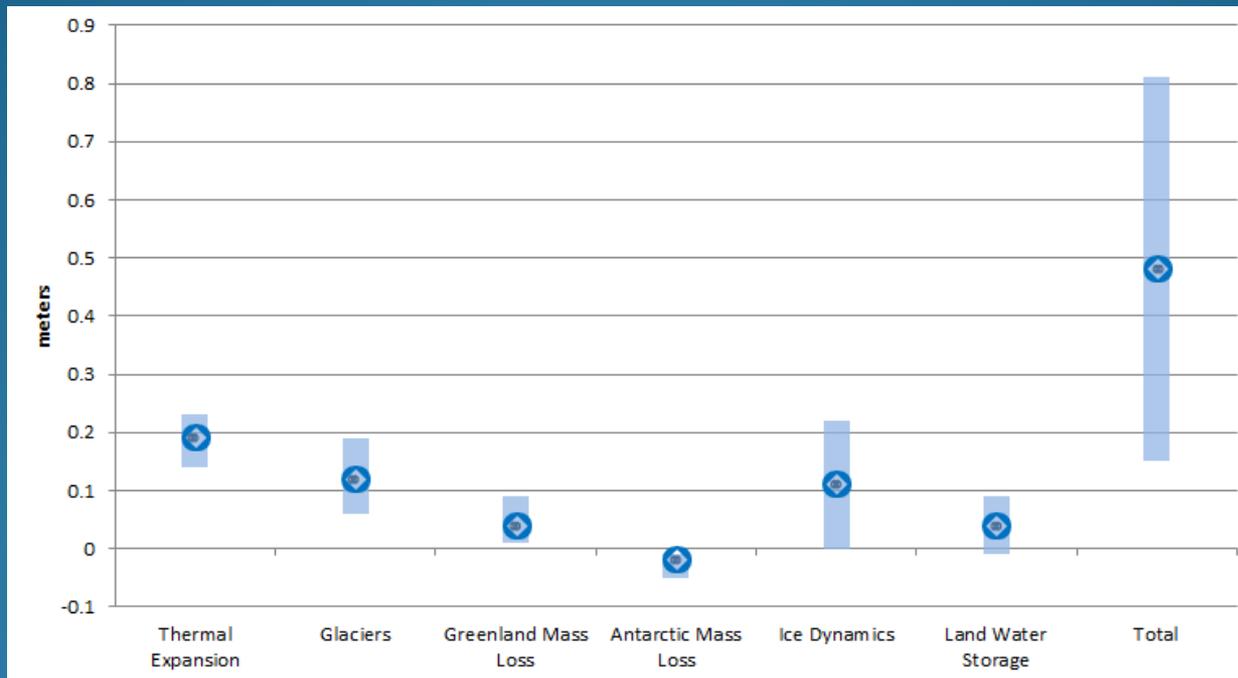


Processes influencing sea level

- Primary Processes
 - Thermal Expansion
 - Melting Glaciers
 - Melting Ice Sheets
 - Terrestrial Storage
- Additional Processes
 - Weather
 - Vertical Land Movement



Sea Level Rise – Relative Contributions of the Various Processes



- 2081 - Assuming greenhouse gas stabilized near current levels

Projected Flooding Extents – 0-foot sea level rise

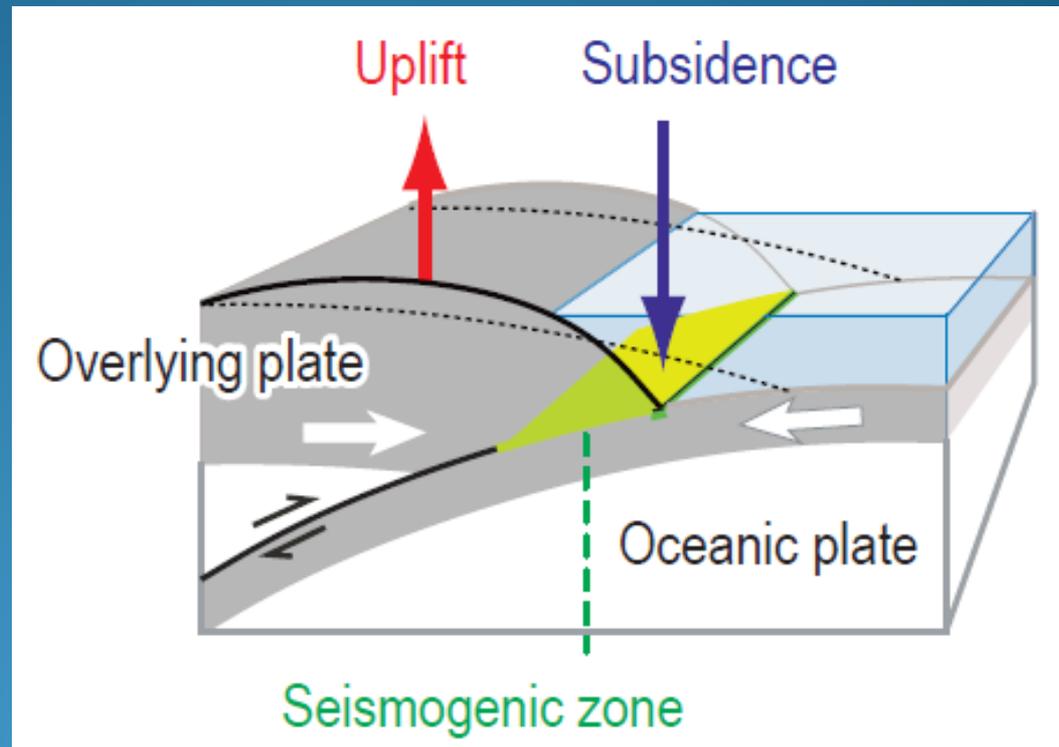


2013 IPCC Report Key Findings

- Global mean sea level rise will continue for many centuries beyond 2100, with the amount of rise dependent on future emissions.
- If Greenhouse gases are curbed, sea level rise will be less than 1 m by 2300.
- If Greenhouse gases are not curbed, sea level rise may be up to 3 m by 2300.
- Larger sea level rise could result from ice sheet flow.
- Near-complete loss of the Greenland ice sheet will occur with warming of between 1°C and 4°C.

