

# **Flood Protection Level of Service Assessment for C7 Basin**

Sponsored by: FEMA & SFWMD

Conducted by: SFWMD, ADA Consulting, Deltares and Rand

With Support from: Miami-Dade County and Municipalities in the C7 Basin

March 24 2017 presentation to stakeholders in the C7 Basin

# Flood Protection Level of Service Program

- Purpose of Flood Protection Level of Service program is to identify and prioritize long-term District infrastructure needs.
- Level of Service projects provide a process to establish flood protection thresholds for each basin. These thresholds initiate retrofit and other adaptation efforts.
- Adaptation will be coordinated with the annual structure maintenance program



# Flood Protection Level of Service: C-7, C-8 and C-9 basins

## ➤ Purpose

- Determine the existing Flood Protection Level of Service for C-7, C-8 and C-9 basins
- Determine the future Flood Protection Level of Service for three sea level rise scenarios
- Develop flood protection strategies with Miami-Dade County and develop FEMA Local Mitigation Strategy (LMS)
  - Project Cost (Fiscal year 2016-2017)
    - \$300,000 FEMA
    - \$150,000 SFWMD cost share



# Project Milestones

- SFWMD Structure Operations Atlas
- Assessment of existing level of flood protection
- Assessment of 2065 level of flood protection assuming no infrastructure changes
- Identification and assessment of alternate flood protection mitigation strategies
- Development of Local Mitigation Strategy document



# Risk Assessment [process]

**PRE-MEETING:**  
Requirements and data compilation, local government, citizen engagement, clarify partnership roles, identify potential measures

**Deep Uncertainty Analyses**

**MEETING #1:**  
Develop Adaptation Strategies  
(Robust Decision Making Process)

**MEETING #2:**  
Analyze Strategy timing, sequencing, components, costs, benefits  
(Dynamic Adaptation Policy Pathways)

**Adaptation Policy Plan – options, timing, financial needs**

**Implementation**

- infrastructure improvements (LMS)
- policy and regulatory changes
- refine / monitor implementation thresholds
- funding options

# Adaptation Strategy Evaluation [tools]

**Flood Drivers**

Rainfall Coastal Storm Surge Sea Level Rise

**IMPLEMENTATION SCENARIOS: DRIVEN BY MODELS**

Suite of 16 Simulations – 4 rainfall x 4 sea levels

- Initial Run – No Action Strategy (Current Infrastructure)
- Subsequent Runs – Adaptation Strategies (Defined by strategy evaluation process)

C7 XPSWMM

Level of Flood Protection

Damage Assessments

(modify model as needed)

