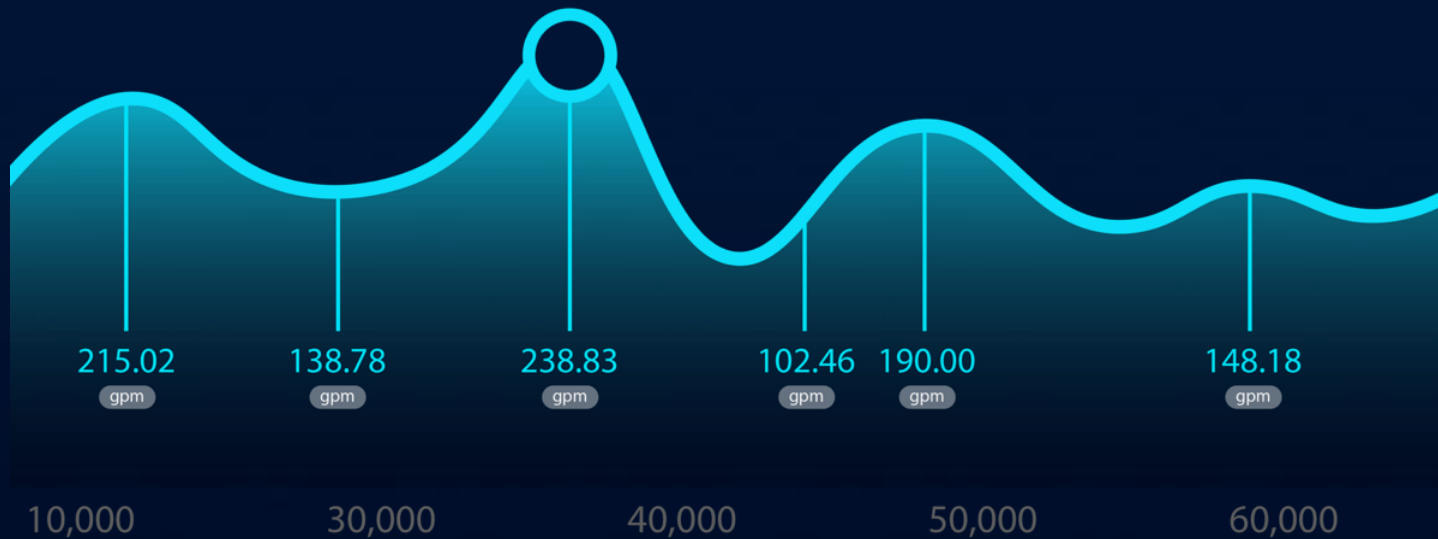


Real-time Software for Distribution System Operations

An Operator-Focused Design Approach

Ashley Ng ashley.ng@xylem.com
Client Solutions Architect



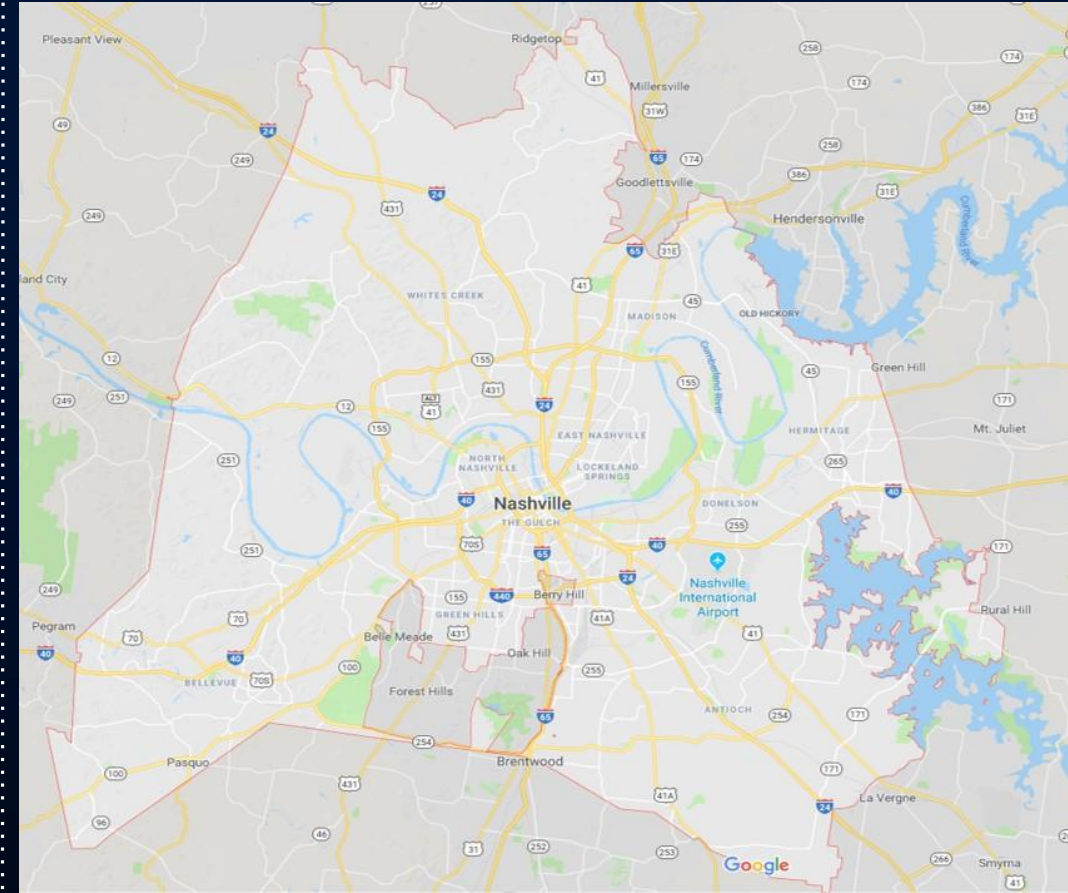
Agenda

1. Overview of Operator: MWS
2. Challenges Faced
3. Solution Walkthrough
 - i. Main Functions
 - ii. Case Example – Root Cause Analysis for Pipe Break
 - iii. Map Features
 - iv. Case Example – Improving Operational Response Plans with Source Tracing

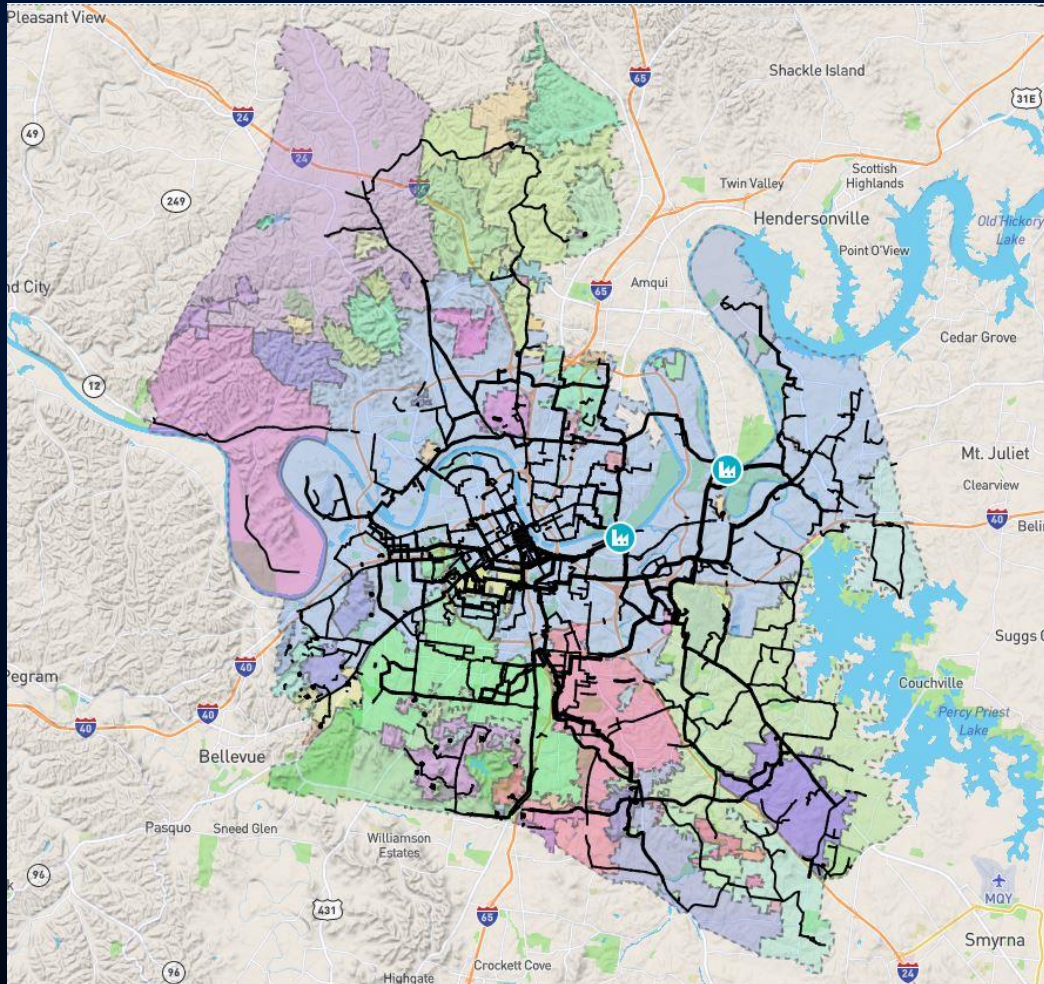


The Operator: Metro Water Services (MWS)

- Metropolitan Government of Nashville & Davidson County
- Serves an area of over 1040km² with an estimated population of over 700,000
- Responsible for:
 - Water
 - Wastewater
 - Stormwater
 - Waste Services
 - District Energy System (Contract Management)



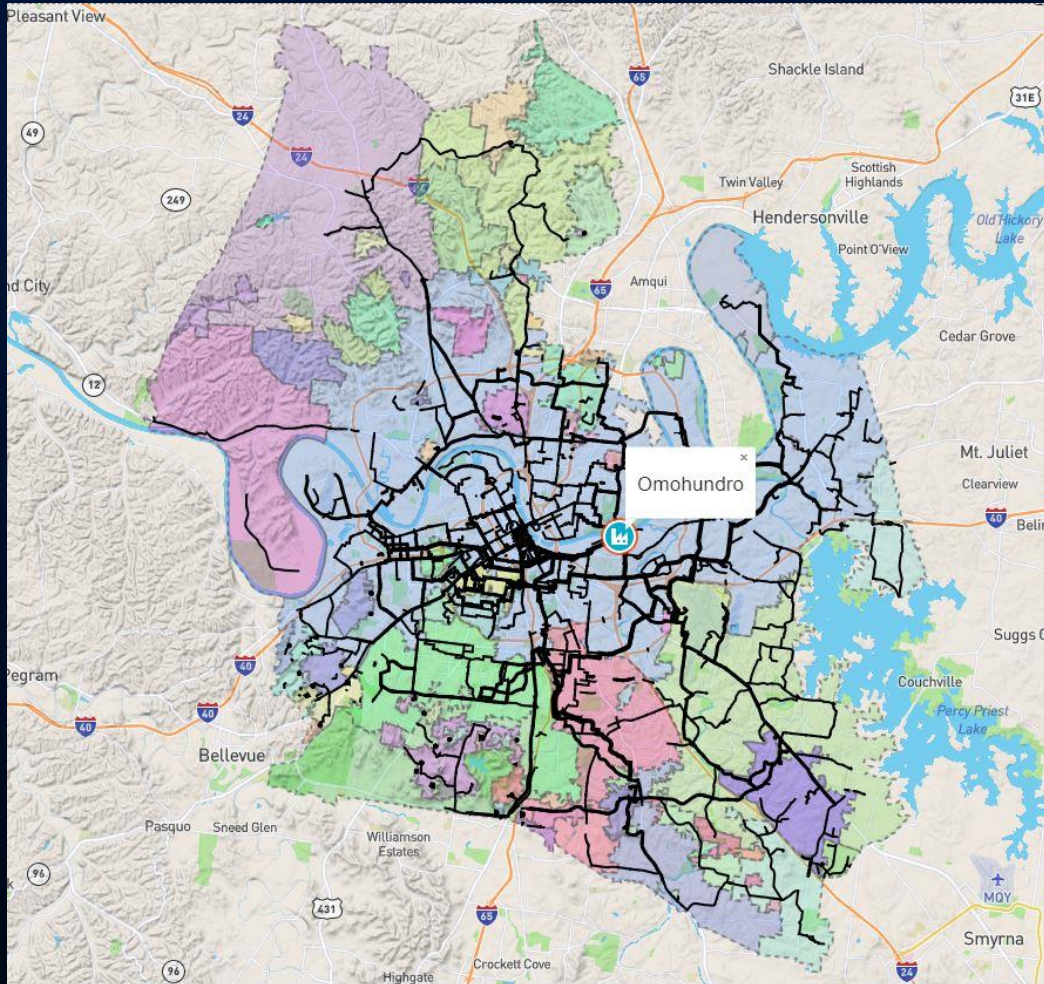
MWS Water Distribution System



Complex Water Distribution System

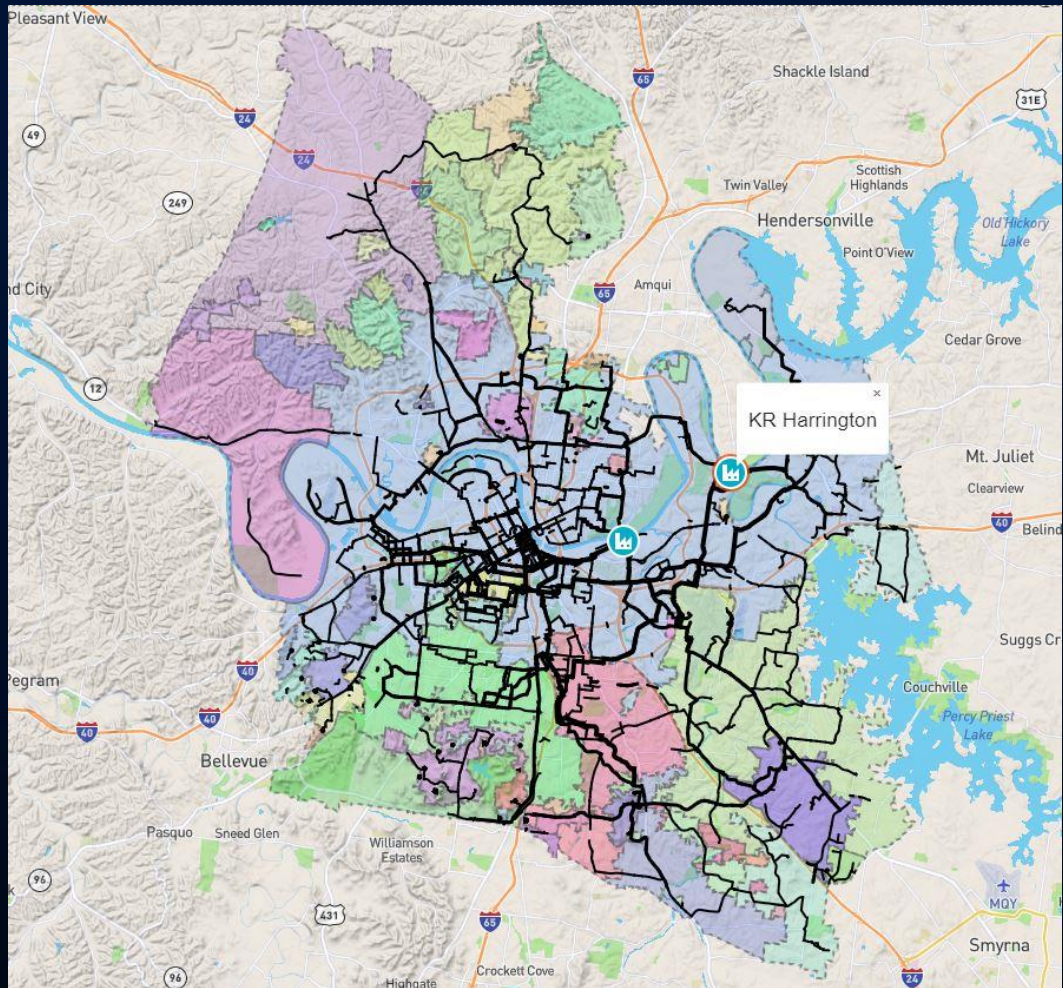
Over 4,800km of water mains

MWS Water Distribution System



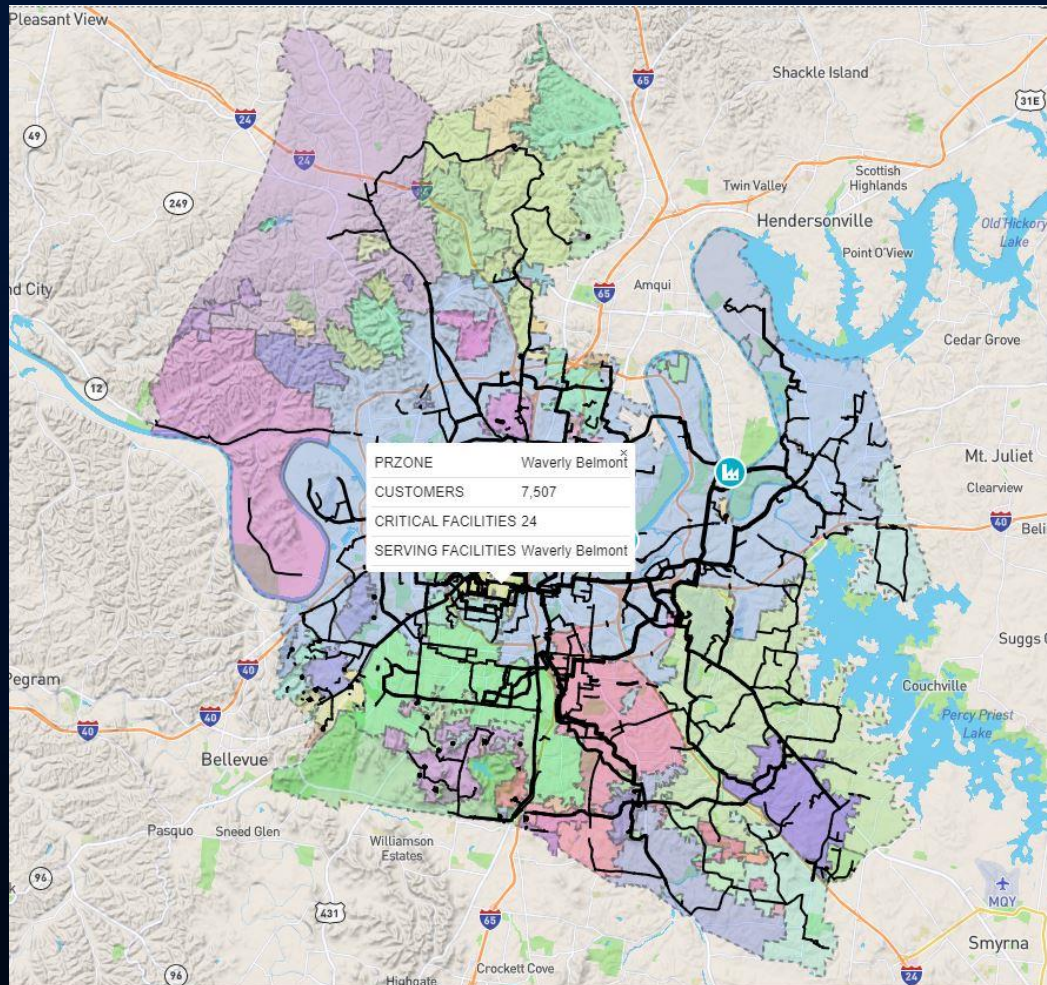
2 Water Treatment Plants (each 90 MGD)