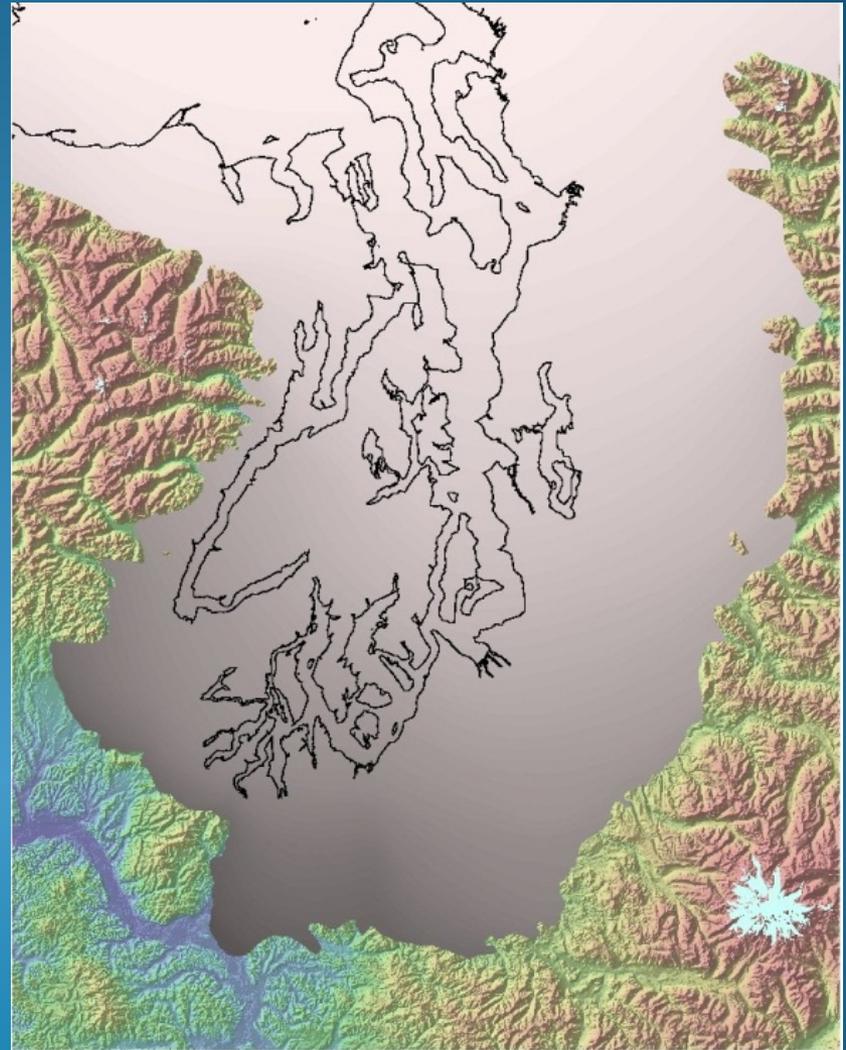
Vertical Land Movement

Tectonics



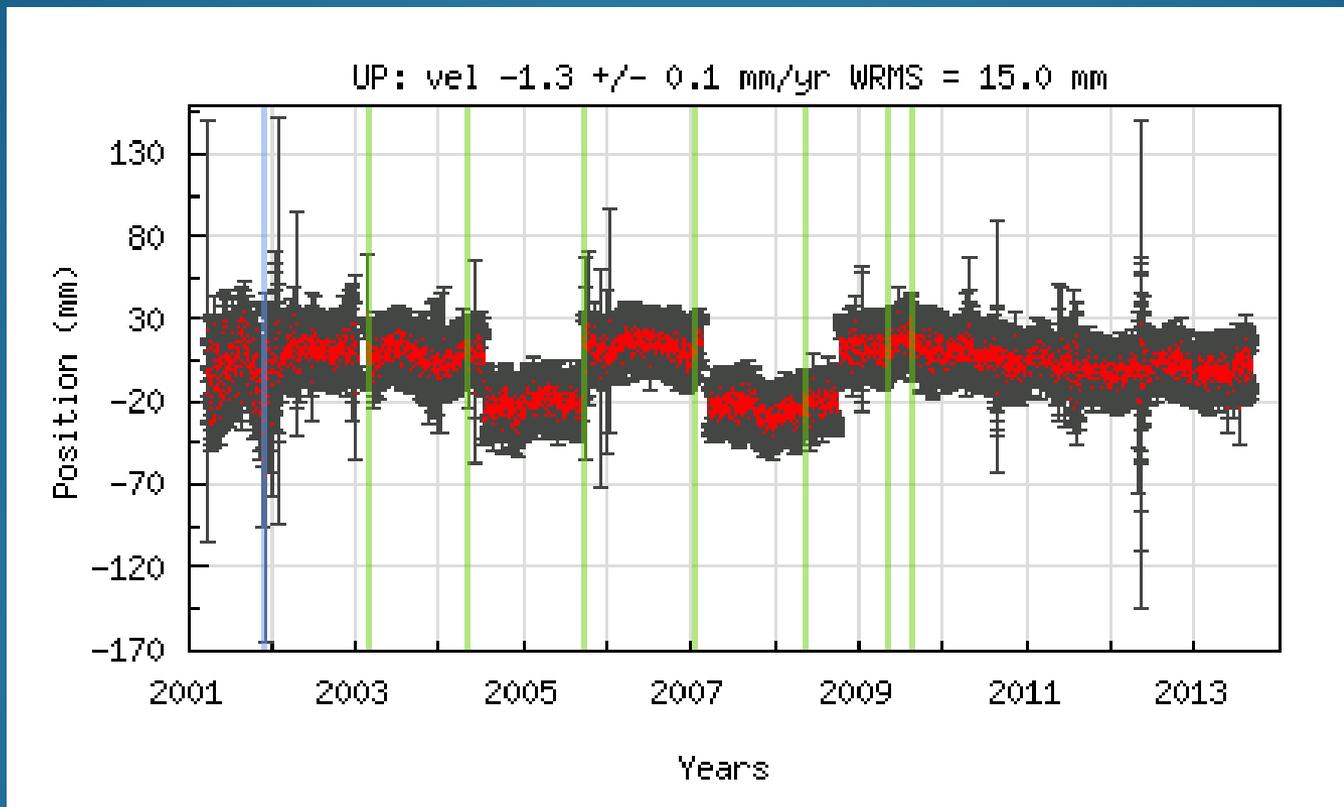
Vertical Land Movement

- Tectonics
- Glacial isostatic adjustment



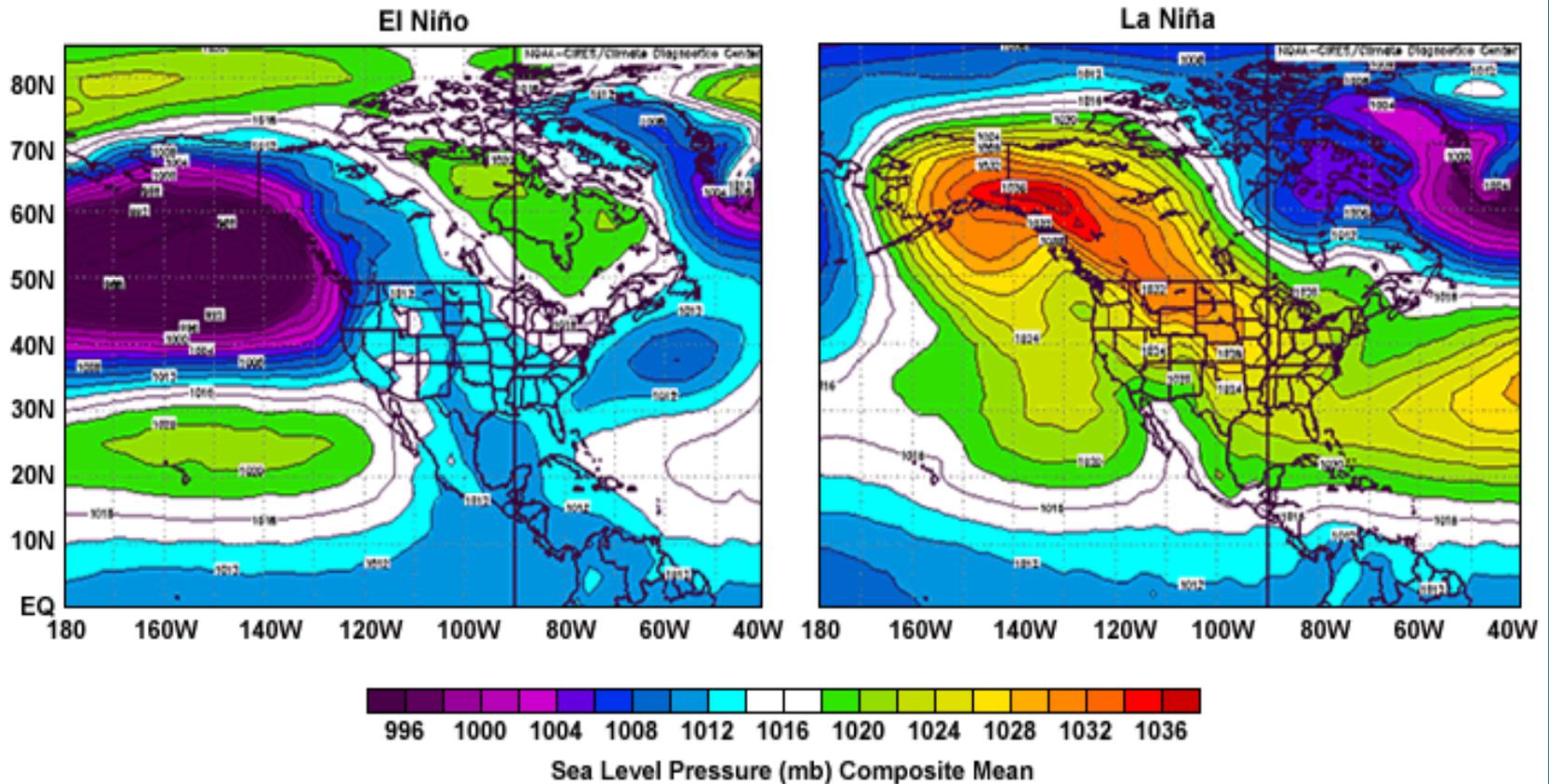
Vertical Land Movement

- Monitoring Olympia's elevations



Importance of El Niño Events

