Mapping Your Stormwater Infrastructure: Methodologies and Implementation Techniques

KSA Quarterly Meeting

Somerset, Kentucky

April 26, 2017

About Bell Engineering

Corporate Profile

- ***Who we are:*** Founded in 1914 in Lexington, Kentucky by Howard K. Bell
- ***What we do:*** Primary focus on civil engineering including water, wastewater and stormwater as well as planning and landscape architecture
- ***Where we are:*** Corporate headquarters in Lexington and regional office in Hopkinsville, Kentucky and Asheville, North Carolina

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New Permit Mapping Requirements

- 2.2.3. Illicit Discharge Detection and Elimination
- Appendix A – Section II – Storm Sewer Map

2.2.3. Illicit Discharge Detection and Elimination

2. The permittee shall develop and maintain a storm-sewer system map showing the location of all known major outfalls, as defined herein, and the names and locations of all surface waters that receive discharges from those outfalls. The comprehensive storm sewer system map shall also include the permittee’s small MS4 system (owned and/or operated by the permittee), including catch basins, pipes, ditches, flood control facilities (retention/detention ponds), post-construction water quality BMPs, and private post-construction water quality BMPs.

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…Continued – The Mapping Requirements

2. If mapping is completed using Geographical Information Systems (GIS) or Computer Aided Drafting (CAD) software, the permittee shall provide to the Division of Water, at a minimum, the small MS4 boundary and the mapped infrastructure in either ESRI shape file formats (to include the .shp, .shx, and .dbf files) or geo-referenced AutoCAD drawings (consult DOW for acceptable formats). <u>Permittees shall have the permit term to complete required mapping.</u>

"Major Outfall"

– Means a municipal separate storm sewer outfall that discharges from a single pipe with an inside diameter of 36 inches or more or its equivalent (discharge from a single conveyance other than a circular pipe which is associated with a drainage area of more than 50 acres); or for municipal separate storm sewers that receive stormwater from lands zoned for industrial activity (based on comprehensive zoning plans or the equivalent), an outfall that discharges from a single pipe with an inside diameter of 12 inches or more or from its equivalent (discharge from other than a circular pipe associated with a drainage of 2 acres or more).

