Sticking our Heads in the Sewers, Not in the Sand

Sea Level Rise and Stormwater

Jason M. Evans, Ph.D.
Assistant Professor of Environmental Science
Stetson University

September 23, 2016
Sea-level Rise and Flooding:
Planning and Law for Local Governments
Jacksonville, FL

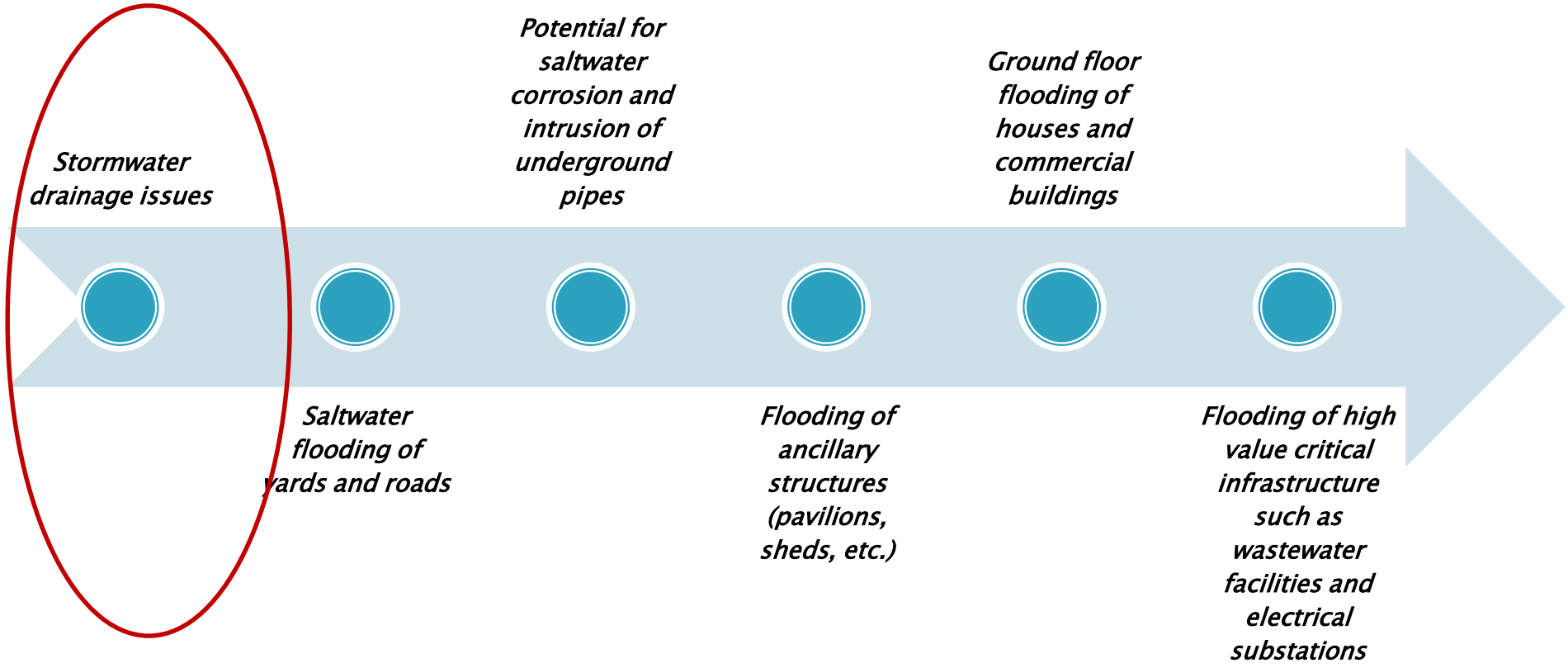
Sea Grant

STETSON UNIVERSITY

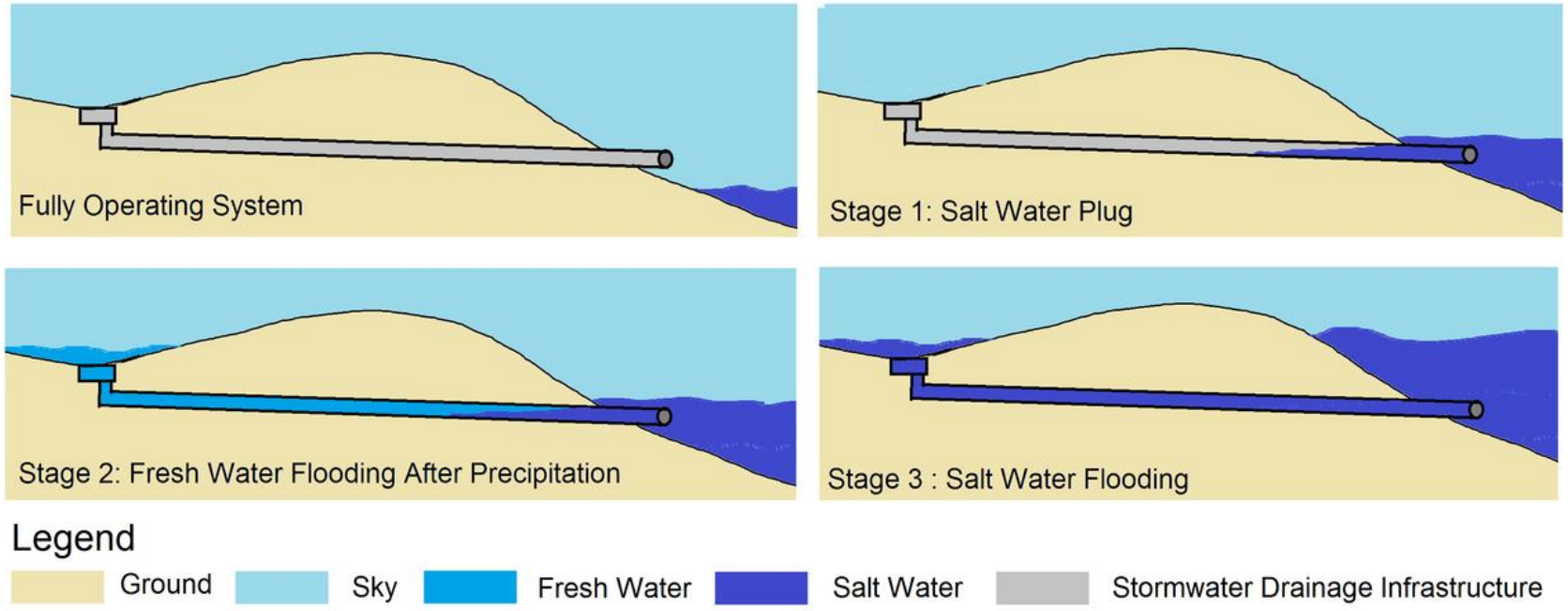
Assertion #4

Almost all coastal communities in the coastal southeast, even those not yet seeing dramatic direct saltwater flooding from king tides, are already being impacted by various stormwater drainage issues and failures.

