Stantec

Springbrook 2D Watershed Model

AGENDA

Agenda

- Project Overview
- Model Setup
- Review Results
- Determine Priority Areas
- Compile Potential Projects

Meeting Goal: Provide update on existing conditions model results and obtain input to determine priority flooding areas and compile potential project list to evaluate in next phase.

Project Overview

- 2D pilot model to understand benefits for planning purposes only, model not used for regulatory requirements
- Utilized existing data sources to develop the model:
    - GIS data from urban areas
    - LiDAR datasets
    - Survey information
    - XPSWMM modeling software
- The ICM model consists of two components:
    - A 1D subsurface (and creek) drainage network
    - A 2D surface model
- Existing conditions model is complete to finalize existing SOW
- Determine priority areas and potential projects for creating proposed model (FOCUS FOR TODAY)

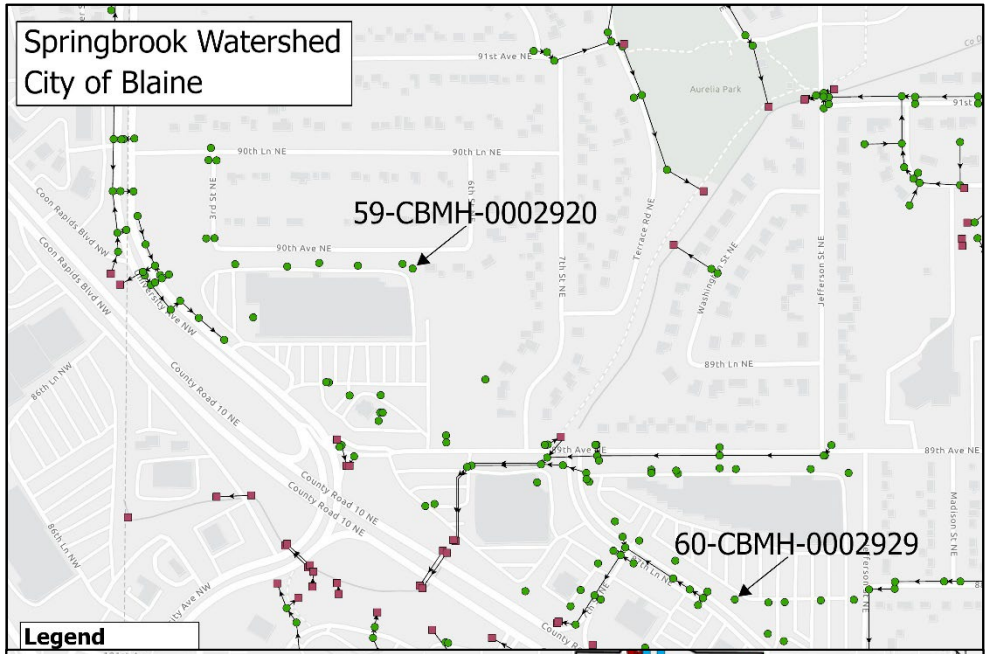
Modeling Approach

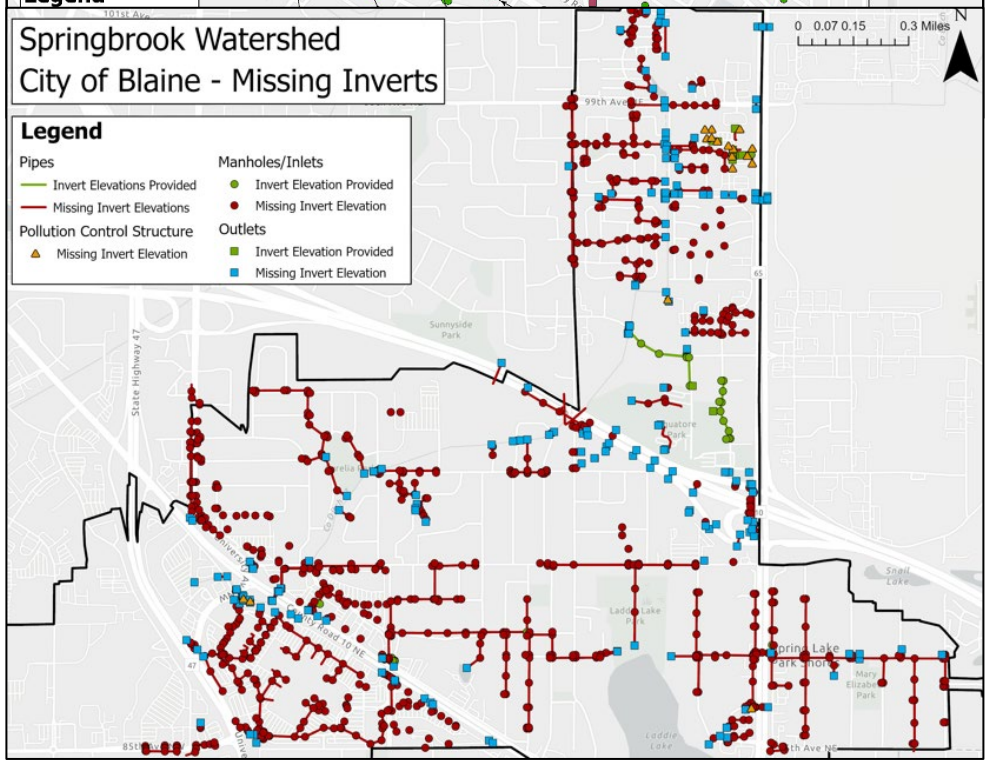
- 1D/2D integrated stormwater model in ICM applying rain-on-mesh methodology
- The subsurface stormwater network was built by combining data from the existing XPSWMM model and available GIS information
- The surface was modeled using a mesh built from a digital elevation model (DEM) covering the region with Horton Infiltration applied
- Major surface conveyance components and permanent water features (rivers, lakes) were modeled with a 1D representation where appropriate

