Excellence in Engineering Since 1946
Comprehensive Stormwater Master Plan Introduction and Overview

City of Paducah, KY Commission Meeting

February 28, 2017
Selecting the Team Achieves Confidence in Sound Stormwater and Flood Control Decision-Making

- Firm history brings confidence for successfully-delivered long-term program outcomes
- SA BFW team brings unparalleled local perspective for thorough identification of community concerns
- Stormwater management planning credentials highlight team’s ability to deliver an effective capital improvements implementation program
- Work plan approach results in integrated solutions that recognize unique system characteristics
- Collaborative CSMP Approach leads to affordable and implementable action plan
Comprehensive Stormwater Master Plan is Key to Addressing Community Flooding Concerns

- 5 Major Watersheds
- Ohio River
- Flash Flooding
- Riverine Flood Influences
- Community Well Being
Rainfall Data Supports Flood Frequency Trends

Historical Rainfall Trends in Paducah

- Local influences
- River-induced influences
- Recurring events
- Homes and businesses
Conveyance System Review Provides Foundation for Problem Area Understanding

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STORMWATER SYSTEM EVALUATION NEEDS:

- Size, Type & Locations – Build Upon Current GIS System Mapping
- Condition Assessment – CCTV Program to Identify Deficiencies
- System Capacity/Level of Service – Stormwater Modeling
LIDAR Mapping Uncovers Topographic Opportunities and Constraints

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**AREAS WITH FLAT LOWLAND TOPOGRAPHY**
- Heavily Urbanized, Limited Open Space
- Presence of Combined Sewer Systems
- Lack of Positive Overland Flood Routes
- Reliance on Pumping for Conveyance During High River Levels

**AREAS WITH STEEP UPLAND TOPOGRAPHY**
- Rapid Storm Response
- Portions are Located Outside of the City
- Potential for Future Development
- Flooding Problems Due to Lack of Adequate Floodplain Conveyance
Floodwall Protected Areas Vulnerable to Multiple Flood Risks

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Floodwall Protection:
~11,000 acres
~20,000 people
~$1.2 billion in assets

Floodwall Murals at Kentucky Ave.
Recently Sliplined Culverts at Noble Park Outfall
Combined Sewer System Areas Present Unique Partnering Considerations

CHALLENGES | RESPONSE
--- | ---
Capacity and Condition of Existing Stormwater Systems | Targeted Evaluations Stormwater System Conditions
Steep Upland Topography, Flat Lowland Topography | Watershed Evaluation Process
Floodwall Interior Drainage, Stormwater Pump Stations | Comprehensive Watershed Modeling
Combined Sewer System Areas | Implementation of Win/Win Partnership Opportunities

• Separate System
• Combined System

“Collaboration: Key to Holistic Approach”
Managing Expectations Key to Development of Feasible Solutions

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**CURRENT LEVEL OF SERVICE**

**TARGET LEVEL OF SERVICE**

Potentially Impacted Properties

Flood Reduction Benefits for Range of Storm Events – Winnetka, IL
**Cost-effective Solutions Foster Support for Financial Commitments**

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**POTENTIAL STORMWATER FUNDING OPTIONS:**

- General Fund Revenues
- Stormwater Utility Fees
- Debt Financing
- Grants/Low Interest Loans
- Hazard Mitigation Grant Program (FEMA)
Misguided Public Perception Requires Carefully Planned Outreach Efforts

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<td>Public Education &amp; Support</td>
<td>Tailored Public and Stakeholder Engagement Process</td>
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Citizen Questionnaires

Public Open House – Stormwater Modeling Results Validation

City Commission Input Session
Firm History Brings Confidence for Successfully Delivered Long-term Program Outcomes

- 70 years of service
- 380 employees
- 2 Kentucky offices
- 11 total locations
- Many specialties, including Community Master Planning
Project Team Brings Unparalleled Local Perspective for Thorough Identification of Community Concerns

- Problem area identification
- Data collection
- Asset management
- Watershed evaluations
- H & H modelling
- Combined sewer system
- Flood PS & floodwalls

### Project Manager
Michael Woolum, P.E., P.L.S.

### Principal-In-Charge/Senior Planning Advisor
John Lyons, P.E.

### Technical Quality Control
Mark Shubak, P.E.

### Assistant Project Manager & Local Client Liaison
Kenny McDaniel, P.E.
CSMP Credentials Highlight Ability to Deliver an Effective CIP Implementation Program

- Watershed Characteristics
- Future Growth
- Design storm(s)
- Event-based Calibration
- Improvement Strategies
- Costing Methodology
- Prioritization Techniques
Major Community Master Planning Achievements Demonstrate Know-how for Getting the Job Done’

- STREAM STABILITY
- WQ/5R/MS4
- ASSET MANAGEMENT
- FLOODING

Holistic Stormwater Management Plan

- Cost-Effective
- Multi-Benefit Solutions
- FEMA Funding
- DRA Funding

Northeast Ohio Regional Sewer District

Village of Winnetka

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

FAVETTE URBAN COUNTY GOVERNMENT CORPORATION OF KENTUCKY
Extensive XP-SWMM Experience Provides City Confidence in Our Stormwater Modeling Results

