Assessing the Influence of Urban Karst on the Sustainability of Stream Flow

Robert G. Ford, Ken M. Fritz, Lauren E. Brase, Adam Lehmann, Ben Gamble

Office of Research and Development
Center for Environmental Solutions and Emergency Response

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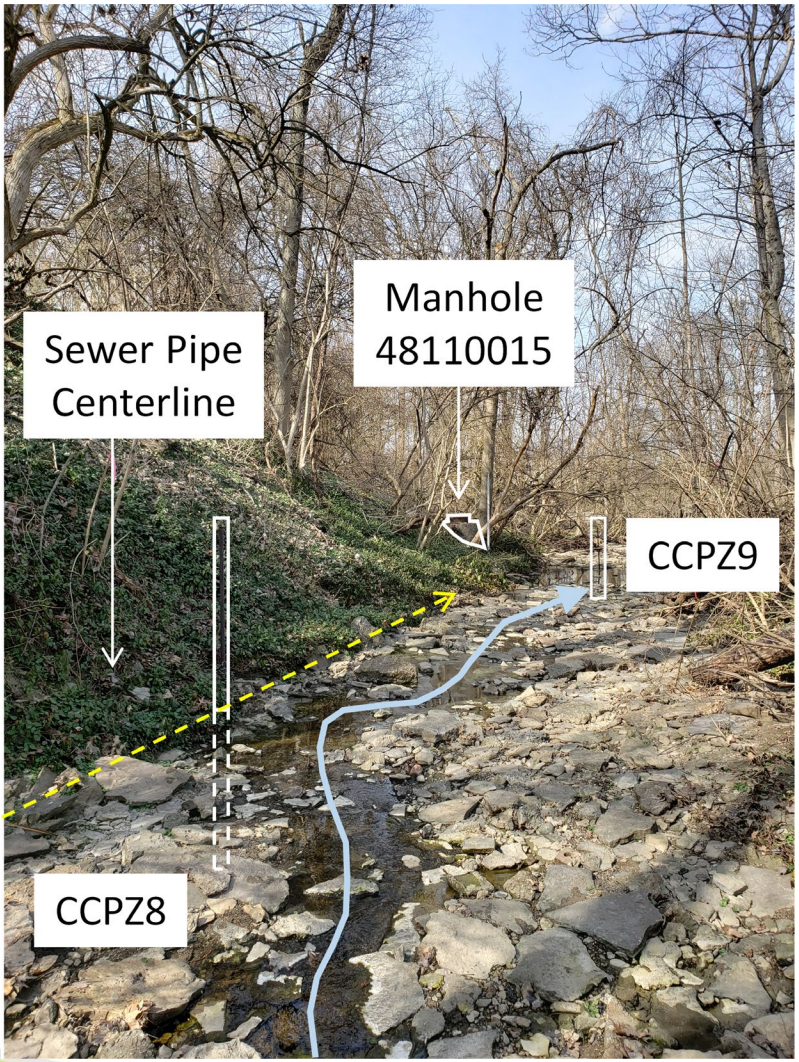
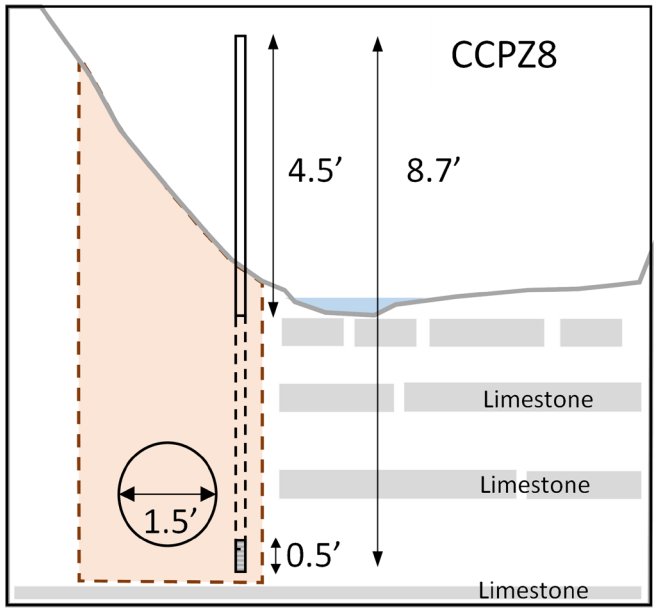
Streams Impacted by Urban Hydrologic Alteration