DATA REVIEW

GIS Data Review – Subsurface Network

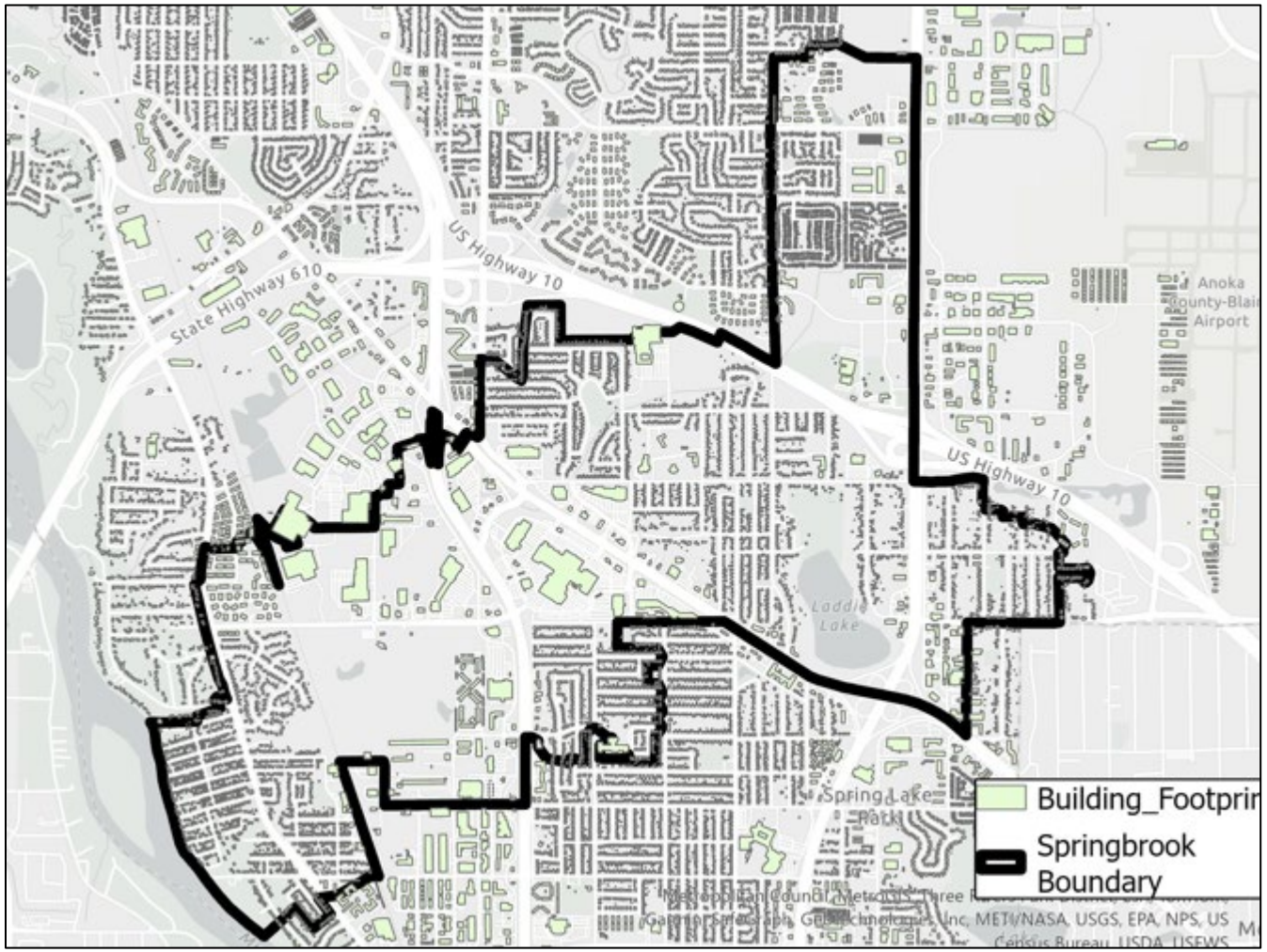
- Majority of subsurface drainage is missing from the XPSWMM model
- City GIS data used where available:
  - Pipe Sizes
  - Invert Elevations
  - Pipes
- Assumptions were used to fill in data gaps and flagged in the model if data becomes available in future