Pacific-North America Pattern during Extreme El Niño and La Niña



Importance of Weather

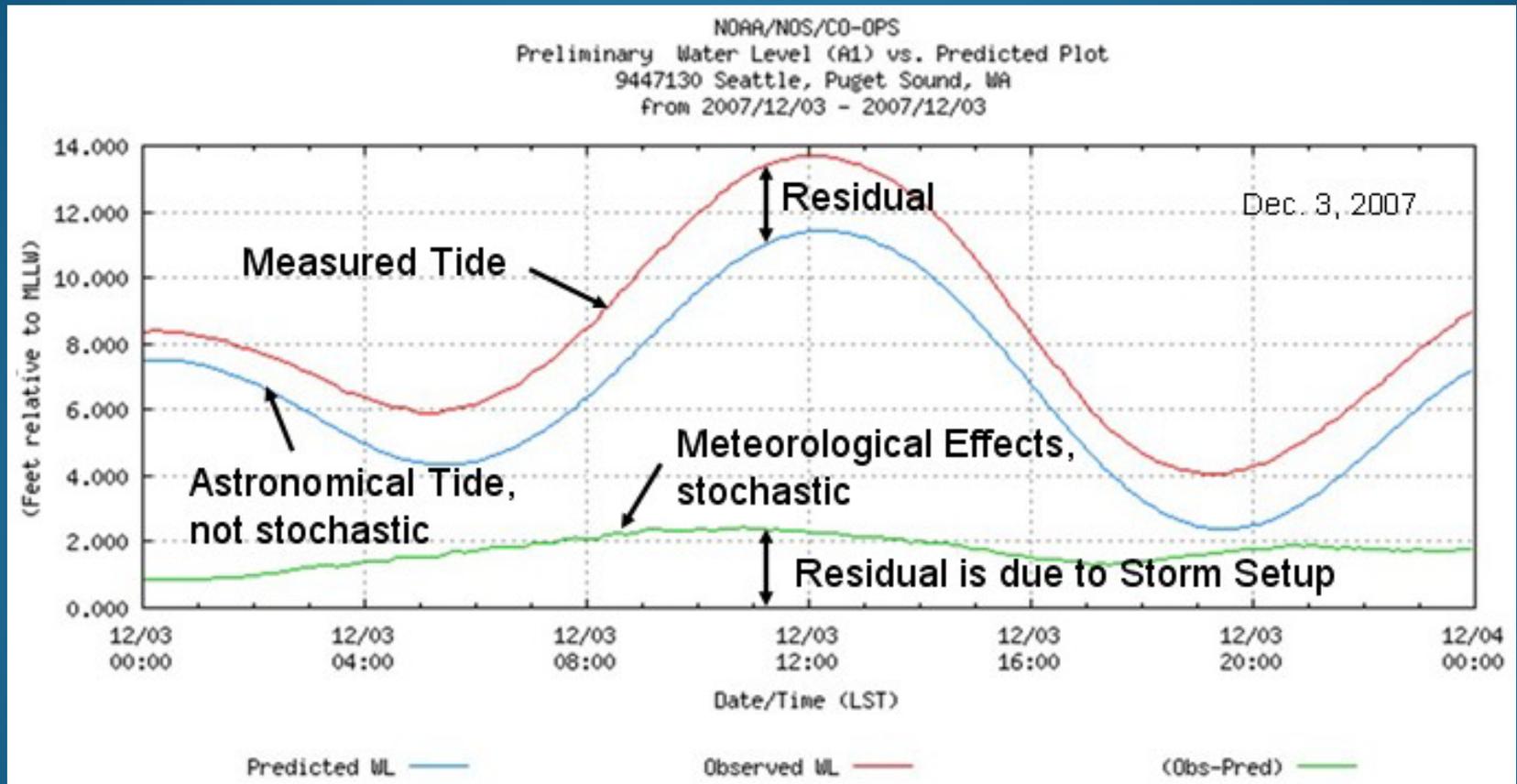


Fiddlehead Marine - December 17, 2012

Tools for Predicting Tides

- Tides are predicted years in advance
- Atmospheric models forecast pressure weeks in advance