MWS Water Distribution System



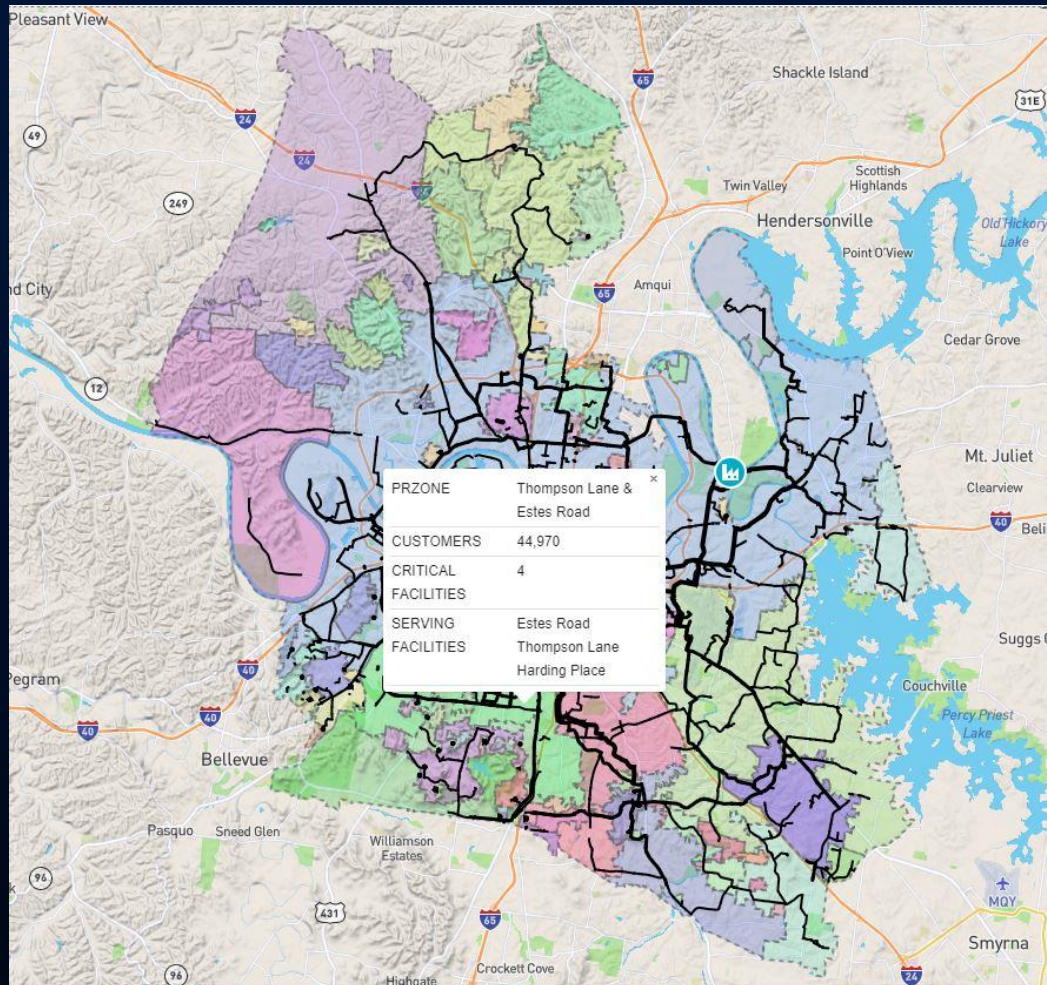
2 Water Treatment Plants (each 90 MGD)

MWS Water Distribution System



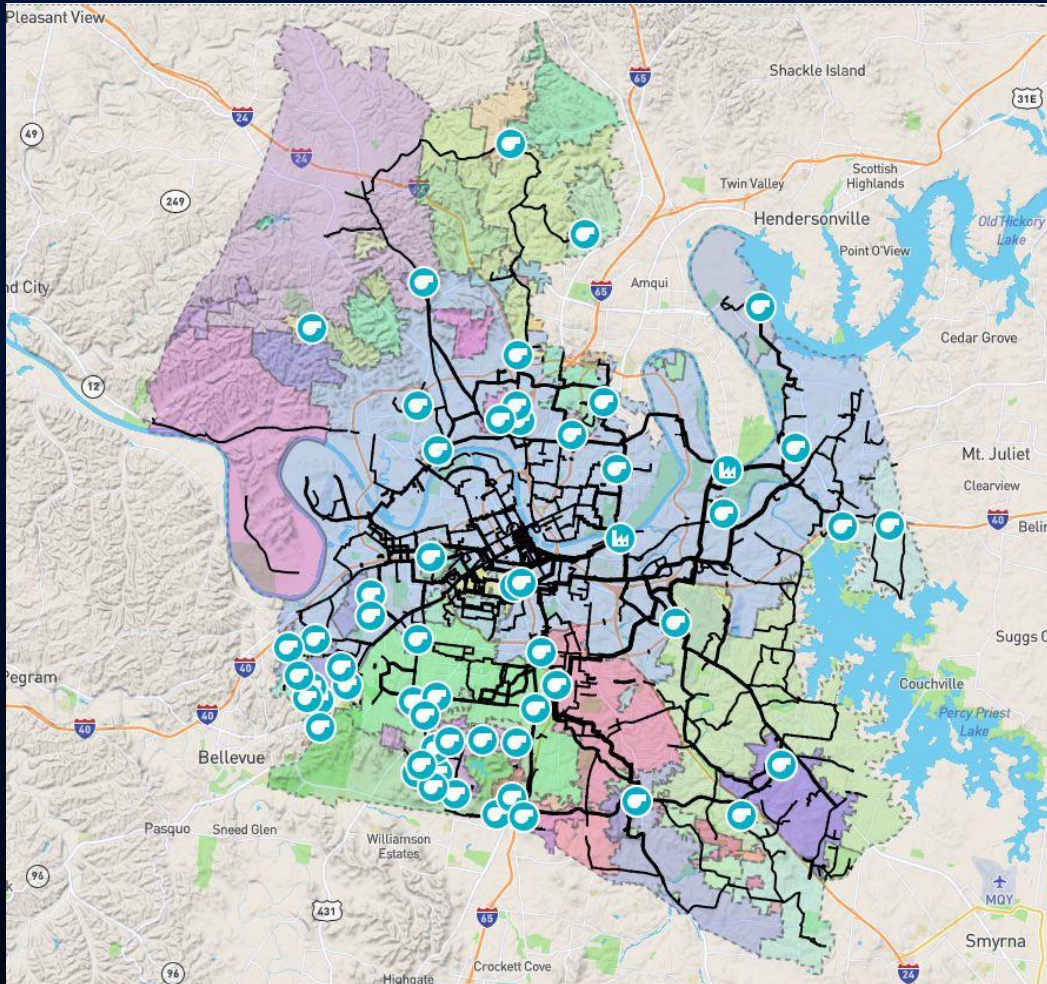
90 Water Pressure Zones

MWS Water Distribution System



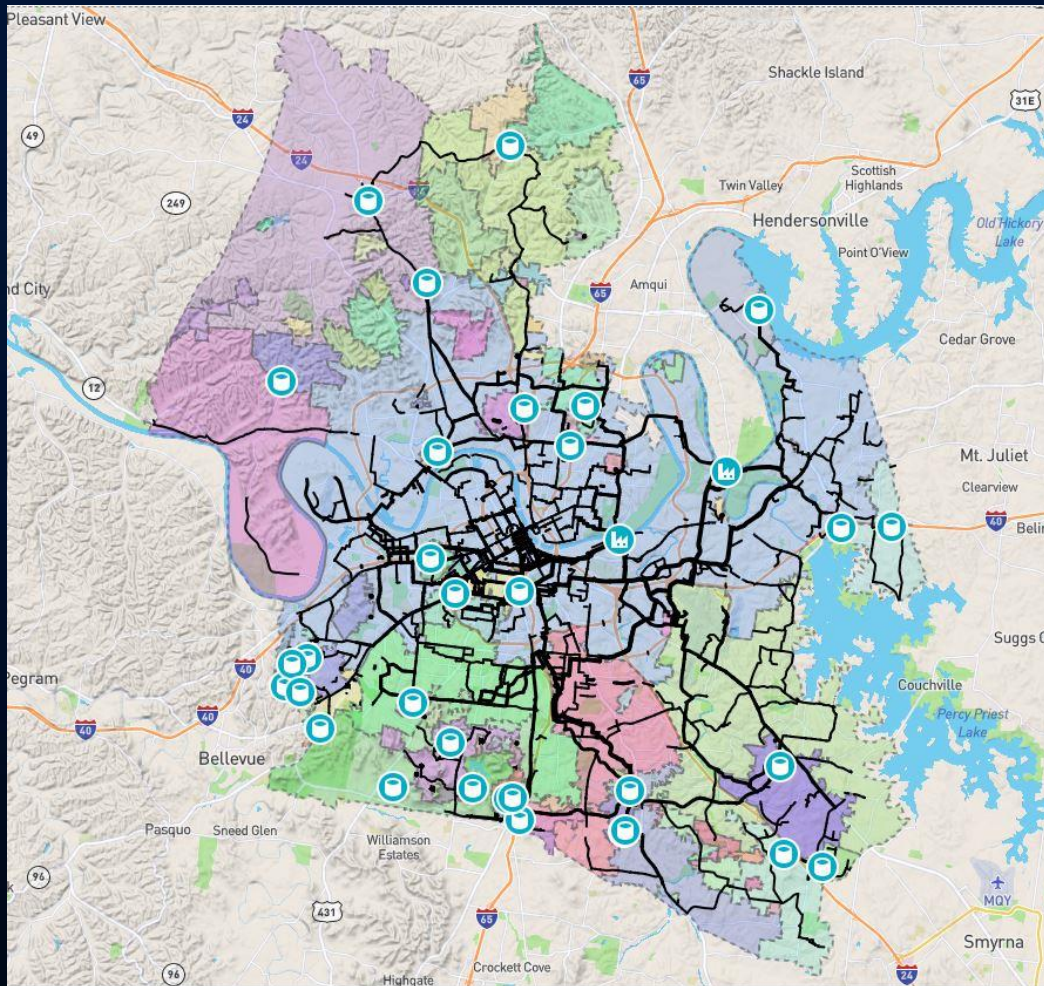
90 Water Pressure Zones

MWS Water Distribution System



56 Water Pumping Stations

MWS Water Distribution System



37 Reservoirs

Main Operational Issues

Water Age

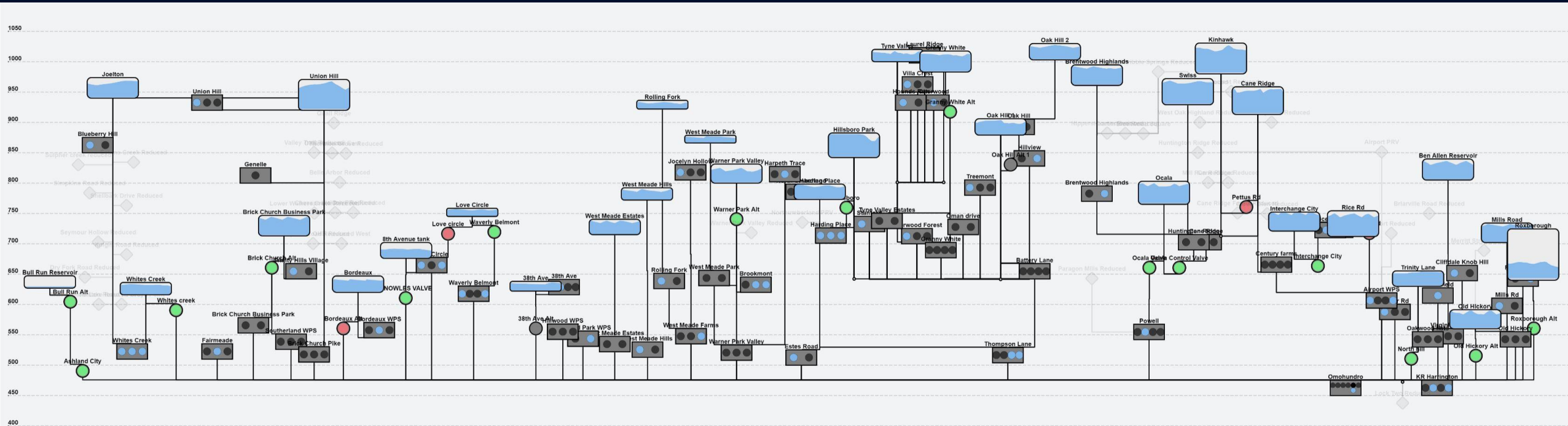
High/Low Pressure

Reservoir Turnover

Chlorine Residual Management

Low Flow

Water Main Breaks



Solving Operational Issues

- First step: Understanding
- Circumstances creating those issues are complex and fluid → determining root-causes of issues is challenging
- Many solutions available for operating the distribution system, but the picture is incomplete



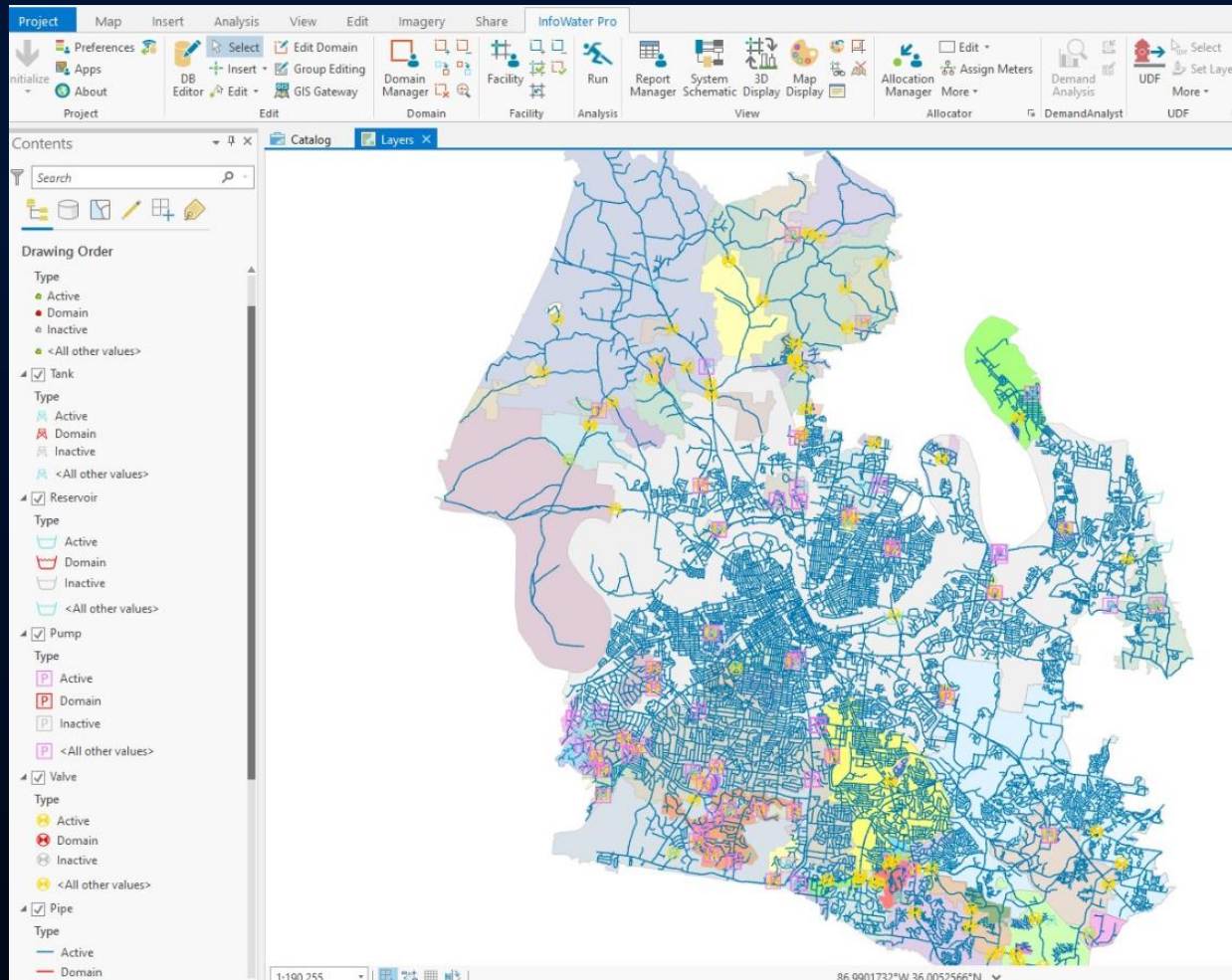
SCADA



SCADA controls the water distribution system

Provides real-time feedback on reservoir levels, pumps, flow, pressure and other critical parameters but just provides data, not system analysis

Water Model



Ability to diagnose issues in the system and provides system analysis

Traditional water modeling approaches rely on a static planning-level description of system operations