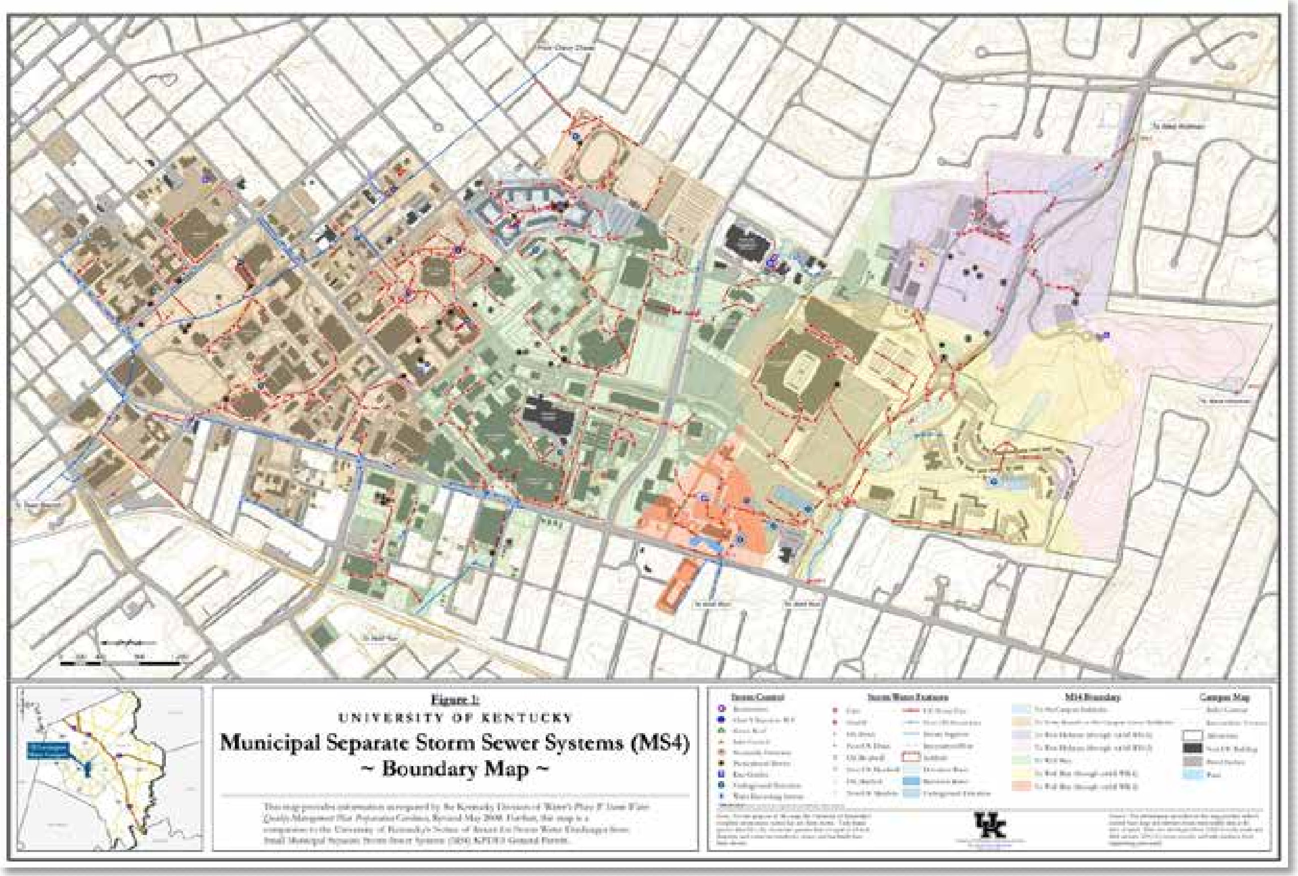
"Ditches"

– Any open conduit or cut into the earth that is man-made used to move stormwater

NOI Requirement

SECTION II – Storm Sewer Map

– Include a detailed map of the storm sewer system indicating all stormwater outfalls to the waters of the Commonwealth and delineating the separate watershed drainage areas.



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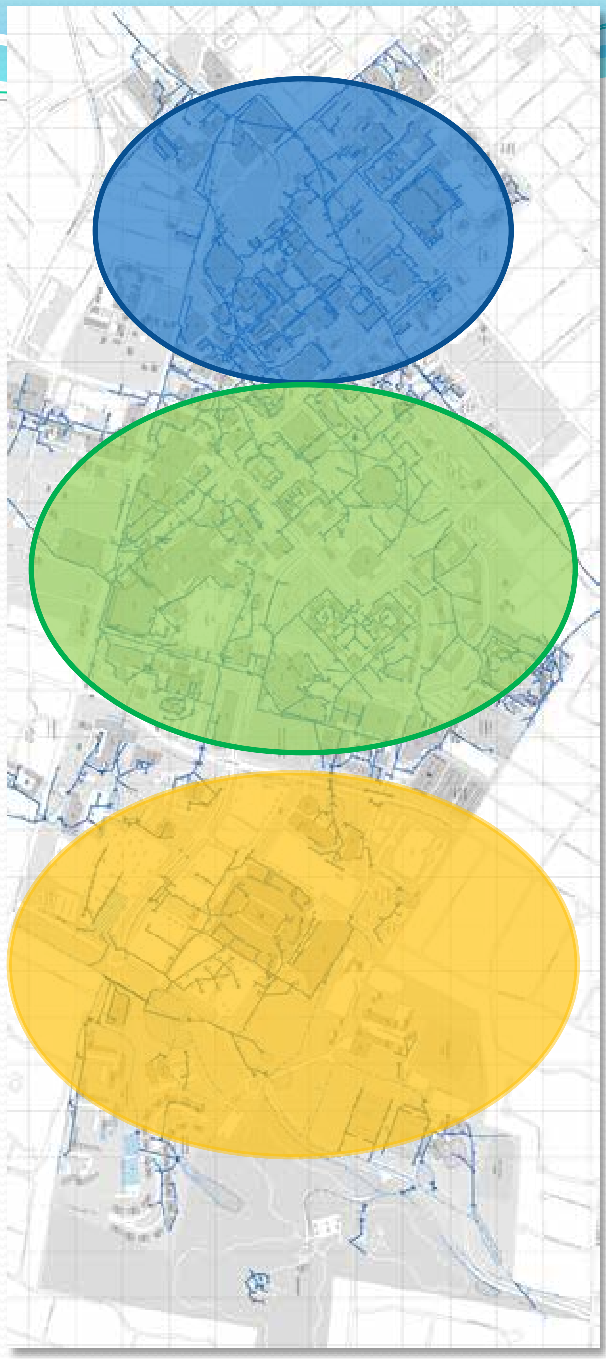
UK Stormwater Mapping Verification Study