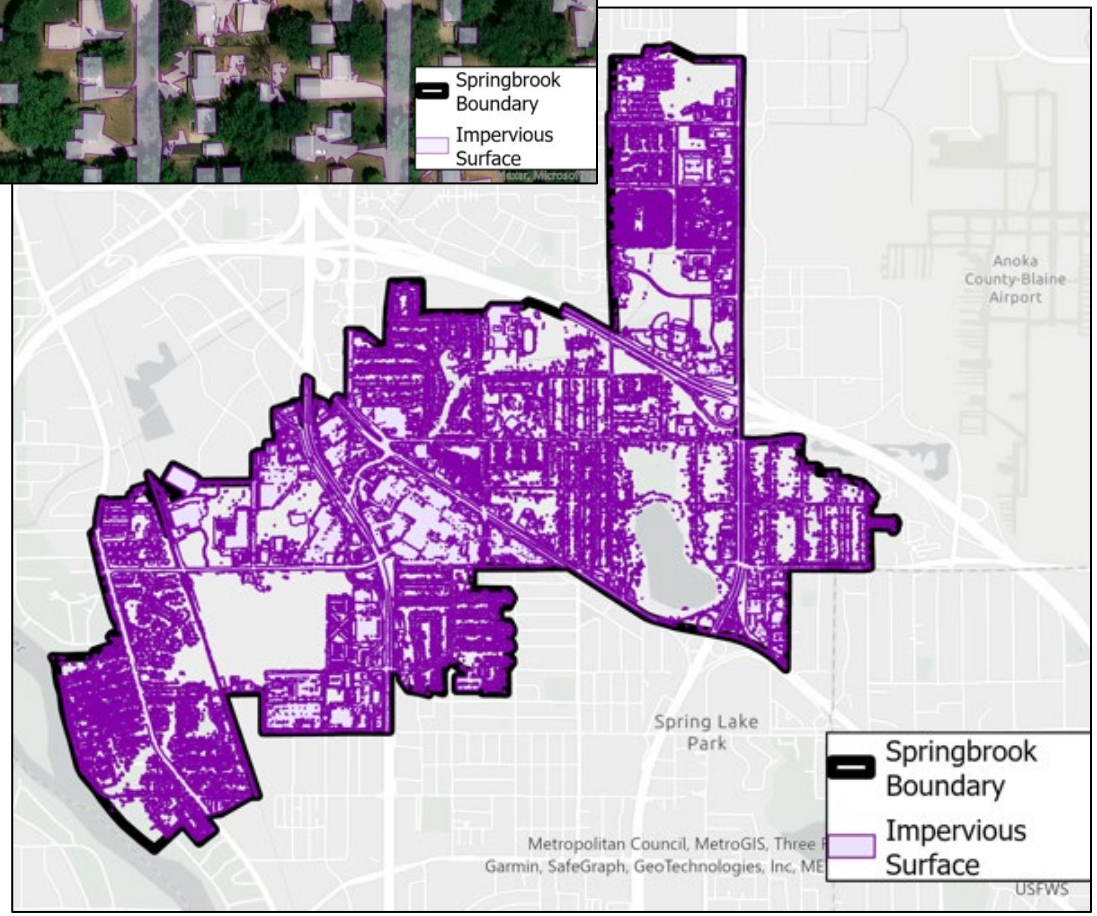
GIS Data Review – Buildings

- Building footprints for the Coon Creek area were pulled from Anoka County website



