Know the Flow – Regional Water System and Sea Level Rise

Tommy Strowd, P.E. - Lake Worth Drainage District
Jeff Kivett, P.E. – South Florida Water Management District

Stormwater Management Workshop
SE Climate Compact
January 22, 2015
Water Management is a Daily Balancing Act
Central and Southern Florida Project for Flood Control and Other Purposes

- Authorized in 1948
- Designed for multiple purposes
  - Flood Control; Water Supply; Navigation; Prevention of Saltwater Intrusion; Protection of Fish & Wildlife
- Constructed by the U.S. Army Corps of Engineers between 1950 and 1970
- Operated by the South Florida Water Management District
Three-Tiered System

- **Primary**
  - USACE
  - SFWMD

- **Secondary**
  - Local Governments
  - Special Districts

- **Tertiary**
  - Home Owners Associations
  - Private Land Owners
Canal / Groundwater Interaction

Canal stages held lower to facilitate surface drainage of urban & agriculture lands

Long-term low canal stages depress regional groundwater levels
Dual Role of Primary Canals

Canal stages held high to facilitate groundwater recharge and assist supplemental irrigation

Low groundwater levels due to low, dry season rainfall
C&SF System:
1950s Planning Assumptions versus now!

This area was assumed to remain agricultural (& dairy)

Only area assumed to be urban
Surface Water Regulation

- Enhanced benefit of the C&SF system by limiting inflows to avoid overwhelming the system
- Requires water storage systems for new development to limit storm flows into the primary canal system
- This insures that no increase in the peak rate of flow is discharged to the canals after development occurs
  - Has been a key in avoiding having to increase canal capacity over time (unlike the highway system)
Stormwater Permitting Considerations

- Water Quality Considerations
- Allowable Discharge

Houses

Lake

Control Structure

Secondary canal

Weir

1 inch of runoff

Bleeder
Potential Impacts of Sea Level Rise on Water Management

- Flood Protection (flooding, storm surge, interior flooding, hurricanes, coastal structures)
- Drinking Water Supply (saltwater intrusion, freshwater wells)
- Natural Environment (Southern Everglades, coastal wetlands)
Potential Implications of Sea Level Rise on Flood Protection: Salinity Barriers
What could happen when the primary system capacity is limited: Flooding
Coastal Water Control Structures

Regional Coastal Water Control Structures
water levels across the state
Why Broward situation is more complex?
(Communities east of SFWMD structures)
Know the Flow – Regional Water System and Sea Level Rise

Tommy Strowd, P.E. - Lake Worth Drainage District

Jeff Kivett, P.E. – South Florida Water Management District

Stormwater Management Workshop
SE Climate Compact
January 22, 2015
Adaptation – Basin Scale

Everglades Restoration

Impoundments & Pumps ("Room-for-the-River")

Pre-storm drawdown

Forward Pumps

Green Infrastructure (+SF Resilient Workshop ideas)

Higher Seawalls

Revised Stormwater Permitting Criteria
Adaptation Example: Forward Pumping at S-26 Structure (not so ‘green’!)
Adaptation: Western C-4 Impoundment: Room for storage of excess flood waters

- C-4 Impoundment to excess flood waters temporarily
- Improves flood protection & facilitates recharge
Adaptation: Everglades Restoration

- National Academy of Sciences 2008 report: “Climate change should be a reason to accelerate Everglades restoration, not a reason for delays”
- Everglades restoration is an important adaptation response to sea level rise
- Ecosystem resilience can be enhanced through increased water flows through the Everglades and increased storage
- Increased flows into the southern estuaries will reinstate widespread organic soil formation and maintain the freshwater head in order to mitigate the effects of sea level rise and saltwater intrusion
LOS Program Elements

- LOS Fundamentals
- Assessment Procedure
- Sea Level Rise
- Changing Rainfall

Basin-Scale Assessment Projects:
- LOS modeling for Basin
- Basin Atlas (update)

What is the desirable Level of Service for each feature within a basin?
Change in Water Table: Pumping (decrease) & Sea Level Rise (increase)

Water table increase is not uniform
Tropical Storms & Climate Change

- Tropical cyclones to shift towards strong storms (2-11% intensity increase by 2100)
- Decrease in global frequency of tropical cyclones (6-34%) - recent paper says this will increase!
- Increase in the frequency of the most intense cyclones
- Increase in rainfall rate, 20% within 100 km of storm center
Potential changes in Rainfall Extremes: update Depth-Area-Duration curves?

Uncertainty due to significant model spread!
Pilot Project #1: Pilot (C-2, C-3, and C-4 basins)

- LOS Fundamentals (white paper and modeling guidance)
- Assessment Process (issues, info collection and exchange)
  - Sea Level Rise & Extremes - modeling guidance
  - Rainfall Change - literature review and assessment
- Basin-Scale Assessment
  - Basin Atlas
  - LOS modeling for one Basin
- Lessons Learned
Resilient Redesign Workshop (August 2014)

South Florida
Resilient Redesign

Southeast Florida Regional Compact
Climate Change
Kingdom of the Netherlands

MIAID
Miami Center for Architecture & Design
AIA Miami
A Chapter of The American Institute of Architects

Image of people looking at maps on the floor.
Design Concepts: Dense Urban – Alton Road

- Protective Promenade Drainage System
- Raised streets/infrastructure
- Garden City Master Plan
- Underground storage (incentives)
- Urban Densification

Miami Beach
Design Concepts: Urban – East Dania Beach Boulevard

- Interconnectivity
- City center on coastal ridge
- Multi-purpose natural infrastructure
- Polder flood control
- Dune (barrier island) enhancement with underground parking
Design Concepts: Suburban – Unincorporated Miami-Dade

- Land readjustment (voluntary)
- Restorative wetland park
- New waterfront property
- Floating trailer park
- Courtyard Islands, Town Center, Water Tiles
Questions?