AN ECONOMIC ASSESSMENT OF EXTREME RAINFALL EVENTS AND STRATEGIES FOR REDUCING ECONOMIC LOSSES

A STUDY IN TOLEDO, OHIO

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PROJECT OVERVIEW

- National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center (CSC)
- An economic study examining green infrastructure options for reducing flooding from extreme rainfall events
- Using current and future precipitation and land use scenarios
- Great Lake Restoration Initiative (GLRI) funded pilot projects – Toledo, OH and Duluth, Minnesota

PROJECTED PROJECT TIMELINE

- Assessment Phase Oct. 2012- Aug. 2013
- Community Assistance Phase Aug. 2013- Aug. 2014
- Regional Knowledge Transfer Spring 2014- Fall 2014

JANUARY 2013 SITE VISIT

- Met with city divisions and other project partners
- Discussed flooding issues
- Established data needs
- Selected possible watersheds: Silver, Swan and Shantee
- Toured watersheds
 - Observed land use, problem areas, and possibilities.

NECESSARY DATA

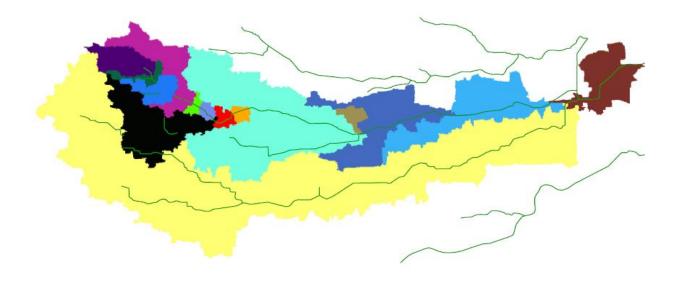
| Data Layers | Date Desired |
|---|--------------|
| Watershed delineation | 2/8/13 |
| Current land use | 2/8/13 |
| Current land cover | 2/8/13 |
| Future land use | 2/8/13 |
| Zoning | 2/8/13 |
| Stream channels/waterways | 2/8/13 |
| Municipally-owned parcels | 2/8/13 |
| Tax-forfeited parcels | 2/8/13 |
| Soil types | March 2013 |
| Piped infrastructure (storm and sanitary) | March 2013 |
| Parks and Recreational Areas | March 2013 |

WATERSHED SELECTION

| Criteria factors | Swan | Shantee | Silver |
|---|---|--|--|
| Community Interest | Not differentiating | Not differentiating | Not differentiating |
| Vulnerable Population | Not differentiating | Not differentiating | Not differentiating |
| Current Percent Developed/Urban | Not differentiating | Not differentiating | Not differentiating |
| Change in Future Land Use | Yes – but less than Silver and Shantee. Also heavily influenced by Lucas County | Yes – more than Swan | Yes – more than Swan |
| Economic Factors | Not differentiating | Not differentiating | Not differentiating |
| Land Price/Land Value | Not yet assessed | Not yet assessed | Not yet assessed |
| Historic Flood Damage | Not yet assessed | Not yet assessed | Not yet assessed |
| Water Quality Impacts from Flooding | Not yet assessed | Not yet assessed | Not yet assessed |
| Hydrology/ Hydraulics Data Available | Hydrograph and HEC-RAS | HEC-RAS available (no hydrograph) | Hydrograph and HEC-RAS |
| Subsurface Geology Amenable to Green Infrastructure Solutions | Not differentiating | Not differentiating | Not differentiating |
| Zoning Restrictions | Not differentiating | Not differentiating | Not differentiating |
| Previous Studies Available | Unknown | Unknown | URS study |
| Tax Forfeited Parcels | Not differentiating | Not differentiating | Not differentiating |
| Number of Complaints | Does not meet study needs (less complaints) | Meets study needs (more complaints) | Meets study needs (more complaints) |
| Drainage Basin Size | Less desirable (large and includes Lucas County) | Desirable | Desirable |

WATERSHED SELECTED – SILVER CREEK

- Located in North Toledo
- History of flooding issues and complaints
- Industrial and Residential area
- Has available information/data