General Timeline of Sea Level Rise Impacts on the Built Environment



Stages of stormwater failure with sea-level rise



Graphic by Emily Niederman, Stetson University

SW Tybee Island: November 14, 2012

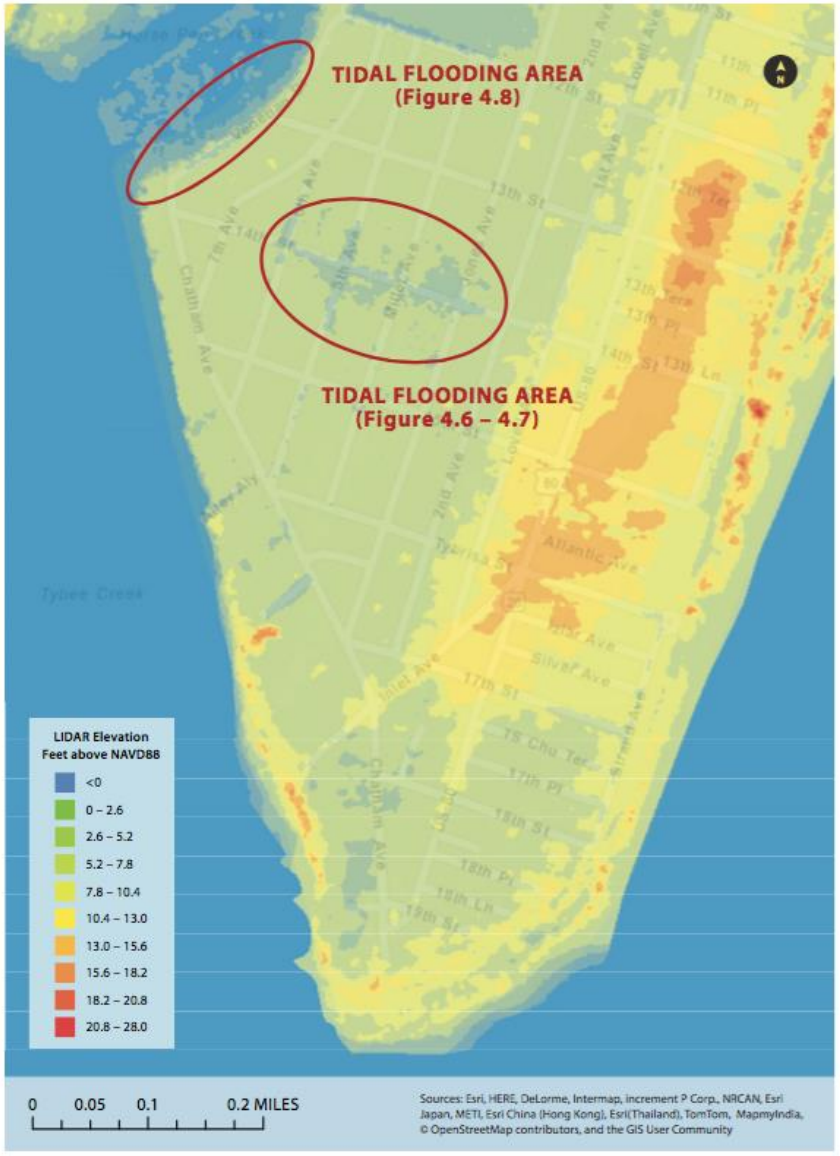
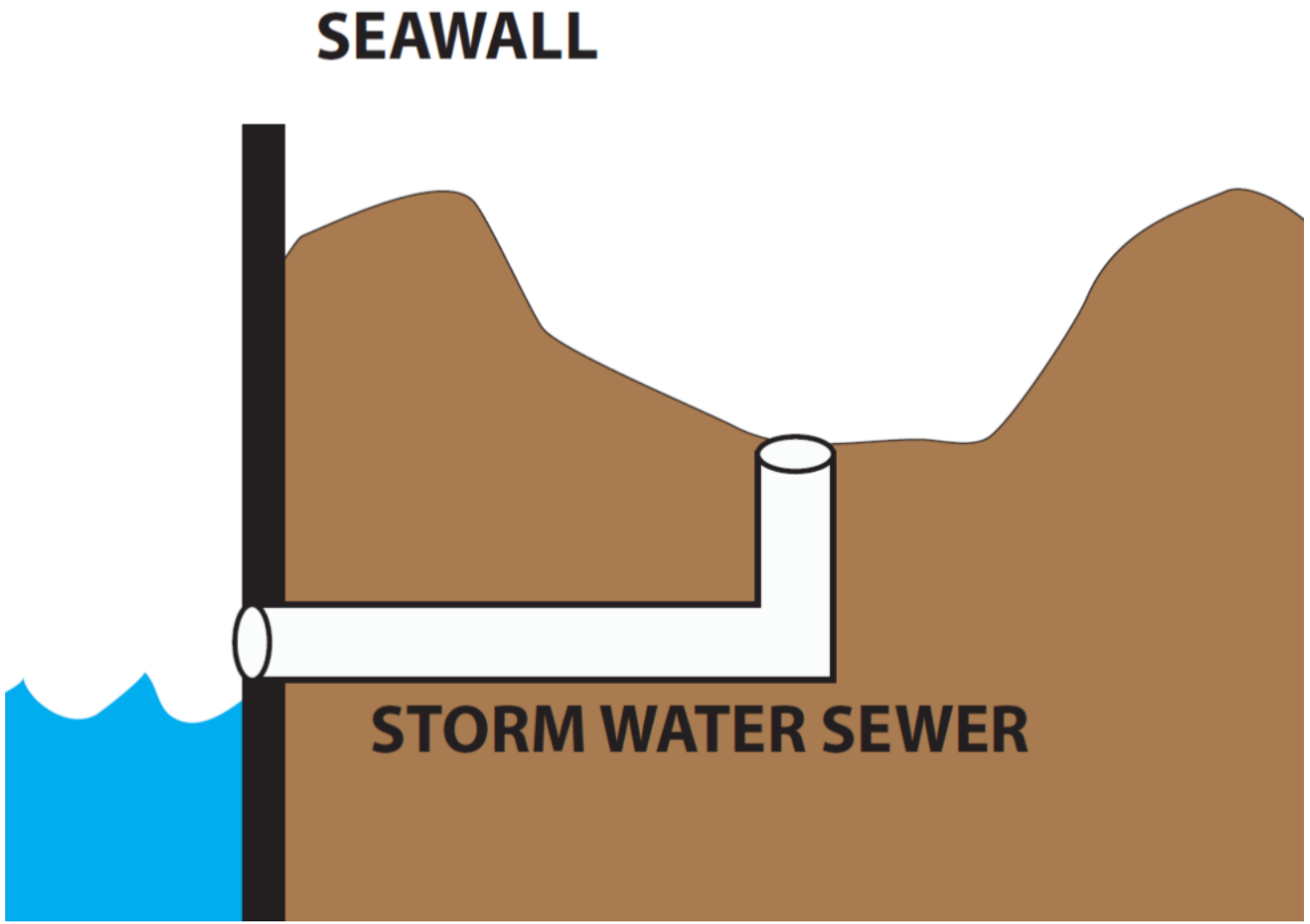
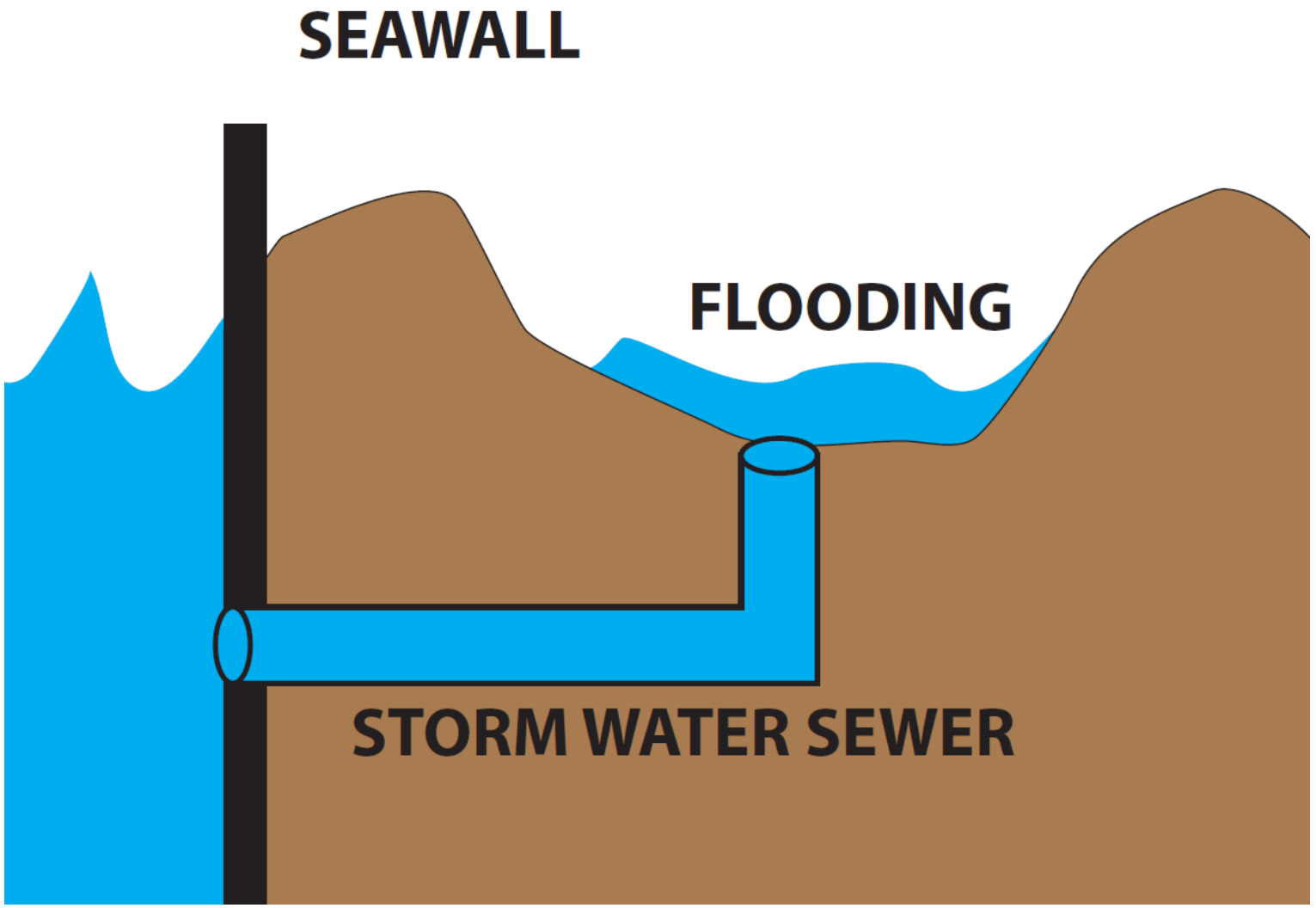