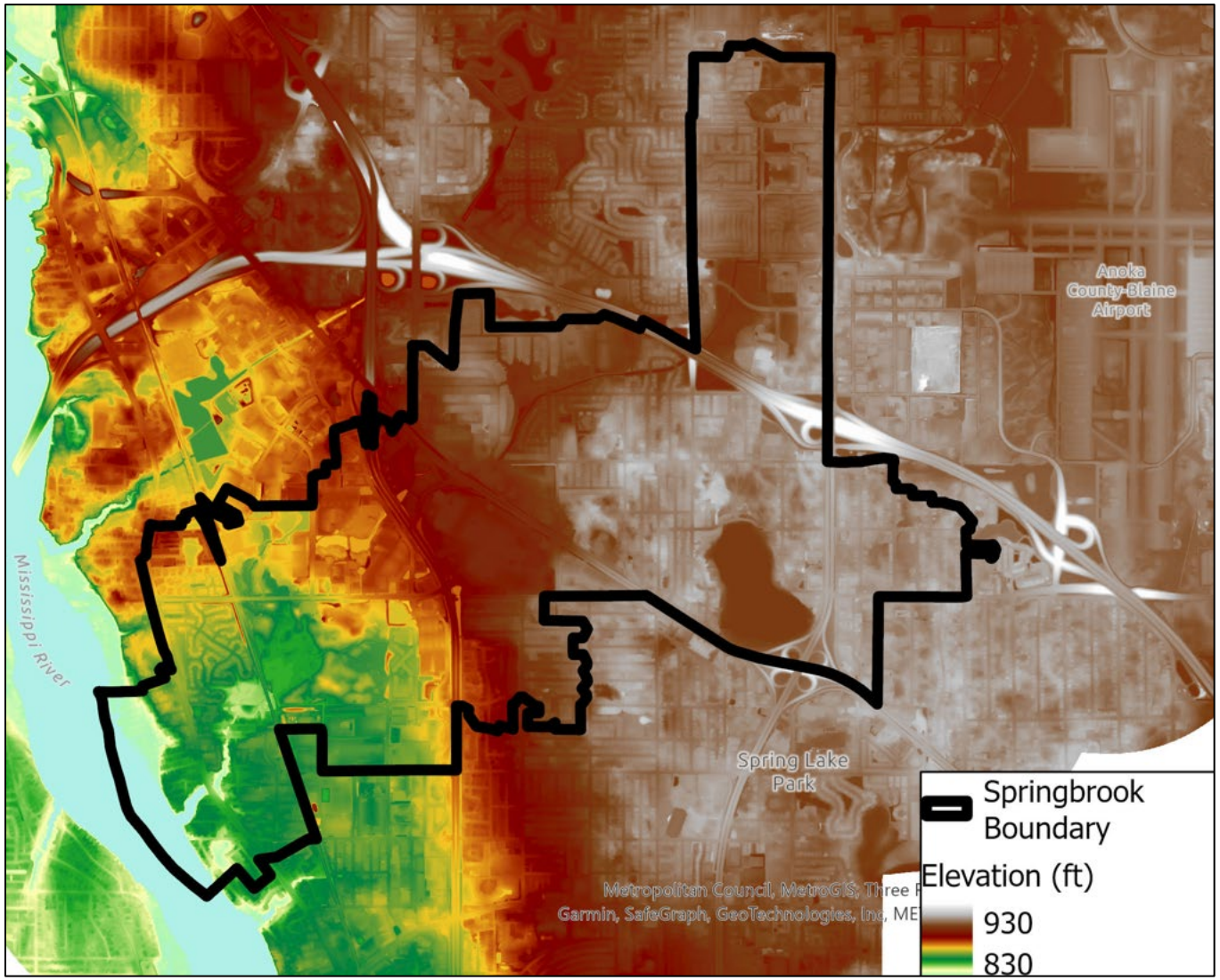
GIS Data Review – Impervious Coverage

- Impervious surface layer provided by CCWD
- Covers most impervious surfaces within the Springbrook watershed