- Increased frequency of erosive flash flows due to excessive stormwater runoff
  - Disturbance to stream bed and biota
  - Increased sediment load due to erosion
- Decreased baseflow
  - Reduced infiltration and recharge to groundwater due to impervious surfaces
  - Parasitic loss of stream water to underground infrastructure (“urban karst”)

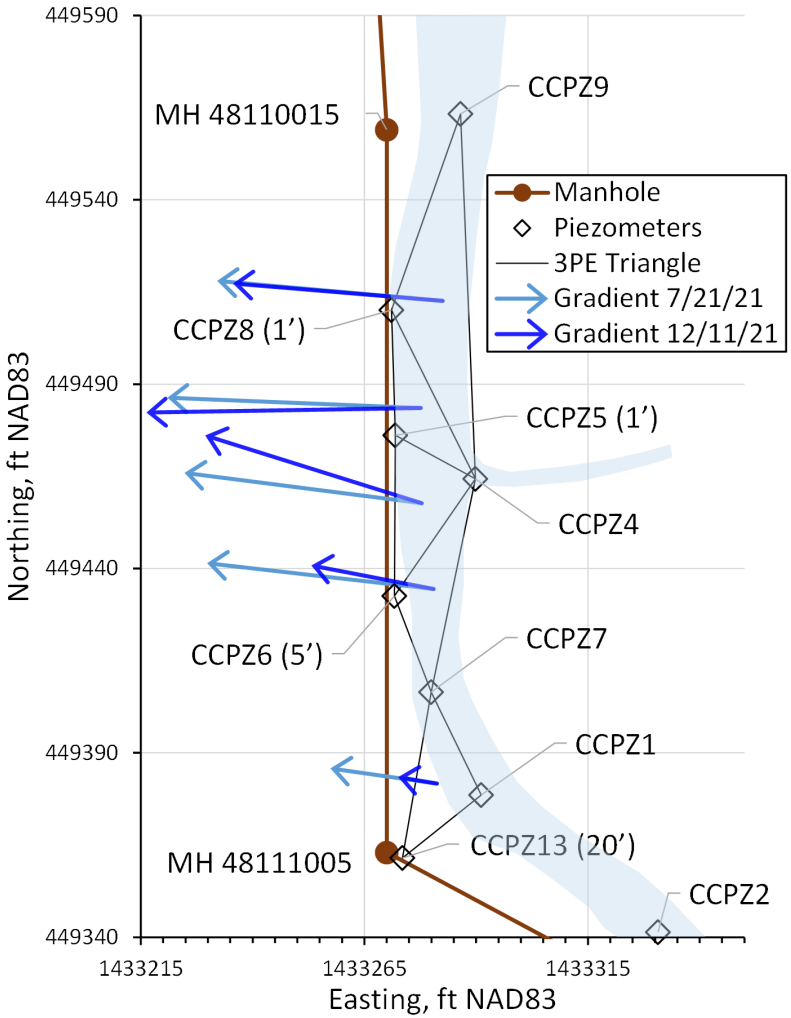
What is “Urban Karst”?