Strategy Evaluation

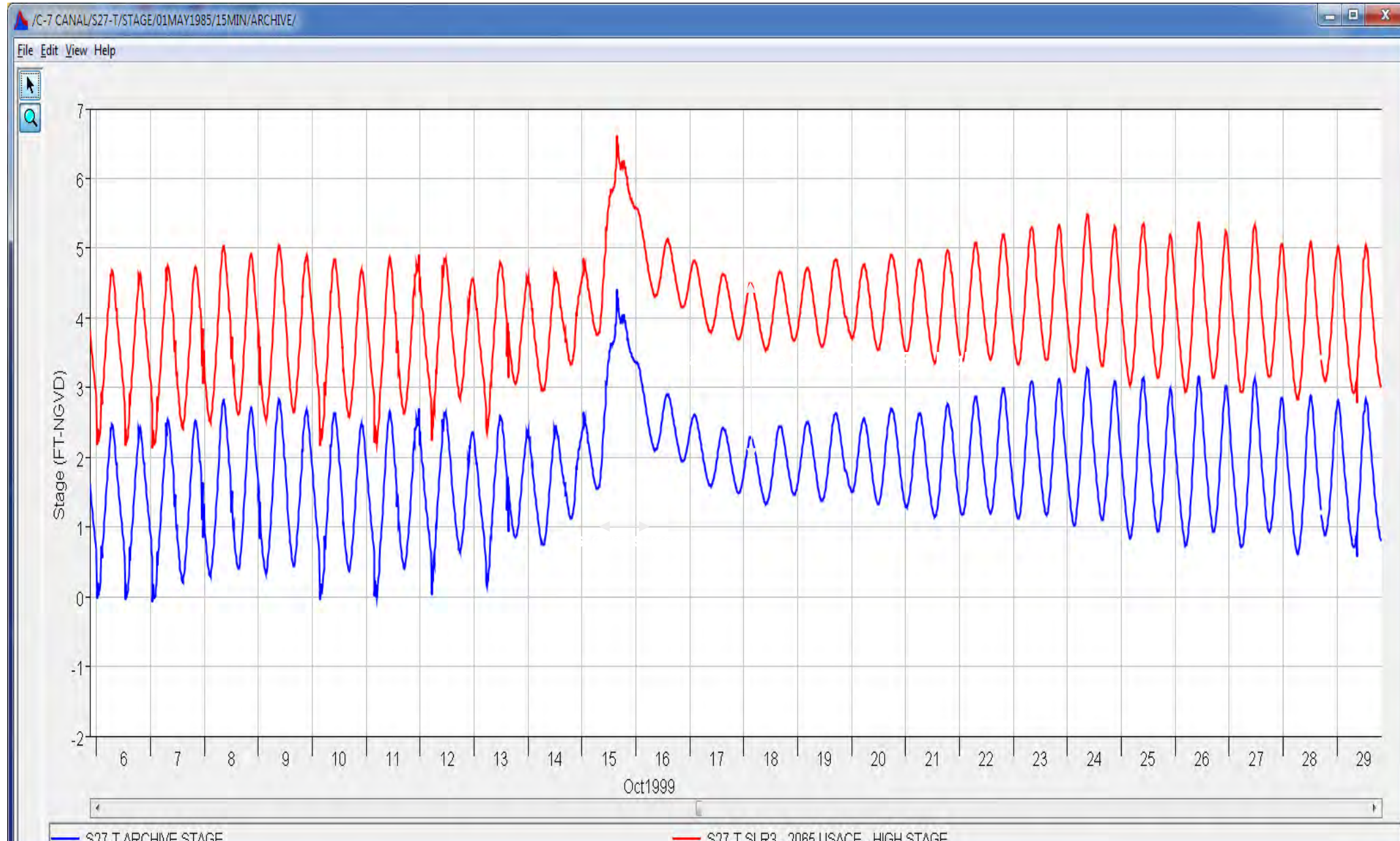
# WORK PROCESS

# Preliminary Results of Sea Level Rise Flood Modeling

March 24 2017 presentation to stakeholders in the C7 Basin

# Why does Sea Level Rise cause flooding upstream of S-27?

10-year  
Storm Surge  
at S27  
Tailwater:  
CSL and  
SLR3

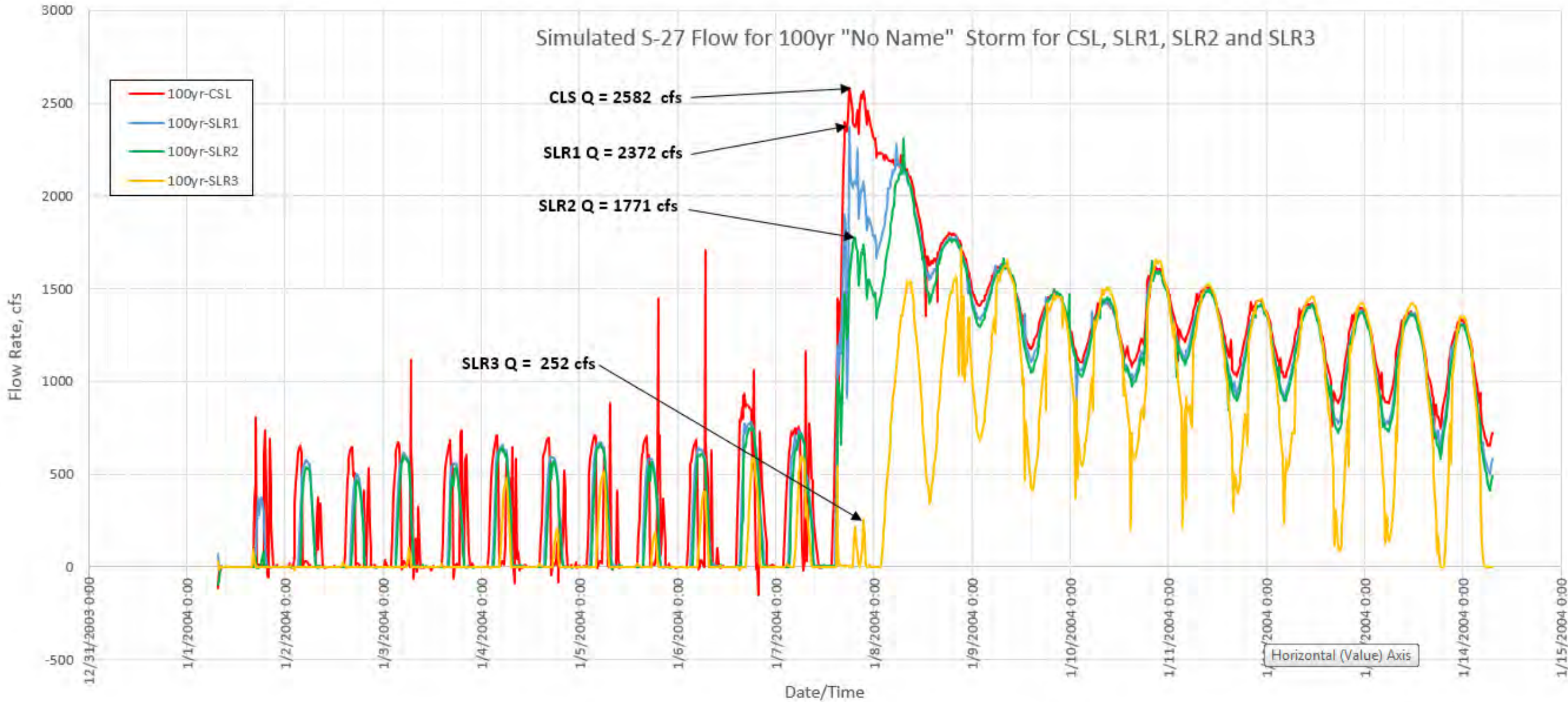


# Preliminary Modeling Assumptions:

- 5-year, 10-year, 25-year, 100-year Rainfall volumes  
    [only 100-year rainfall events presented today]
- Rainfall Pattern of the Oct 2000 No-Name Event
- No-Name Storm Surge (10-year return period)
- October Average Groundwater (no effect of sea level rise on groundwater in these preliminary results)
- Four Sea Level Thresholds:
  - Current Sea Level (CSL)
  - SLR1 (+0.76 ft)
  - SLR2 (+1.09 ft)
  - SLR3 (+2.21 ft)
- NO BACKFLOW FROM OCEAN TO BASIN