- NOAA and Emergency Management Organization Warnings
- Stream gages on the Deschutes River

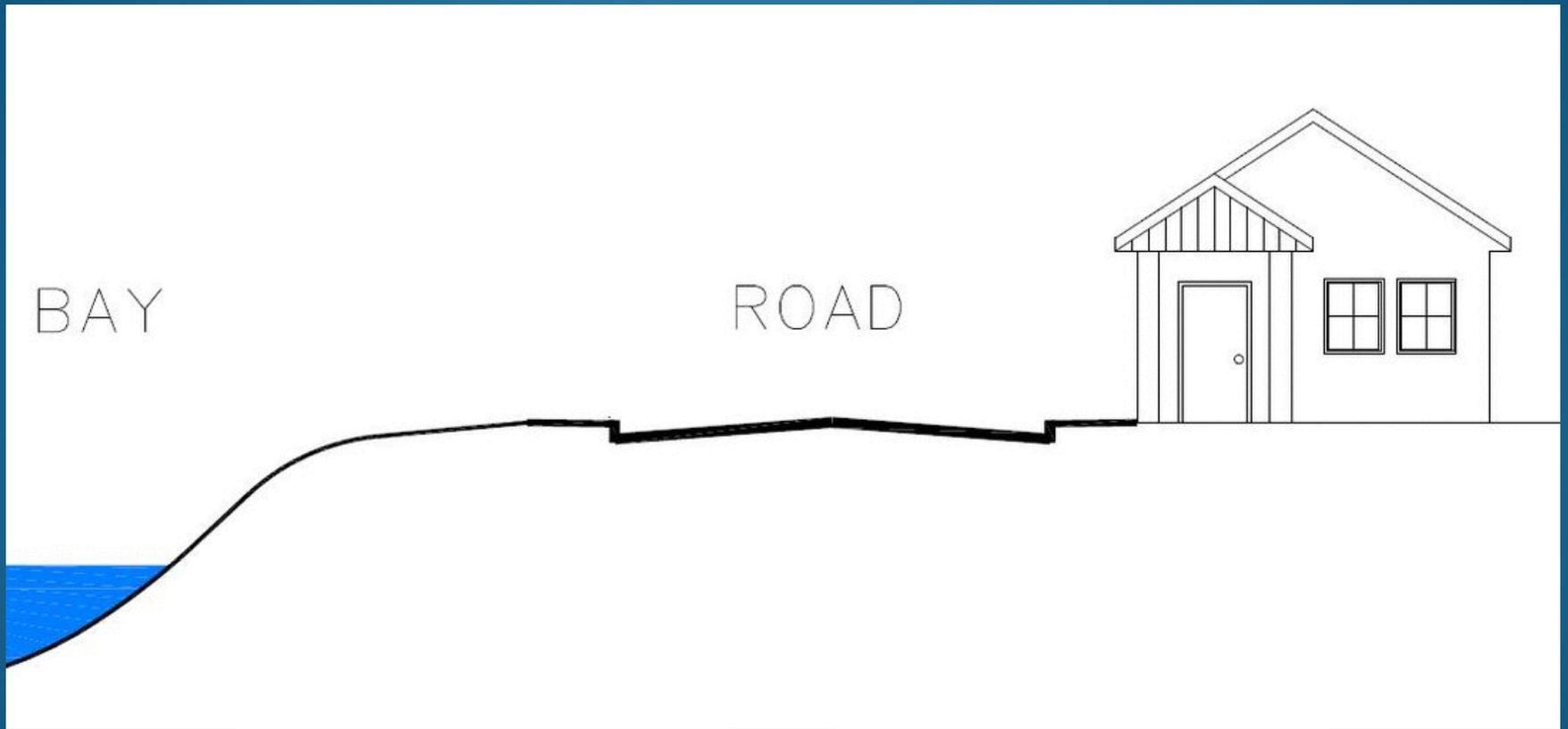
Tacoma NOAA Real Time Tide Data



Flooding Mechanisms

- Inundation of Budd Inlet and Capitol Lake Shorelines
- Pipe Backflow from Budd Inlet and Capitol Lake
- Terrestrial Runoff