FIGURE 4.6: STORMWATER DRAIN WITH SALTWATER DISCHARGE DURING KING TIDE, NOVEMBER 14, 2012

FIGURE 4.7: SALTWATER FLOODING OF YARDS AND STREETS FROM STORMWATER DRAIN DISCHARGE DURING KING TIDE, NOVEMBER 14, 2012


SEAWALL
STORM WATER SEWER


SEAWALL
FLOODING
STORM WATER SEWER

SW Tybee Island: Local Government Action

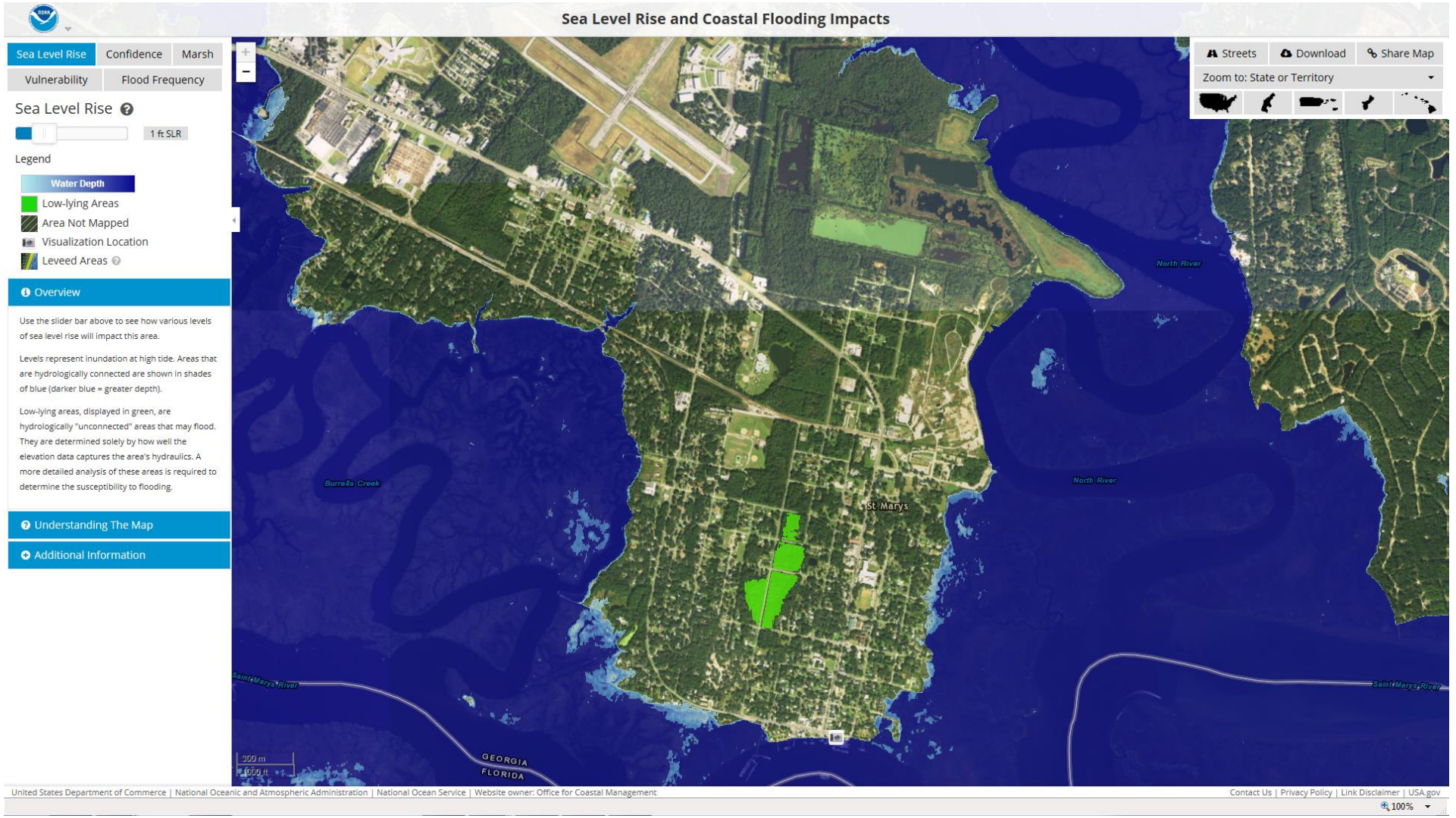
Action: Stormwater backflow preventers and pipe enlargement