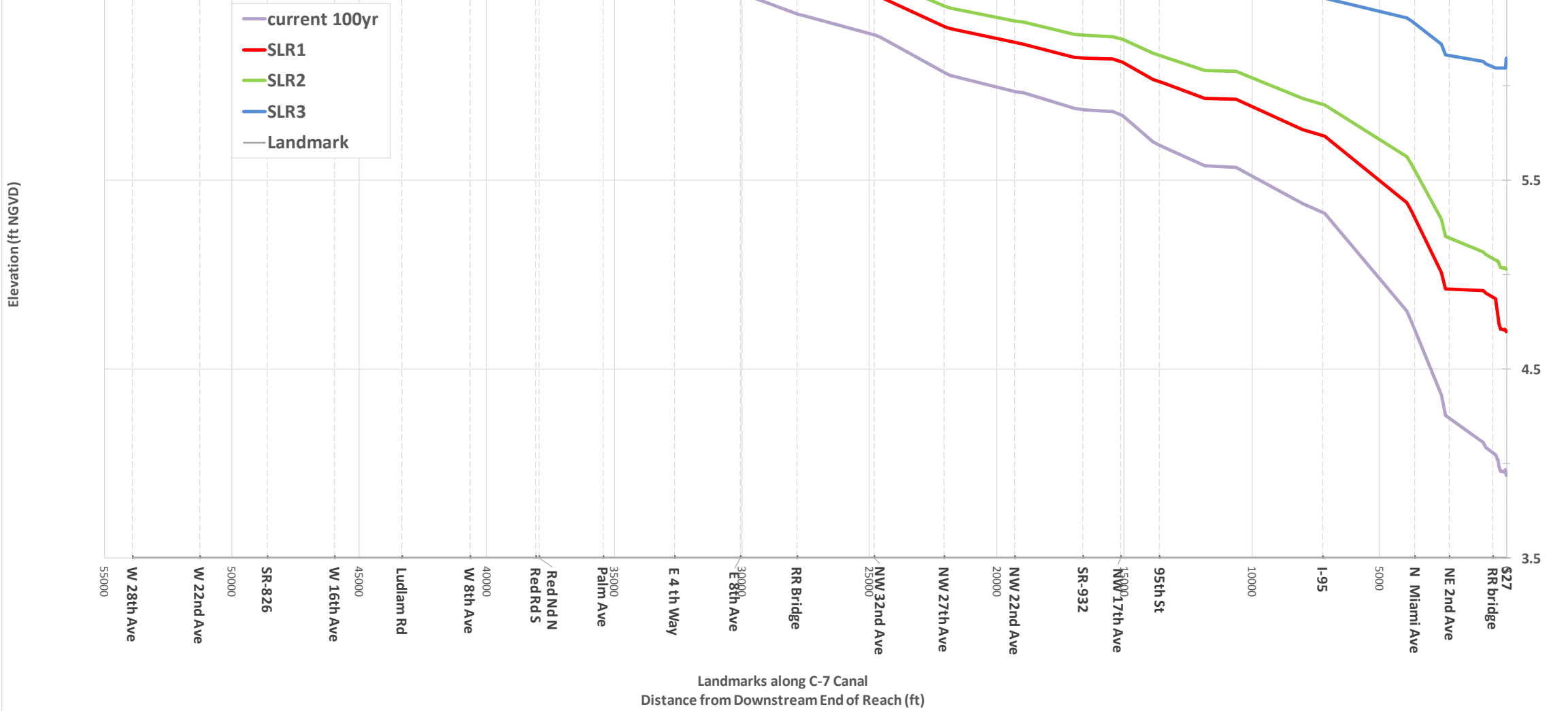


# Flows at S27



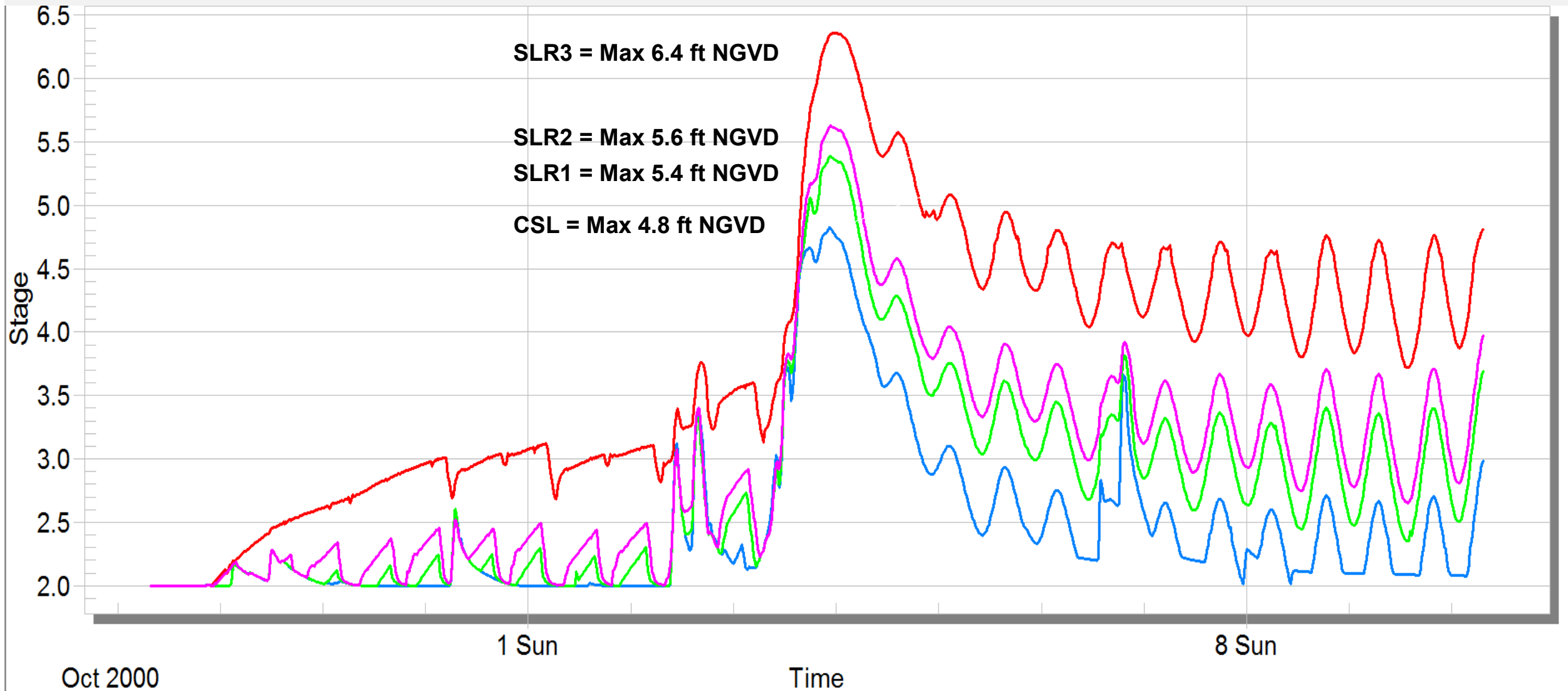
# CANAL PEAK STAGE PROFILES

C7 Canal Current Infrastructure & SLR1,SLR2,SLR3  
Maximum Water Surface Profile  
100-year storm events and 10-year surge event



