

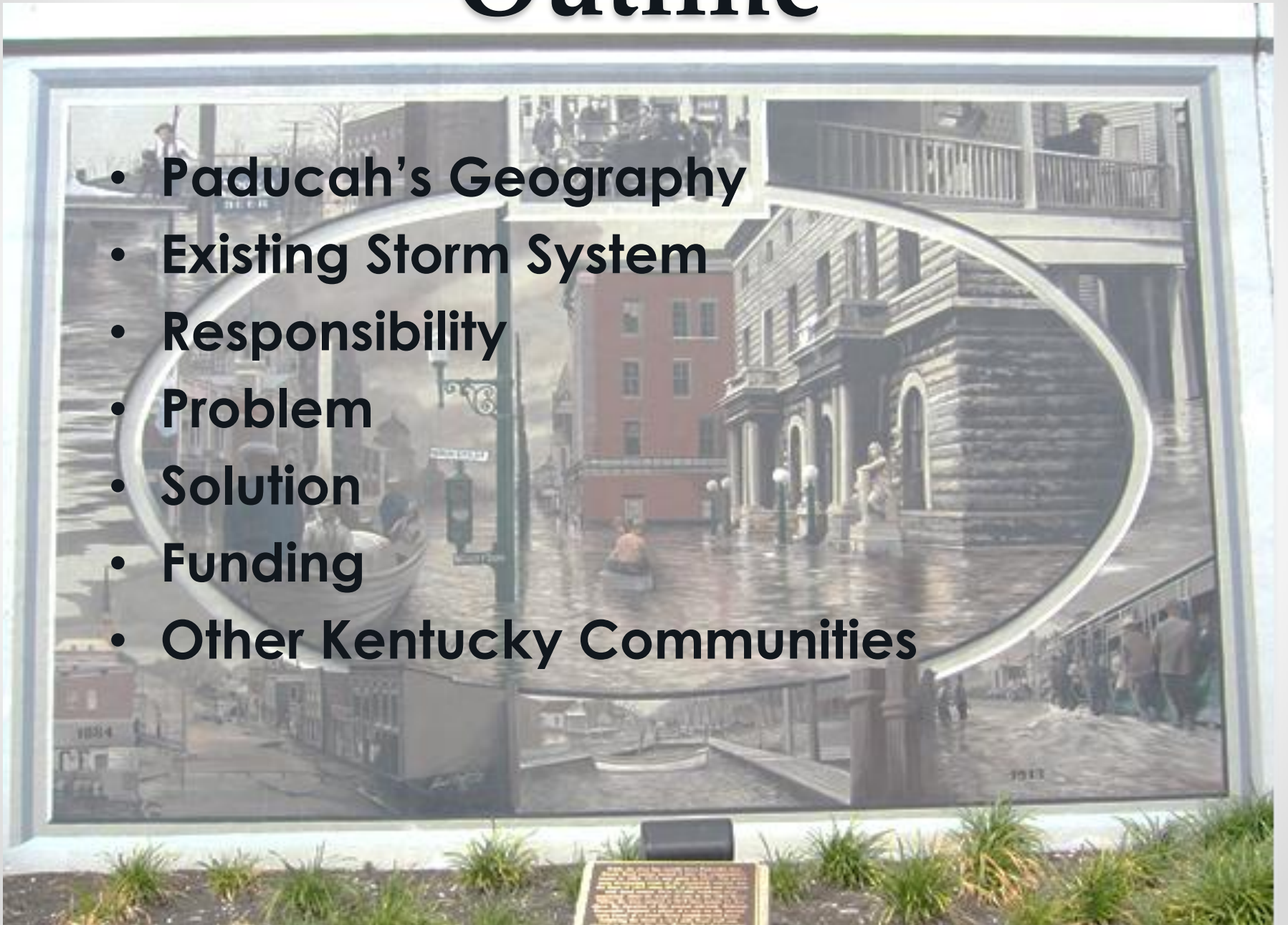


City of Paducah Storm Water & Drainage

Eric Hickman, P.E.
Storm Water & Drainage Engineer
February 2016

Outline

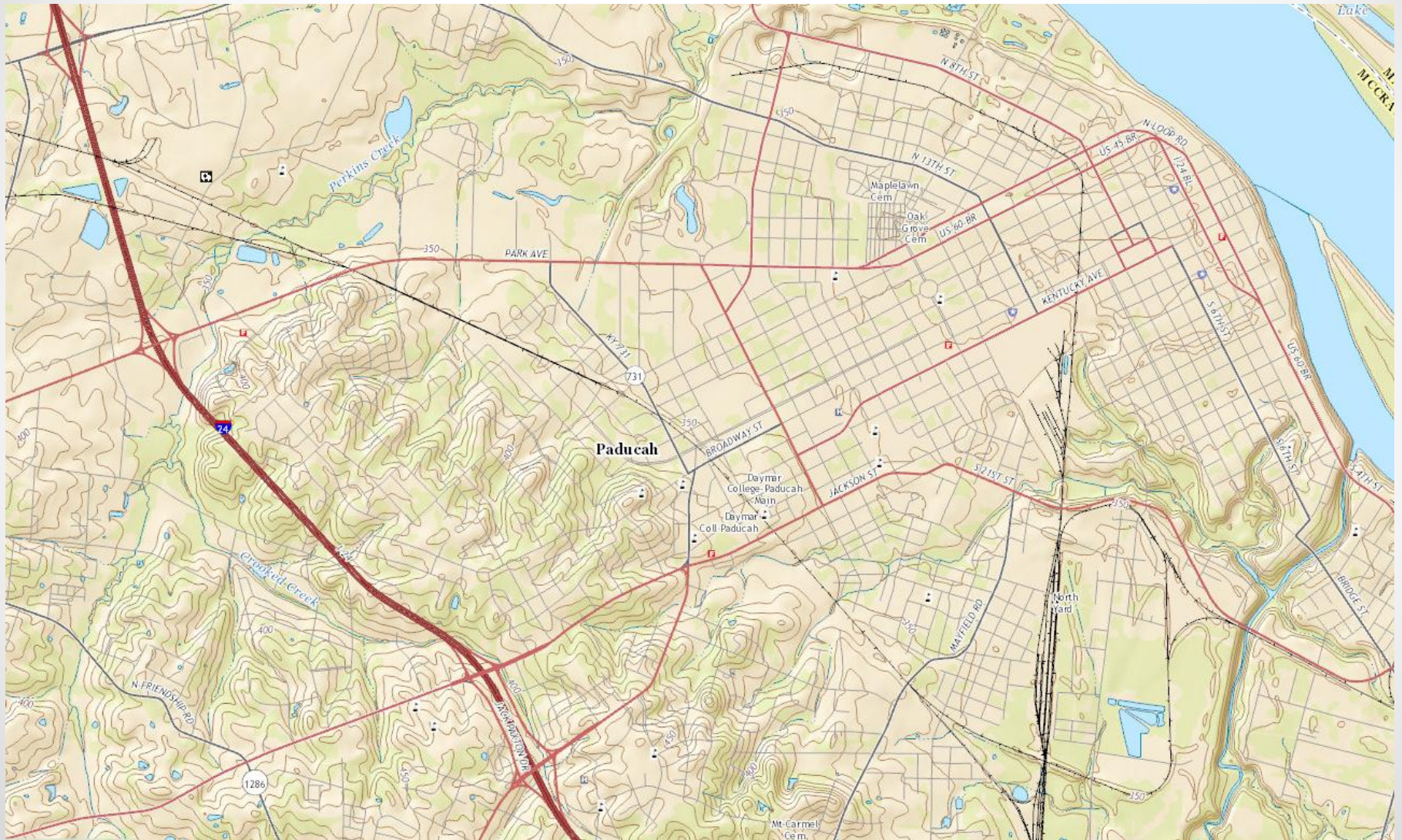
- Paducah's Geography
- Existing Storm System
- Responsibility
- Problem
- Solution
- Funding
- Other Kentucky Communities



Paducah's Geography

- Majority of drainage problems that the City experiences originate from the natural geography of the City
- Located on the Ohio River at the mouth of the Tennessee River, natural floodplain for the Ohio River
- 46 miles upstream from the confluence of the Ohio and Mississippi Rivers
- Nearly 204,000 square miles (over 130 million acres) of land drain to Paducah through the Ohio River
- 46 square miles (almost 30k acres) drain through the city limits through Cross Creek, Crooked Creek, Perkins Creek, and Island Creek to the Ohio River.