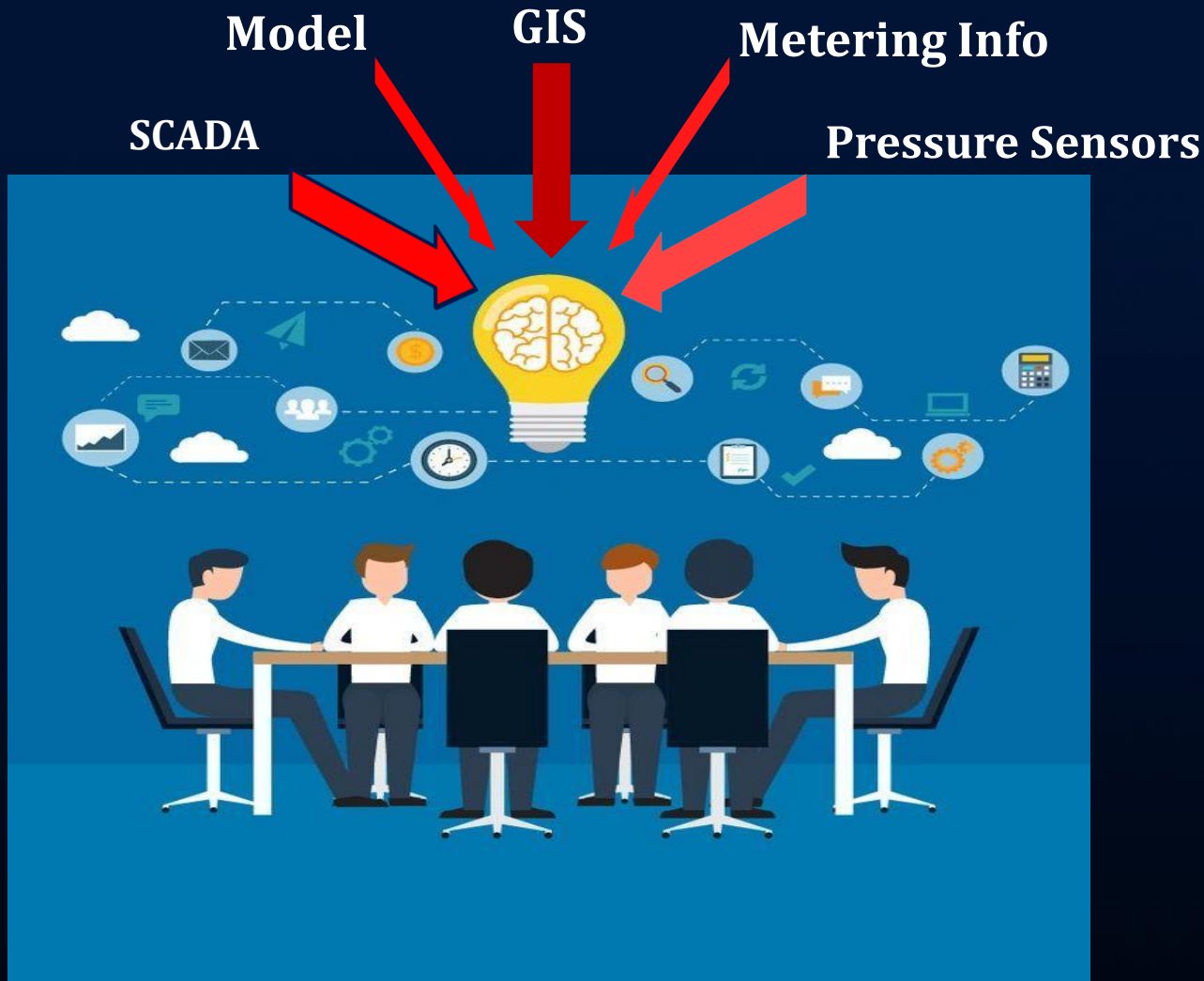
GIS



Great tool for providing maps of the system and asset history

Does not provide real-time data or system analysis

The Challenge



How much time and staffing is dedicated within the utility to just put data and knowledge together to investigate and troubleshoot the issue prior to any attempts to solve a problem?

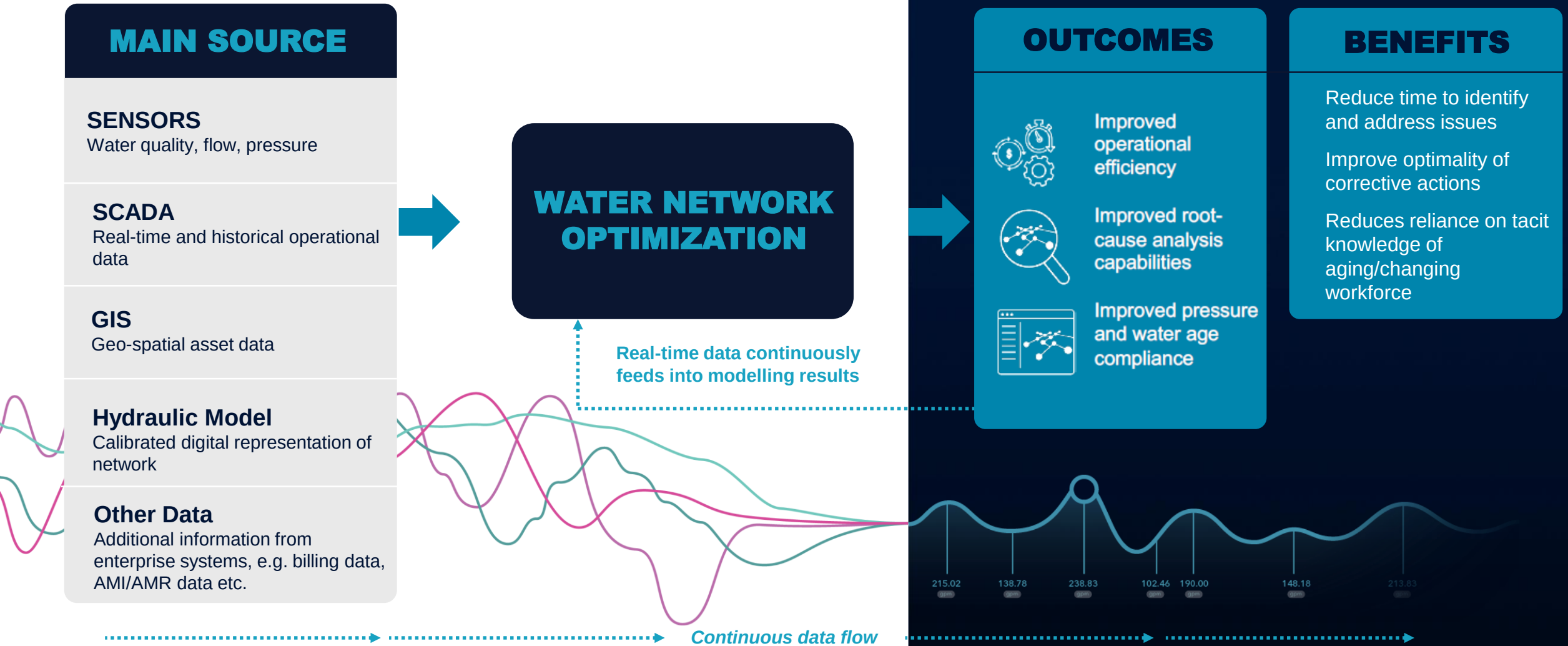
The Solution – Water Network Optimization

MWS partnered with Xylem to develop a real-time hydraulic and water quality modelling tool that would **integrate data** across the different platforms (i.e. SCADA, GIS, AMI/AMR, etc.) and visualize all relevant parameters clearly to give the operator a **real-time complete picture** of the state of the water network

No more muddling around!

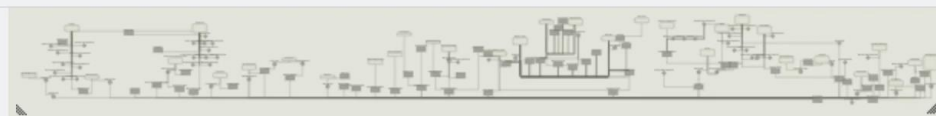
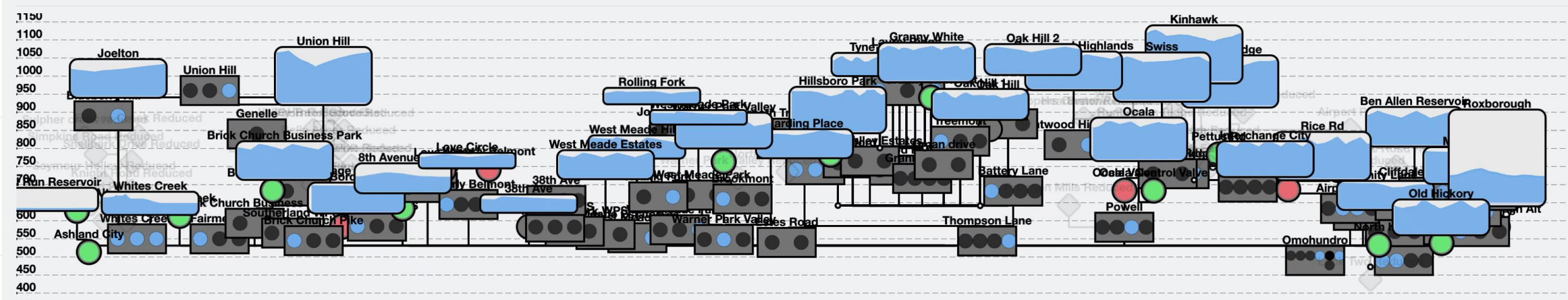


Water Network Optimization

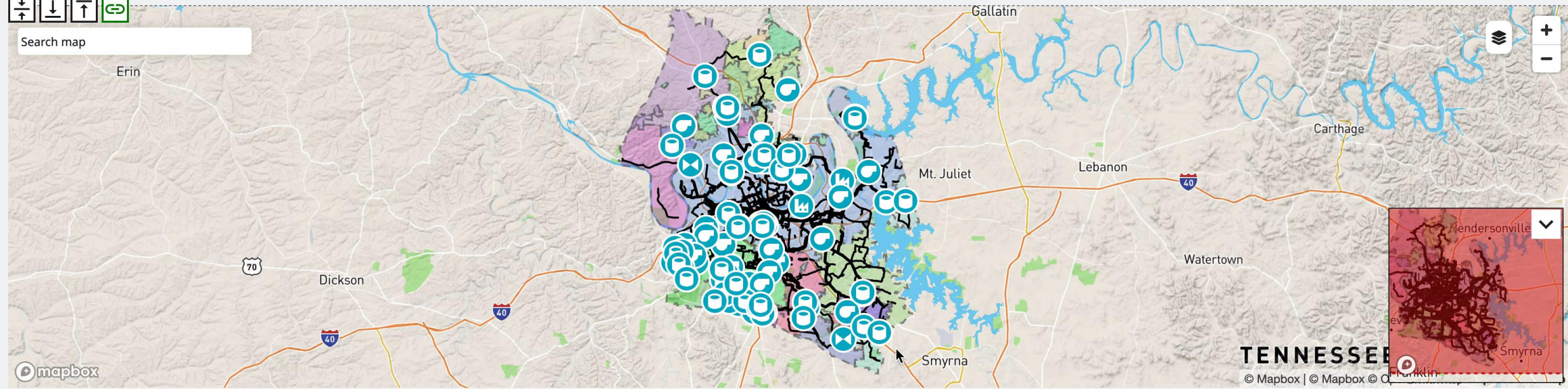


Let's check out WNO...

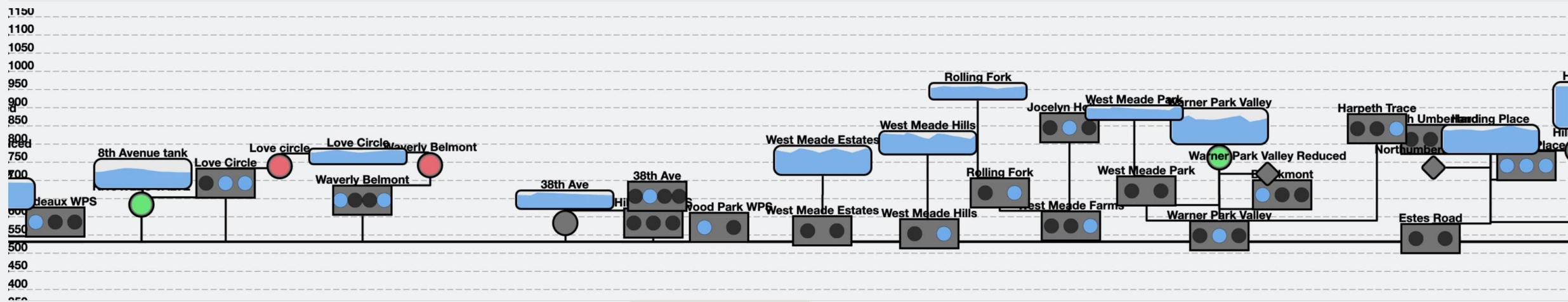
Schematic Overview – How the user Navigates



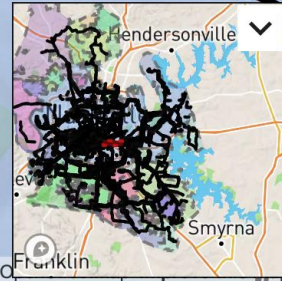
Search map



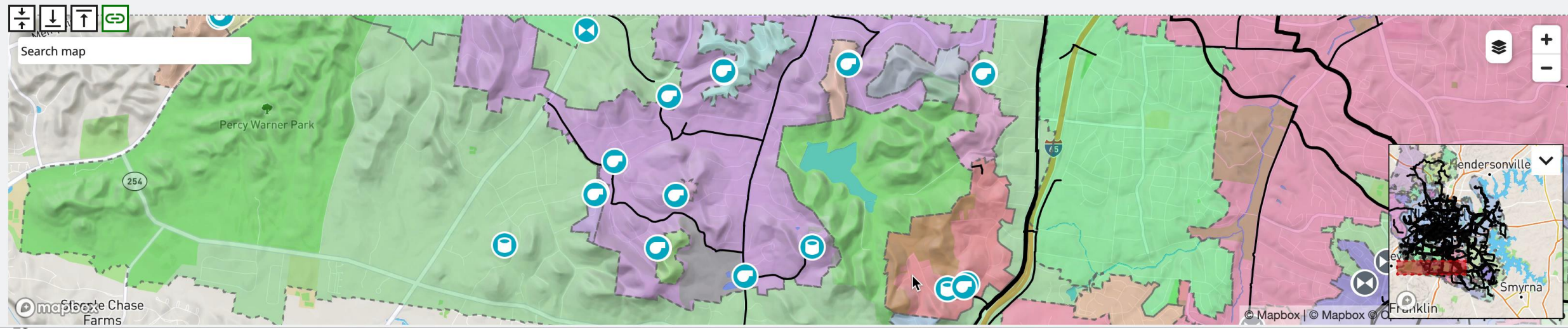
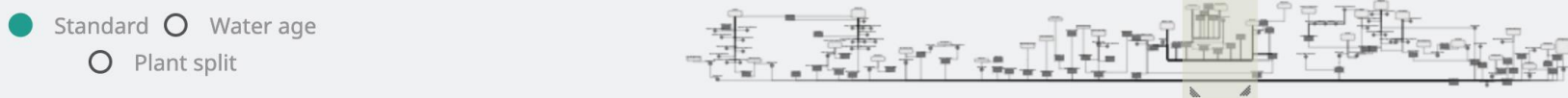
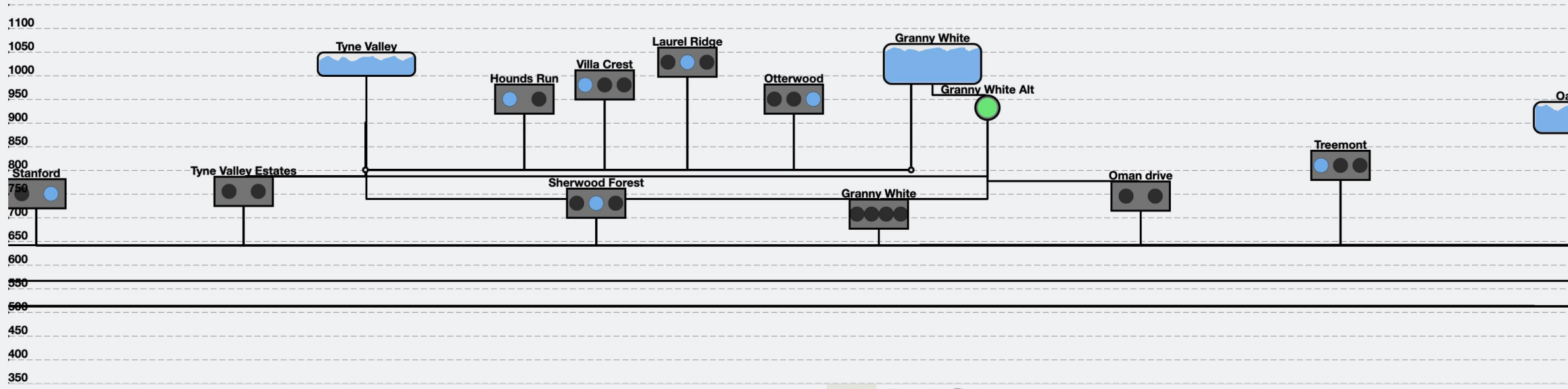
Split-view Function