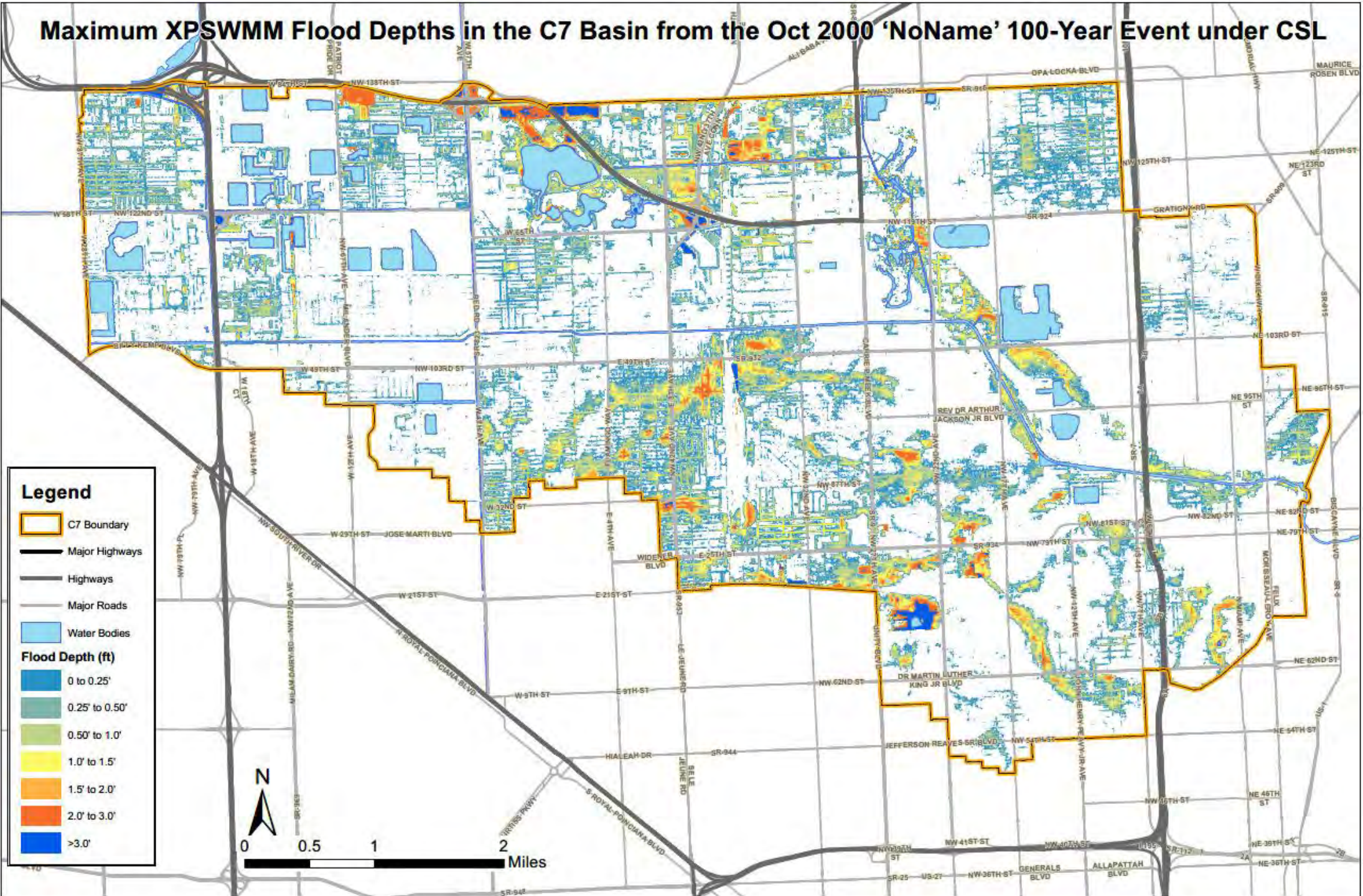
Landmarks along C-7 Canal  
Distance from Downstream End of Reach (ft)