Paducah's Geography

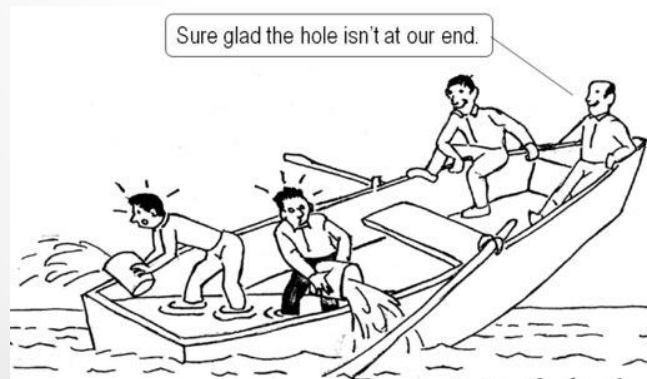


System Makeup

- The present storm water infrastructure is operated and maintained by the Engineering and Public Works Department of which includes:
 - 110 miles of separate storm sewer
 - Over 6000 storm inlets (40% of inlets are connected to the combined sewer system)
 - 313 miles of streams – only small portion of these creeks are owned by the City
 - 9 miles of river
- Flood protection system is an integral part of the storm water system. The Floodwall Division is responsible for operating and maintaining:
 - 3 miles of concrete floodwall
 - over 9 miles of earthen levee
 - 12 pump stations.
- Paducah is on a network of combined sewers.
 - Unique situation ownership of the combined sewer network
 - City operates and maintains storm inlet and laterals that tie into the trunk lines of the combined sewer network owned and operated by JSA
 - 69 miles of combined sewer

Responsibility

- The City of Paducah Engineering & Public Works Department is responsible for:
 - Public health, safety and welfare
 - Water quality from storm water runoff
 - Adequately maintaining, operating, upgrading, and replacing existing storm water and drainage systems
 - Reducing the effects from flooding
 - Complying with Paducah's Storm Water Phase II Small Municipal Separate Storm Sewer System (SMS4) General Permit regulated by the Kentucky Division of Water (KDOW)



RESPONSIBILITY

"You cannot escape the responsibility of tomorrow by evading it today."

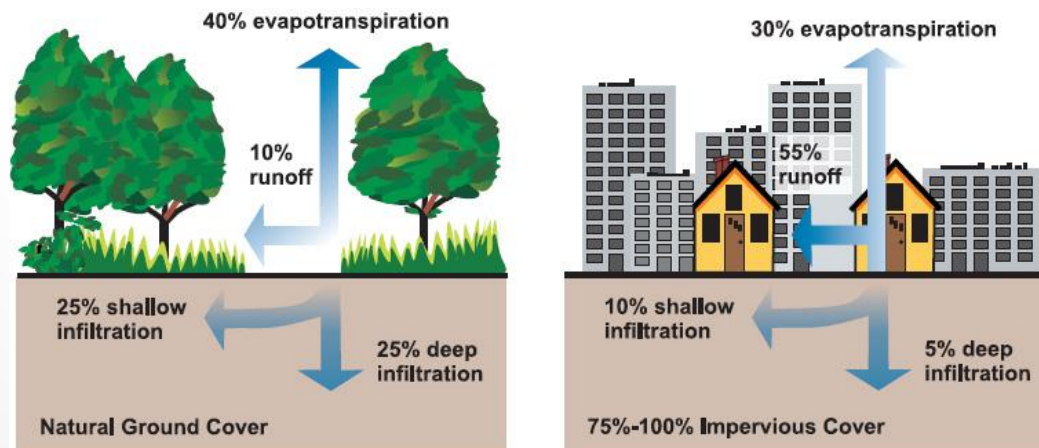
~ Abraham Lincoln ~



Photo posted on Flickr by ~MVI~

What is Storm Water Runoff?

- Occurs when precipitation from rain or snowmelt flows over the ground
- Natural undeveloped environment, rainfall is either absorbed in the soil, evaporates or slowly runs off
- Rooftops and paved areas prevent the water from being absorbed into the ground and causes faster runoff rates and more volume of runoff

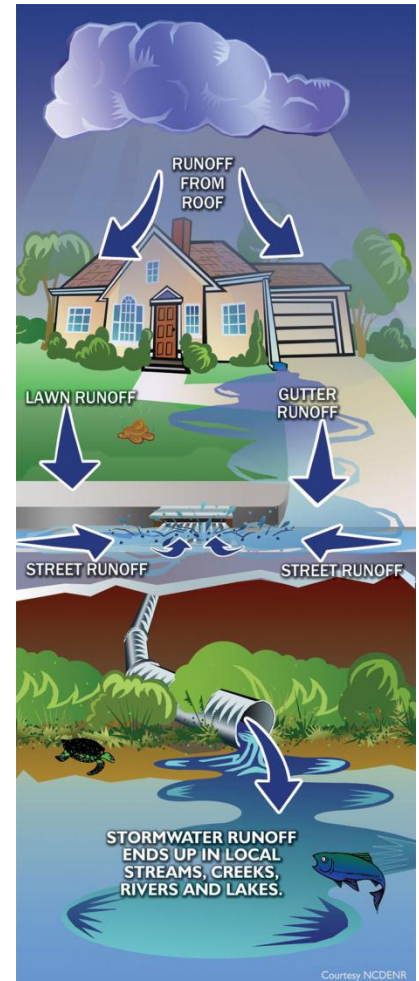


Problem

Historical population

Census	Pop.
1830	105
1850	2,428
1860	4,590
1870	6,866
1880	8,036
1890	12,797
1900	19,446
1910	22,760
1920	24,735
1930	33,541
1940	33,765
1950	32,828
1960	34,479
1970	31,627
1980	29,315
1990	27,256
2000	26,307
2010	25,024
Est. 2014	24,978