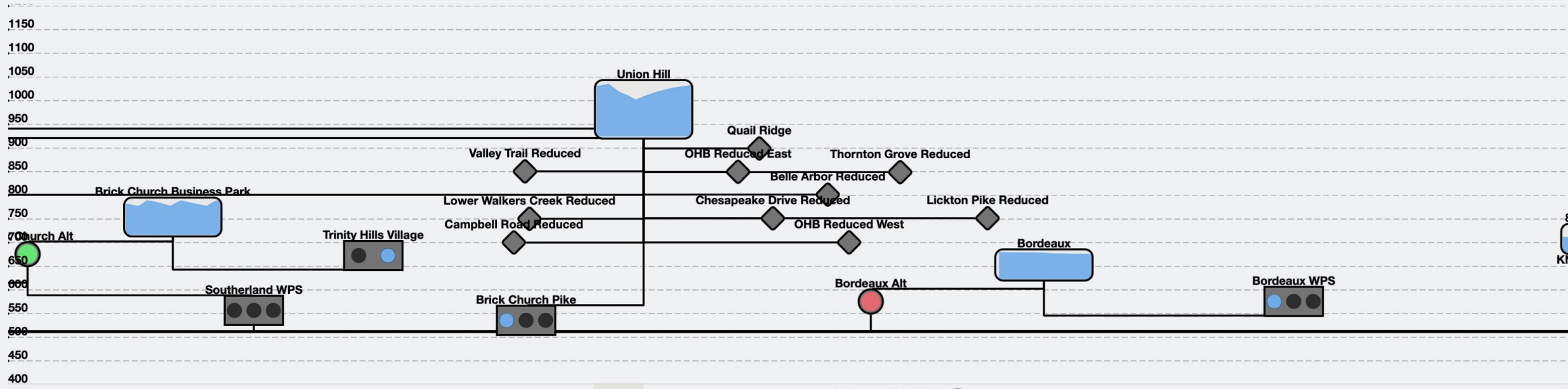
Standard Water age Plant split



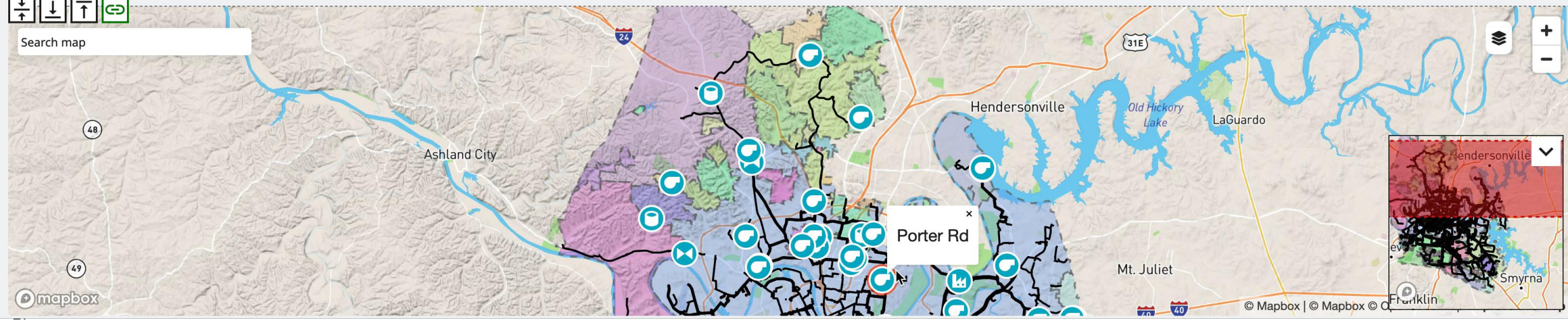
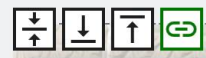
Trending Facilities in the Schematic



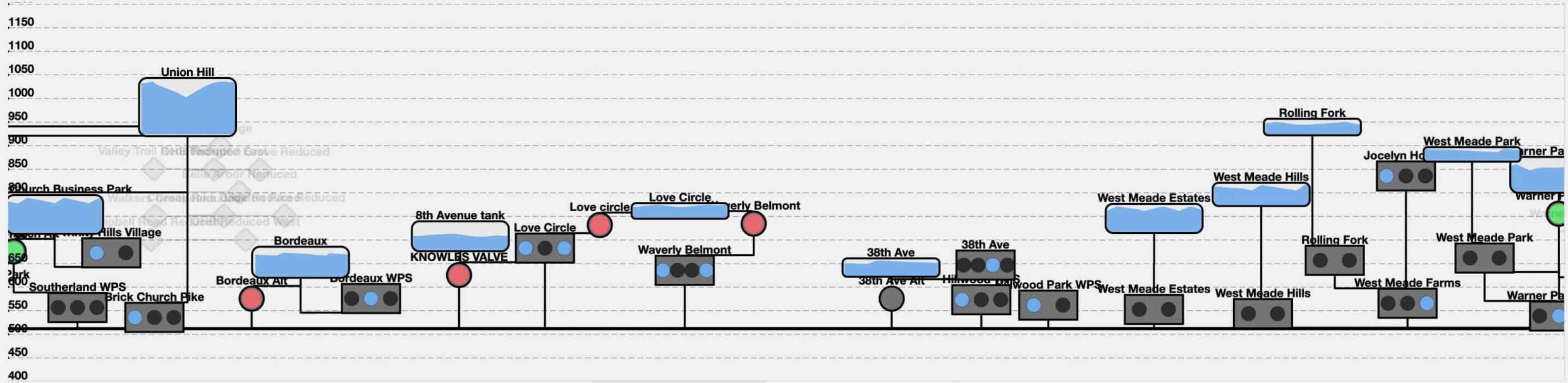
Layer Function



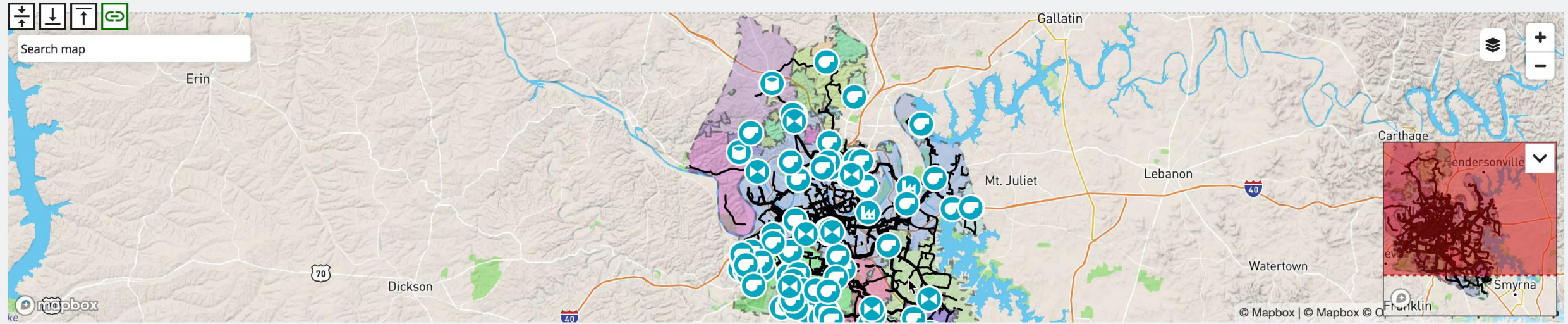
Standard Water age Plant split



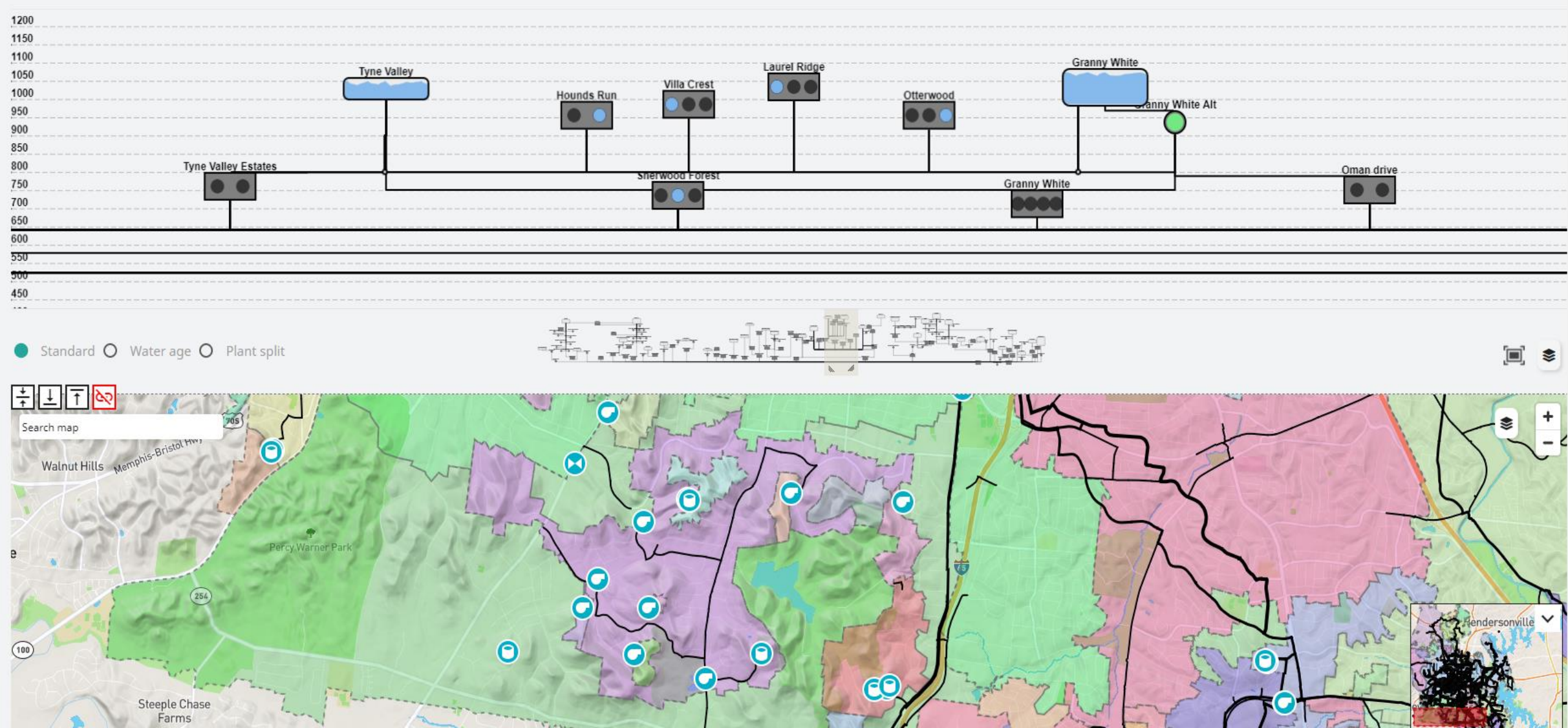
Calendar Function



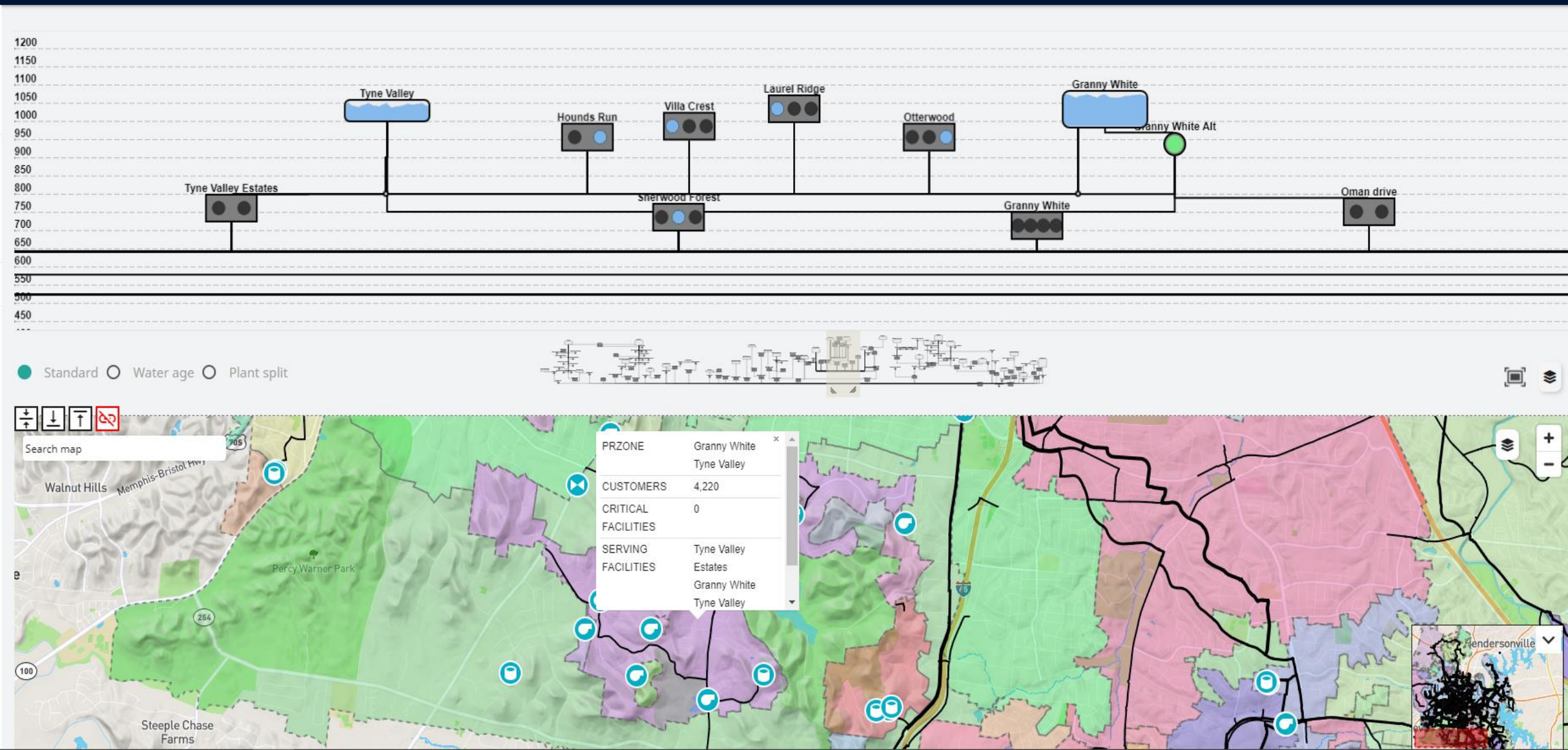
Standard Water age Plant split



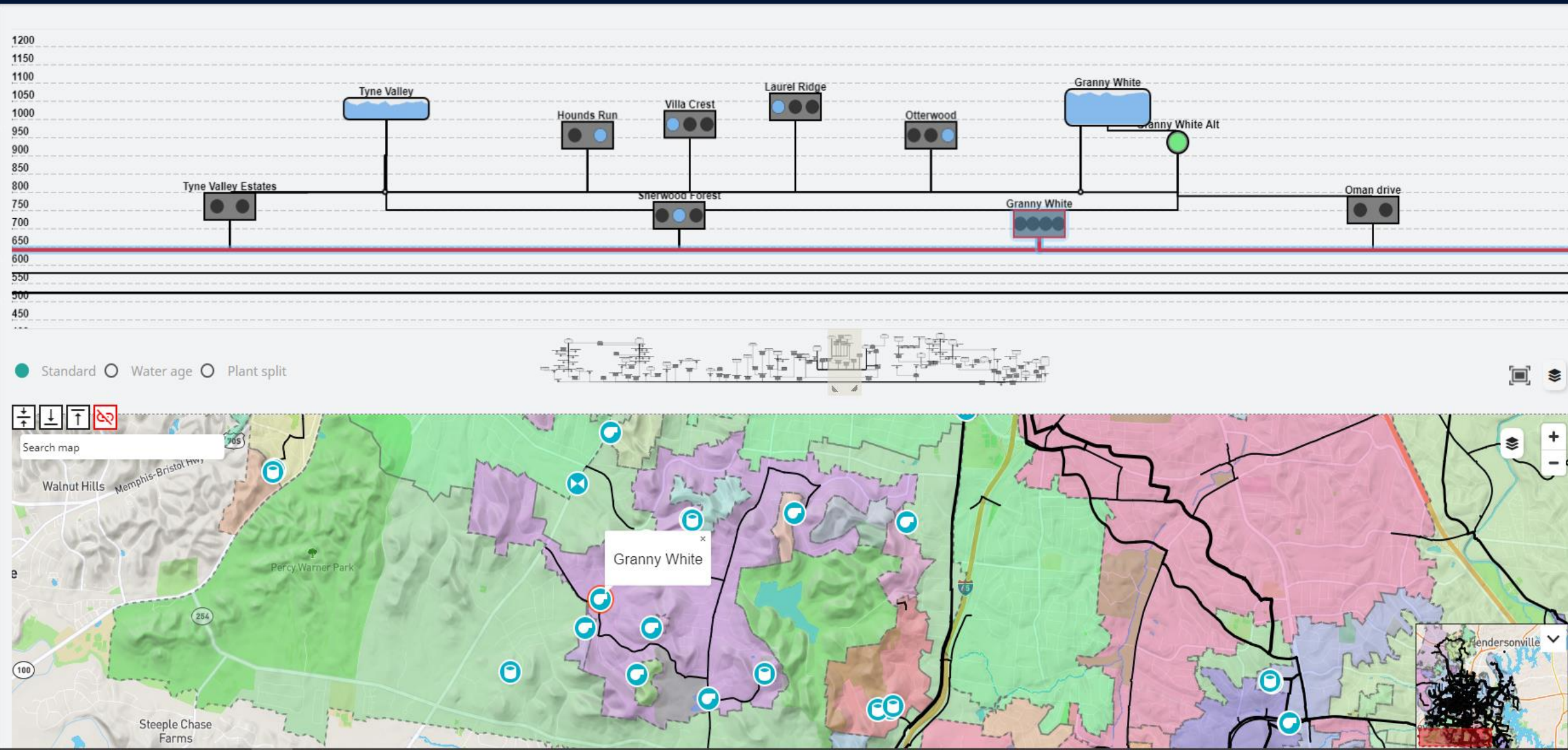
Case Example – Root Cause Analysis for Pipe Break