# Computed peak stages for the 100-y Rainfall with 10-yr Surge for CSL, SLR1, SLR2 and SLR3 Sub-basin C7-S-16



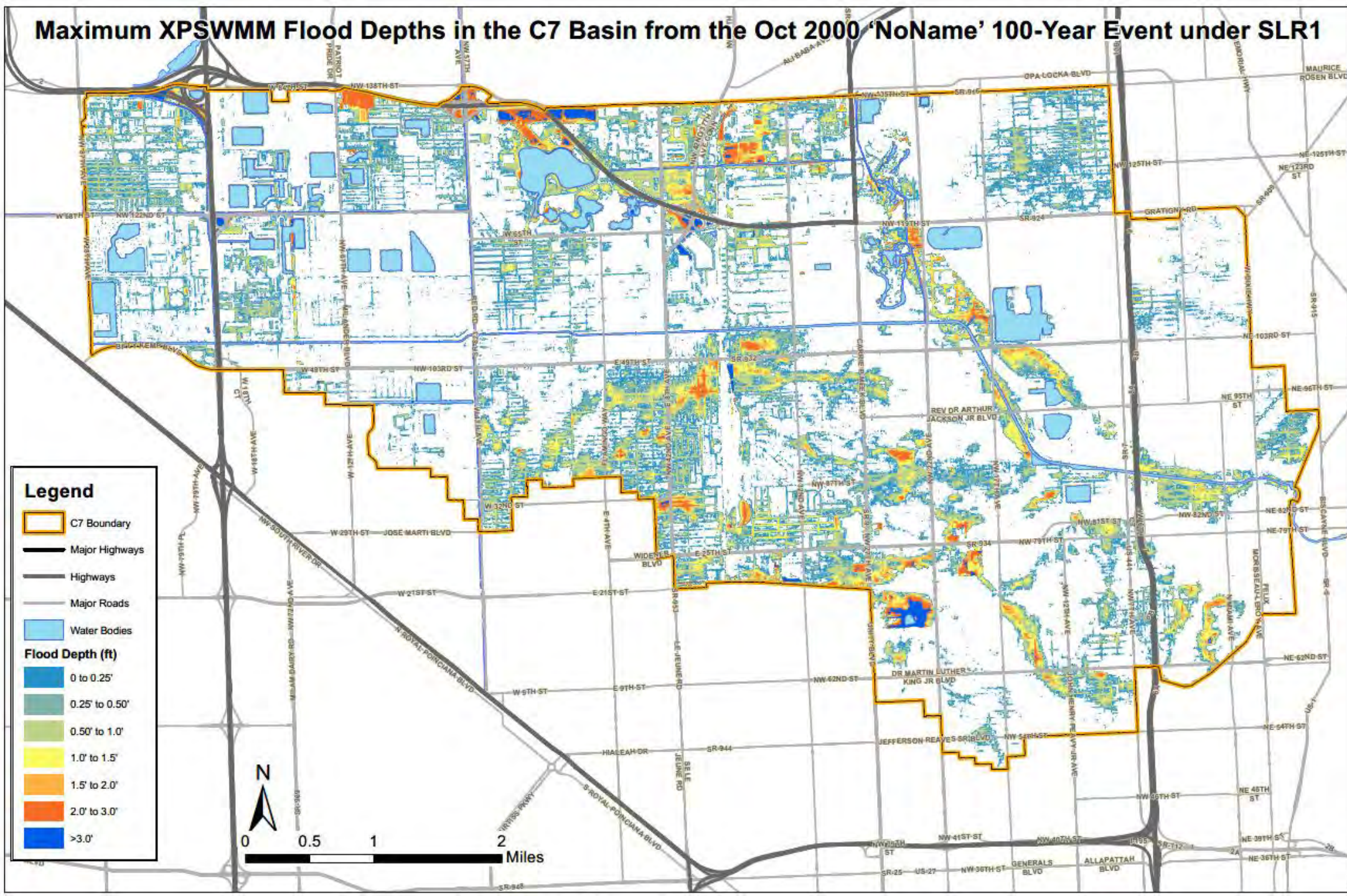
# Maximum XPSWMM Flood Depths in the C7 Basin from the Oct 2000 'NoName' 100-Year Event under CSL