Inundation of Budd Inlet and Capitol Lake Shorelines

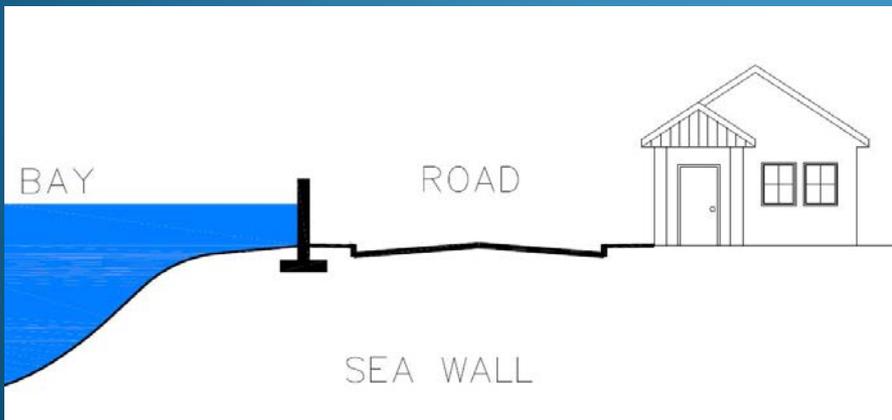
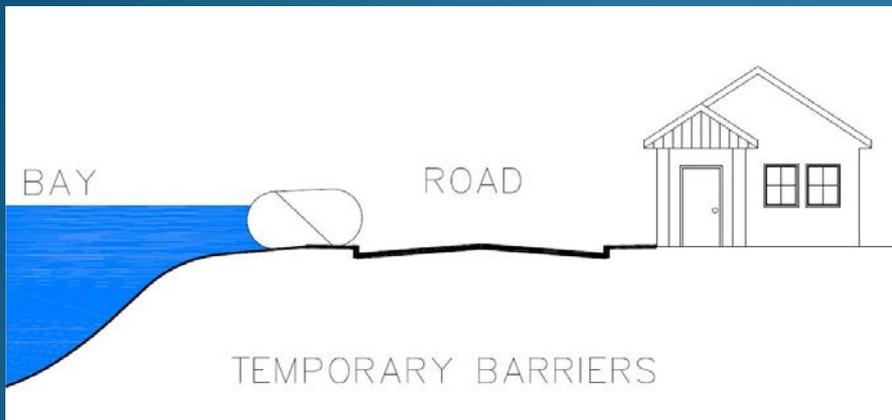


Inundation of Budd Inlet and Capitol Lake Shorelines

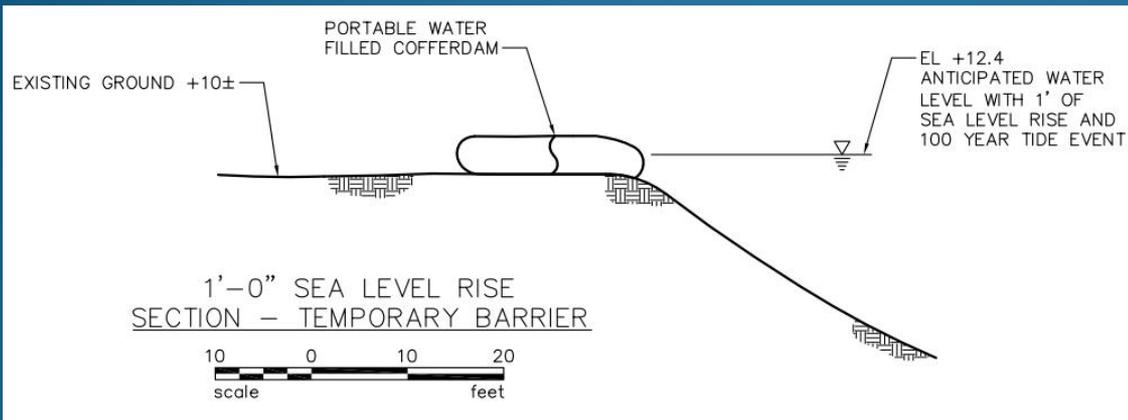


Oyster House - December 17, 2012... 17.6 Foot Tide

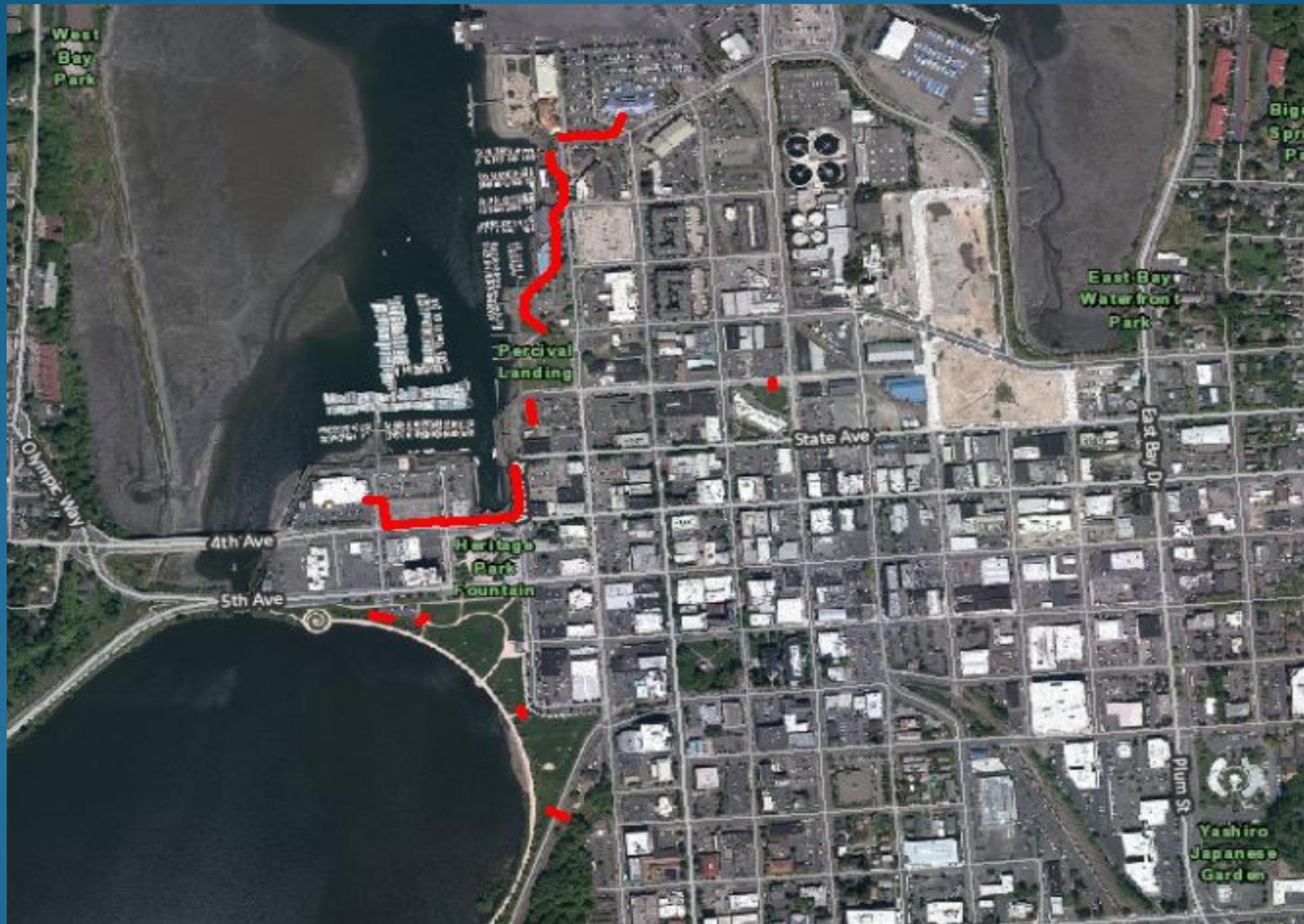
Inundation of Budd Inlet and Capitol Lake Shorelines