- Inferred geology is layered system of limestone and weathered shale
- Sanitary sewer pipe trench is an example of man-made lithology that intersects natural subsurface structure – potentially supports preferential flow

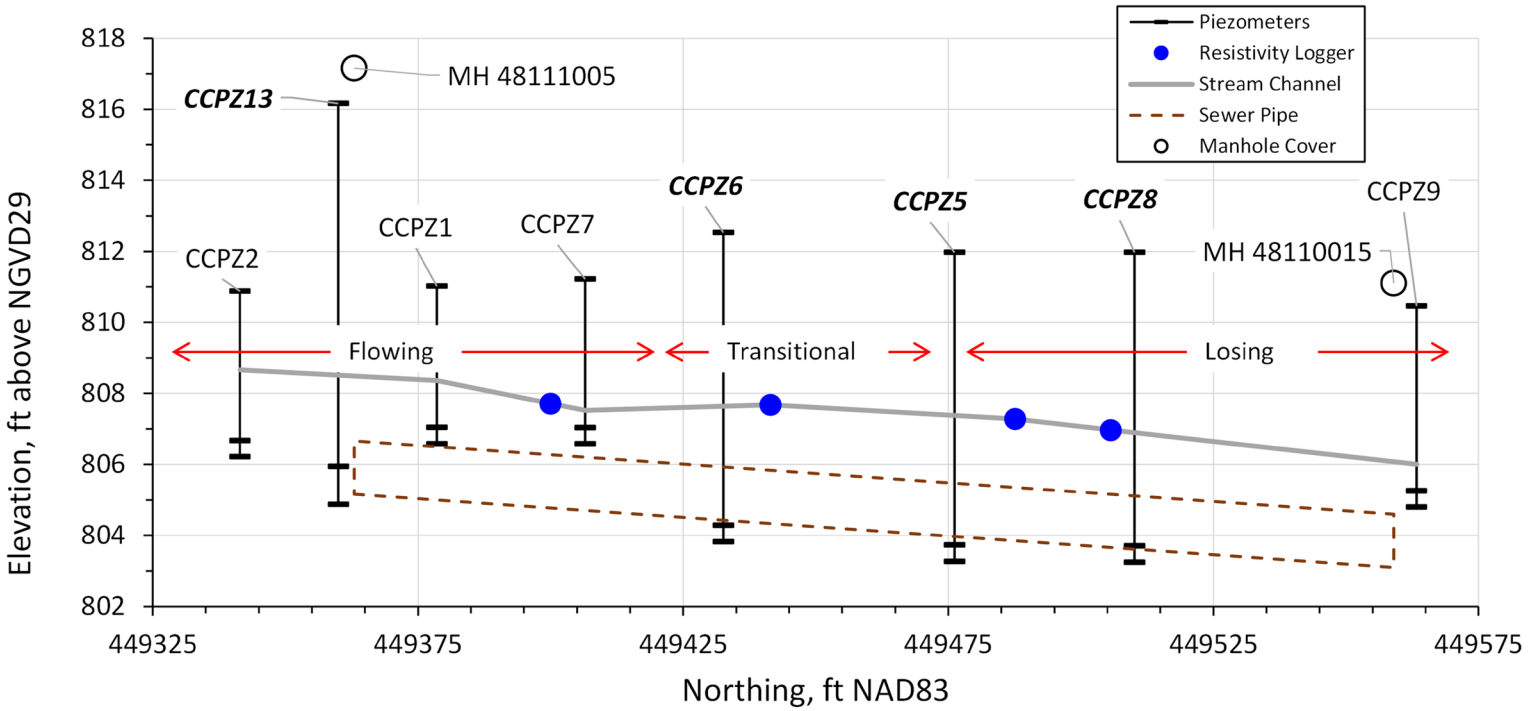


Continuous Monitoring of Stream and Shallow Groundwater - Network