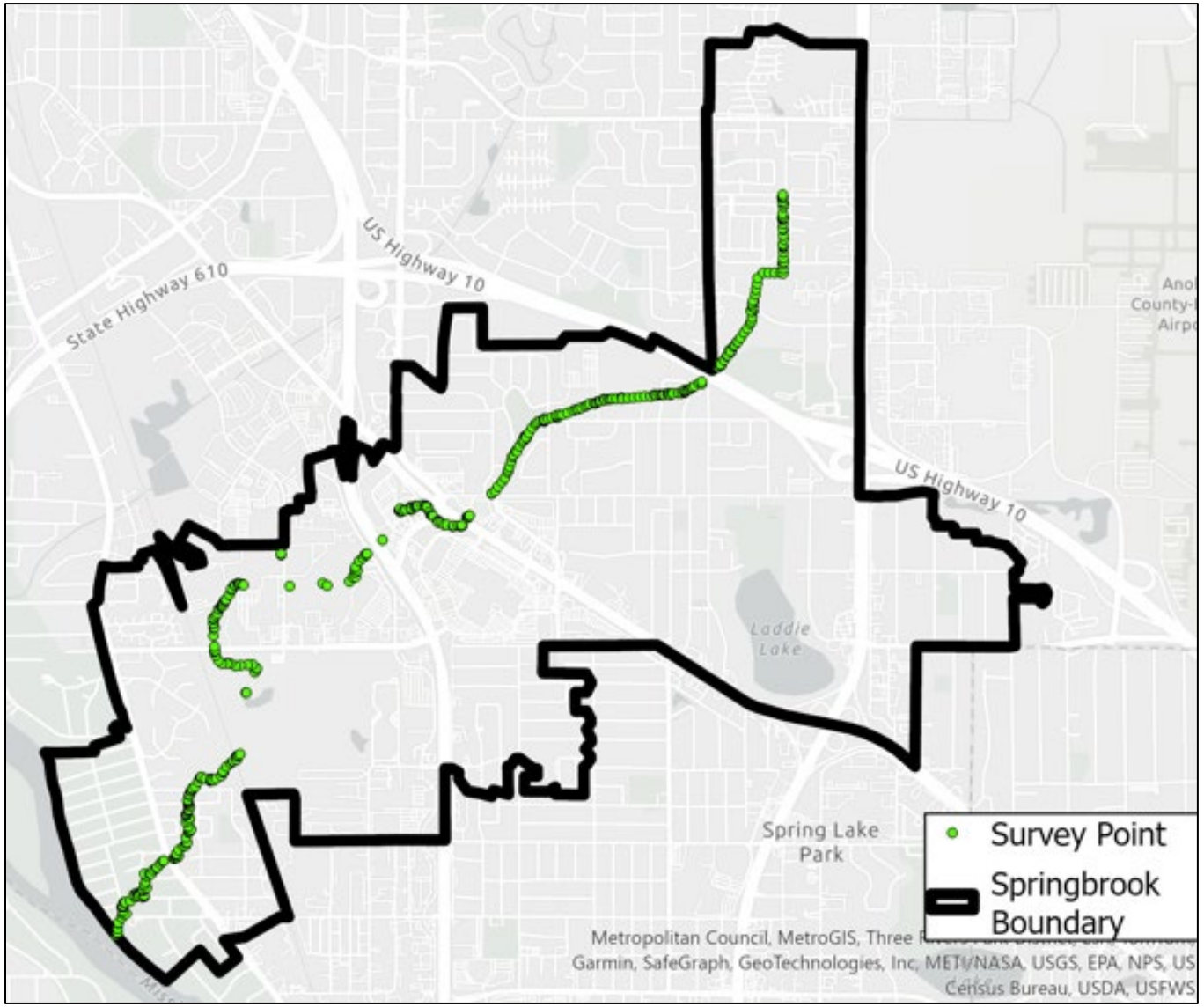
LiDAR Data

- Stantec previously converted 2022 LiDAR data to a useable DEM
- The DEM covers the entire Springbrook watershed and will be used for the 2D model ground surface (outside of permanent water features)
- DEM resolution is 1ft x 1ft