Temporary Flood Barriers



Temporary Flood Barriers - Locations



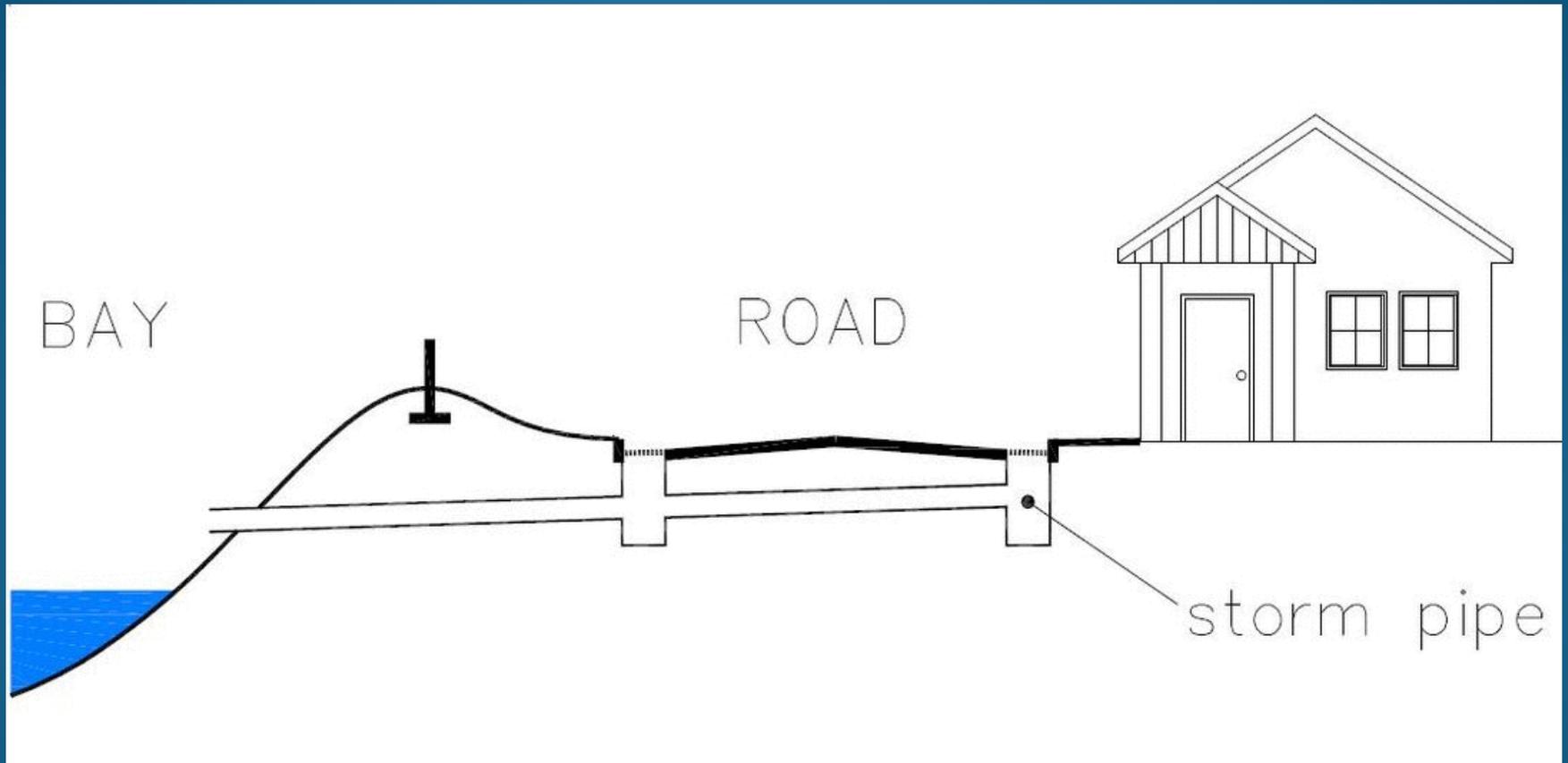
Barrier Locations – 0.25 ft sea level rise