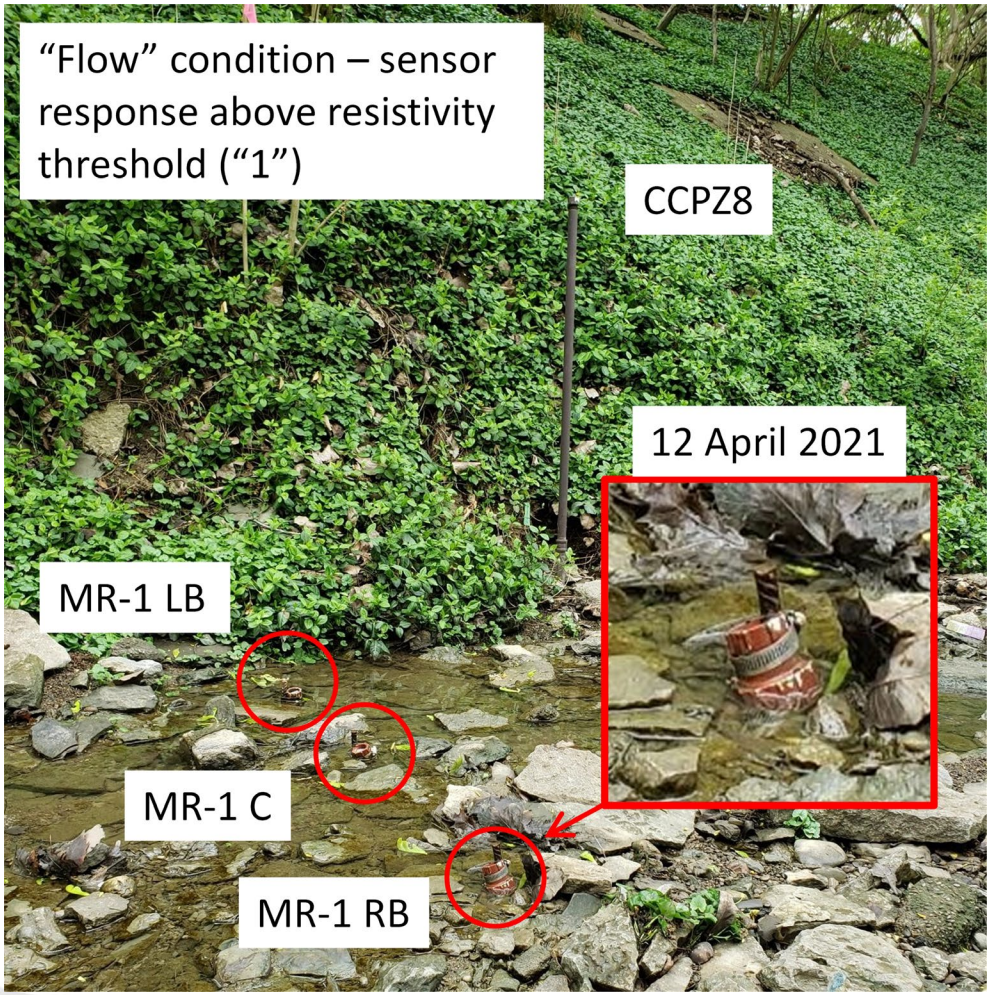
- Temporary piezometers used to monitor shallow groundwater elevations under stream and adjacent to sewer line.
- Logging transducers provide a continuous record that can be compared to stream stage and sewer pipe flow (monitored at MH 48110015 by MSD).