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<tr>
<th>XP-SWMM Modeling Experience</th>
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<tr>
<td>Cincinnati MSD, OH – Lick Run Watershed Design</td>
<td>✦</td>
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<td>N. KY SD1 – Boone County – Upper Woolper Creek Watershed Analysis</td>
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<td>Dubuque, IA – Upper and Lower Bee Branch Creek Restoration</td>
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<td>Frankfort, KY – CSO LTCP</td>
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<td>Galena, IL – Downtown Stormwater Pumping Station</td>
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<tr>
<td>Jeffersonville, IN – Downtown Canal Project Feasibility Study</td>
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<tr>
<td>Kenosha, WI – Forest Park Area Stormwater Management</td>
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<tr>
<td>Madison, WI – Willow Creek Watershed</td>
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<tr>
<td>N. KY SD1 – Woodlawn Creek Watershed Drainage Improvements</td>
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<td>Columbus, OH – Blueprint Clintonville – Stormwater Management Plan</td>
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<tr>
<td>Oshkosh, WI – Campbell Creek Watershed</td>
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<td>Owensboro RWRA – CSO LTCP</td>
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<td>Oshkosh, WI – Sawyer Creek Watershed Alternatives</td>
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<td>Sterling, IL – Locust Street Drainage Improvements</td>
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<td>UW-Madison Arboretum, WI – Phase 3 Stormwater Planning</td>
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<tr>
<td>UW-Madison, WI – West Campus Stormwater Master Plan</td>
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<td>WisDOT – Verona Road Interchange, Madison, WI</td>
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Work Plan Approach Results in Integrated Solutions that Recognize Unique System Characteristics

“Scoping study evaluation is key to charting efficient direction”

Past Reports and Evaluations

FEMA Flood Studies for Perkins, Crooked & Cross Creek

Flood Damage and City Complaint Database

JSA XPSWMM Modeling of CSS
Our Process Asks Questions that Others Don’t
Comprehensive Inventory and Analysis

- Natural Systems
- Built Systems
- Community Character

- Policy Issues
- Existing and Planned Projects
- Stakeholders

Paducah Natural Systems – Hydrologic Soils Groups (left), Wetlands (right)

Paducah Comprehensive Plan Informs Future Planning Considerations
Data Collection Approach Establishes Framework for CSMP and Future Asset Management Program

- Field investigation
- Enhanced GIS shapefile
- Structure data (x, y & z)
- Condition assessment
- Open channel evaluations
State-of-the-Art XP-SWMM 2D Modeling Platform Provides Accurate and Illustrative Results

ADVANTAGES INCLUDE:

- Proper Representation of Flood Storage Volume
- Accurate Simulation of Overland Flood Routes
- Visual Flooding Extent and Depths – Invaluable Tool for Communicating Results to the Public

XP-SWMM 2d existing vs. proposed flooding depths and extents results.
EXISTING CONDITIONS, 100-YR, 3-HR EVENT

PROPOSED CONDITIONS, 100-YR, 3-HR EVENT
Proven Model Calibration and Validation Techniques Provide Reliable Foundation for Sizing of Improvements

“Documented modeling results can increase public confidence in study”
Flood Control Alternatives Needs to Consider Local Context and Reflect Realistic Costs

- Sizing of Controls/LOS
- Feasibility and Constructability
- Cost of Proposed Controls
- Reduction in Property Flooding

Cost-Benefit Analysis Helps Justify Potential Flood Control Expenditures
Relevant Case Studies

Rapid Run Watershed – Cincinnati, OH
  FEMA / CSO Solution
  Open channel conveyance

Winnetka, IL
  Flat topo, Levee, CSS
  Robust public engagement

Bee Branch – Dubuque, IA
  Levee/Floodwall
  Mississippi River
  Flood Buyouts

Woodlawn Creek – Newport, KY
  Construction of a dam
  Allowed downstream development
  Removed homes from floodplain
Comprehensive Solutions Extend Beyond Political and Jurisdictional Boundaries

- Look Beyond Study Area
- Consider Partnerships
  - JSA
  - Paducah Parks Services
  - Delta Regional Authority
  - County
- Common Sense Approach
Our Preliminary Understanding and Observations

CROOKED CREEK WATERSHED

Areas Affected: Buckner Ln., Oakcrest Dr., Oakcrest Apts.

July 7, 2015 – Buckner Lane
Perkins Creek Watershed

Areas Affected: Days Inn, Hinkleville Rd. (US 60)

Cross Creek Watershed

Areas Affected: 21st & Old Mayfield Rd., S. 24th St. Culvert, Morgan School Neighborhood

July 7, 2015 – 21st & Old Mayfield Rd.
Noble Park – PS No. 1 Watershed

Areas affected: Noble Park, Madison St., Monroe St., 25th St.