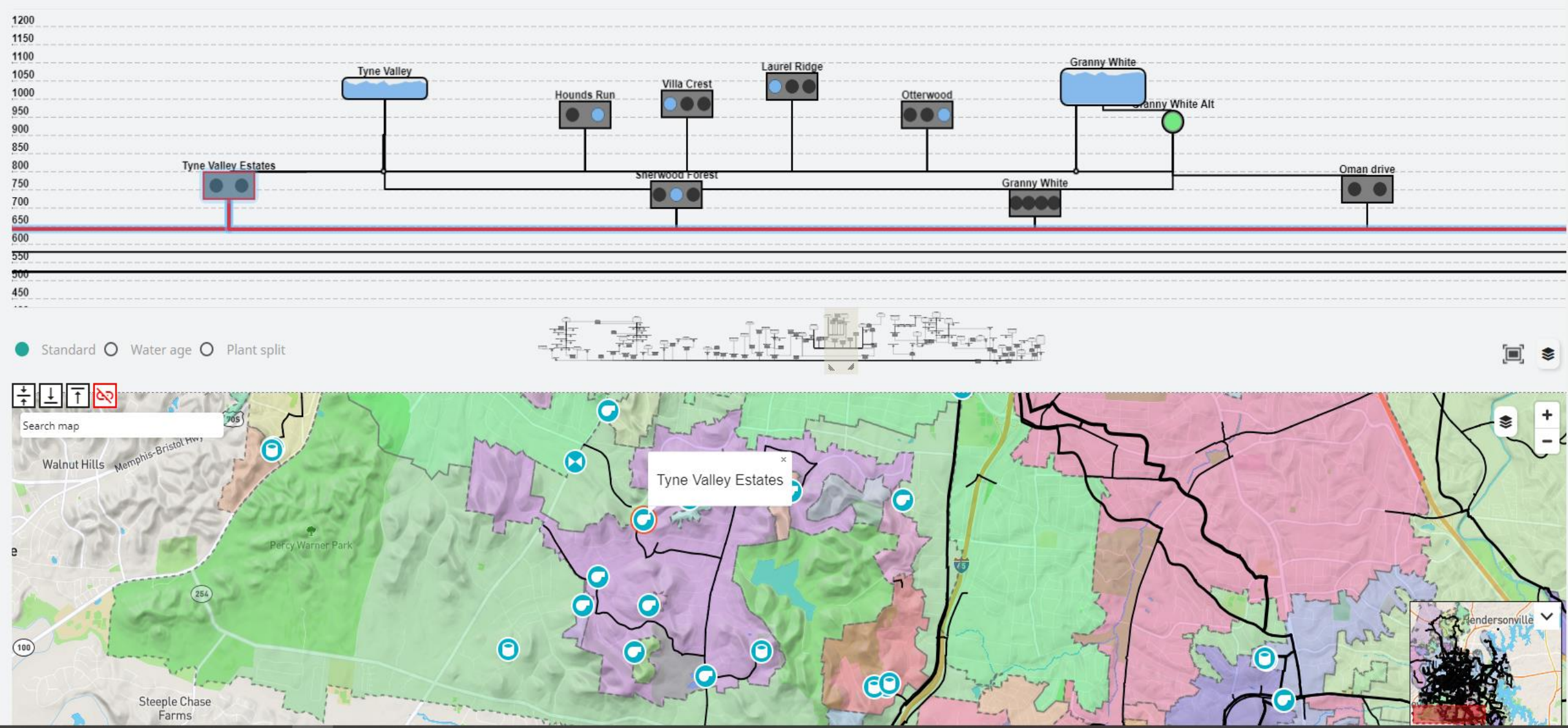
Case Example – Root Cause Analysis for Pipe Break



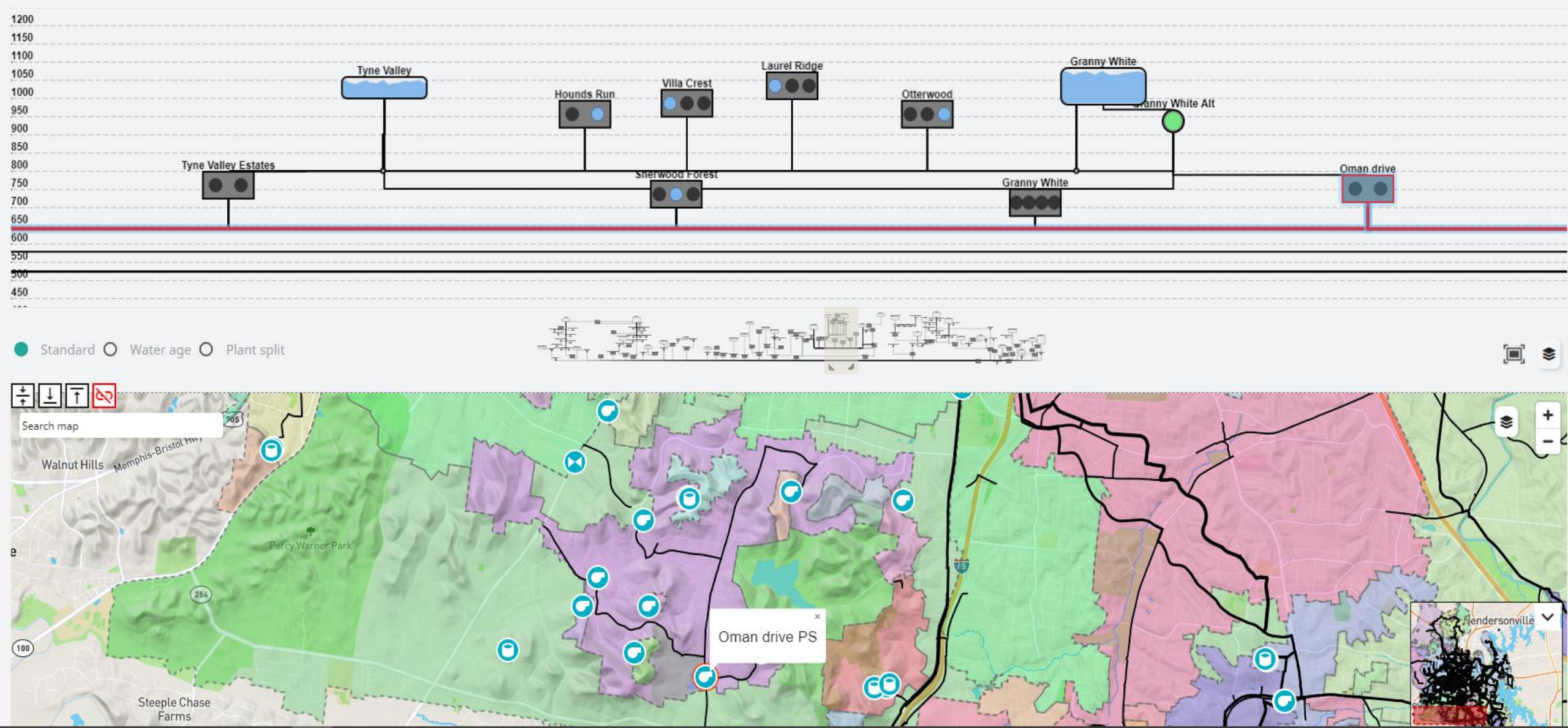
Case Example – Root Cause Analysis for Pipe Break



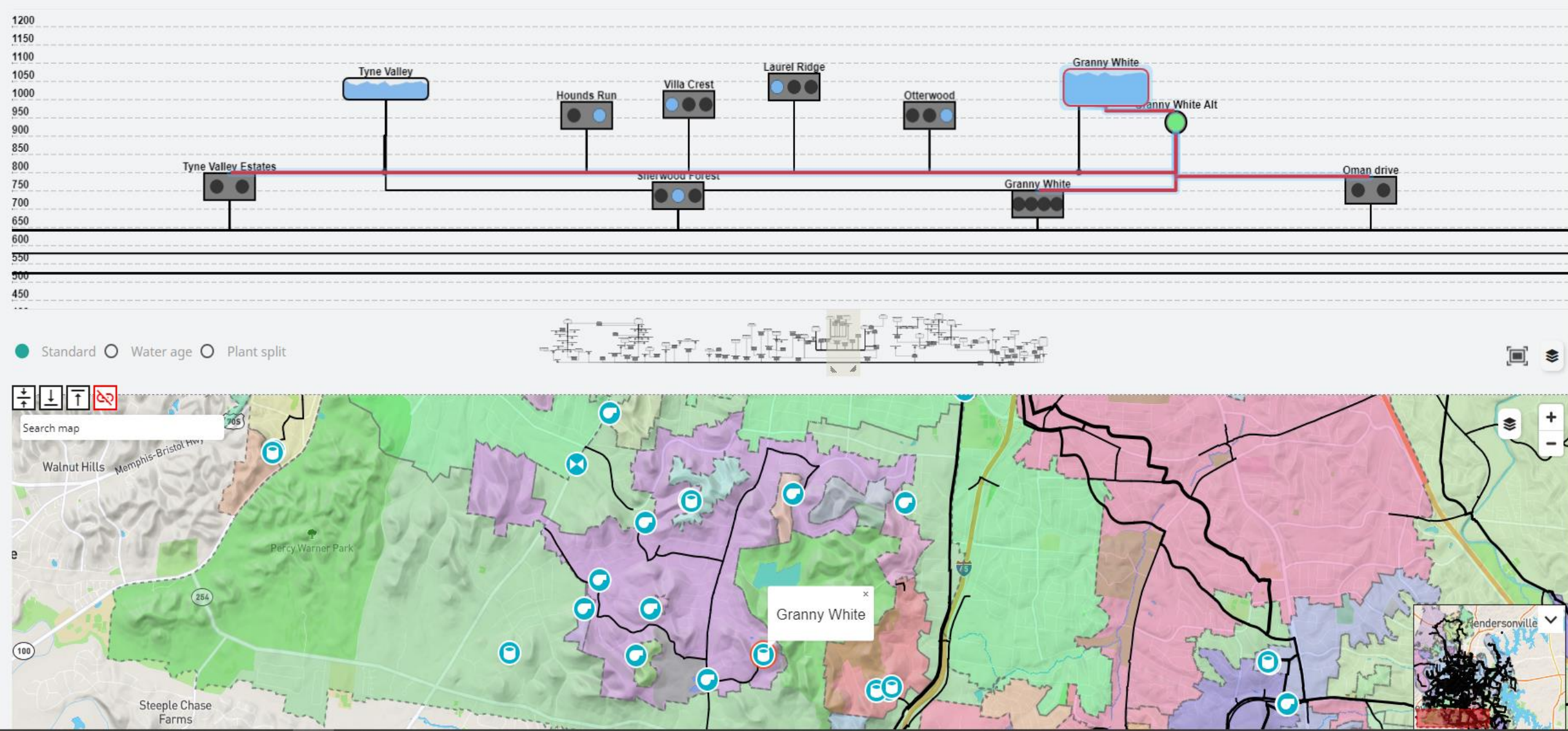
Case Example – Root Cause Analysis for Pipe Break



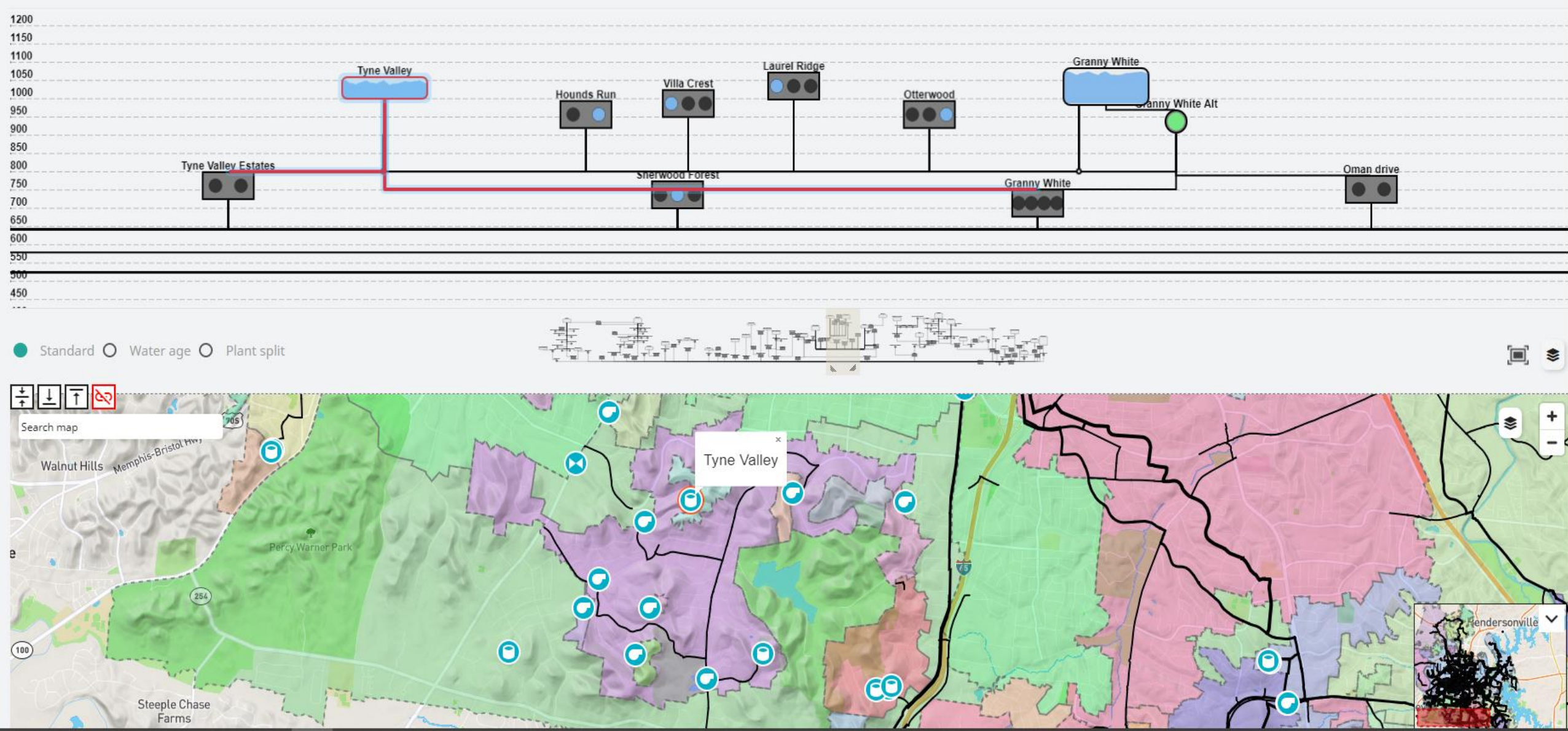
Case Example – Root Cause Analysis for Pipe Break



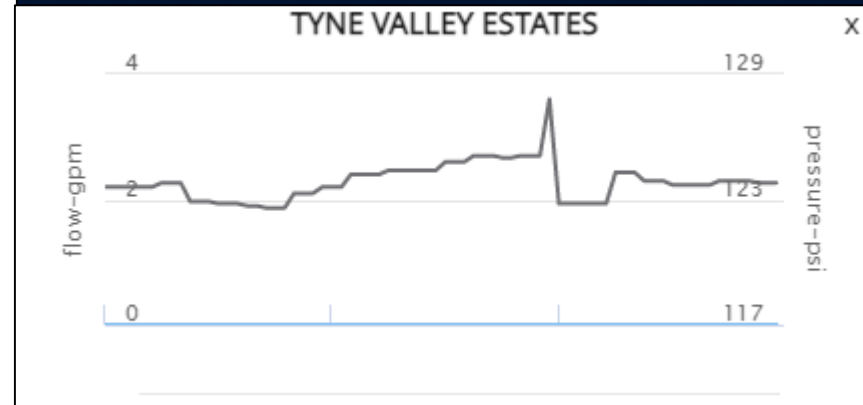
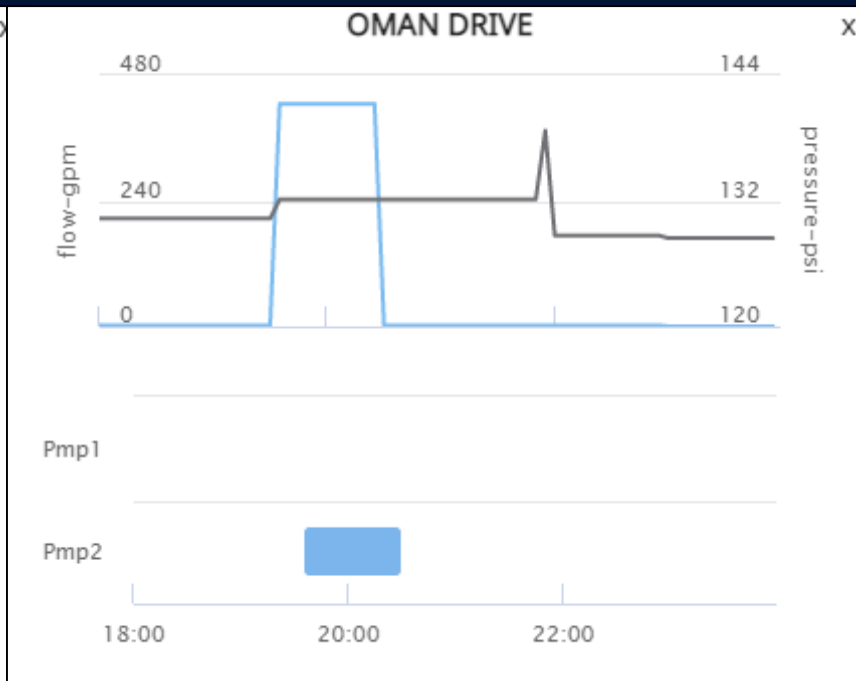
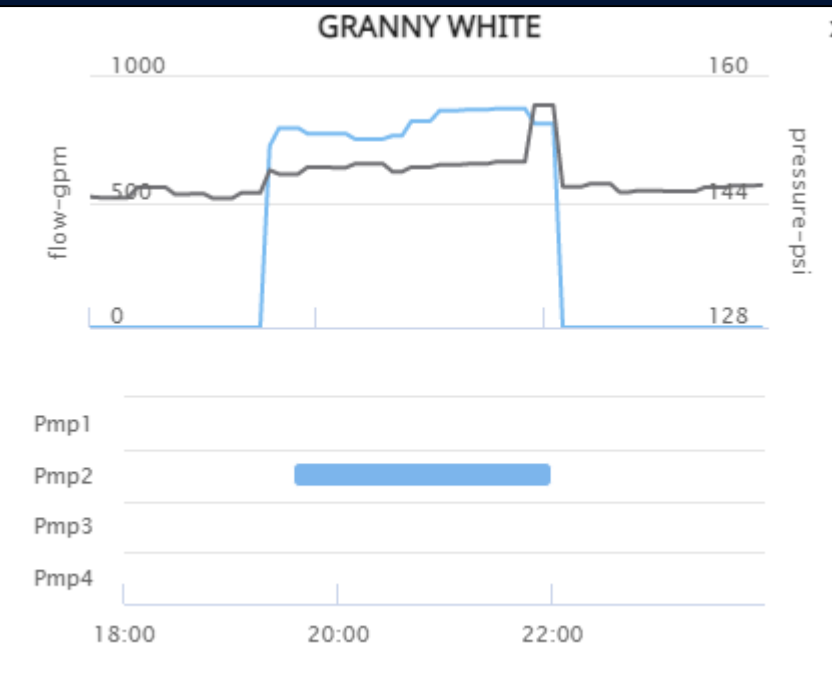
Case Example – Root Cause Analysis for Pipe Break