Continuous Monitoring of Stream and Shallow Groundwater - Piezometers



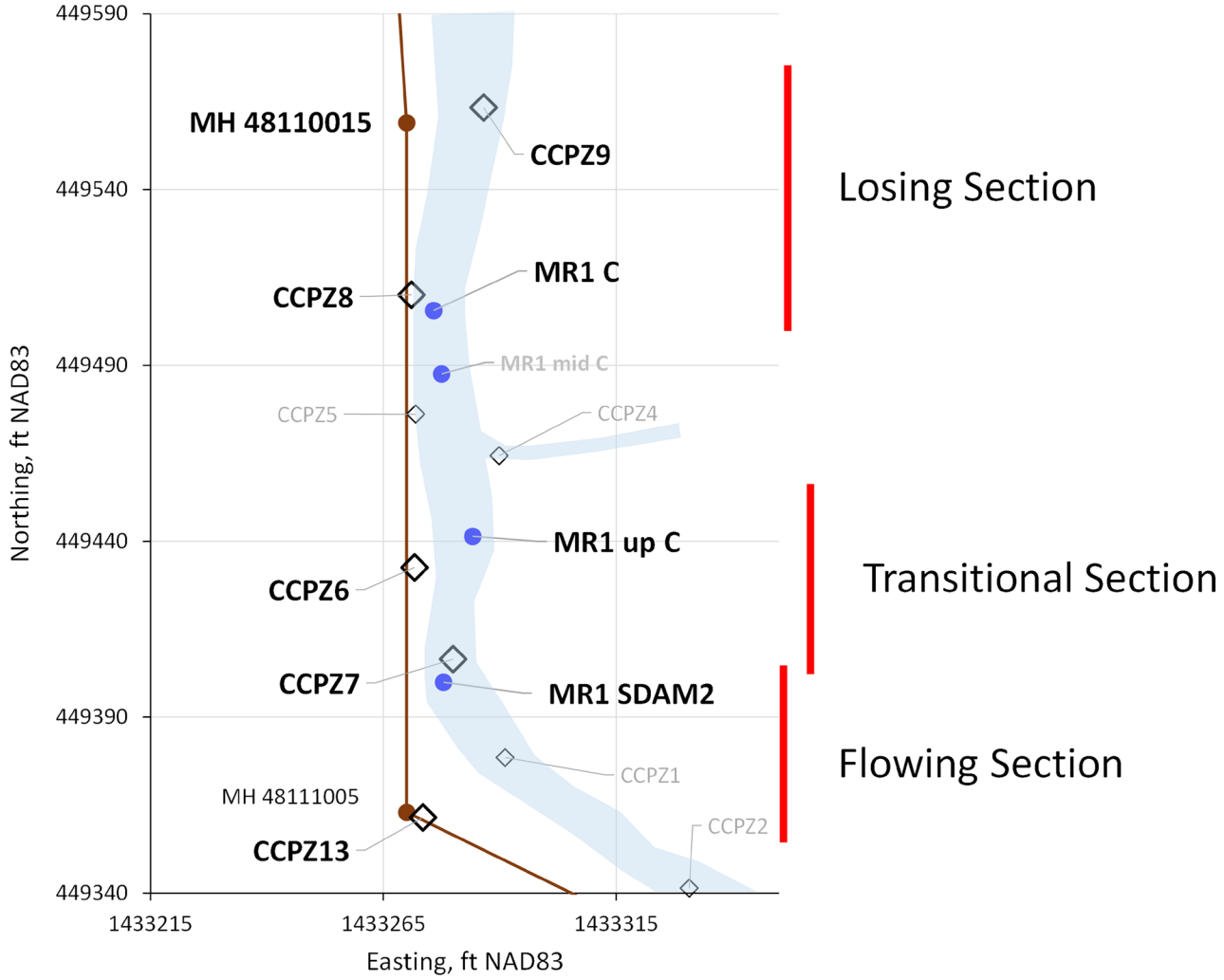
- In-stream temporary piezometers in thalweg at depth 1.5-2.0 feet below stream bed
- ***Shoreline*** temporary piezometers adjacent to sewer pipe at depths near pipe invert