- Step 1 – Verification
- Step 2 – Condition Assessment
- Step 3 – Modeling and System Evaluation (next phase of work)

Project Background

- The University of Kentucky (UK) maintains its own stormwater system. UK's campus can be divided into three areas based on their runoff conveyance system.
  - North campus is characterized by closed underground conduit conveyance.
  - Central campus runoff is conveyed by a combination of sinkholes and close conduits.
  - South campus runoff is generally carried through open channels and overland flow and uses underground storage and above ground detention systems.
- The current storm sewer map only shows lines 15" or greater and drains 3'x3' or larger.



UK's Stormwater System

- Estimated to be approximately 17 miles of gravity stormwater conduit (12-inch diameter or greater),
- Based on UK's GIS mapping, there are approximately 2,100 stormwater conveyance structures.

Table 1 Overview of Existing Stormwater Pipe		
UK Stormwater Closed Conduit Sizes		
Pipe Diameter (inches)	Length (feet)	% by Diameter
12	24,055	26.2
15	18,770	20.5
18	19,639	21.4
21	2,192	2.4
24	13,550	14.8
30	4,644	5.1
36	1,954	2.1
42	1,047	1.1
48	3,183	3.5
54	863	0.9
60	492	0.5
72	945	1.0
91	423	0.5
Total Closed Conduit =	91,757	100.0

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UK's Stormwater System

– Over five miles of open channel flow, and numerous sink holes.

Table 2 Summary of Open Channel Flow	
Open Channel Flow	
Channel Material	Length (feet)
Crushed Stone	1,660
Grass Ditch	22,923
Creek	2,292
Concrete	2,535
Total Open Channel Flow =	29,410