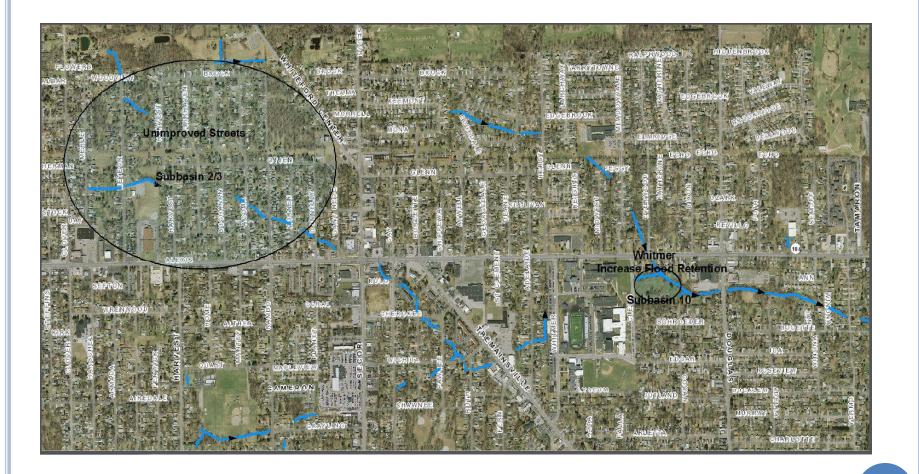


JUNE 2013 SITE VISIT

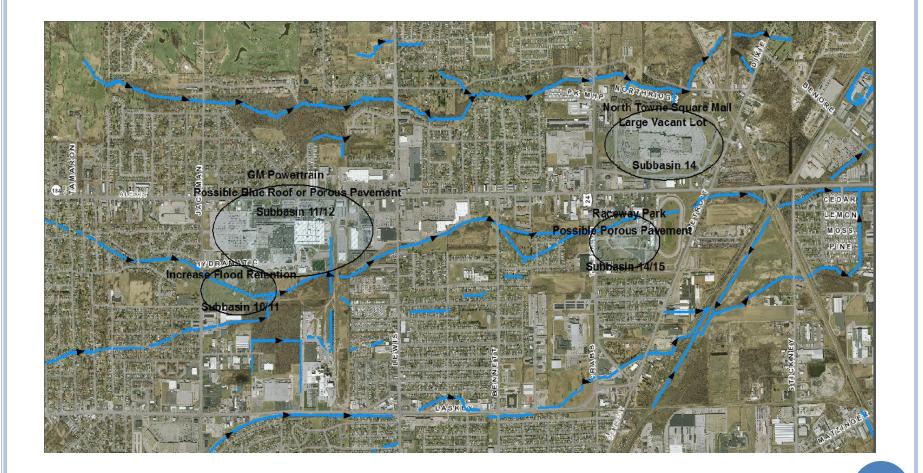


- Met with local City officials.
- Presented information on Green infrastructure and the cost and benefits.
- Examined what types of projects have been most effective historically.
- Discussed specific problems within the watershed and expected outcomes.
- Project team tour of watershed and green infrastructure projects.

SILVER CREEK-WEST



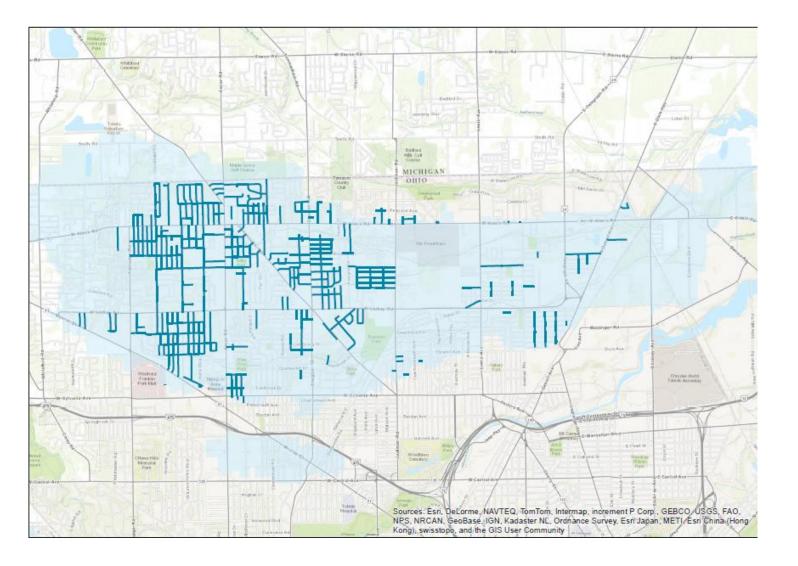
SILVER CREEK-EAST



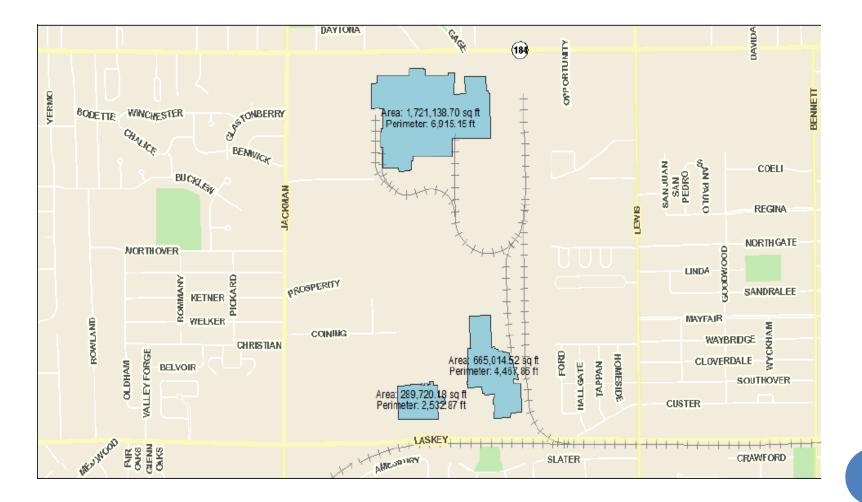
INFORMATION FOR ASSESSMENT

- Location of "hot spots" or problem areas
- GIS data/layers
- Size and location of possible green infrastructure sites
- The volume of stormwater retention possible from potential projects
- Cost information of past projects, and the stormwater retention achieved.