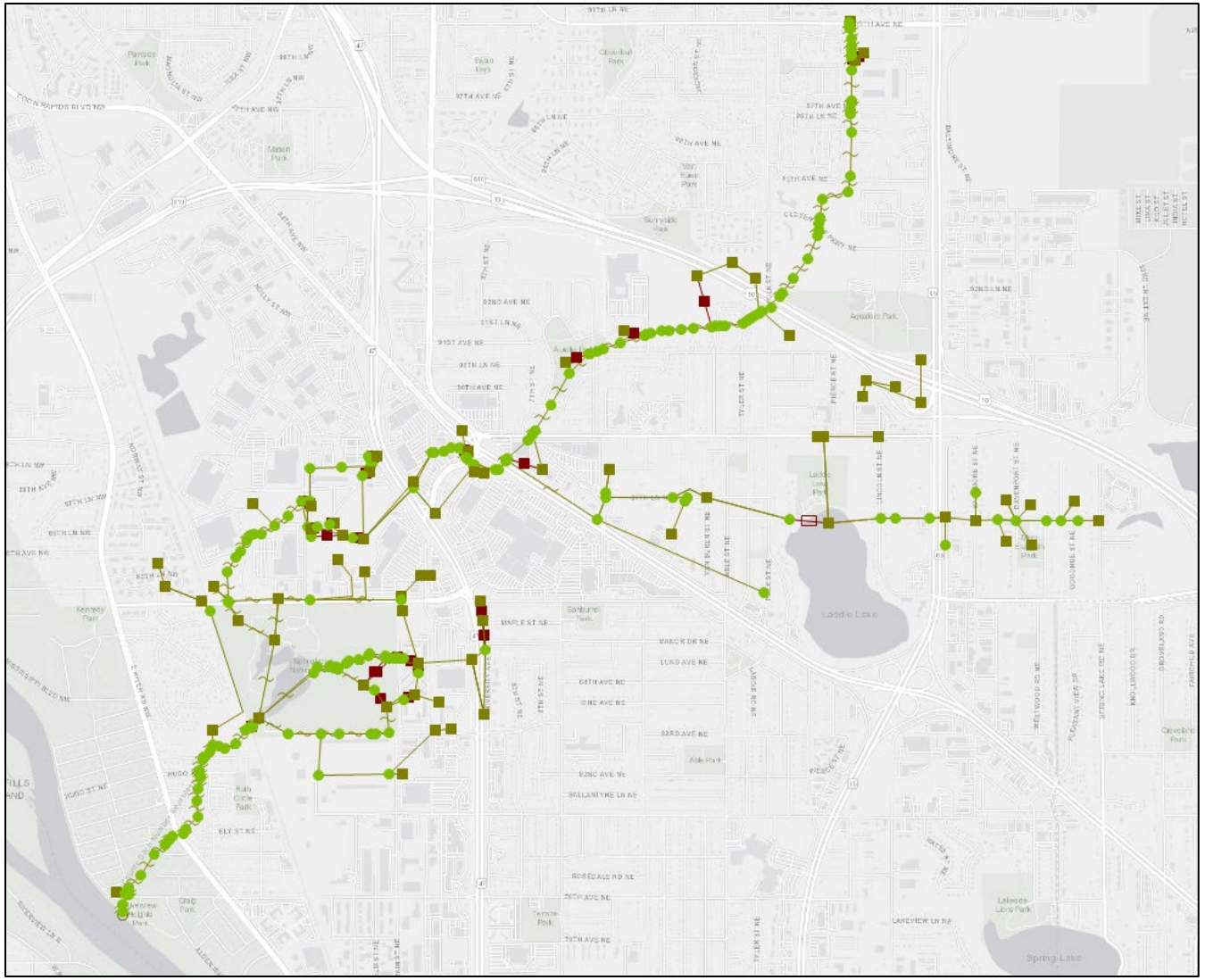
Survey Data

- 2021 ditch centerline survey elevation data used to represent Springbrook stream reach
- Limited survey data covering an entire cross section
- Cross sections for the model will be built by combining DEM and survey data



XPSWMM Model

- Only contains major conveyance network
- Some stream reaches are simplified and do not follow the stream centerlines
- Primary source for structure information (culverts, etc.) along major conveyance pathways



Model Assumptions – Flagging in ICM

- Every field in ICM is accompanied by a data flag
- This allows us to identify the data source used to populate the information within the model by creating user defined flags
- Assumptions used to fill in data gaps were flagged in the model for easier updating if data becomes available

AS			Assumed Value
DEM			From DEM
GIS			From GIS Dataset
INF			Inferred Value
XP			From XPSWMM Model

Conduit : 8045.1 : SpringbrookWatershed

Conduit Object Properties

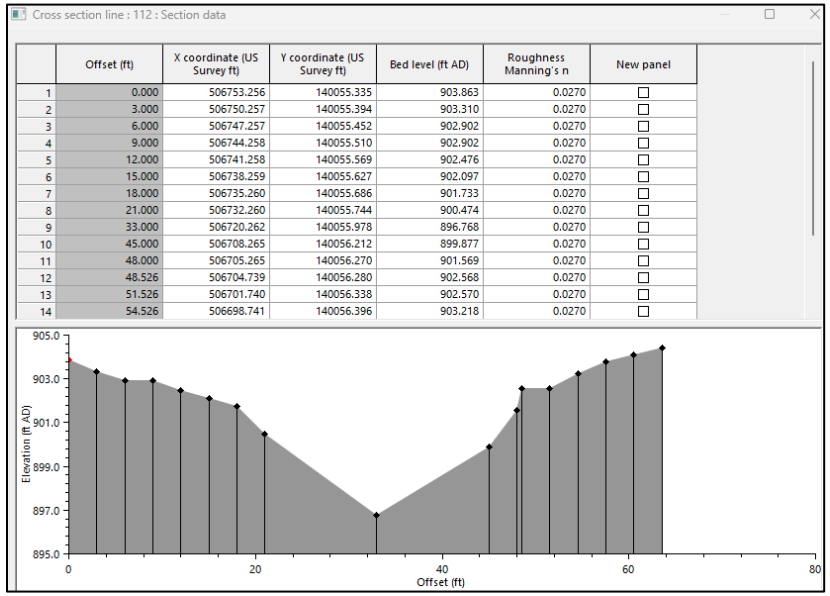
Link definition			
US node ID	8045		GIS
DS node ID	8046		GIS
Link suffix	1		
Link type	Cond		
Asset ID	8112		GIS
Sewer reference			
System type	Other		
Branch ID			
Water quality settlement efficiency			
Conduit definition			
Cross section			
Shape ID	CIRC		#D
Width (in)	18.0		GIS
Height (in)	18.0		#D
Sediment depth (in)	0.0		#D
Number of barrels	1		#D
Roughness parameters			
Long section			
Length (ft)	283.4		#D
Inflow (MGD)	0.0000		#D
Gradient (%)	1.004		
Full capacity (MGD)	6.81		
US invert level (ft AD)	857.616		INF
DS invert level (ft AD)	854.769		INF
US headloss type	Normal		#D
DS headloss type	Normal		#D