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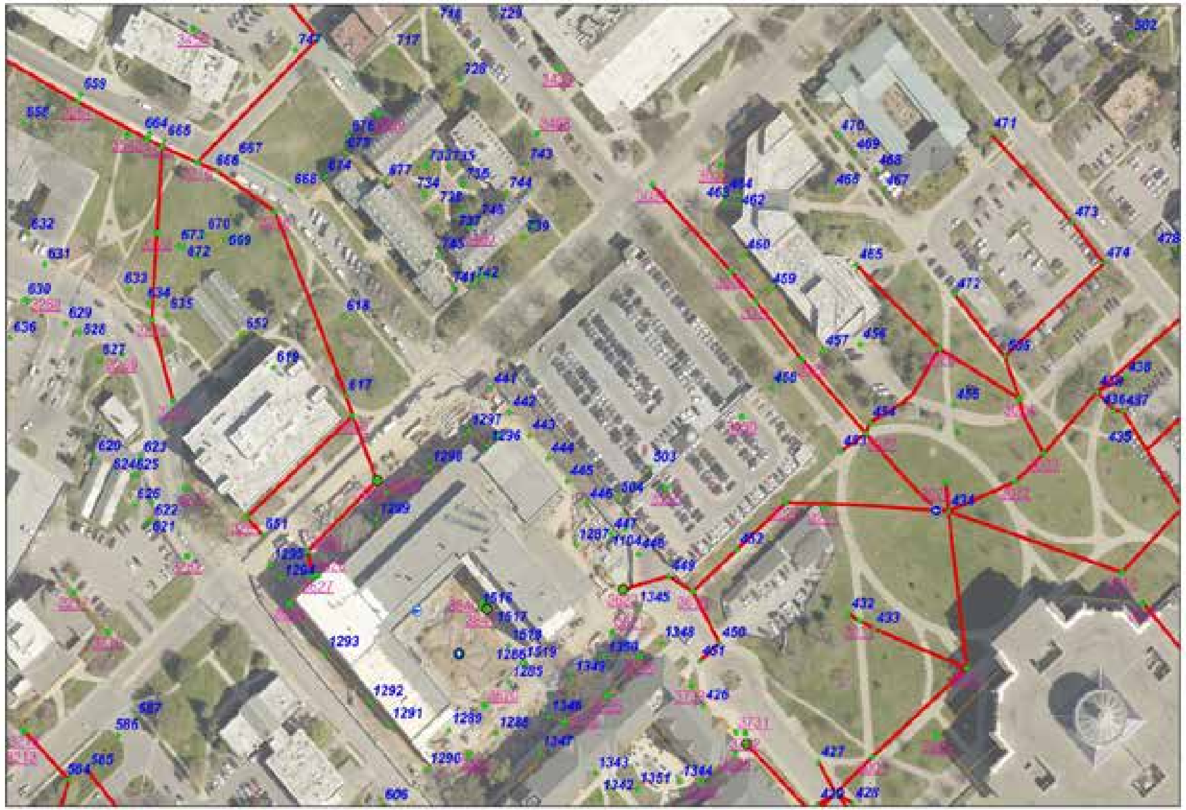
Verification

The first step and highest priority for completing a stormwater evaluation is to conduct a comprehensive inventory and GIS mapping of all stormwater structures. Specifically, these tasks include:

- Conduct field verification of up to 2,100 stormwater conveyance structures.
- Provide a geo-tagged photo of each verified structure.
- Compile the collected information along with the existing information into a single, user-friendly tool.



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Condition Assessment

Owner: University of Kentucky
Manhole Inspection Form

Manhole Identification Number: TB2_146

Manhole Comment: COULD NOT OPEN MANHOLE

Surveyed By	
Date	
MH Address	
MH Topo Location	
MH Surface Type	
Runoff Potential	
Signs of Surcharge	
Depth Rim to Grade	
Cover Diameter (ft)	
Cover No. of Holes	
Cover Condition	
Insert	
Insert Condition	
Adjustment Ring No.	
Adjustment Ht (in)	
Frame Condition	
Frame Offset (in)	
Chimney Material	
Chimney Condition	
Cone Material	
Cone Condition	
Wall Material	
Wall Condition	
Bench Material	
Bench Condition	
Channel Material	
Channel Condition	

Steps No.	
Steps Condition	
Pipe 1 Clock (Out)	
Pipe 1 Diameter (in)	
Pipe 1 Material	
Pipe 1 Rim to Inv.(ft)	
Pipe 1 Wall Seal Cond.	
Pipe 2 Clock (CW)	
Pipe 2 Diameter (in)	
Pipe 2 Material	
Pipe 2 Rim to Inv.(ft)	
Pipe 2 Wall Seal Cond.	
Pipe 3 Clock (CW)	
Pipe 3 Diameter (in)	
Pipe 3 Material	
Pipe 3 Rim to Inv.(ft)	
Pipe 3 Wall Seal Cond.	
Pipe 4 Clock (CW)	
Pipe 4 Diameter (in)	
Pipe 4 Material	
Pipe 4 Rim to Inv.(ft)	
Pipe 4 Wall Seal Cond.	