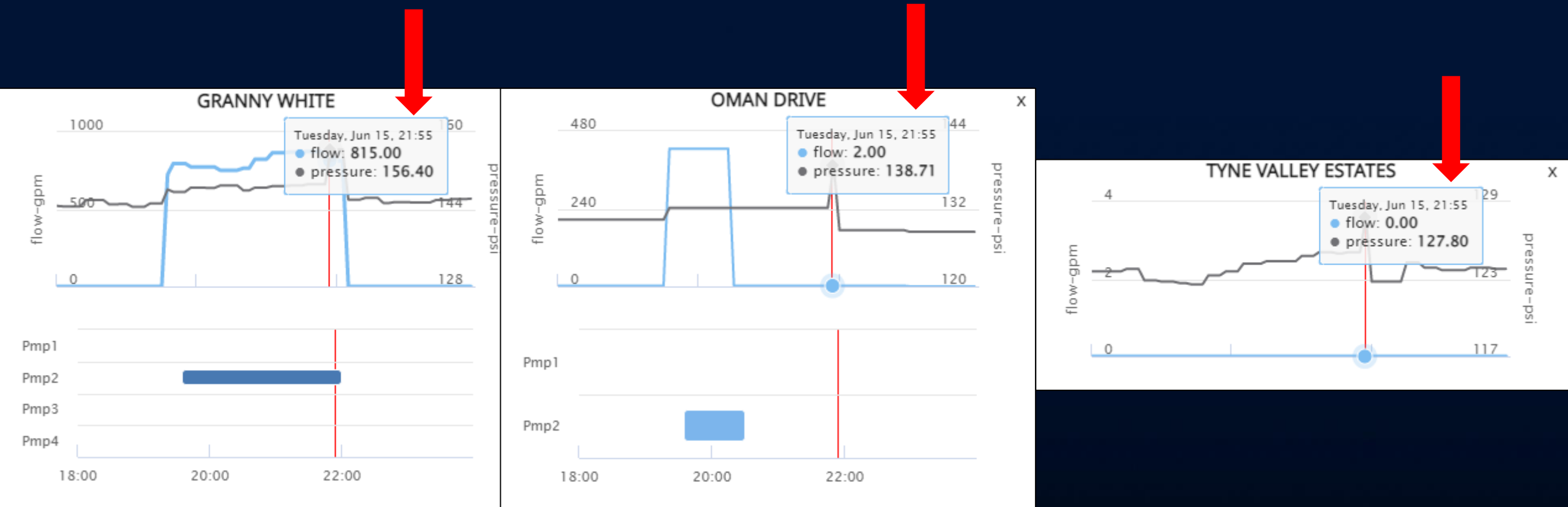
Case Example – Root Cause Analysis for Pipe Break



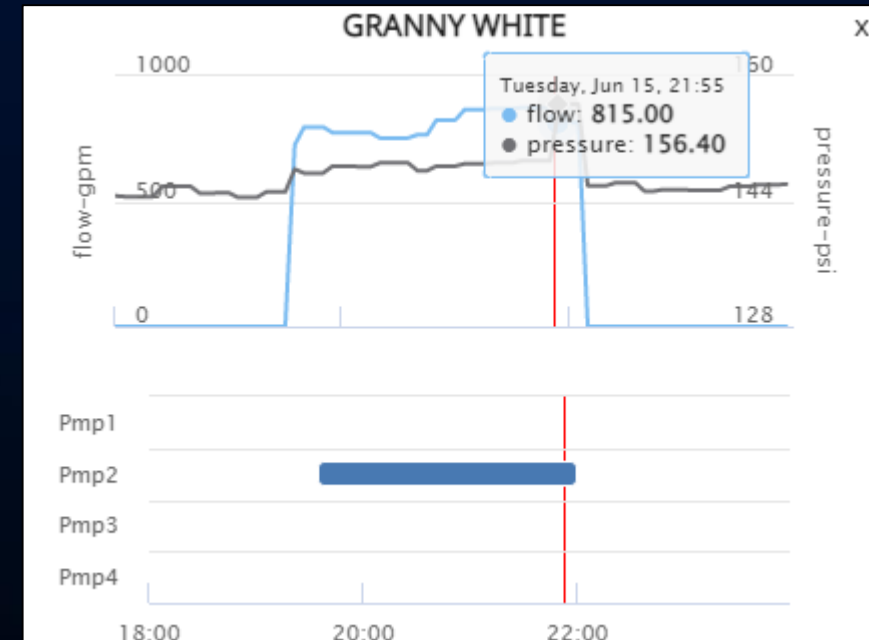
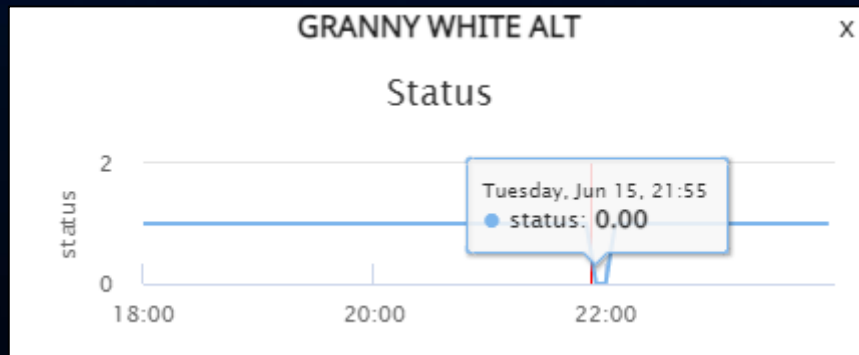
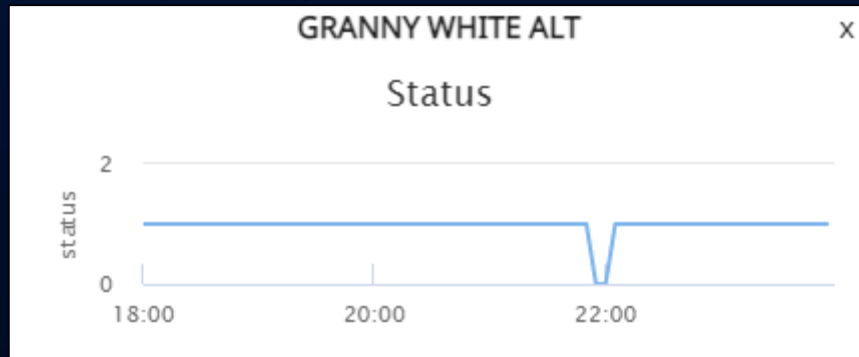
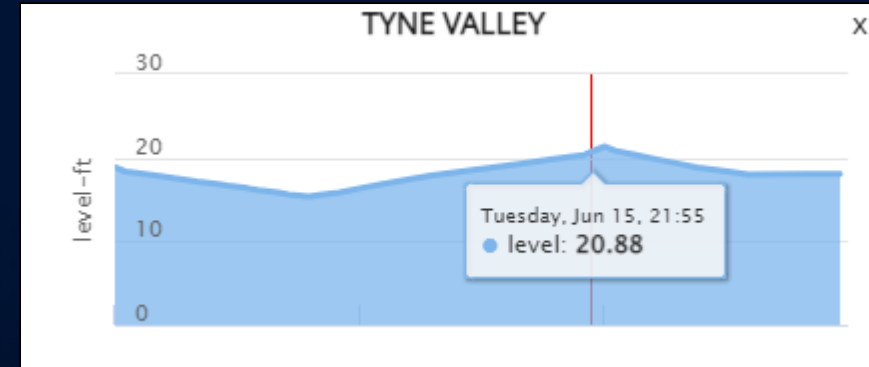
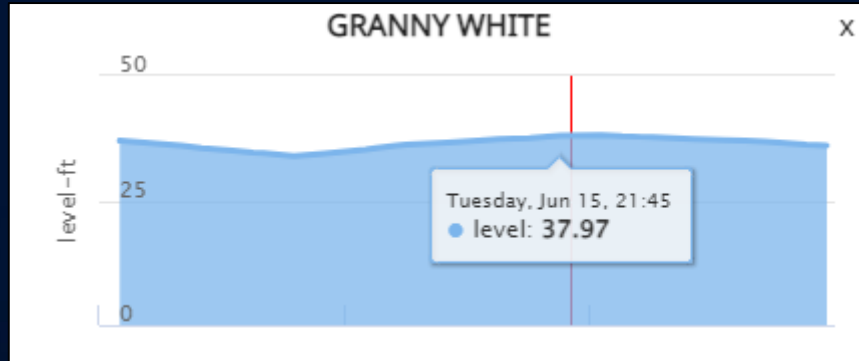
Case Example – Root Cause Analysis for Pipe Break



Case Example – Root Cause Analysis for Pipe Break



Case Example – Root Cause Analysis for Pipe Break



Case Example – Root Cause Analysis for Pipe Break

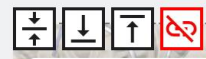
Solution

Adjusted control logic for the pumps at Granny White to shut off when Granny White Reservoir was full, not Tyne Valley Reservoir

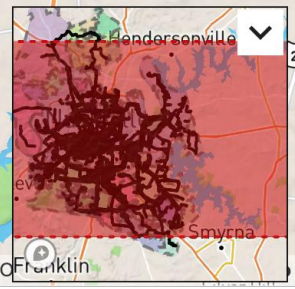
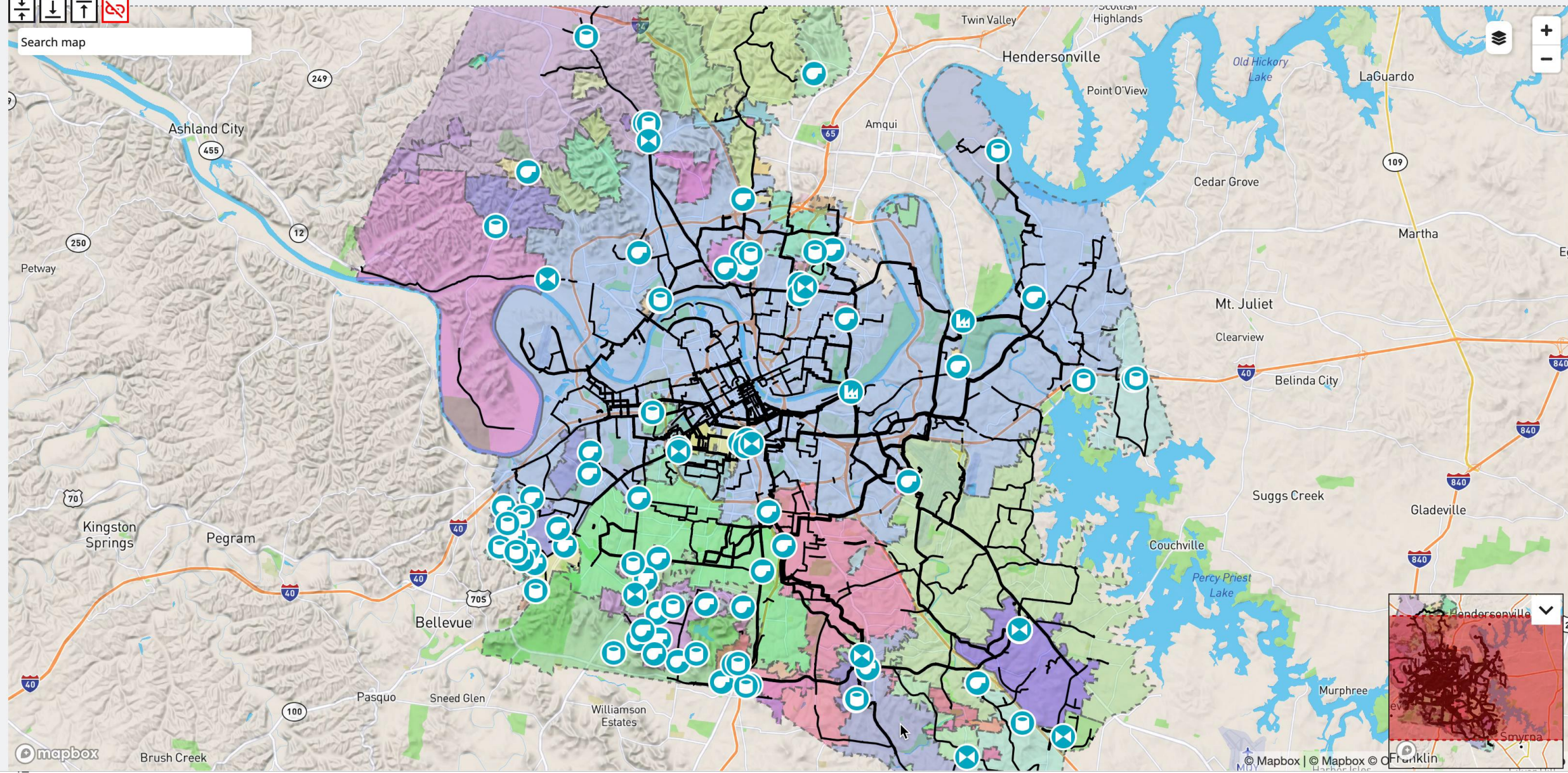
Adjusted control logic to have Tyne Valley WPS top off Tyne Valley Reservoir if needed, not Granny White WPS

Result: Granny White Altitude Valve stays open and the pressure surge was eliminated

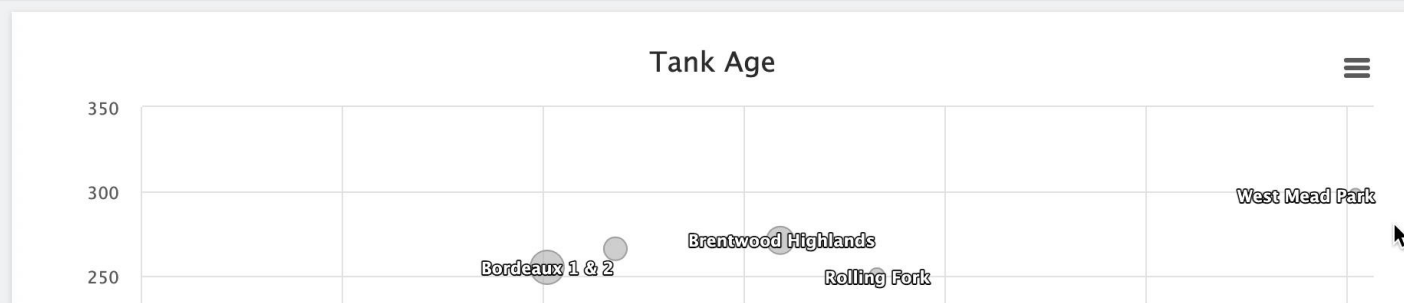
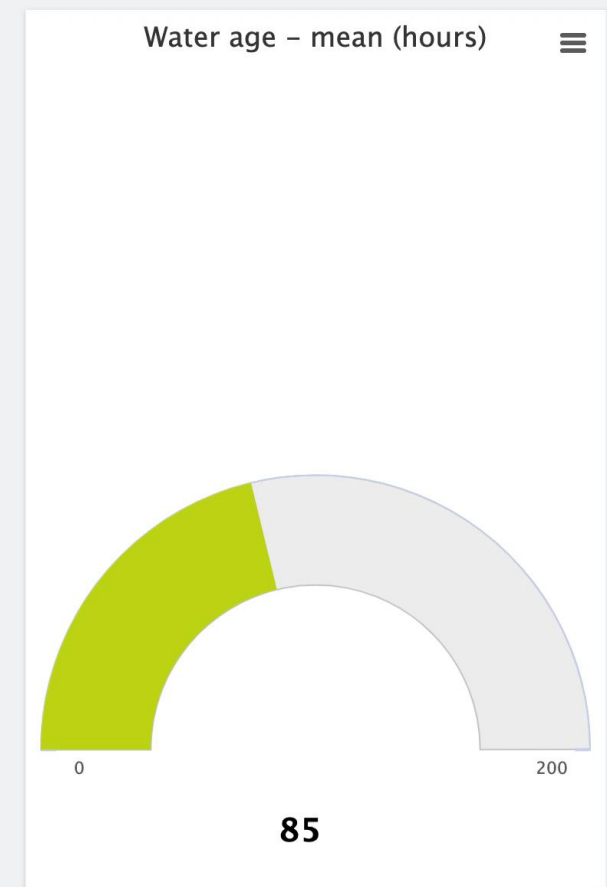
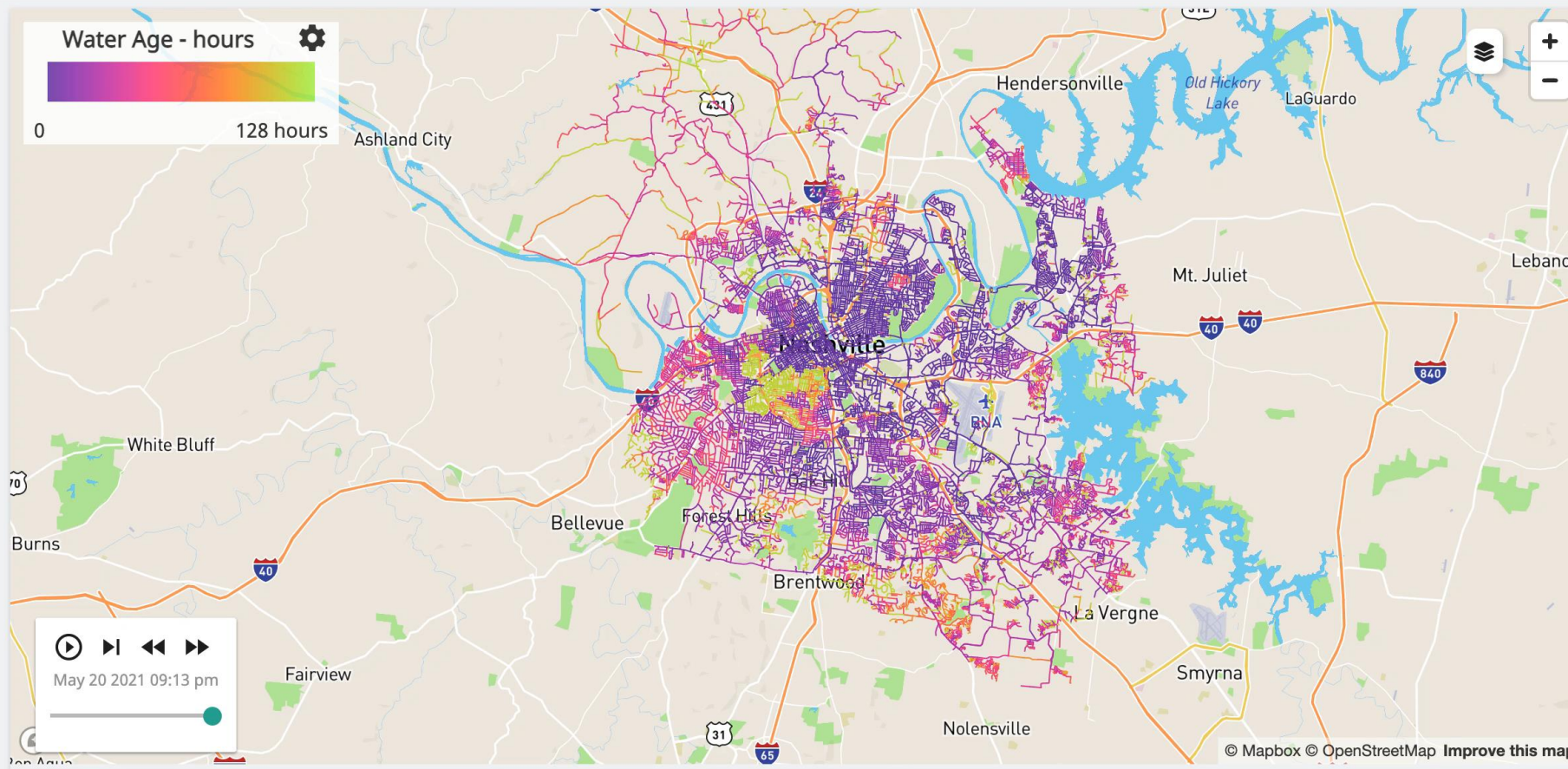
Map Features