- Problem:
 - Current storm water system is aging and needs to be upgraded and/or replaced in areas to provide public health, safety, and welfare from flooding events
 - Systems are over capacity/under designed and inundated with small/frequent rain events
 - **Insufficient funding at present: \$60k annually**
- Cause:
 - Greatest population growth in the 1920s & '30s
 - Development increased during this time period increasing impervious surface areas and eliminating past ponding areas
 - Storm water management was an afterthought during these times unlike today's requirements through our Ordinances on new development
 - Lack of dedicated resources to adequately maintain and update storm conveyance systems
 - Lack of identity of storm water management in City budget and organizational structure



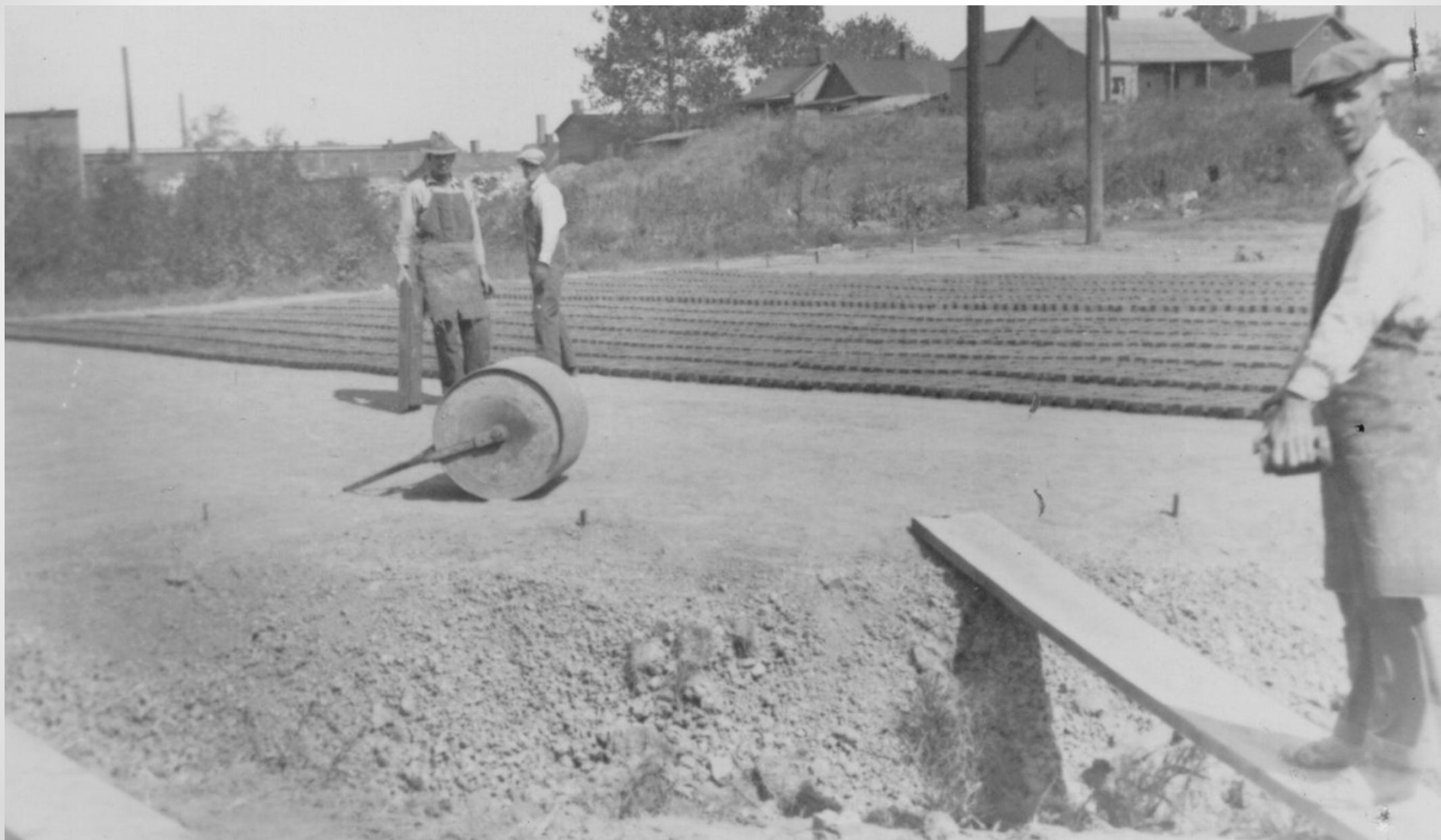
Paducah's Storm Sewer System Timeline

- Original Infrastructure – 1900's
- Works Progress Administration – 1934 – 1942
- Floodwall constructed - 1939 -1949
- Paducah Storm Relief Sewers – 1950s - 1960s
- Majority of Paducah storm sewers are 60 – 100 years old and are over capacity