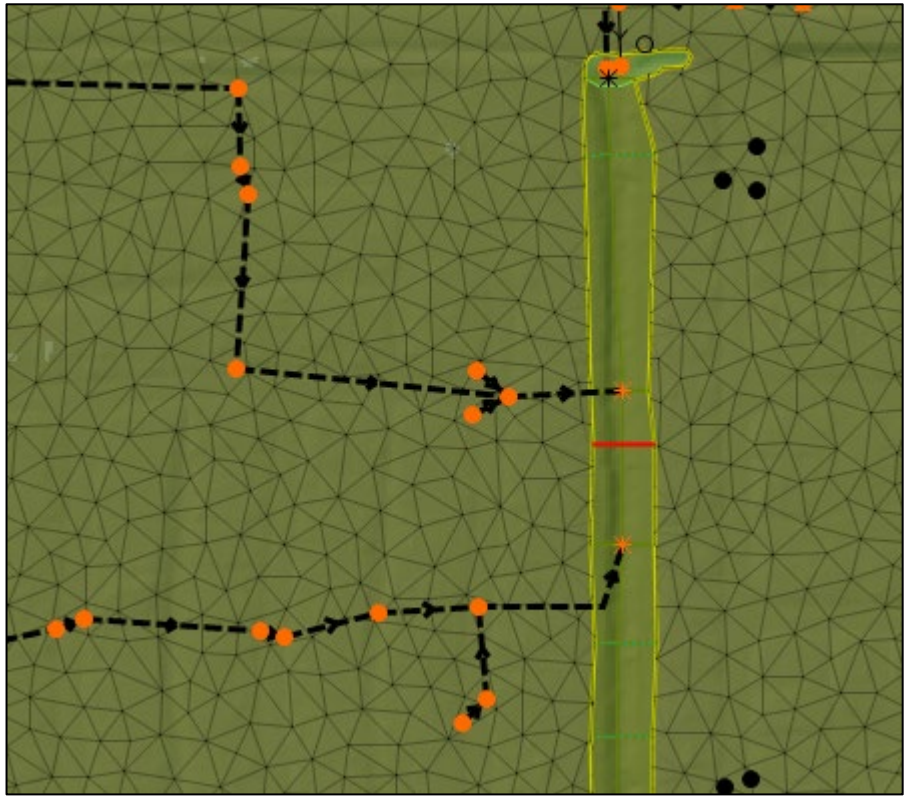
Model Assumptions – GIS Data Gaps

- Missing ground surface information
  - Sampled from DEM
- Missing invert information
  - Interpolated from US/DS known inverts where possible
  - If US inverts are not known – assume 3 feet of cover
  - For long sections of unknown pipe inverts – generally follow ground surface
- Missing pipe size
  - Use downstream or upstream pipe size if known
  - Assume 18-inch size on any unknown pipe segments
- Missing pipe
  - Use best judgement following ground surface to connect manholes/inlets to nearby ditch

Model Assumptions – River Reaches

- Major overland conveyance routes modeled as 1D river reaches with bank lines that are connected to the 2D mesh
- Cross sections for the 1D river reaches are built by using the DEM data combined with the ditch centerline data for the stream bottom





Model Assumptions – Other inputs

- Standard Horton Infiltration Values for the region used as a starting point, modifications were made after comparing model results to historic event data