~$3 Million Investment

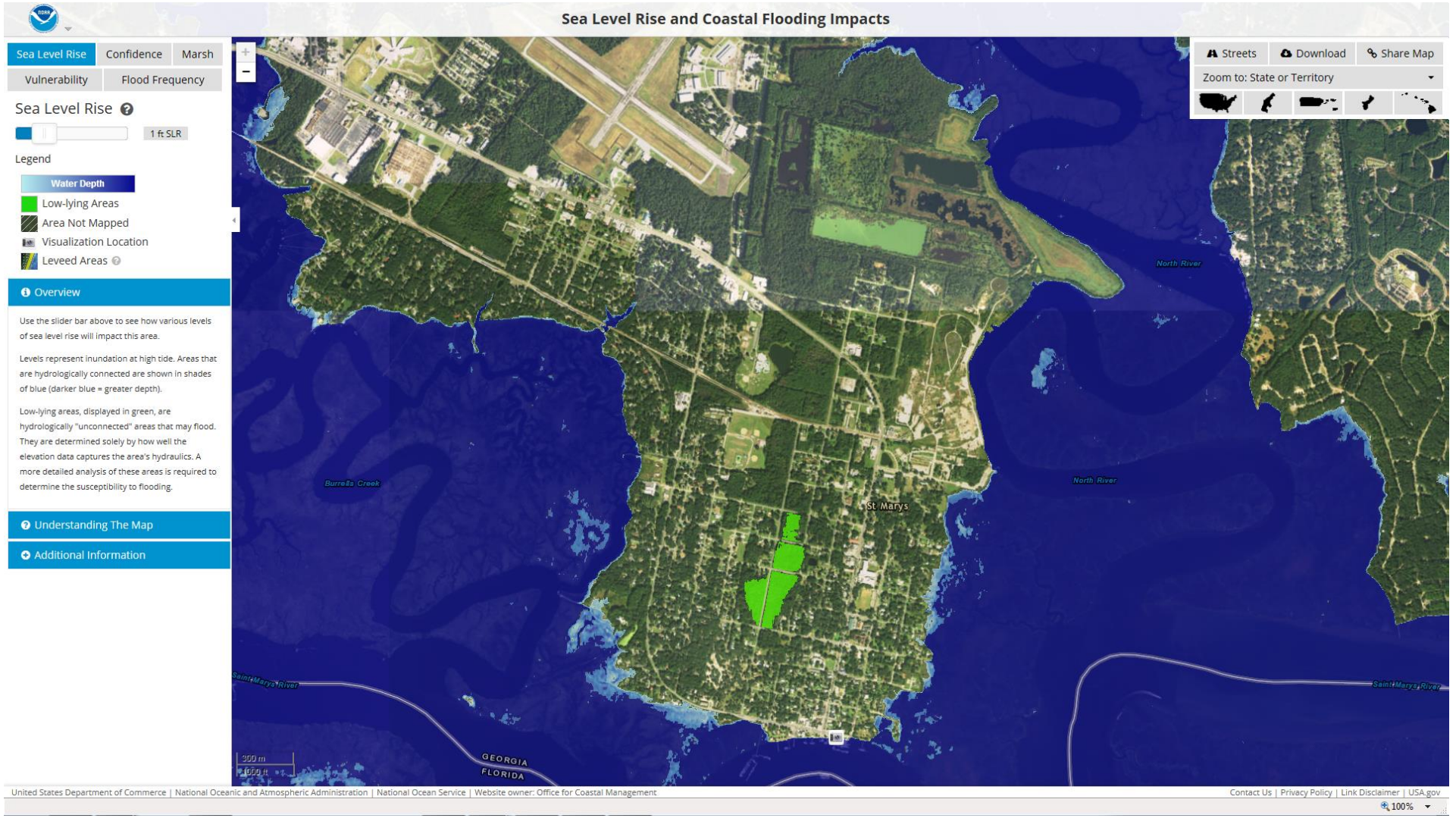
L BACKFLOW PREVENTERS, NEAR INTERSECTION OF 14TH ST. AND VENETIAN DR.