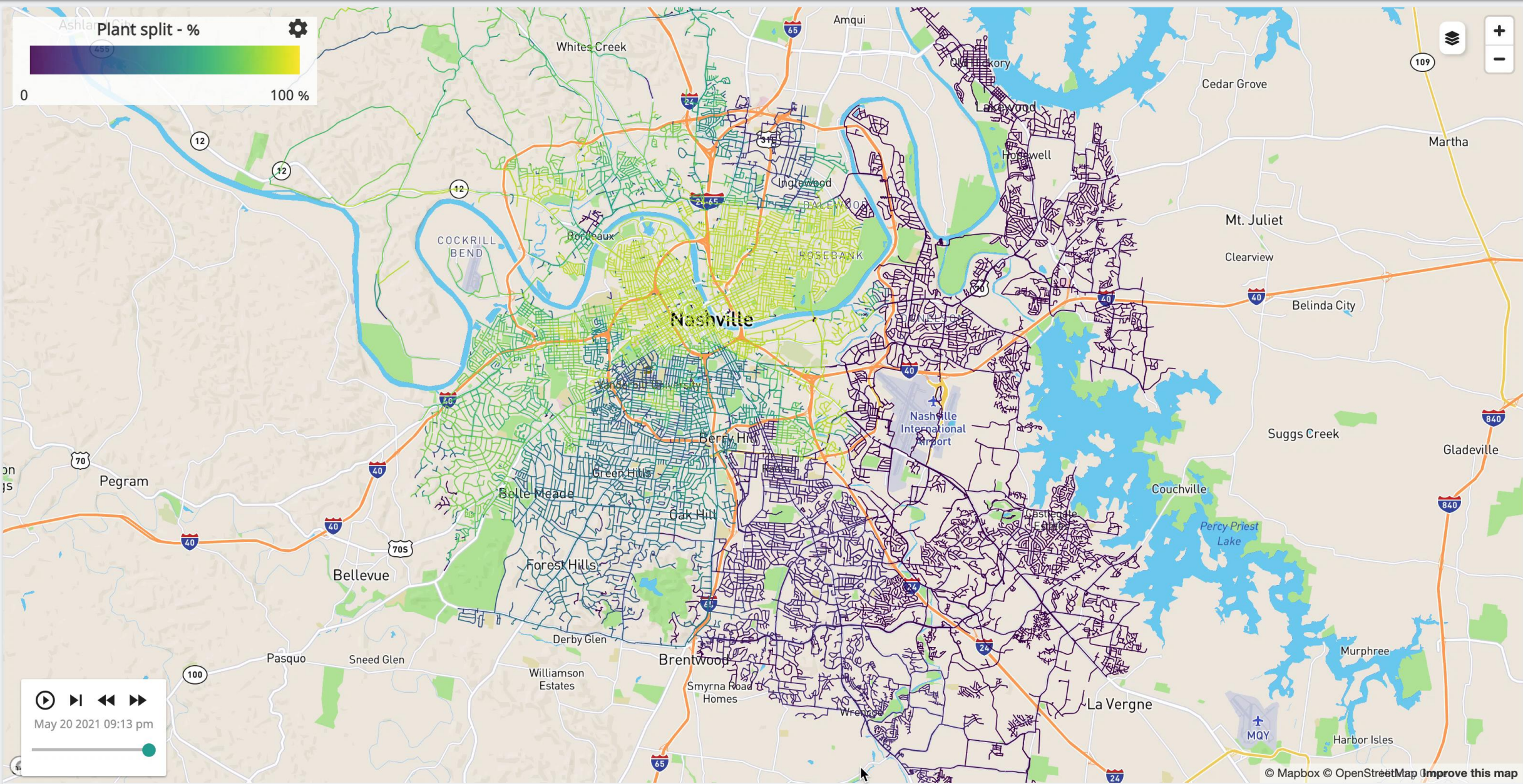
Search map



Water Age



Plant Split



Benefits of Source and Age Understanding

- Why is this important?
- What can you do with this information?
- How will this change your response to water quality issues?

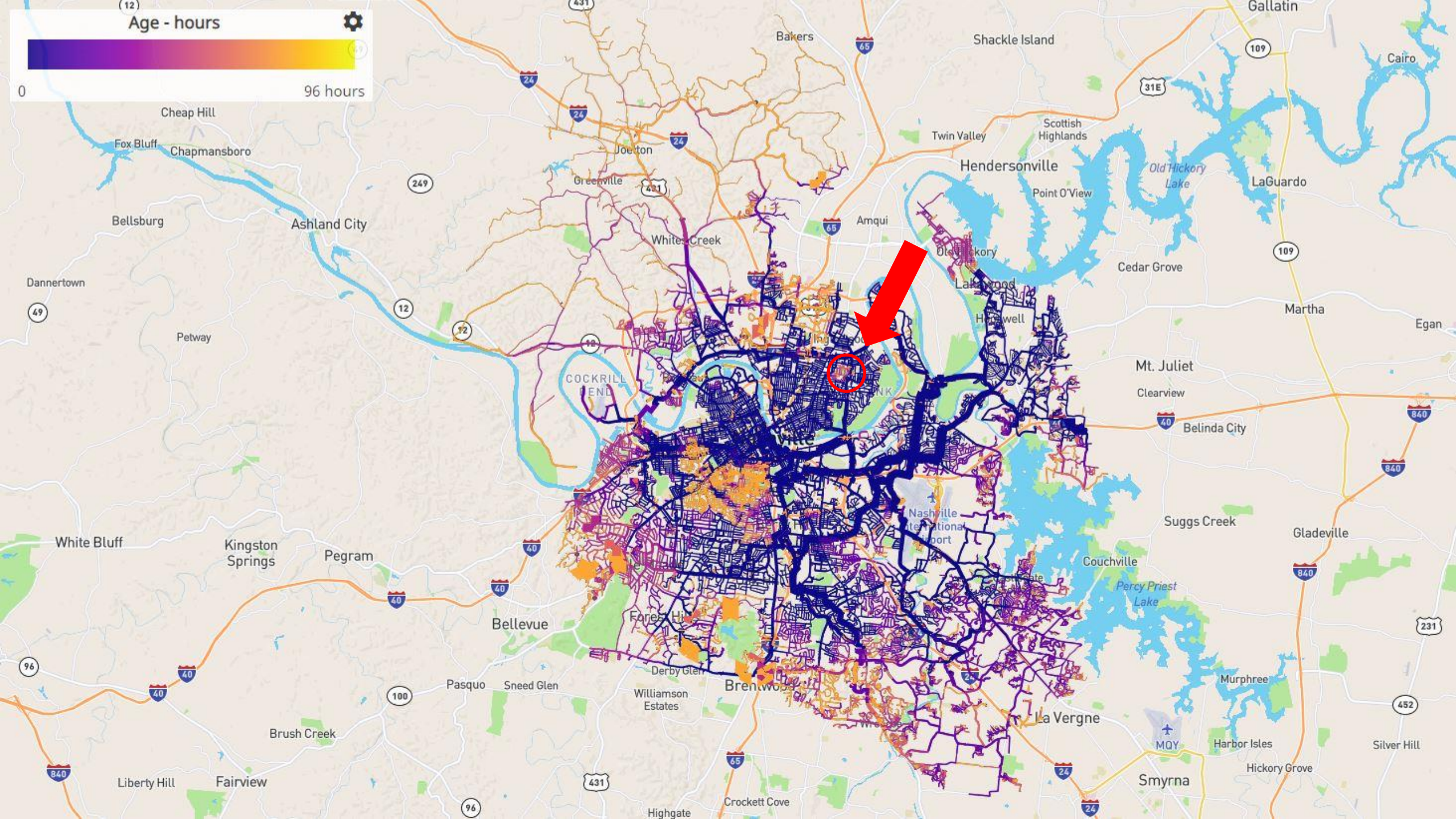
Case Example

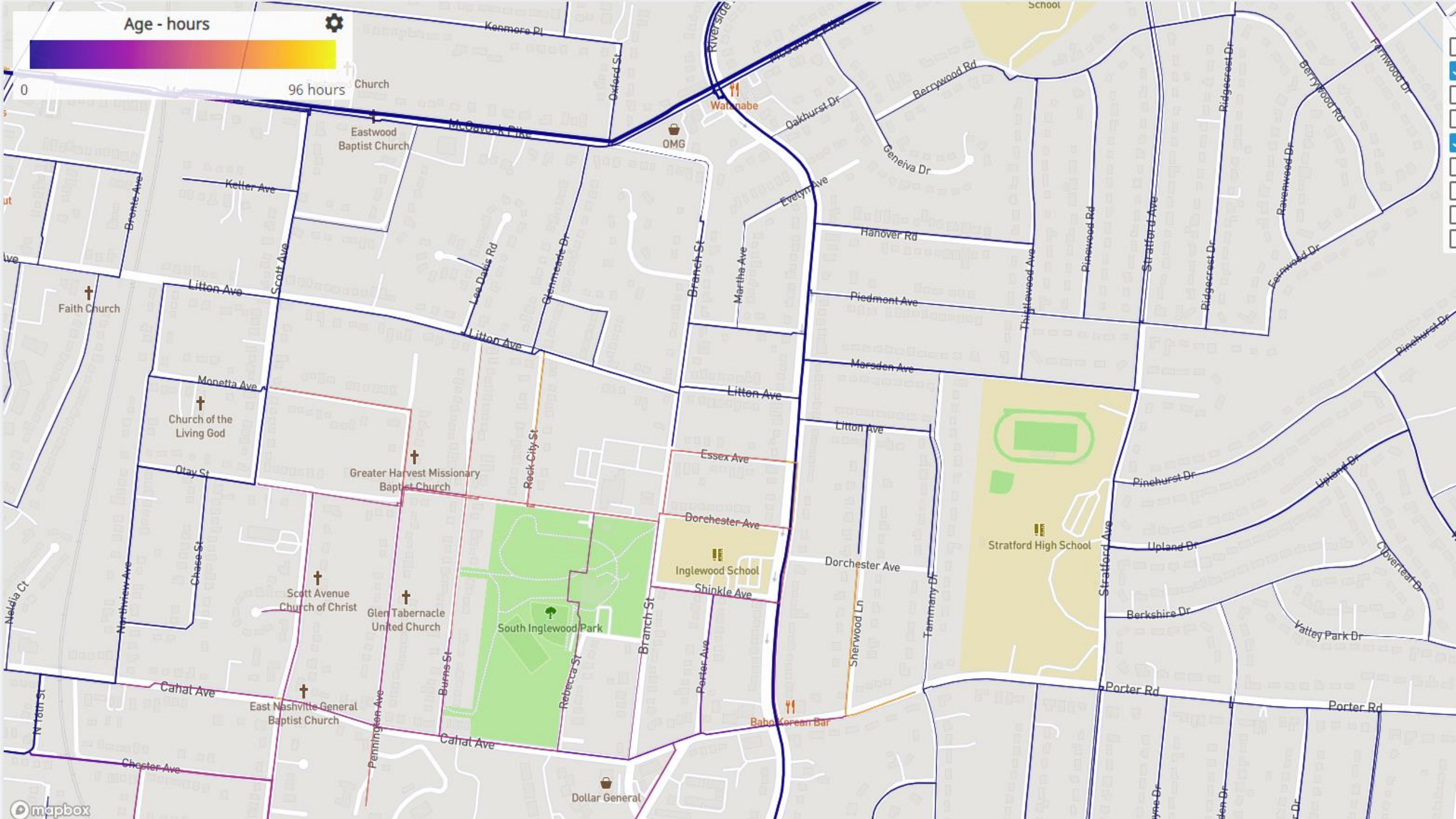
Improving Operational
Response Plans with
Source Tracing

Age - hours



0 96 hours





Age - hours



96 hours

Select date range

Last 1 day

(C-0406-119)



1.66

Age - hours



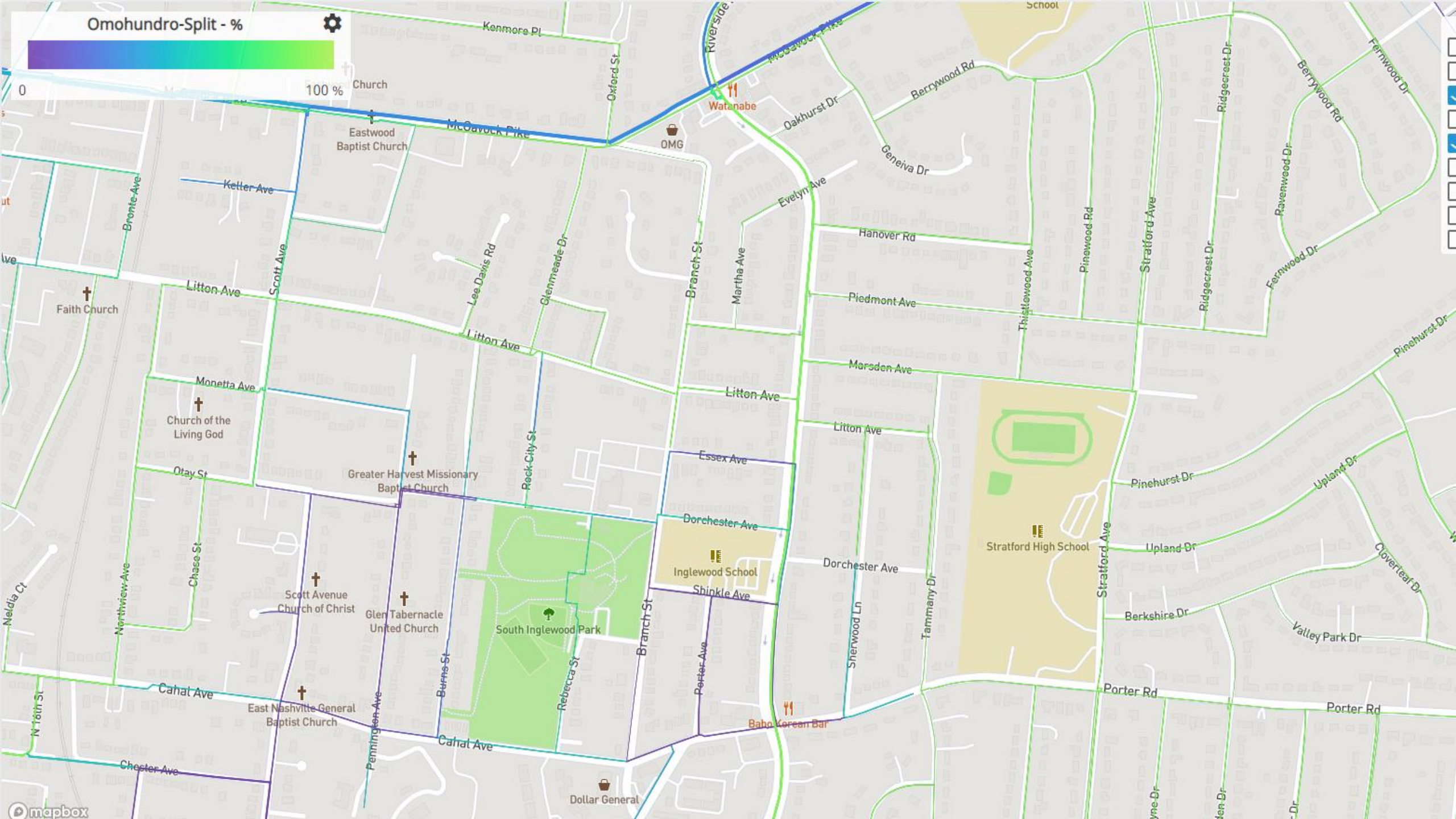
96 hours

Select date range

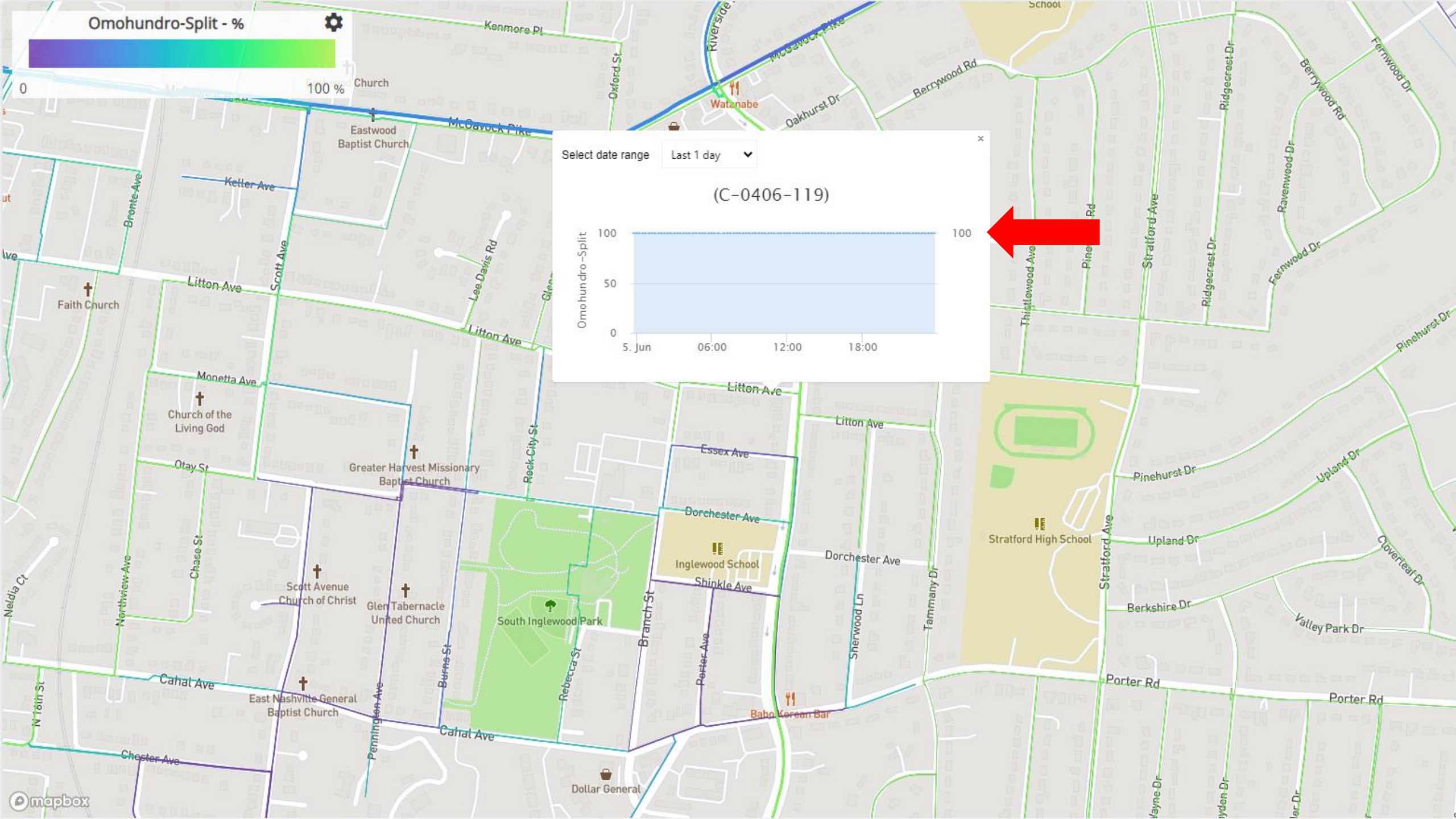
Last 1 day

(C-0506-2666)