Continuous Monitoring of Stream and Shallow Groundwater – Resistivity Loggers

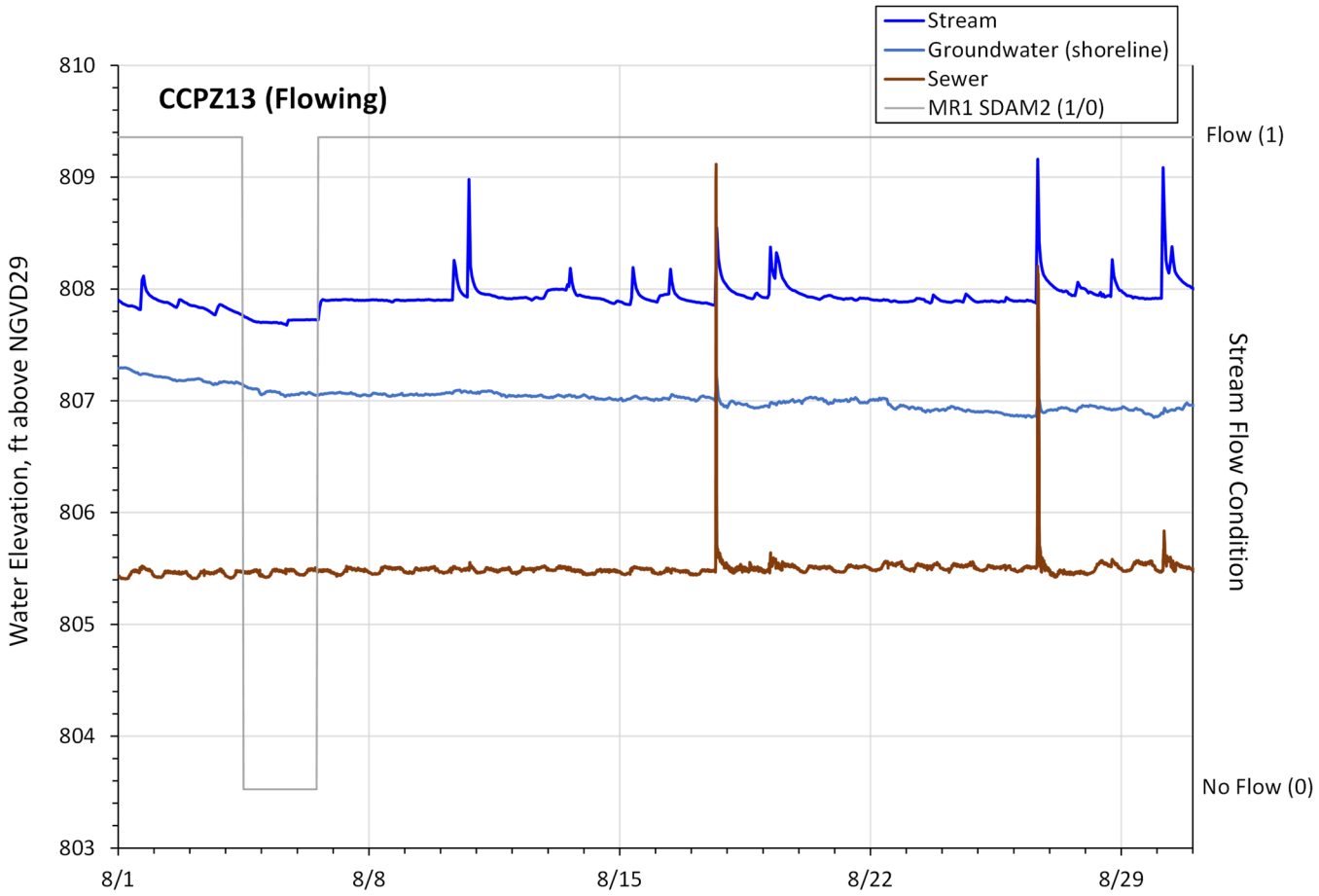


- Resistivity loggers placed at surface of stream channel
- Hourly resistivity signal classified binarily for flow ("1") or no flow ("0") conditions at each logger
- 11 loggers distributed among stream sections