St. Marys, GA: Mean Higher High Water, Today

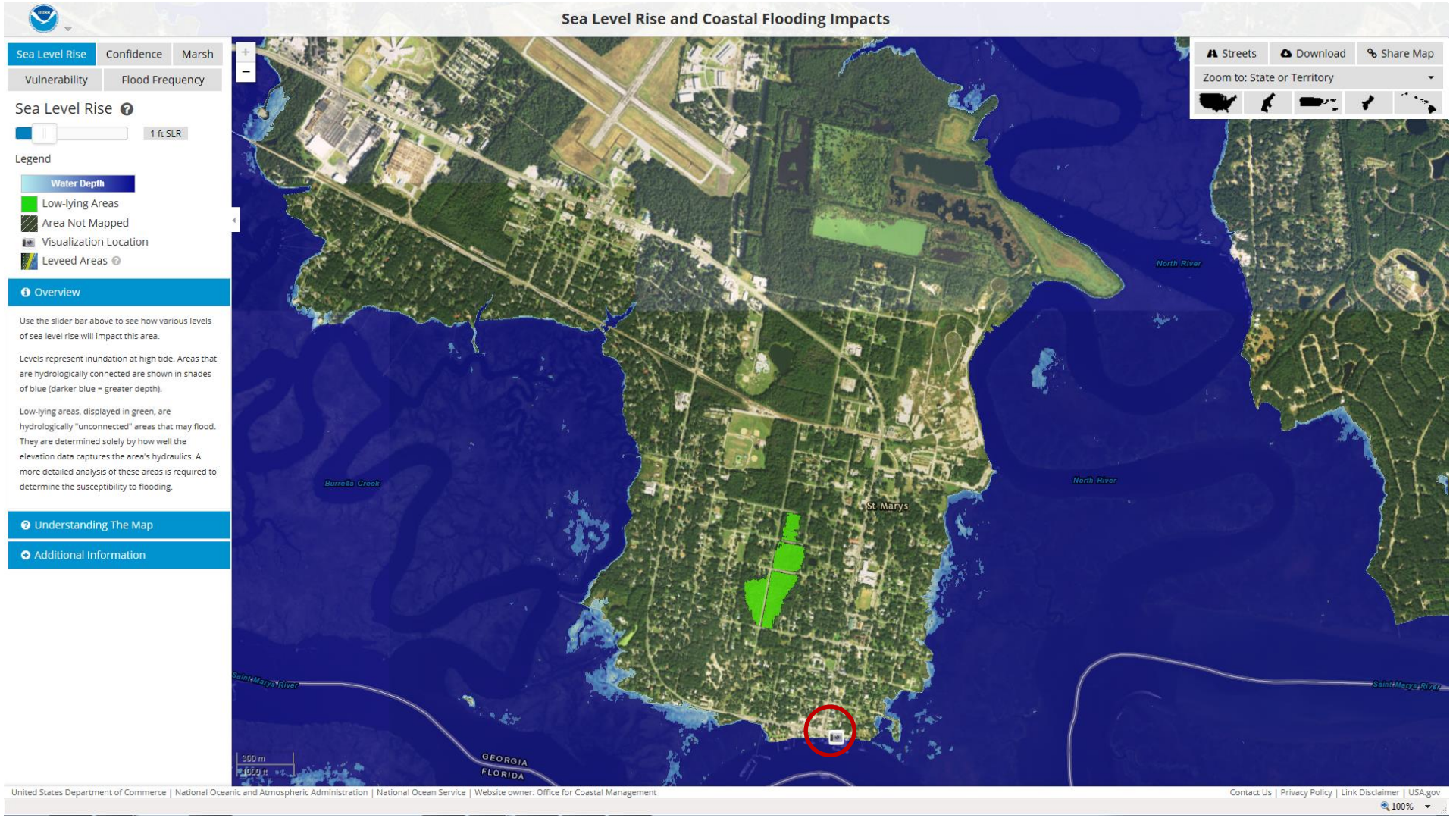
St. Marys, GA: Mean Higher High Water, 1 Foot SLR



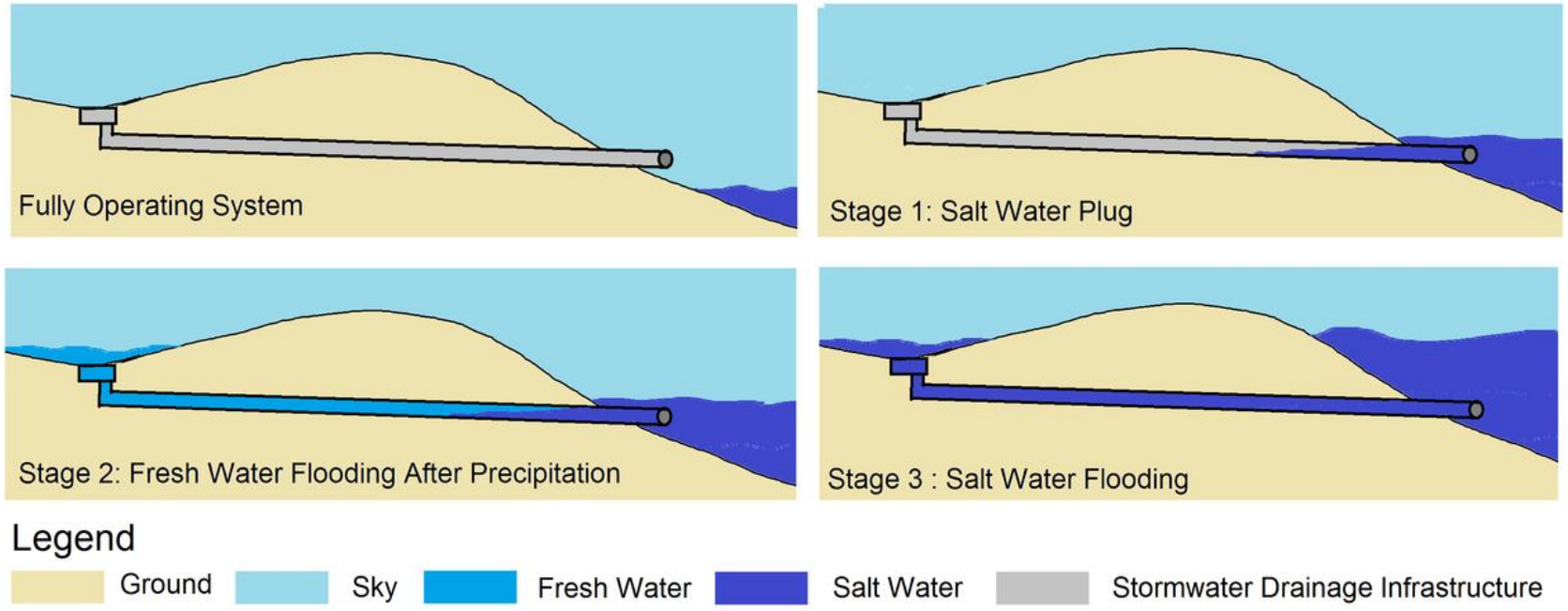
St. Marys, GA: Mean Higher High Water, 2 Foot SLR