Current  
Sea  
Level



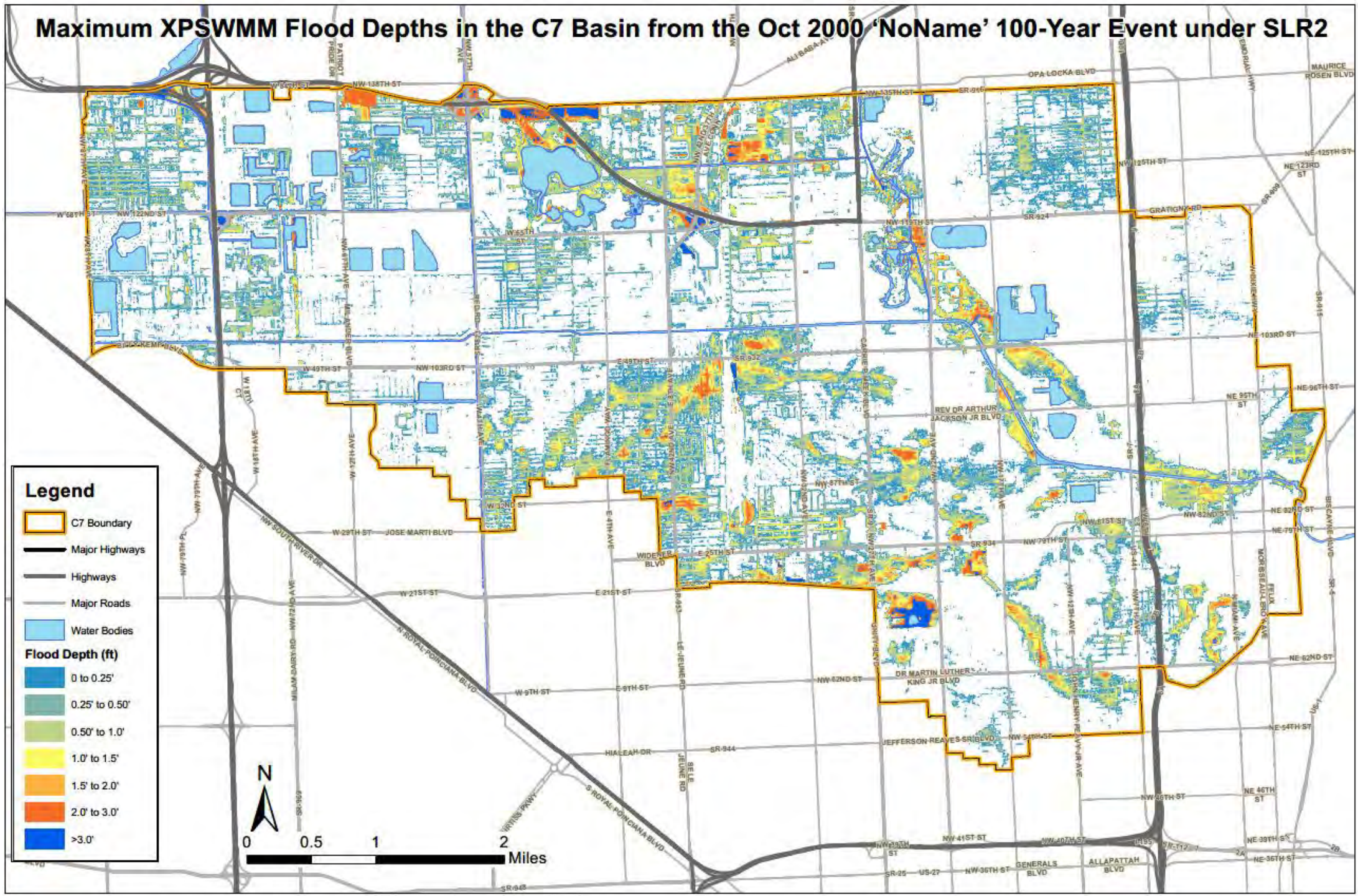
# Maximum XPSWMM Flood Depths in the C7 Basin from the Oct 2000 'NoName' 100-Year Event under SLR1

**SLR1  
=  
CSL  
+  
0.76 feet**



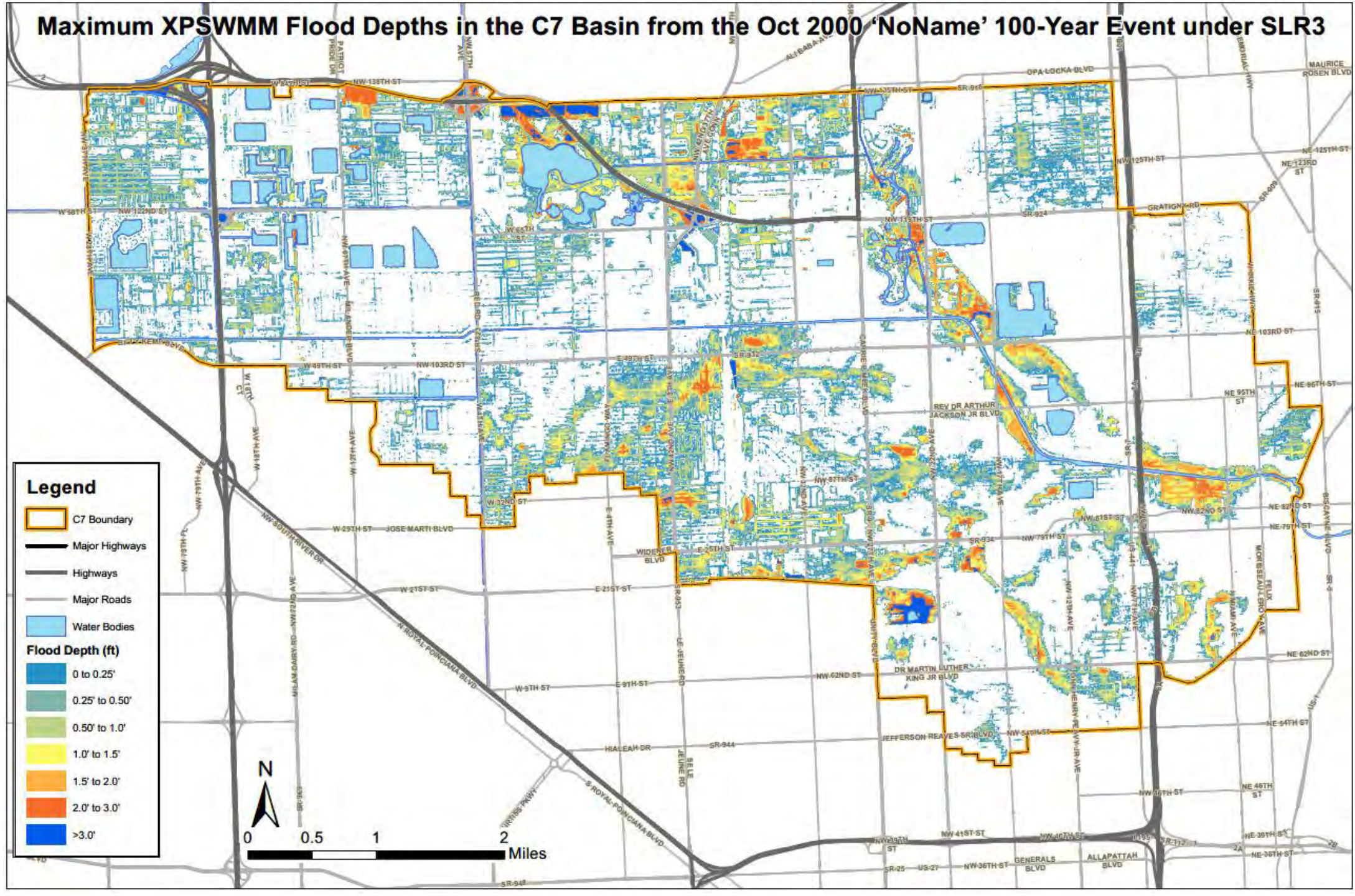
# Maximum XPSWMM Flood Depths in the C7 Basin from the Oct 2000 'NoName' 100-Year Event under SLR2

