Watershed Modeling Update
Fowl River Watershed Study

- Funded by NFWF-GEBF
- Fowl River Watershed Restoration
- Watershed model developed to inform restoration and stormwater management
Weather Station Locations

- Installed four (4) Davis Instruments Vantage Pro 2 Precision Weather Stations
- 1 USGS Gauge
- Collected rainfall, wind speed, humidity, temperature, and pressure
Stream Gauge Locations

- Installed three (3) Trimble Telog RU-33 with Level Logger Gauges
- 1 USGS Gauge
- Collected stream stages during rainfall events
GSSHA Hydrologic Model

What is GSSHA?

- Gridded Surface Subsurface Hydrologic Analysis (GSSHA) is a physics-based, distributed, hydrologic, sediment and constituent fate and transport model.
- Features include two dimensional (2-D) overland flow, 1-D stream flow, 1-D infiltration, 2-D groundwater, and full coupling between the groundwater, shallow soils, streams, and overland flow.
- GSSHA can be used as an episodic or continuous model where soil surface moisture, groundwater levels, stream interactions, and constituent fate are continuously simulated.
GSSHA Model Information

Elevation Data
Land Use Data
Soil Data
Gridded GSSHA Model

- The watershed was divided into thousands of grid cells.
- Each grid cell is 60 meter x 60 meter (approx 200 feet x 200 feet).
- Total number of grid cells for the watershed is approximately 37,900.
- Each individual grid cell is assigned an elevation, overland roughness value, infiltration variables (hydraulic conductivity, porosity, capillary head), and an initial soil moisture value.
Gridded GSSHA Model

Gridded Elevation Data

Gridded Land Use
Gridded GSSHA Model

Gridded Soils Data
Gridded Land Use/Soils Data
Initial Rainfall Event

• After the model had been built, a rainfall event was necessary for calibration
• On June 20-21, 2017 approximately 5-6” of rain fell across the watershed
• A calibration was made to this rain event to gain an initial understanding of how the watershed reacts
• Typically a model calibrated to a small rain event will not translate to a larger storm
• Another rain event was necessary to see if the variables would apply to a larger discharge event
• A larger rain event fell on August 29-30, 2017
August 29 – 30, 2017 Rain Event

Rainfall plot for August 29 – 30 Rain Event (inch / 30 min)

Data obtained from installed weather stations

Cumulative Rainfall for August 29 – 30 Rain Event (inches)
GSSHA vs Field Measured

GSSHA vs Field Measured at I-10

GSSHA vs Field Measured at Half Mile Rd (USGS Gauge)
GSSHA Results vs Field Measured

GSSHA vs Field Measured at Half Mile Rd (RU-33 Gauge)

GSSHA vs Field Measured at Thomas Road Gauge
GSSHA Results vs FieldMeasured
August 29 – 30, 2017

• This model used variables calibrated to the June 20-21, 2017 event
• The timing of the peak discharge was reasonable, however peak discharges were too high
• Several iterations and adjustments to the Manning’s overland ‘n’ value, channel ‘n’ values, hydraulic conductivity, and initial soil moisture were performed.
• Each adjustment made some improvement, however the peak discharges at the Half Mile Road gauges were still outside the range of a reasonable comparison
• Retention depths were added throughout the model
GSSHA Results w/Retention vs Field Measured

GSSHA vs Field Measured at I-10

August 29-30, 2017
I-10 Gauge vs GSSHA

GSSHA vs Field Measured at Half Mile Rd (USGS Gauge)
GSSHA Results w/Retention vs Field Measured

GSSHA vs Field Measured at Half Mile Rd (RU-33 Gauge)

GSSHA vs Field Measured at Thomas Road
GSSHA Results with Retention vs Field Measured
August 29 – 30, 2017

• The timing of the peak discharge was reasonable
• Retention helped bring most of the discharges into a reasonable range except at Half Mile Road
• Another rain event was necessary for comparison
October 22-23, 2017 Rain Event

Rainfall plot for October 22-23 Rain Event (inch / 30 min)

Data obtained from installed weather stations

Cumulative Rainfall for October 22-23 Rain Event (inches)
GSSHA Results w/Retention vs Field Measured

GSSHA vs Field Measured at I-10

GSSHA vs Field Measured at Half Mile Rd (USGS Gauge)
GSSHA Results with Retention vs Field Measured
October 22-23, 2017

• The timing of the peak discharge was reasonable
• Retention helped bring most of the discharges into a reasonable range except at Half Mile Road
• It was determined that appreciable storage is occurring between I-10 and Half Mile Road
• The topography in this area starts to flatten, there are also a lot of trees and wetlands
• It appears that the railroad bridge acts as a constriction providing detention-like storage
• A hydraulic structure was added to the model to replicate detention
Railroad Detention

Storage

Railroad Bridge Constriction
Railroad Detention
GSSHA Results w/Retention and Detention vs Field Measured

GSSHA with retention and detention vs Field Measured at Half Mile Road for the October 22-23 rain event

GSSHA with retention and detention vs Field Measured at Half Mile Road for the August 29-30 rain event
GSSHA Results with Retention & Detention vs Field Measured

- Adding retention (throughout the watershed) and detention (between I-10 and Half Mile Road) helped bring the discharges into a reasonable range at all locations
Fowl River Conclusions

• There is significant storage throughout the watershed
• A 5-year rainfall event produces rural basin discharges despite the development in the headwaters
• Until a larger rainfall event is captured, it is undetermined the impact the storage will have on peak discharges during larger flooding events
Next Steps:

- Funding received to develop models for remaining NFWF funded watersheds
- Need for training program
- Technical Committee