St. Marys, GA: Mean Higher High Water, 2 Foot SLR



Stages of stormwater failure with sea-level rise



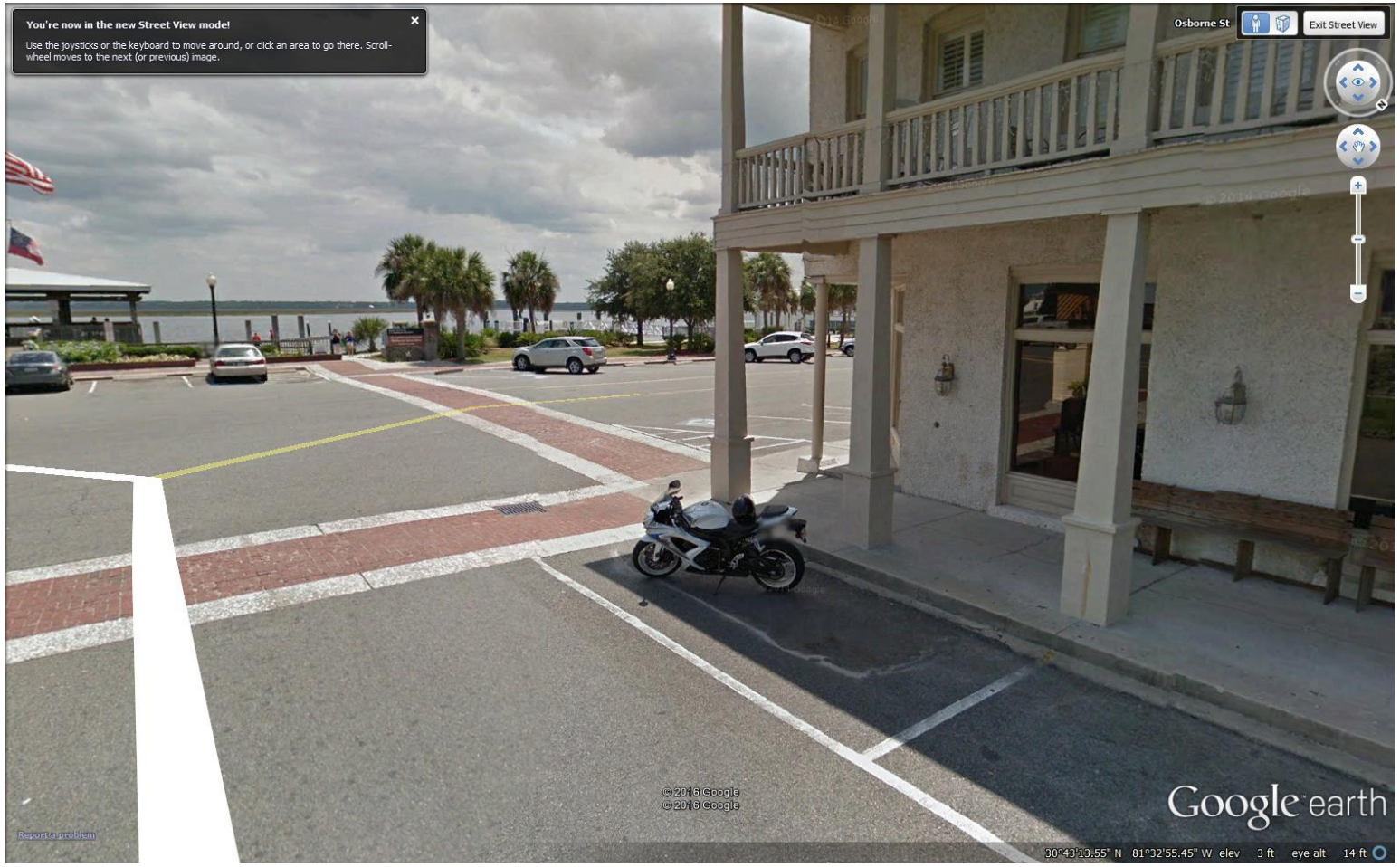
Graphic by Emily Niederman, Stetson University

Osborne Waterfront Stormwater Drainage

St. Marys, GA

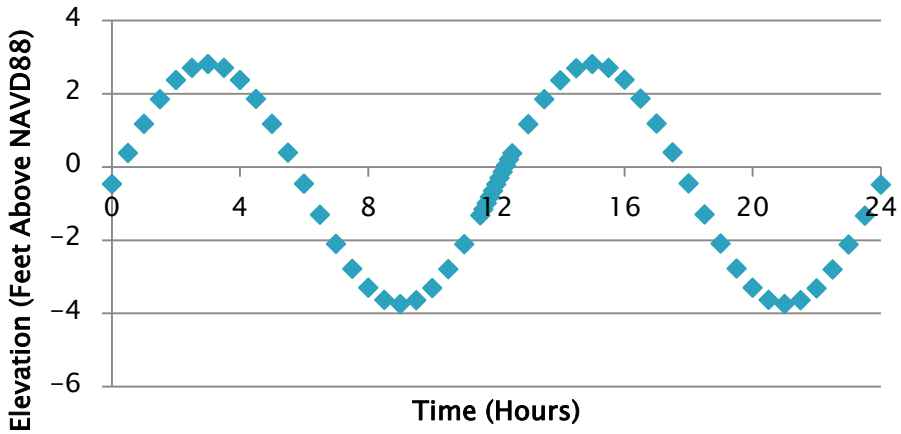
Osborne Ave., St. Marys, GA (Facing North)

Osborne Ave., St. Marys, GA (Facing South)

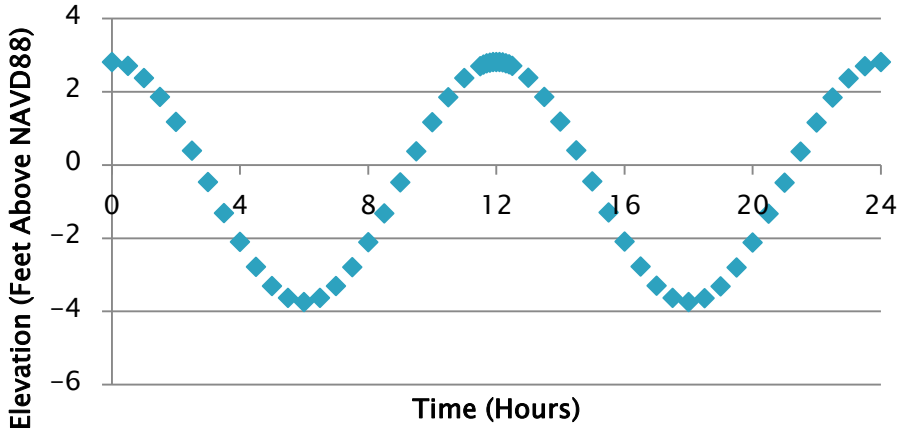


Idealized Tidal Scenarios (24-Hour Rainfall Event)