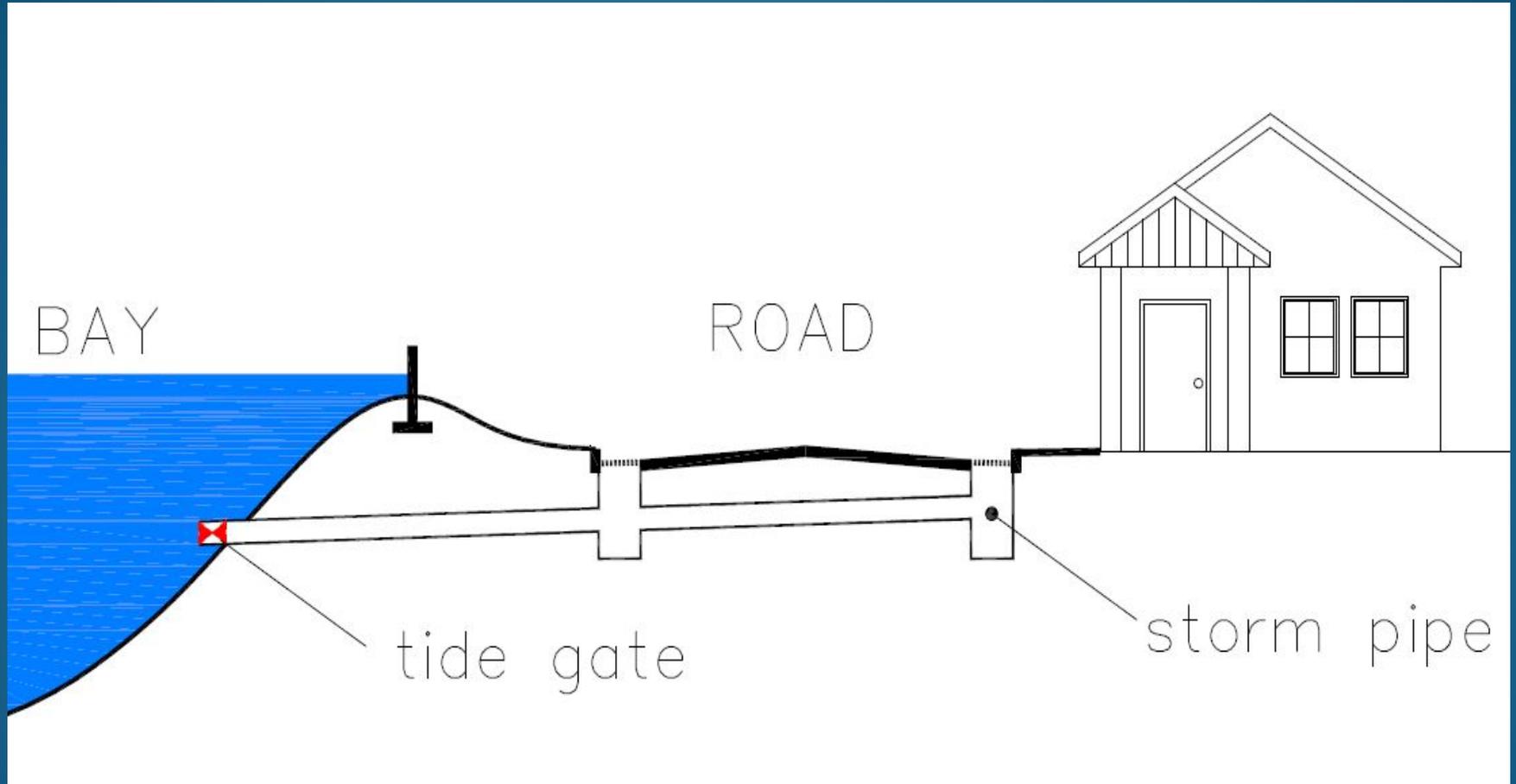
Barrier Locations – 0.5 ft sea level rise and beyond