Monitoring for Flowing, Transitional, and Losing Stream Sections

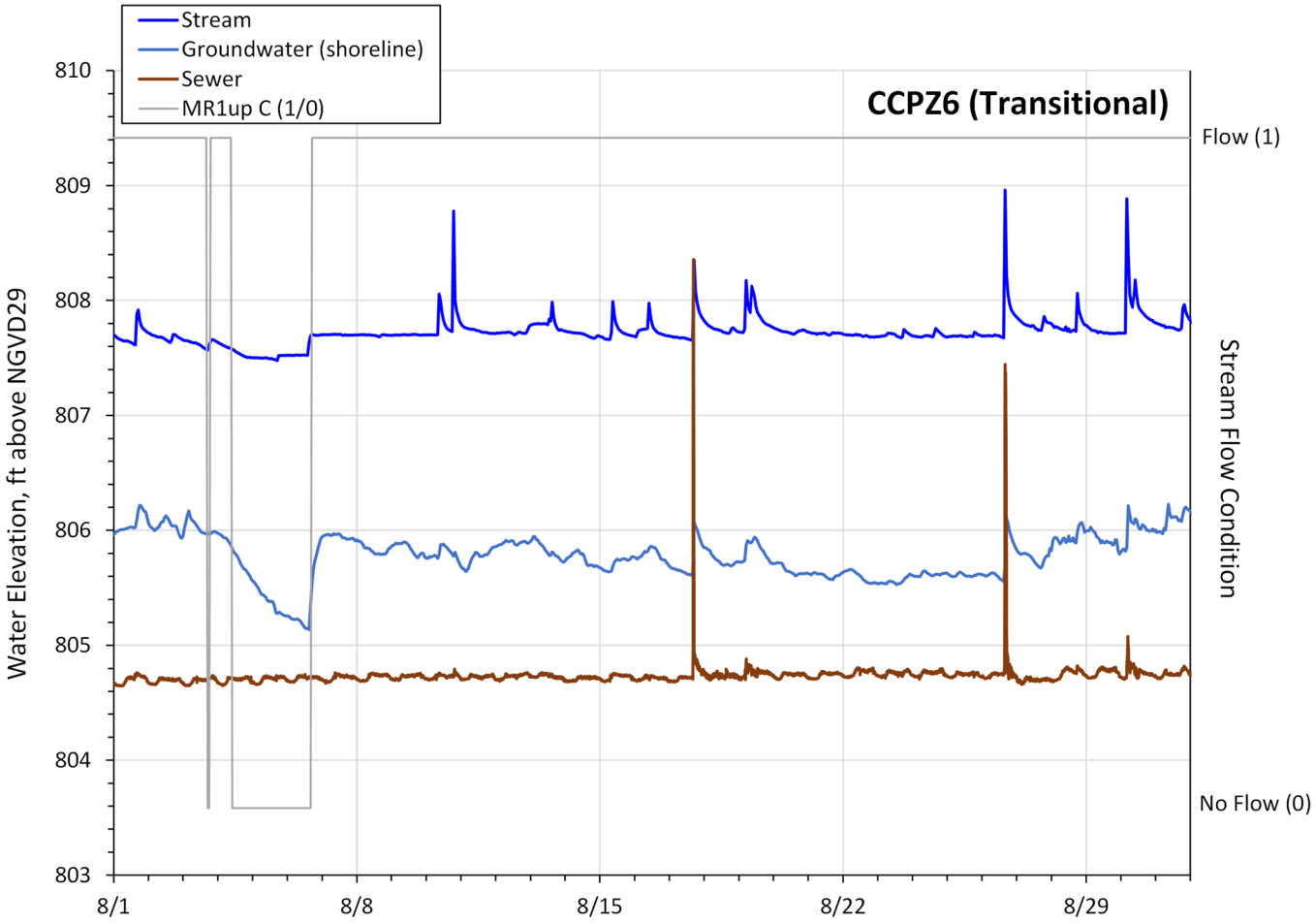


Groundwater and Surface Water Elevation Trends – Flowing Section



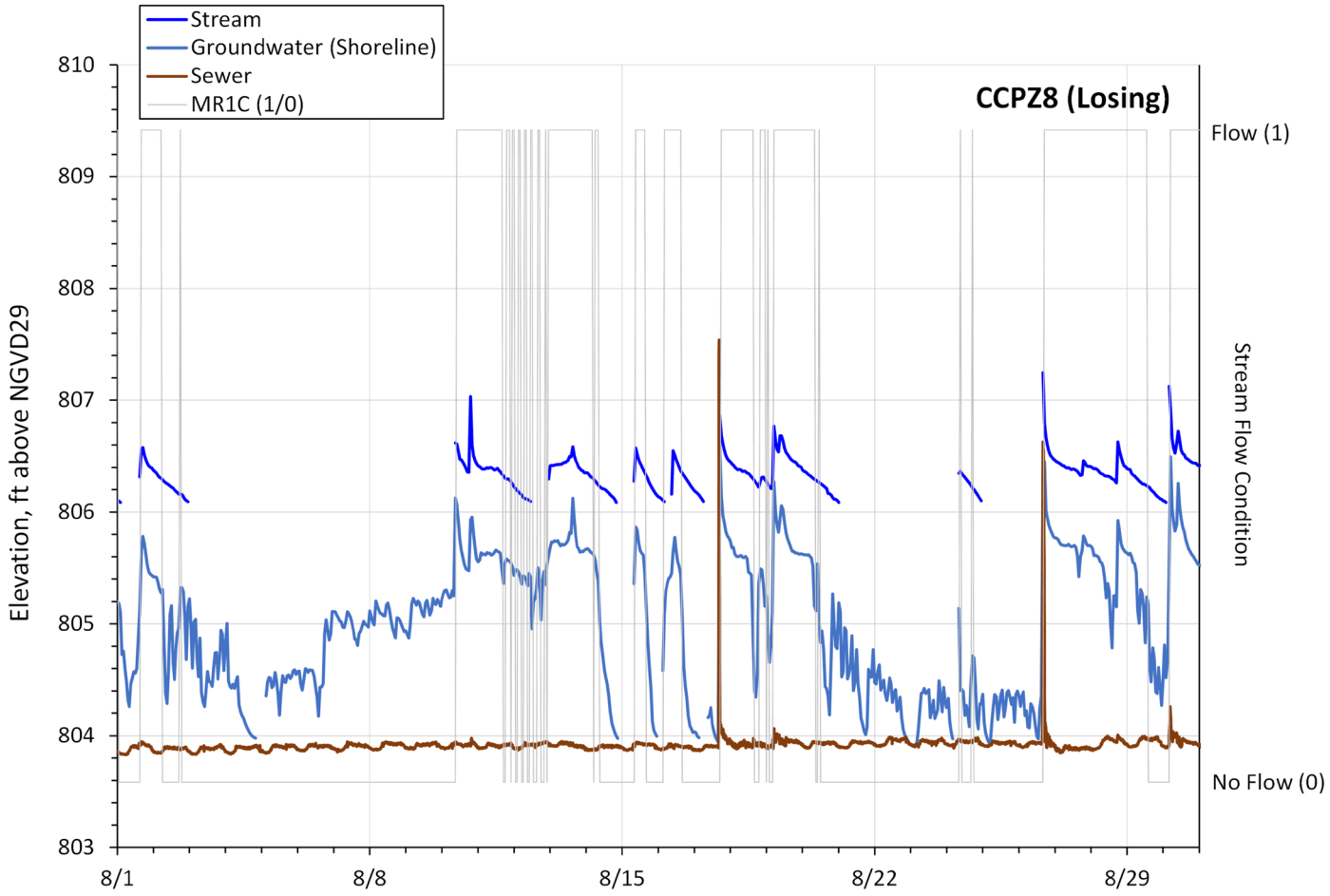
- Horizontal separation between sewer and stream channel about 20 feet
- Stream maintains nearly continuous flow
- CCPZ13 piezometer shows muted response to stream stage

Groundwater and Surface Water Elevation Trends – Transitional Section



- Horizontal separation between sewer and stream channel about 5 feet
- Stream maintains nearly continuous flow
- CCPZ6 piezometer more responsive to stream stage

Groundwater and Surface Water Elevation Trends – Losing Section



- Horizontal separation between sewer and stream channel about 1 foot
- Stream dries out multiple times
- CCPZ8 piezometer shows quick response to stream stage

Observations

- Horizontal gradient in shallow groundwater indicates flow to the west
- Patterns in shallow groundwater elevation are quite variable over the 200-feet of monitoring network
- Combination of shoreline piezometers and resistivity loggers in stream provide an integrated view of hydrologic system
- Frequency of “no-flow” condition at resistivity logger locations appears to correlate with stream-sewer horizontal separation distance

Future Steps

- Surface geophysical investigation to better comprehend characteristics of geology and sewer infrastructure (UC Dept of Geology – Booth 38, Junior Ballroom B)
- Examining other locations within Cooper Creek to assess if stream-sewer proximity correlates to stream drying
- Pilot test to assess if installation of “grout curtain” between stream and sewer trench can mitigate flow loss