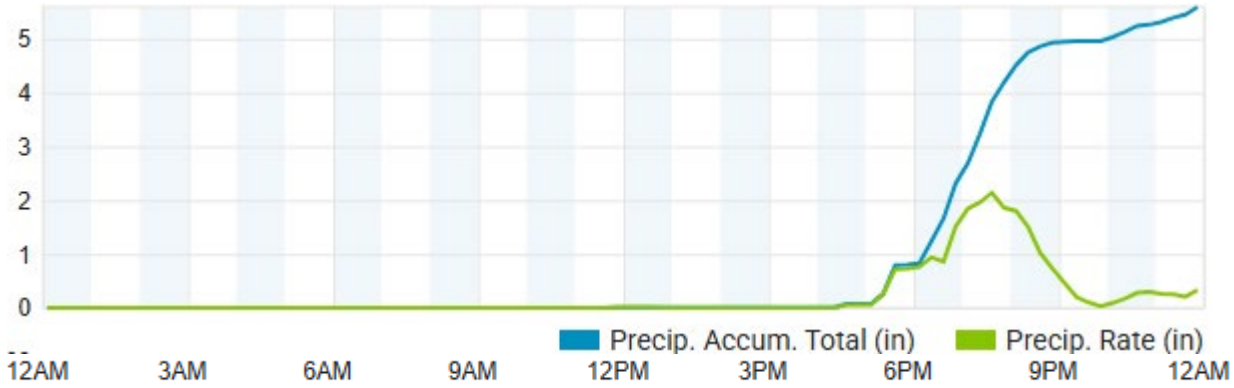
Hydrologic Soil Group	Max. Infiltration Rate (in/hr)	Min. Infiltration Rate (in/hr)	Decay Coefficient (1/s)
A	5	0.5	0.00115
B	3	0.3	0.00115
C	2	0.1	0.00115
D	1	0.03	0.00115

- Standard manning's n roughness values will be applied to the model (XPSWMM values):
  - Pipes: 0.013
  - Stream Channel: 0.027
  - Channel Banks: 0.045
  - Impervious Surfaces: 0.018
  - Pervious Surfaces: 0.06

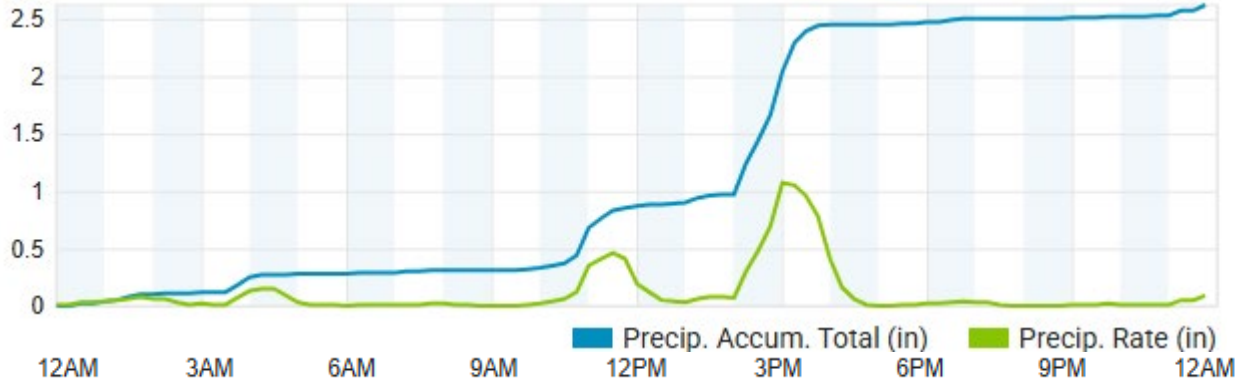
Historic Storms

- Two historic storms used to validate model results
- These events are:
    1. September 21-22, 2016
    2. September 25, 2023
- Precipitation data for these events were sourced from nearby weatherunderground Personal Weather Stations
- ICM can apply multiple raingauges, mesh elements were assigned rainfall from closest raingauge

September 21, 2016



September 25, 2023



Internal Model Review

- Add buffer to existing subwatershed boundary to ensure runoff that might be flowing into or out of Springbrook during larger storm events was captured
- Reviewed Mississippi River elevations for sensitivity of the model and set it at NWL based on aerial images and local gauges
- Broke up roof drainage for buildings greater than 2 acres

Model Results

- Results for 10- and 100-Yr storm designs
  - Overall water surface extent
  - Structural flooding
  - Road overtopping

Springbrook Creek 10/100 Year Flooding Impact

Priority Areas and Potential Projects

Springbrook Creek 10/100 Year Flooding Impact

MODEL ASSUMPTIONS

Next Steps

Questions

Stantec

Thank you