Men working on combined sewer line during Works Progress Administration 1934-1942



Compaction during Works Progress Administration 1934-1942



Excavating with men, mules and slip scrapers during Works
Progress Administration 1934-1942



Men working on sewer line during Works Progress Administration 1934-1942



Manufacturing brick by mixing clay using a mule driven mud-wheel during Works Progress Administration 1934-1942



Manufacturing brick by mixing clay using a mule driven mud-wheel during Works Progress Administration 1934-1942



Original System Design

- Early 1900's System Design:
 - Designed for average storm period of 15 years
 - One-hour rainfall intensity for 15 year storm = 2.0"
 - Time of concentration = 15 minutes
 - Runoff Coefficient varied from .11 to .22
- Deficiencies:
 - 15 year storm return period used in design is usually better than those recommended. However, storm data in early 1900's for 15 year storm return is a 5 year storm return period based on today's data.
 - Time of concentration used throughout design is too high for majority of the system causing under-designed flows = under-designed storm system
 - Runoff coefficients used are extremely low from what they should be today which causes for under-designed flows = under-designed storm system

What is the solution?



Where do we start?

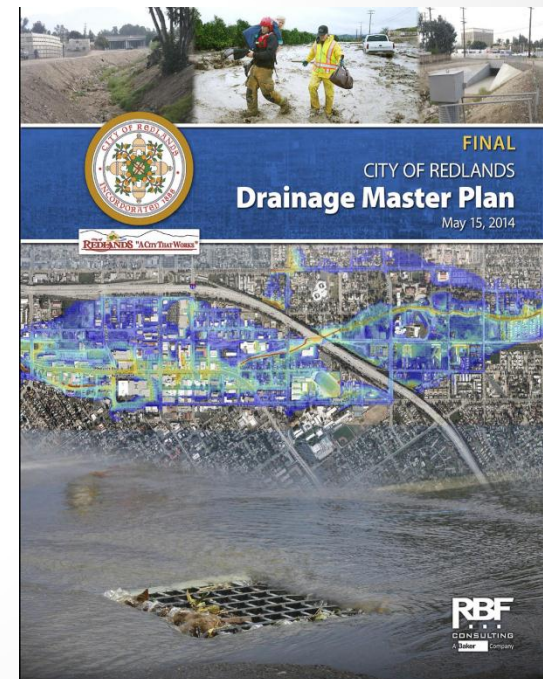
Storm Water Master Plan

- “Master Plan Report” on Sanitary, Storm & Combined Sewers completed in 1961 – 55 years ago
- Storm Water Drainage Study completed in 1989, only looked at analyses of 5 flood prone areas
- City of Paducah, our storm system, industry standards & design, and development has all changed in the last 55 years
- City is overdue for a holistic study of the storm water system, policies & ordinances, and funding mechanisms



Storm Water Master Plan

- A document that provides a clear and concise explanation of the City's existing storm water management program
- Presents a detailed investigation into key components of storm water as it is related to the City of Paducah
- Establishes storm water management goals for the future
- Creates tools to meet or exceed established goals
- Provides a foundation for future policy decisions



Storm Water Master Plan

- Clear and concise explanation of the City's existing storm water management program.
 - Schedule kickoff meeting
 - Gather data
 - Conduct interviews with City personnel familiar with the system
 - Schedule site visits with city personnel
 - Develop a database used to assess condition of City's current system



Storm Water Master Plan

- Detailed investigation into key components of storm water.
 - Analyze all basins and systems to determine hydraulic constraints, predicted flows and quantify effects of flood storage areas
 - Identify major open channels which connect into the City's storm system
 - Provide a table listing the major reaches and their respective modeling characteristics
 - Identify locations that show potential strategic value as detention, water quality, or controlled flood storage areas based on geography, ownership, capacity, land value, and development potential



Storm Water Master Plan

- Establish goals for the future.
 - Group identified improvements into projects for capital improvement planning
 - Prioritize capital projects for the next XX years
 - Perform an analysis on the City's staffing level to determine operations, engineering, and administration to adequately maintain and manage the City's surface water collection system