**SLR2  
=  
CSL  
+  
1.09 feet**



# Maximum XPSWMM Flood Depths in the C7 Basin from the Oct 2000 'NoName' 100-Year Event under SLR3

**SLR3  
=  
CSL  
+  
2.21 feet**

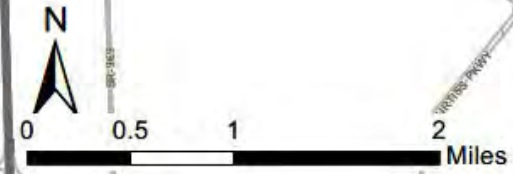


**Legend**

- C7 Boundary
- Major Highways
- Highways
- Major Roads
- Water Bodies

**Flood Depth (ft)**

- 0 to 0.25'
- 0.25' to 0.50'
- 0.50' to 1.0'
- 1.0' to 1.5'
- 1.5' to 2.0'
- 2.0' to 3.0'
- >3.0'



## FLOOD MITIGATION STRATEGIES FOR CONSIDERATION

- Improve Storm Surge Protection
- Maintain basin discharge while sea levels rise
- Land-use Change
- Implement operational strategies at S27 structure to maintain flood protection as sea levels rise
- Maintain canal conveyance while sea levels rise
- Increase basin storage





## STRATEGY: Improve Storm Surge Protection

- Raise elevation of tie-back levees (bypass elevation now 4 ft) and also raise overflow elevation of S27 structure (now at 5 ft?)



## **STRATEGY: Maintain basin discharge while sea levels rise**

- Add pumps at S27:
  - Full-service pumps (replace S27 spillway) OR
  - Booster pumps (like the pumps at S25b and S26 structures)
- Redesign structures to operate with lower head differential (current differential is 0.5 ft)
- Deep well injection of flood waters
- Divert portion of flood waters to adjoining C6 and C8 Canals. Discharge to WCA1 via the C6 canal might be possible but would require treatment and back-pumping.



## STRATEGY: Land-use Change

- Bring in dirt to raise ground elevations in high-risk flood prone areas (need to consider the potential loss of conveyance if area is in flow way)
- convert high-risk flood prone areas to different land-use (parks, marsh, ... ) to limit flood damage
- reduce impervious surface areas
- increase on-site infiltration & ET



## **STRATEGY: Implement operational strategies at S27 structure to maintain flood protection as sea levels rise**

- Implement pre-storm drawdown to increase groundwater storage:
  - using gravity drained local drainage systems (slow, probably would require a change in the wet-season water control level for the basin to provide significant increase in storage)
  - using municipal pumping facilities (faster, but may require pump at S27 to provide significant increase in groundwater storage)



## **STRATEGY: Maintain canal conveyance while sea levels rise**

- Raise water levels in canal so that runoff still occurs even though sea levels are raised
  - Add flood levees along critical sections of C7 canals
  - Add municipal pumps to provide local drainage behind the levees (efficiency of pumps should consider return flow from C7 canal back into local drainage system)
- Widen canal and remove constrictions
- Add a new water control structure in the C7 canal to protect vulnerable downstream areas



## **STRATEGY: Increase basin storage**

- Interconnect and actively manage water levels in larger lakes
- Add stormwater reservoir (like the C4 stormwater reservoir)