“Flooding in Combined Sewer System Service Area”

July 7, 2015 – Madison St.
Other Downtown Areas

Park Ave. & 9\textsuperscript{th} St., 10\textsuperscript{th} & Olive St., McCracken Co. Jail, 16\textsuperscript{th} St. & Kentucky Ave., Baptist Hospital

July 7, 2015 Flooding – Main Entrance Western Baptist Hospital

July 7, 2015 Flooding – 16\textsuperscript{th} & Kentucky Ave.
Traditional Solutions Form the Backbone of Improvement Strategies

- Wet Detention/Retention
- Dry Detention
- Underground Storage
- Pump/Lift Stations
- Surface/Roadway Storage
- Maximizing Existing Infrastructure
- Storm Sewer Upgrades/Sewer Separation
- Consider Property Buyouts
Our CSMP Approach Leads to Affordable and Implementable Action Plan

Key Master Planning Considerations Guide Approach

- Project Drivers
- Goals & Objectives
- Expected Outcomes
- Others

Overall Study Map Showing Areas of Existing Flooding
Project Objectives

• What will City achieve through the Master Plan?
  ➢ Flood Mitigation CIP
    – Surface Flooding
    – Water in Basement (WIB)
    – CSOs
    – PS/Floodwall
  ➢ Asset Management Program
    – Long Term CIP
    – O&M
  ➢ Basis for Funding Mechanism
  ➢ Future Growth/Development Considerations
Study Area

• What are the limits of study area?
  ➢ Targeted Problem Areas
  ➢ Separate Storm Sewer Area
  ➢ Combined Sewer System
  ➢ City of Paducah
  ➢ County
  ➢ Watershed
Community Engagement

- Define Organizational Structure & Stakeholder Involvement Approach?
  - Technical Advisory Group (TAG)
    - City Engineer’s Office
    - JSA/County
    - Strand/BFW
  - Stormwater Advisory Committee (SWAC)
  - Citizen/Public Involvement
  - City Manager/City Commission
    - Policy Decisions
    - Implementation Methodology
What does the Master Planning Process Look Like?

**City’s Technical Advisory Group – Continuous Involvement Throughout**

**Preliminary Engineering**
- Review Exist. Information
- CSMP Goal Setting
- Identify Data Gaps
- Define Key Policy Decisions
- Refine Study/Master Plan Approach

**Baseline Analysis**
- Develop Exist. Condition H&H Models
- Perform Targeted System Inventory
- Establish LOS Parameters
- Correlate Problem Areas w/Probable Causes

**Alternatives Evaluation**
- Model & Evaluate Alternatives
- Develop Watershed Solutions Matrices
- Consider Strategic Partnership Opportunities
- Validate Alt’s./Acceptability

**Develop CIP**
- Define Discrete Improvement Projects
- Identify Early Action Projects
- Establish Ranking Methodology
- Prepare Cost Opinions
- Conduct BCA Evaluations

**Funding & Programming**
- Evaluate Funding Options
- Define CIP Implementation Approach
- Integrate Asset Management Program Needs
- Develop Financial Model for Program Implementation

**Implement CIP**
- Implement Capital Projects in Accordance with Commission Directives

**COMMUNITY ENGAGEMENT PROCESS**

- Citizens
- Stakeholders
- Community Partners
- Commission
Communication Approach

Draft Communication Strategy for Preliminary Engineering Phase

How will you communicate throughout various phases of the master plan process?

“Similar approach to be used for subsequent phases”

“TAG (7), SWAC (3), Public (3), Commission (3)”
CSMP Deliverables

What will the deliverables include?

- Identification of 10 Priority Flood Areas
- Analysis of 20 Flood Mitigation Alternatives
- Benefit Cost Analysis/Prioritized Ranking
- Development of Capital Project Program

- Evaluation of Funding Options
- Asset Management Program Needs Analysis
- CIP Implementation Plan
- Early Action Projects
Schedule

What are the Expectations for Schedule?

- Preliminary Engineering Evaluation
- Completion of Master Plan
- Identification of Early Action Projects
- Determination of Funding Approach
- Implementation of Master Plan Projects
Schedule

CITY OF PADUCAH – CSMP PROJECT SCHEDULE

1) Project Administration and Communication
2) Community Background Review and Assessment
3) Organize Existing GIS Mapping Data
4) Analysis of Existing Flood Protection Components
5) Analysis of Existing Asset Management System
6) Evaluate Existing Modeling Tools
7) Policy Review and CSMP Goal Setting
8) Inventory and Analysis
9) Work Plan Refinement
10) Existing Conditions Modeling, Calibration, & Flooding Problem Prioritization
11) Flood Mitigation Alternatives Development & Evaluation
12) Funding Evaluation
13) Early Action Project(s) Design/Implementation

Pending Task  
(Task Order No.1)  
Future Task TBD  
(Task Order No.2)