UNIMPROVED STREETS IN SILVER CREEK WATERSHED



SQUARE FOOTAGE OF INDUSTRIES IN SILVER CREEK WATERSHED



NEXT STEPS

| Practice | Length (ft) | Width (ft) | Depth (ft) | Square Feet | Storage Volume (CF) | Storage Volume (acre-feet) | Capital Cost | O&M Cost |
|---|-------------|------------|------------|--|---------------------------|----------------------------------|-----------------|-------------|
| Bioretention/bioswale s along unimproved roads | 366,945 | 6 | | 2,201,670 | 3,082,338 | 70.8 | | |
| Blue Roofs | | | 0.5 | 2,598,000 | 129,900 | 3.0 | | |
| Permeable Pavement (Unimproved Roads) | 366945 | 20 | | 7,338,900 | 1,908,114 | 43.8 | | |
| Permeable Pavement (Unimproved Roadways Sidewalk) | 366945 | 5 | | 1,834,725 | 1,513,648 | 34.7 | | |
| Underground Storage | | | | We could potentially make this the area of unimproved roadway, or just put in an estimated value | | | | |
| Parcel Buy-outs> on site detention | | | | need the area of tax- forfeited parcels | | | | |
| TOTAL | | | | | 3212238.0 | 73.7 | | |

| Practice | Notes |
|------------|---|
| | This is the total length of unimproved roadway in the Silver Creek watershed that could idealistically have bioretention installed. This means that storage could double if bioretention was implemented on both sides of the roadway. Assumptions: - 50% of the roads install bioretention on both sides. - Vr soil = 0.25 - Vr gravel = 0.4 - Vr surface storage = 1 |
| | - Vi surface storage – 1 - Top layer mulch depth: 3" - Gravel layer depth: 1' - Soil media depth: 2' - Ponding depth: 6" |
| Blue Roofs | What is the SF of commercial/industrial rooftop? The city is working on providing this number. Commercial roofs have a lot of HVAC equipment that needs to be worked around Assumptions: 10% of the 3 commercial rooftops is turned into blue roof - SHOULD WE ASSUME 50 % WHICH WOULD PROVIDE 15 ACRE FEET?? GM Roof est: 1,700,000 sf JM Smucker roof est: 629,000 sf Teledyne roof est: 269,000 sf Roof areas are rough estimates based off of Google Earth measuring |
| | |

| Permeable Pavement (Unimproved Roads) | Toledo will talk to Engineering Dept as well as the Streets Dept to see if permeable pavements are feasible> they say not feasible | | | | |
|---|--|--|--|--|--|
| | Assumptions: - Porous concrete is the permeable pavement being installed - 20% of unimproved roads are retrofit with permeable pavement when they require replacement - Roadway width = 20' - Porous concrete depth = 8" - Vr of porous concrete = .15 - Reservoir layer depth = 3' - Vr of reservoir layer = 0.4 - Dimensions based off of green alley project done in Toledo in 2010 | | | | |
| Permeable Pavement (Unimproved Roadways Sidewalk) | Toledo will talk to Engineering Dept as well as the Streets Dept to see if permeable pavements are feasible> they say not feasible - WOULD STILL BE VALUE IN SHOWING THE POTENTIAL STORAGE VOLUME? Assumptions: - One side of all unimproved roadway gets a sidewalk - Permeable interlocking concrete pavers (PICP) is the permeable pavement being installed - 20% of unimproved roads are retrofit with permeable pavement sidewalks on one side when they require replacement - Sidewalk width = 5' - PICP depth = 3" - Vr PICP = .1 - Reservoir layer depth = 2' - Vr of reservoir layer = 0.4 | | | | |
| Underground Storage | This is in the Engr. Code. Talk to Scott Sibley. There are accumulation requirements. There have been some private storage options. Toledo will see if there are examples to provide us with rough storage and cost estimates. Assumptions: - | | | | |
| Parcel Buy-outs> on site detention | Toledo will look into providing a square footage available | | | | |

NEXT STEPS

- Continue to gather and share information needed for the assessment process
- Re-run H&H and HAZUS to see results of implementation on reducing flooding and associated costs
- Share the information with the community -implementation of proposed projects -increased education and outreach



QUESTIONS ? THANK YOU !



Presented by:

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