Storm Water Master Plan

- Create tools to meet or exceed goals
 - Storm Water Master Plan
 - Maps of City's storm water system, identified deficiencies, and proposed improvements
 - Population projections and storm water demand
 - Charts, graphs, and figures conveying technical information and analysis
 - Justification for recommended work to be accomplished
 - System condition assessment database
 - Storm Water System Capital Improvement Plan
 - System Development Charge and Rate Study



Storm Water Master Plan

- Provide a foundation for future policy decisions
 - Review and recommend updates to the City's Ordinances & policies as they relate to storm water management and conveyance with new development
 - Recommend changes to design policies and provide supporting data for amending City requirements



Storm Water Master Plan

Project Tasks

1. Project Management
2. Data Gathering
3. System Condition Assessment
4. Hydraulic Modeling
5. Storm Water System Capital Improvement Plan
6. Staffing Level Analysis
7. System Development Charge & Rate Study
8. Storm Water Master Plan
9. City's Plan Review Policies Regarding Storm Water Management Requirements of Private Development





Possible Solutions



1. Let someone else deal with it...
2. Occupational Tax or Property Tax– Generally public is not in favor of raising taxes
3. Business or Building License Fee – Would not produce enough revenue
4. Site Plan/Erosion Control/Right of Way Permit Fee – Would not produce enough revenue
5. Special Assessment Fee – Special benefit to specific properties
6. User Fee – System expansion to those paying fee that do not have storm sewers
7. **Storm Water Utility**

Storm Water Utility

- Create a Storm Water Utility under JSA KRS 76.005-76.240
- Primary Role:
 - Own, manage, control and operate separate storm water facilities within the City of Paducah
- Establish a Paducah Surface and Storm Water Utility Fee
 - Under and pursuant to provisions of KRS 91A.510-91A.530
 - City has authority to establish a separate and independent storm water utility under the management and control of the Paducah-McCracken County Joint Sewer Agency (JSA) by City of Paducah Ordinances Ch. 114-257
- Benefits:
 - Can generate funds to alleviate costs of an improvement
 - All users are subject to fee
 - Legal authority already exists to create Storm Water Utility
 - Fees shall be uniform for residential classification
- Obstacles:
 - Fees shall not generate revenues or profits in excess of the reasonable costs associated with providing a public service
 - Takes political effort to pass
 - Subject to court challenges
 - If not properly advertised, can create opposition from the development community



Equivalent Residential Unit (ERU)

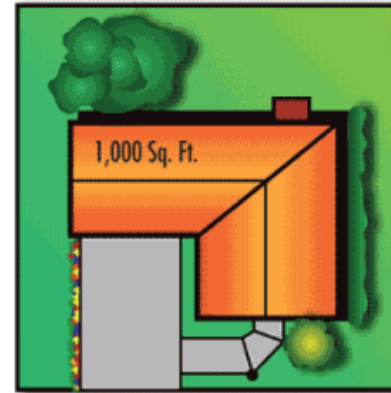
- ERU – Most widely used method of funding in Storm Water Utilities

- Impervious surface area impedes natural infiltration of water causing higher runoff rates and volumes
- ERU should be based on the average residential impervious area within the City of Paducah
- Properties should be required to pay a monthly storm water utility fee based on their contribution to storm water runoff

- Property Class

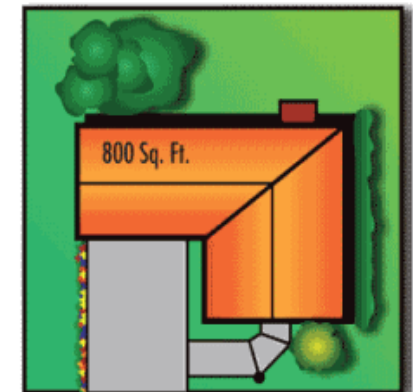
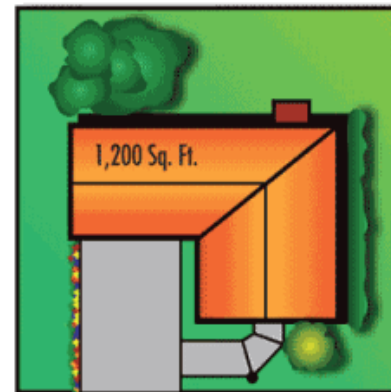
- Class A Properties – residential \$X.XX a month (based on average residential impervious area equal to XXXX square feet)
- Class B Properties – commercial, charged by dividing the impervious area of a property by the average residential impervious area and rounding to the next highest ERU

Impervious Area Approach: Definition of ERU



Example:

1 ERU = 1,000 ft² of impervious area

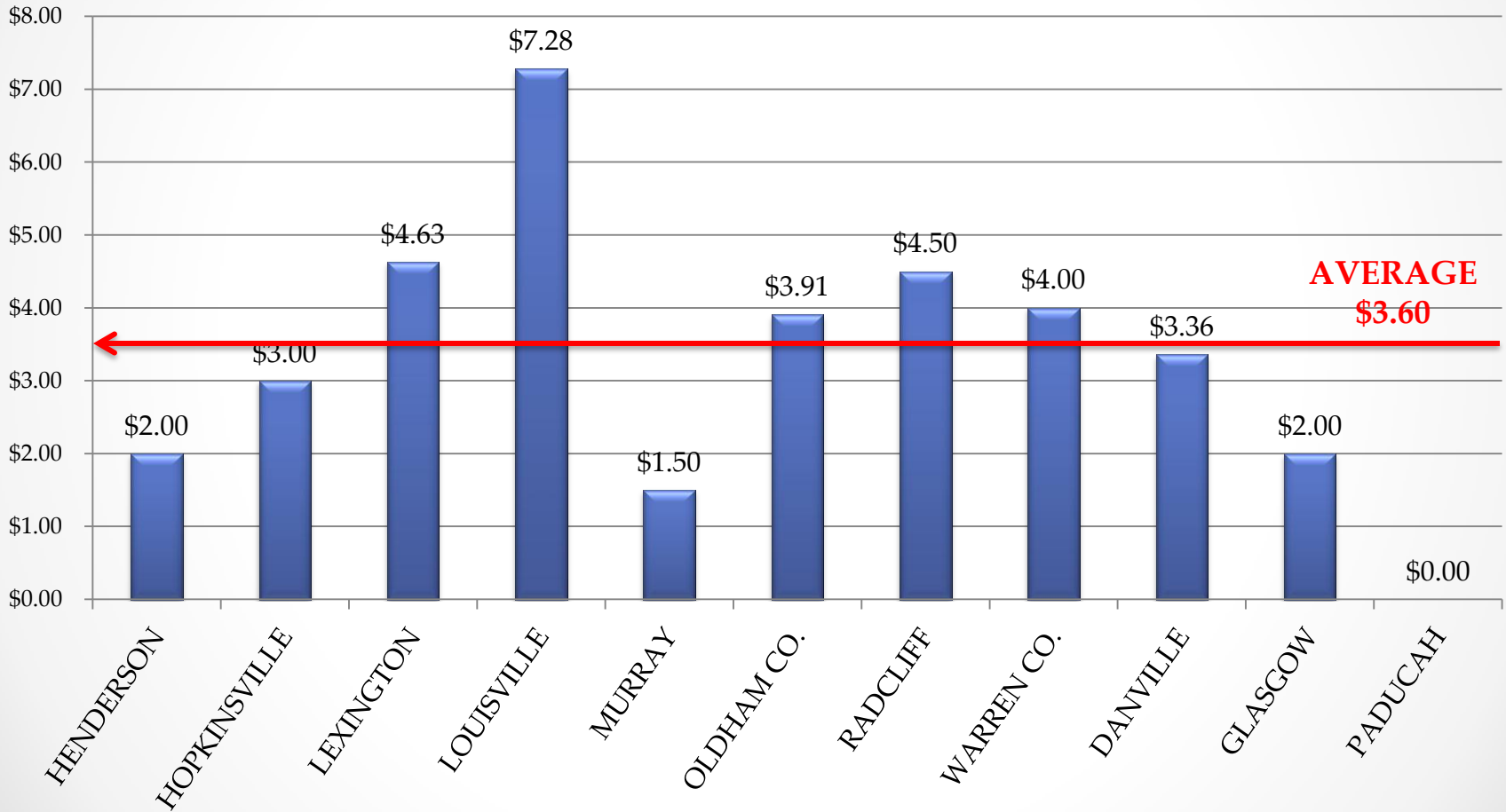


Example of Equivalent Unit definition adapted from The Florida Stormwater Association.

Kentucky Communities:

COMMUNITY	ERU (FT2)	MONTHLY FEE	FEE TYPE	YEAR CREATED	POPULATION	ORGANIZED
HENDERSON (2 nd Class)	3,000	\$2.00	Stormwater Utility Fee	1998	28,757	Water & Sewer Commission of the City of Henderson – Storm Water Utility
HOPKINSVILLE (2 nd Class)	3,350	\$3.00	Stormwater Management Fee	2006	31,577	Surface and Storm Water Utility
LEXINGTON (Urban)	2,500	\$4.63	Water Quality Management Fee	2009	295,803	Lexington-Fayette Urban County Government
LOUISVILLE (1 st Class)	2,500	\$7.28	Drainage Service Charge	1987	597,337	Metropolitan Sewer District
MURRAY (3 rd CLASS)	3,000	\$1.50	Stormwater Utility Fee	2004	17,741	Murray Municipal Utilities
RADCLIFF (2 nd Class)	2,800	\$4.50	Stormwater Management Fee	2003	21,688	Storm Water Utility
WARREN CO. (excludes Bowling Green)	NA	\$4.00 residential \$10.00 commercial	Stormwater Management Fee	2007	58,067	Joint Storm Water Sewer Agency (JSWSA)
DANVILLE (3 rd Class)	3,813	\$3.36	User Fee	2007	16,218	City of Danville Storm Water Utility
GLASGOW (3 rd Class)		\$2.00	Stormwater Management Fee	2012	14,028	City of Glasgow
PADUCAH (2 nd Class)					25,024	