Comment 1	
Comment 2	
Comment 3	

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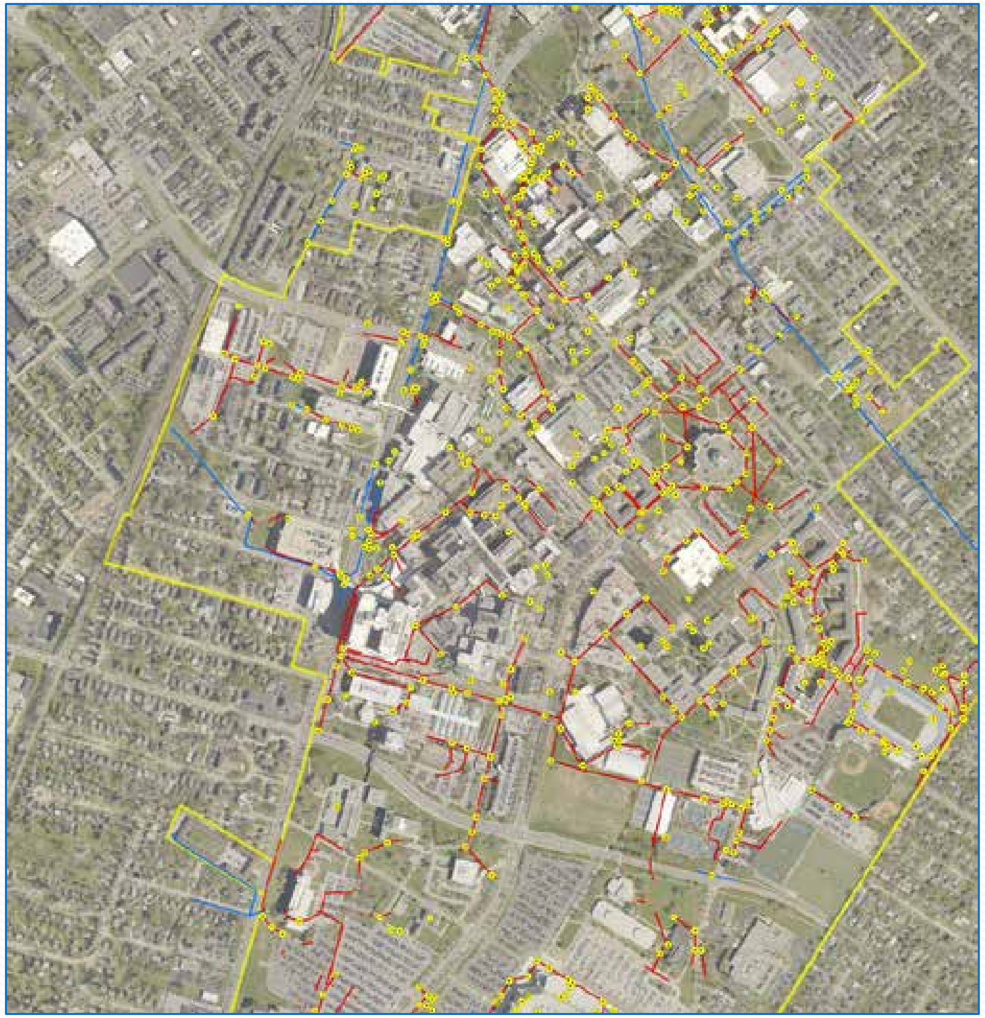
Report & Next Steps

- Complete field work
- Process and QA data sets
- Generate GIS shapefiles
- Develop recommendations

Next phase of work:

- Watershed level models
  - water quantity (flooding)
  - water quality (possible pollutants)



Thank you

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