Pipe Backflow Flooding



Pipe Backflow Flooding



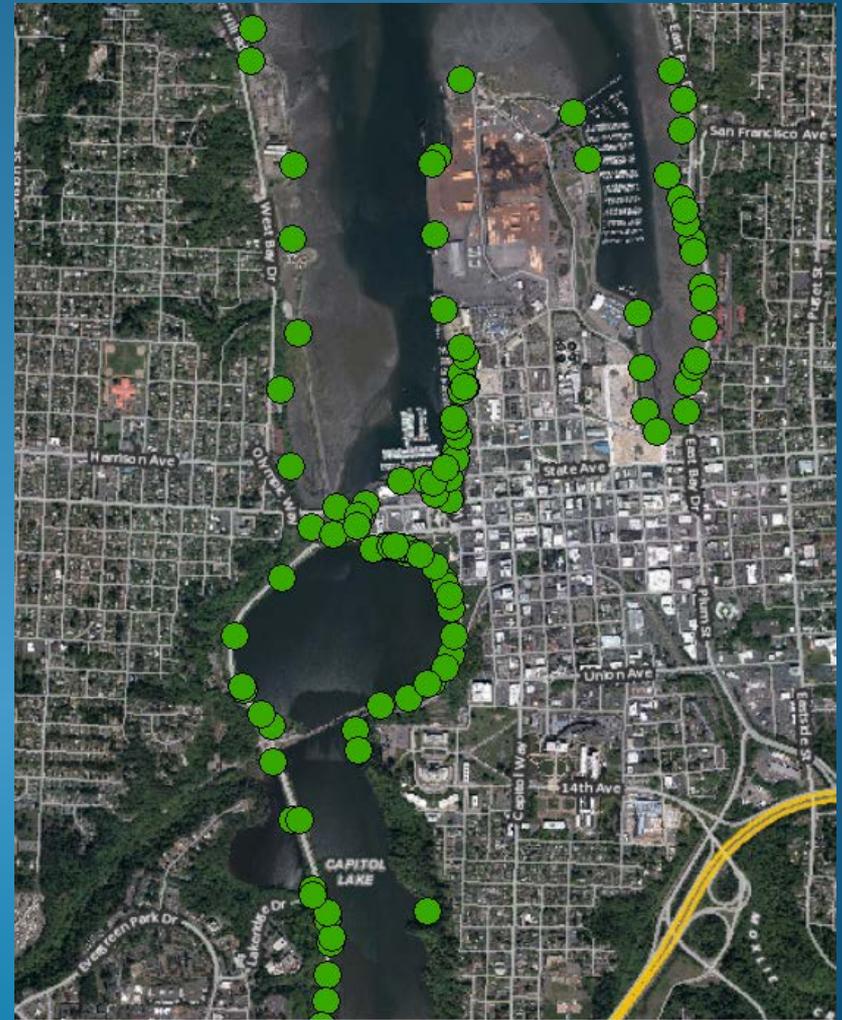
Pipe Backflow Flooding



Budd Bay Cafe

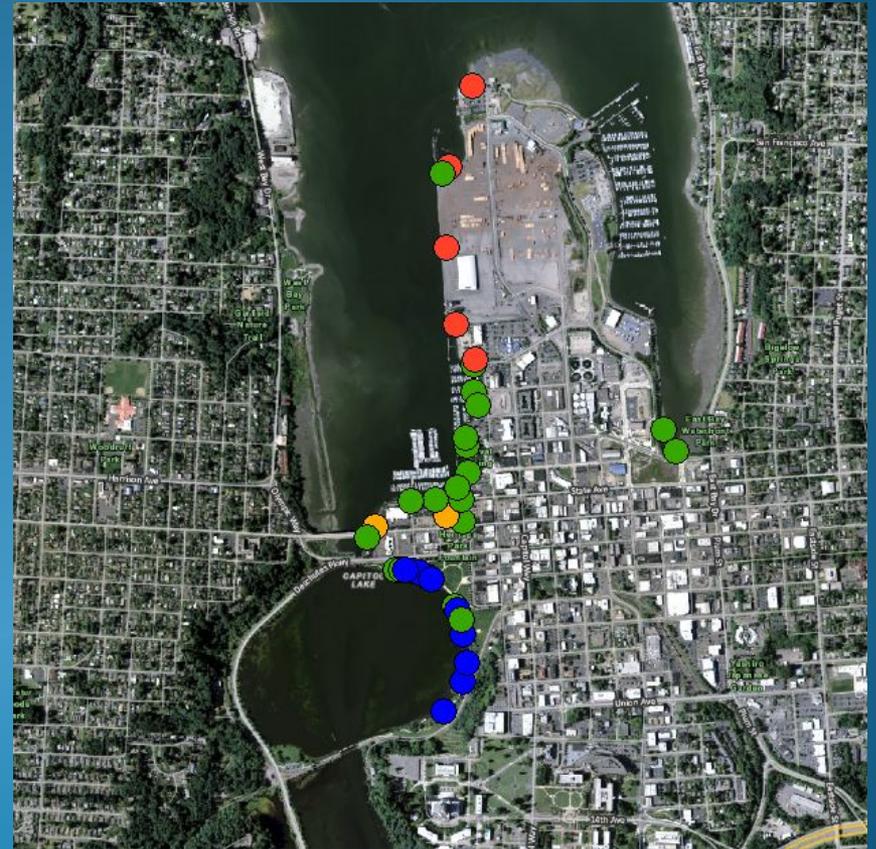
Pipe Backflow Flooding

- 112 known outfalls to Capitol Lake and Budd Inlet within the city limits



Pipe Backflow Flooding

- Of those piped outfalls, 36 are susceptible to backflow flooding
- 20 City –owned
- 9 State-owned
- 5 Port-owned
- 2 Privately-owned



Capitol Lake and East Bay



Backflow Prevention Devices

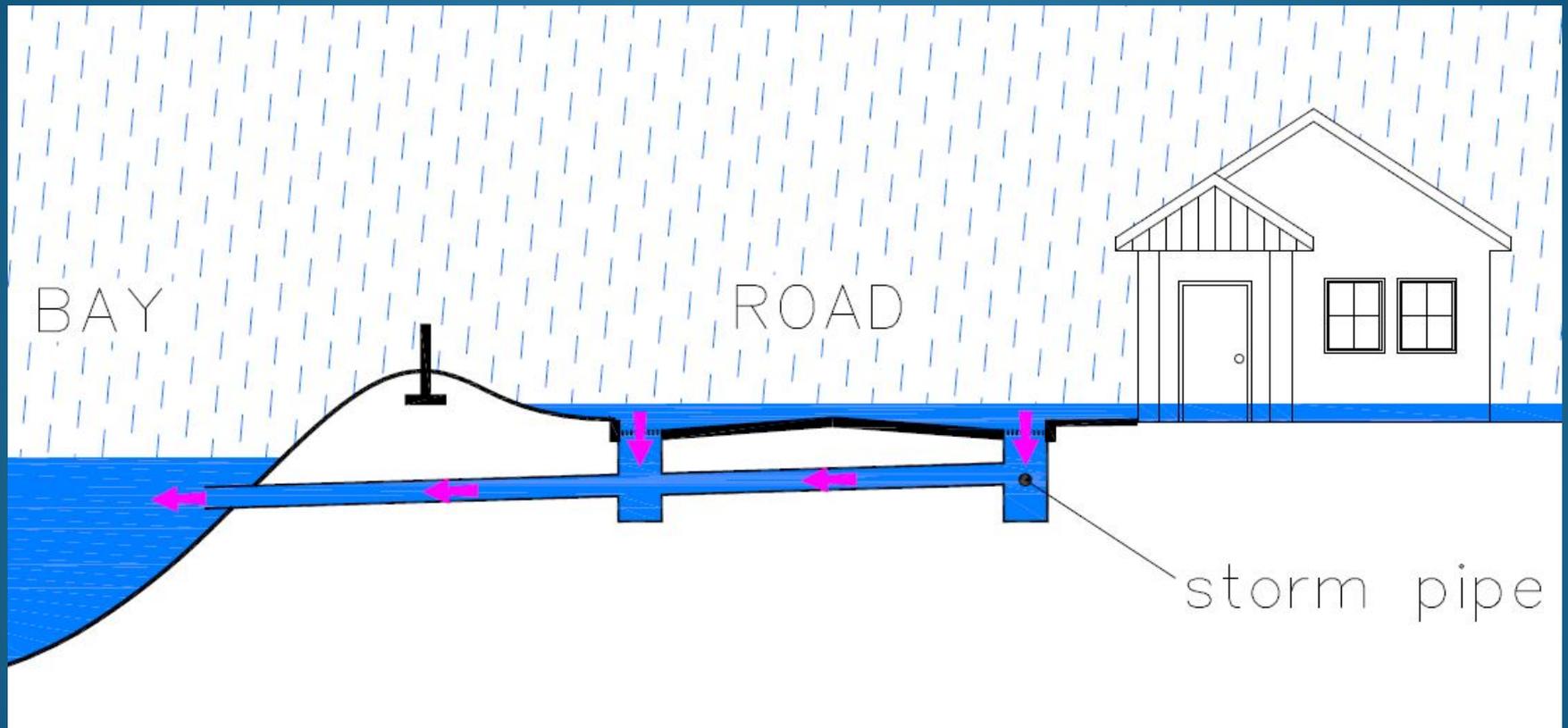


Flap tide gates & Gate valve



Pinch valve "duck bill"

Terrestrial Runoff Flooding



Inundation of Budd Inlet and Capitol Lake Shorelines



Capitol Lake

2014 Work Plan Tasks

- Survey shoreline elevations
- Survey vulnerable structure elevations
- Identify combined sewer catch basins vulnerable to flooding
- Purchase temporary barriers and practice placement

Additional Short-term Tasks

- Design strategic tide gates
- Modify drainage system for the Capitol Lake to eliminate need to pump 20-acre basin
- Investigate the permeability of downtown soils

Medium-term Tasks

(0.25 to 0.5 feet of sea level rise)

- Modify elevations of Heritage Park
- Install permanent flood barriers on western shore of peninsula
- Consolidate peninsula drainage systems
- Disconnect flood-prone streets from the Moxlie Creek drainage system
- Purchase pumps to handle downtown runoff during high tides

Long-term Tasks

- Raise barriers building on existing foundations
- Construct pump stations for consolidated drainage systems and Moxlie Creek.

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