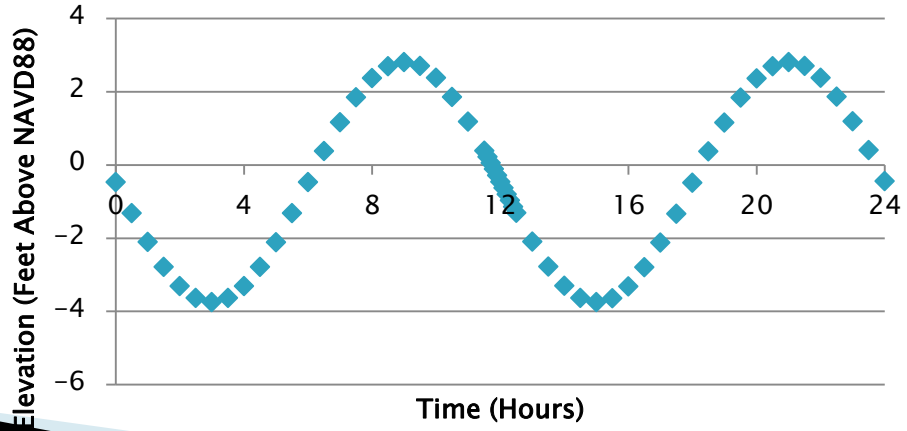
Sine Tide



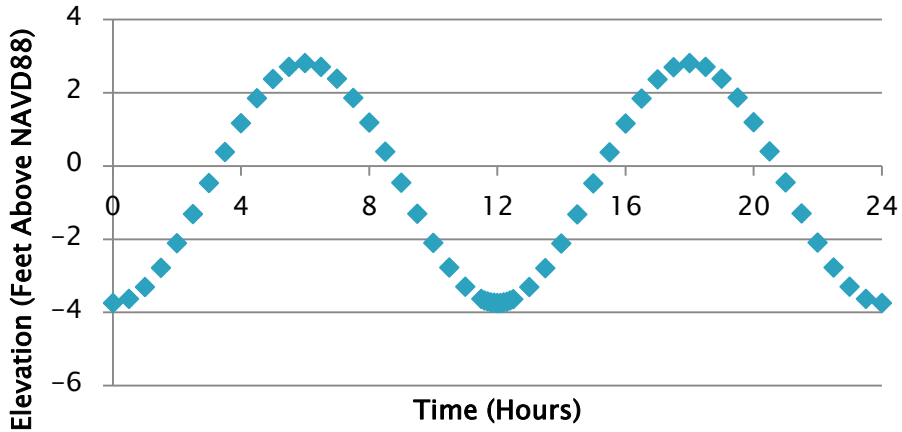
Cosine Tide

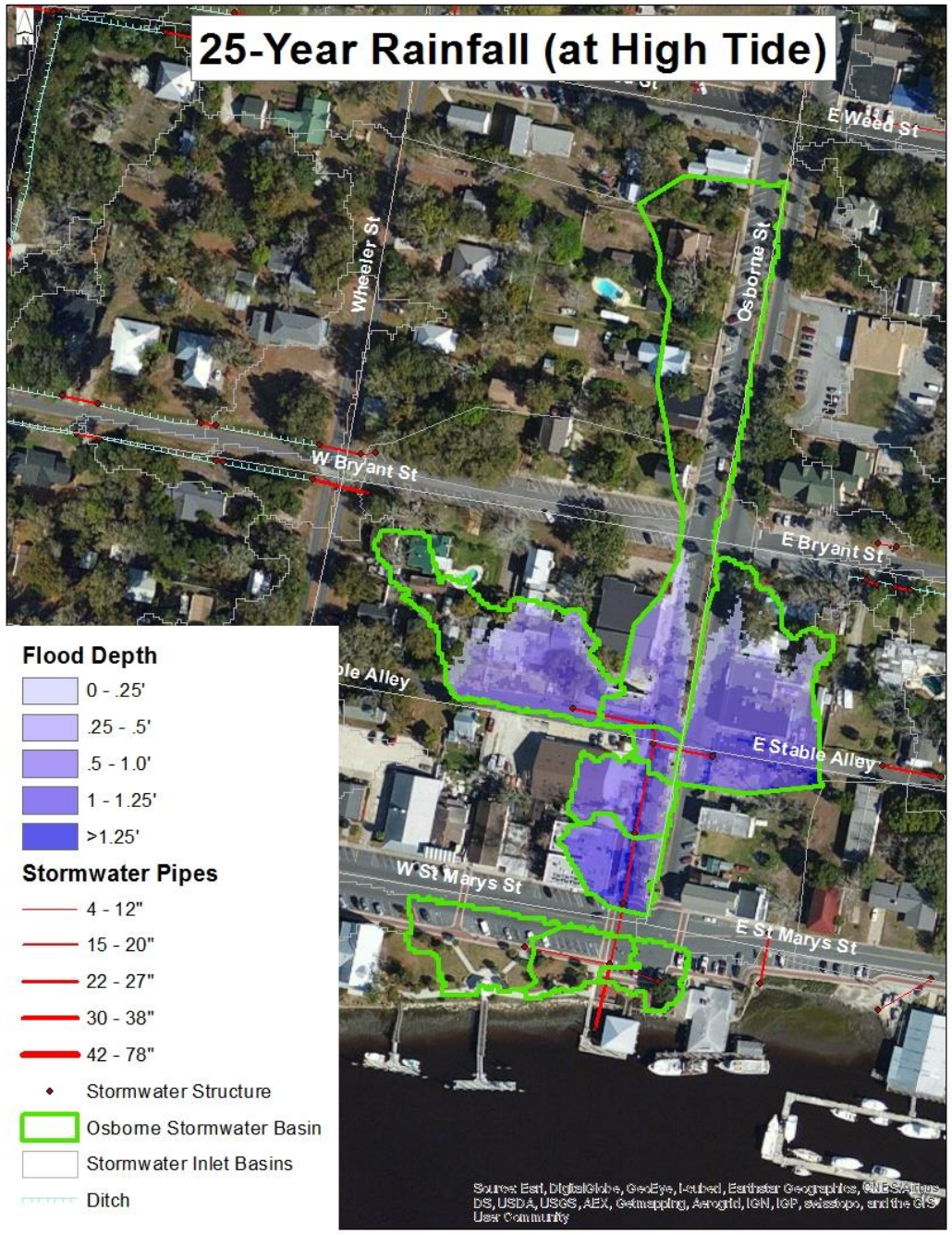


Negative Sine Tide



Negative Cosine Tide





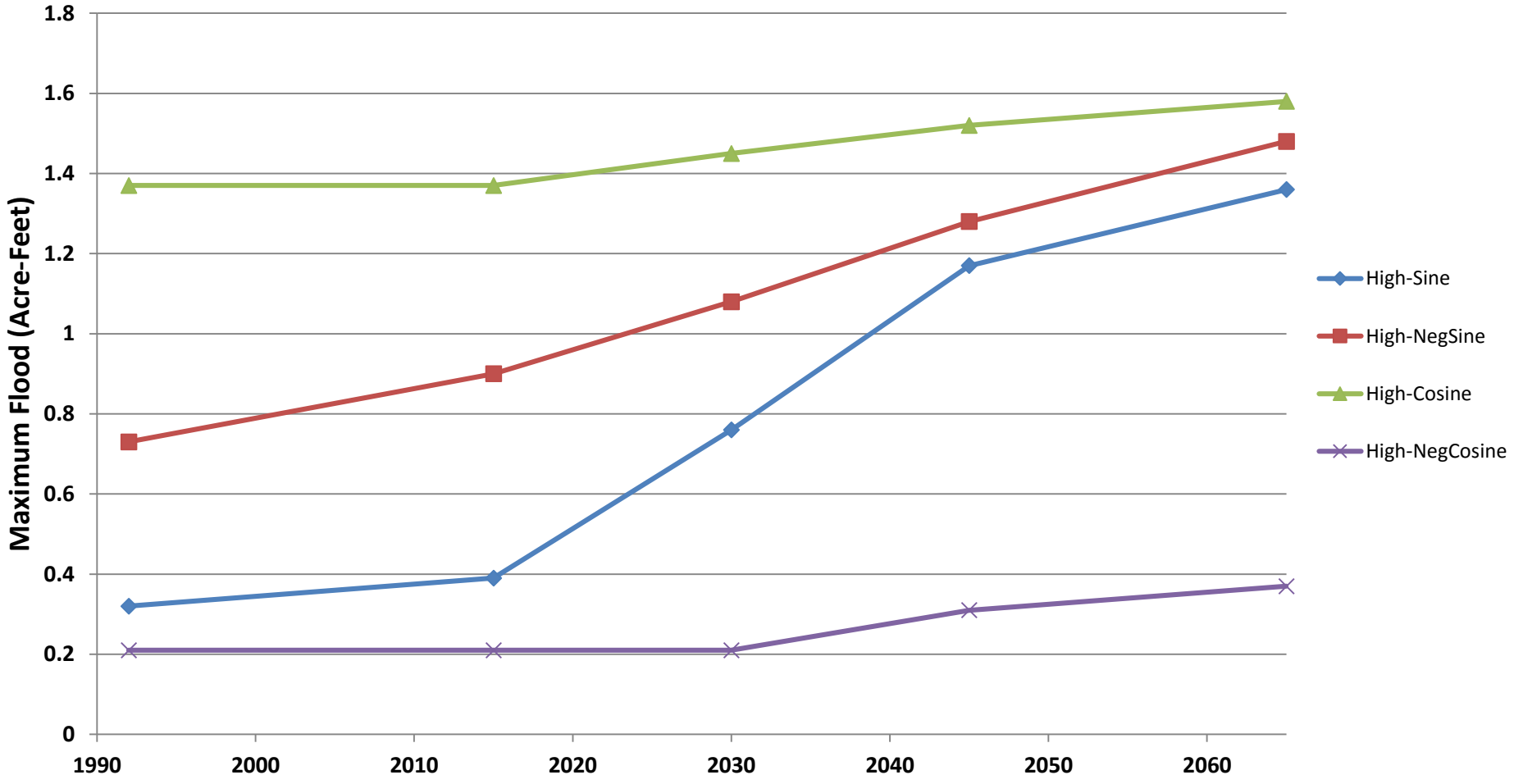
Osborne Waterfront Stormwater Drainage

St. Marys, GA

25-Year Rainfall with Peak Flow at High Tide

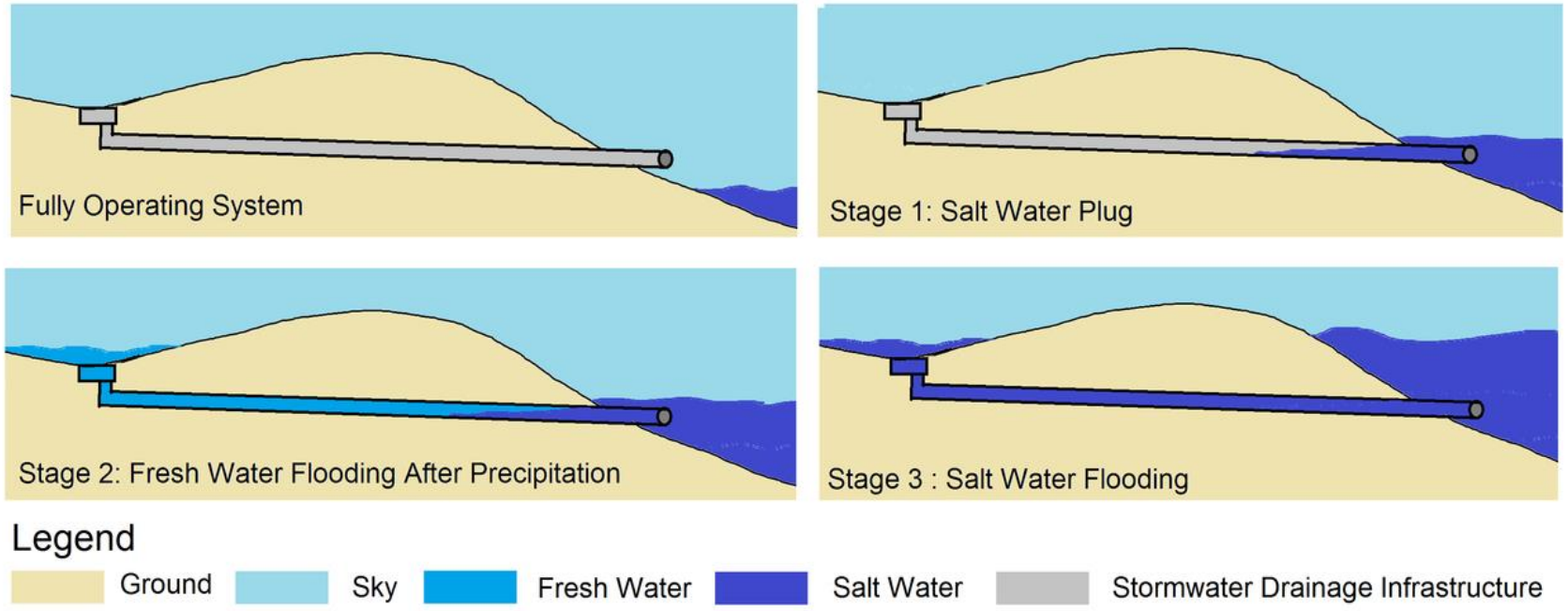
(Cosine Scenario)

25-Year Rainfall* Max Drainage Volume Deficit with High Sea Level Rise (Osborne Drainage, St. Marys, GA)



*9.05" in 24-Hours

Stages of stormwater failure with sea-level rise



Graphic by Emily Niederman, Stetson University

Stages of stormwater adaptation

1) Systematically documenting stormwater drainage failures, such as street flooding
2) Digital mapping of storm
   a) Outfall and infall points
   b) Pipe extents
   c) Invert elevations
3) Near-term retrofits – "du
   a) Backflow preventers
   b) Decrease run-off coefficien
4) Long-term retrofits
   a) Increase pipe sizes
   b) Green infrastructure
   c) Pumps

More expensive further down the list!

Long-term and dedicated funding mechanisms very much implied

Modeling: More Accurate by the Day Policy Framing: Much More Difficult

What is an appropriate level of service for maintaining stormwater and roads under sea level rise?

Cost of upgrades and maintenance for elevation of road bed, improved drainage, pumps, etc.?

How much are citizens willing to pay for enhanced stormwater and road service?

What thresholds may make a public road no longer viable from an economic and/or engineering perspective?