Equivalent Residential Unit

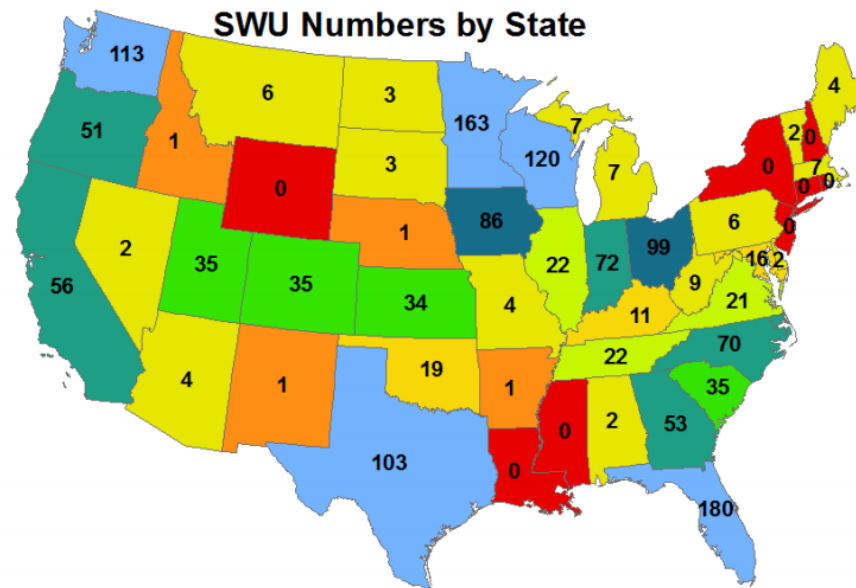


Murray Example:

- City collects storm water utility fees under Murray Municipal Utilities where it has charges for gas, water, sewer, and storm sewer services
- Collects fee on active water service accounts – typical
- Residential flat fee of \$1.50 per ERU
- 1 ERU = 3,000 ft²
- Commercial billed based on square footage measurement at \$1.50 per ERU + \$1.00 per ERU for additional area over and above 60,000 ft²
 - Fees may seem to be unfair to large developments because more impervious = more runoff to system = \$\$\$
 - Credits are typically given for storm water quantity and storm water quality structures incorporated into the design of the development (i.e. detention & retention ponds)
- Multi-family (duplex, tri-plex, four-plex, condominiums, mobile home parks and other properties containing more than one dwelling unit but less than five dwelling units shall be charged .5 ERU per dwelling unit

National Averages

- 1491 Storm Water Utilities in the United States
- Median monthly storm water utility fee is \$3.50 for those communities using the equivalent residential unit (ERU) system
- Median ERU is 2842 square feet impervious



Steps

1. Storm Water Master Plan – Guidance on Funding
2. Create a new ordinance under Chapter 50 Article V: Stormwater Utility
 1. Regulations in KRS 91A and KRS 76 allow for the City to establish the equivalent residential unit method of billing for drainage facilities
3. Establish an ERU
4. Establish billing procedures
5. Legal Review
6. Transfer operation, control, maintenance and assets of all surface drainage responsibilities to the Paducah Surface and Stormwater Utility Fund (PSSU)
 1. Could help with expenses of floodwall operation and maintenance as required by USACE
7. JSA release the management and control of this utility by a change in the JSA agreement to the City of Paducah

Conclusion

- The City's storm water and drainage systems are in need of maintenance, upgrades, and in some cases replacement
- A Storm Water Master Plan is essential in laying the framework for implementation
- The Storm Water fee will help the City manage storm water expenses more efficiently without sacrificing services to the citizens of Paducah
- A path forward for Paducah's future regarding improving its storm water infrastructure has been presented before you this evening. Initiating the path forward requires visionary thinking and ultimately tough decision making by the policy makers.



Paducah Storm Water Path Forward

The path forward regarding Paducah's future improvements to its storm water infrastructure has been presented before you this evening. Initiating the path forward requires visionary thinking and ultimately tough financial decision making by the policy makers.