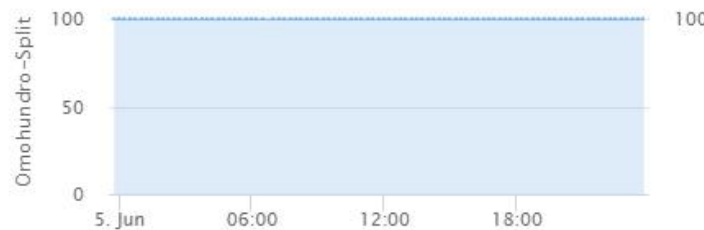
Omohundro-Split - %



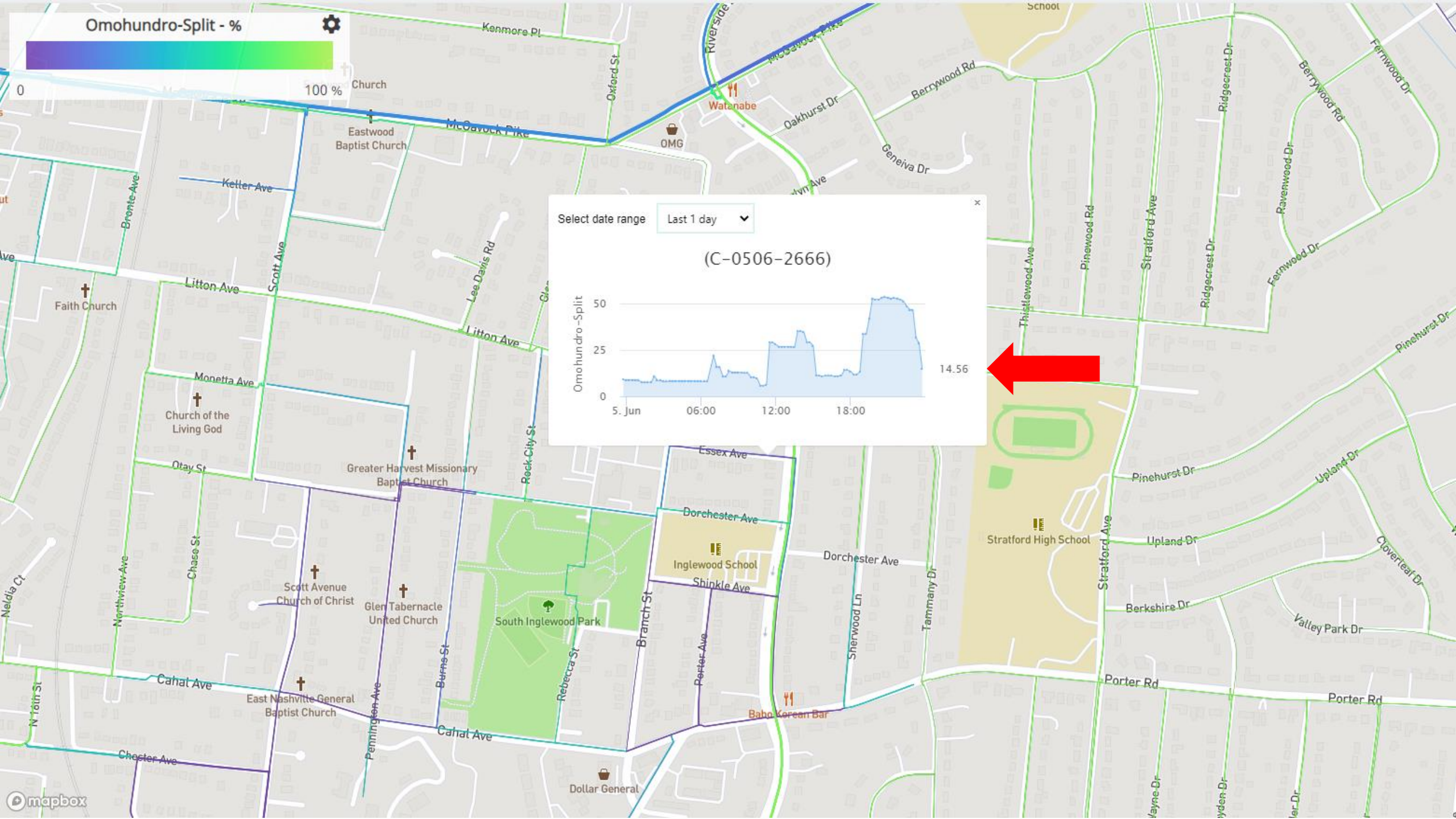
Select date range

Last 1 day

(C-0406-119)



Omohundro-Split - %



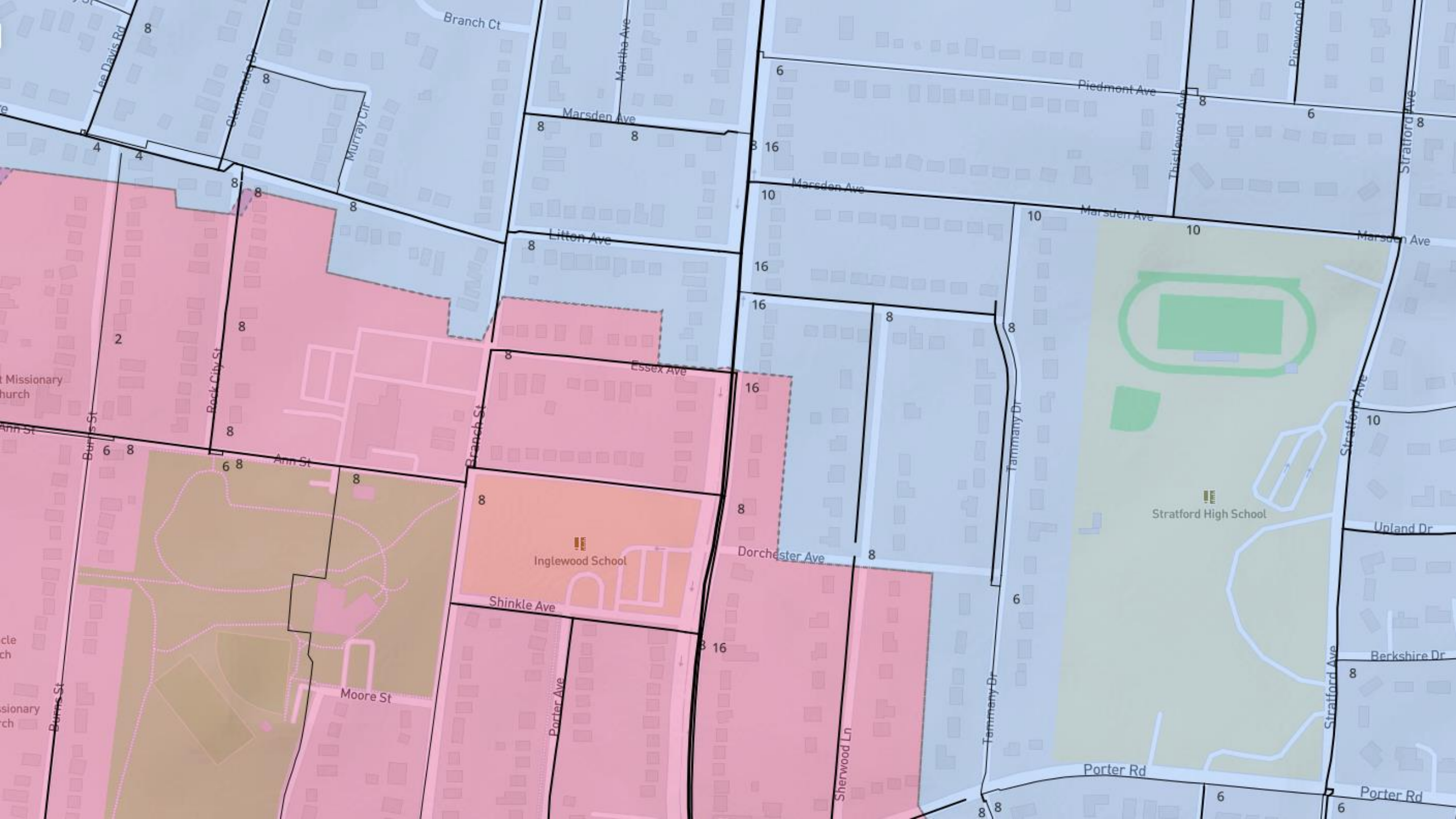
Select date range

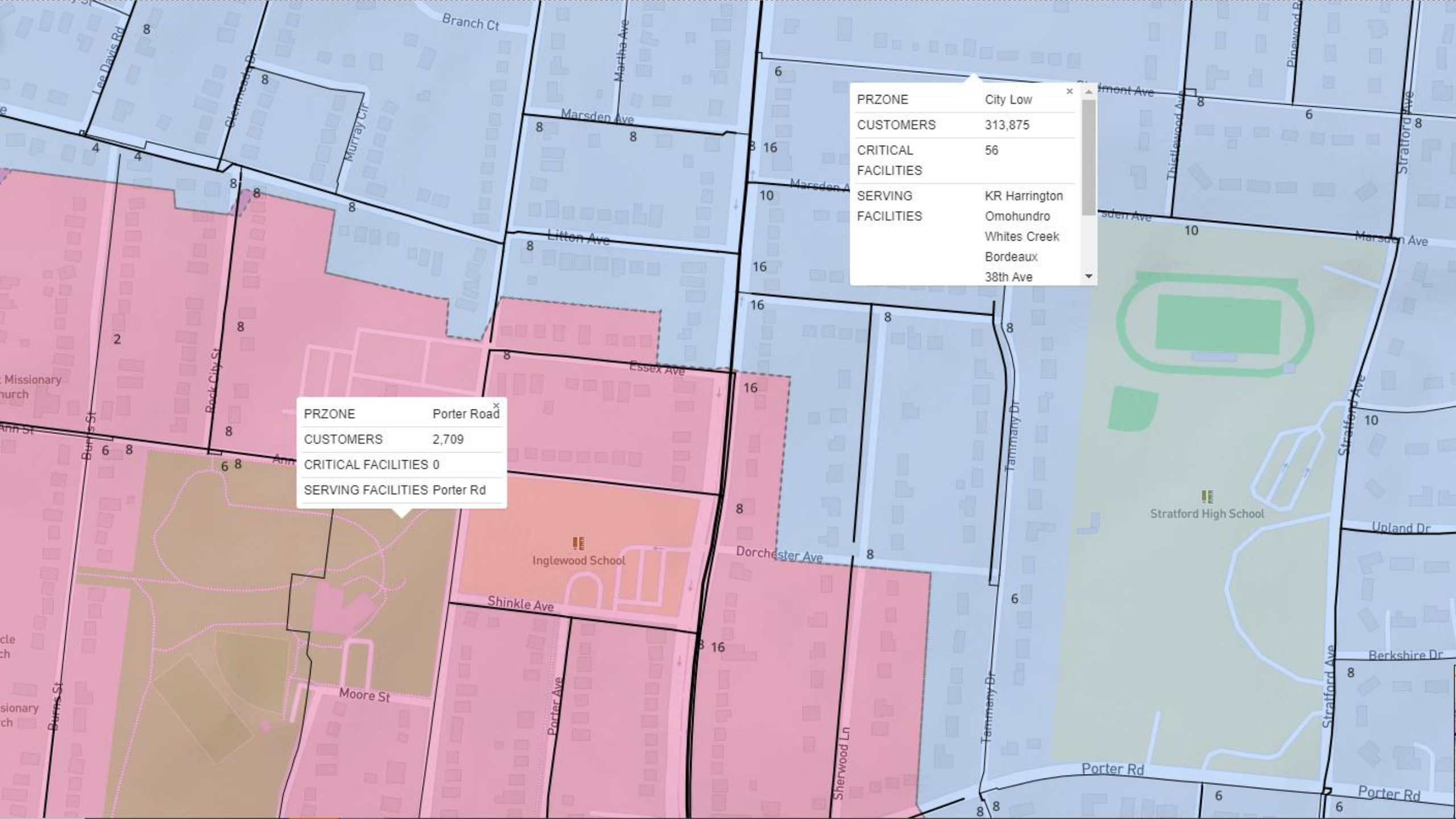
Last 1 day

(C-0506-2666)



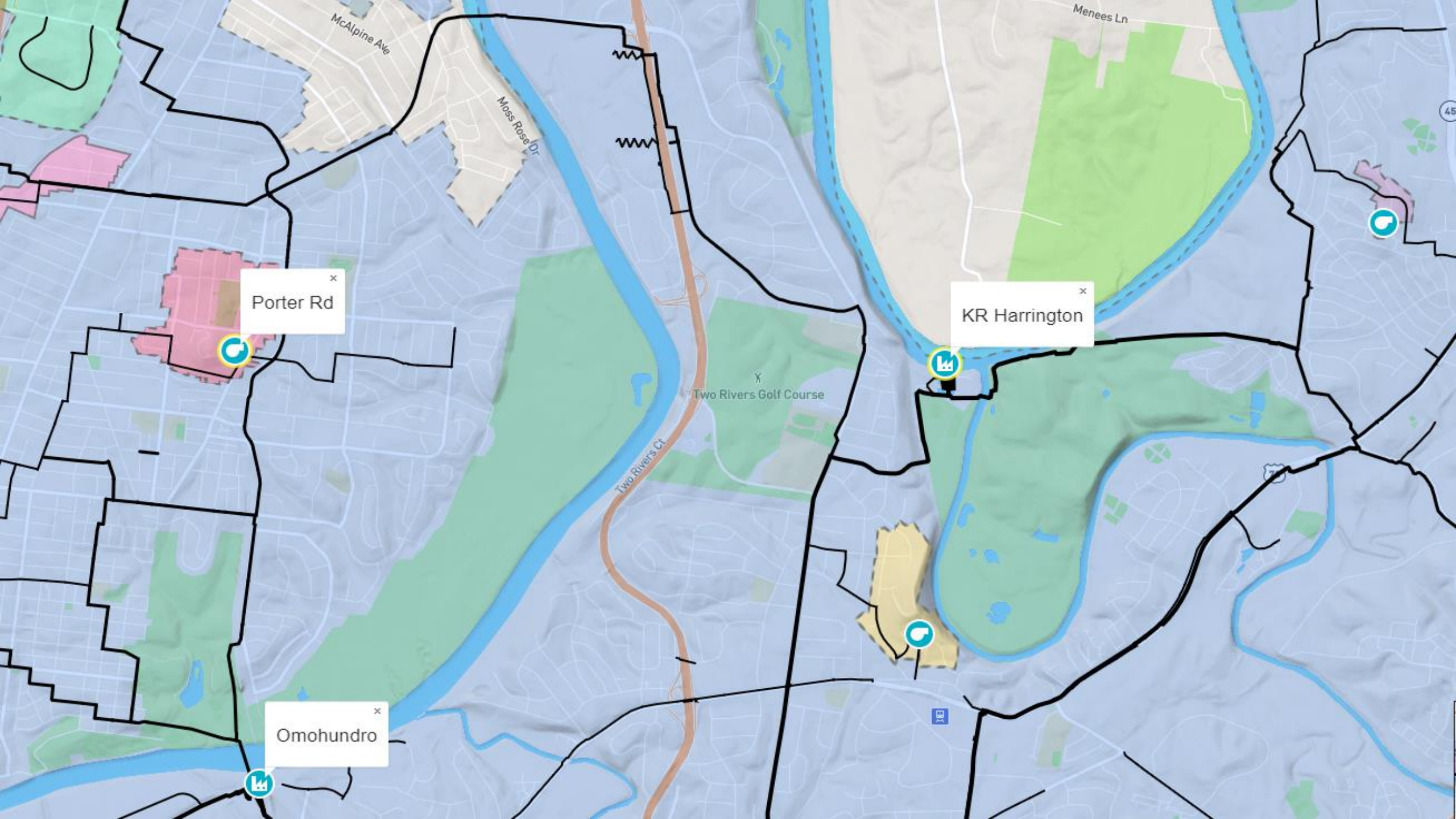
14.56





PRZONE	Porter Road
CUSTOMERS	2,709
CRITICAL FACILITIES	0
SERVING FACILITIES	Porter Rd

PRZONE	City Low
CUSTOMERS	313,875
CRITICAL FACILITIES	56
SERVING FACILITIES	KR Harrington Omohundro Whites Creek Bordeaux 38th Ave



Porter Rd

KR Harrington

Omohundro

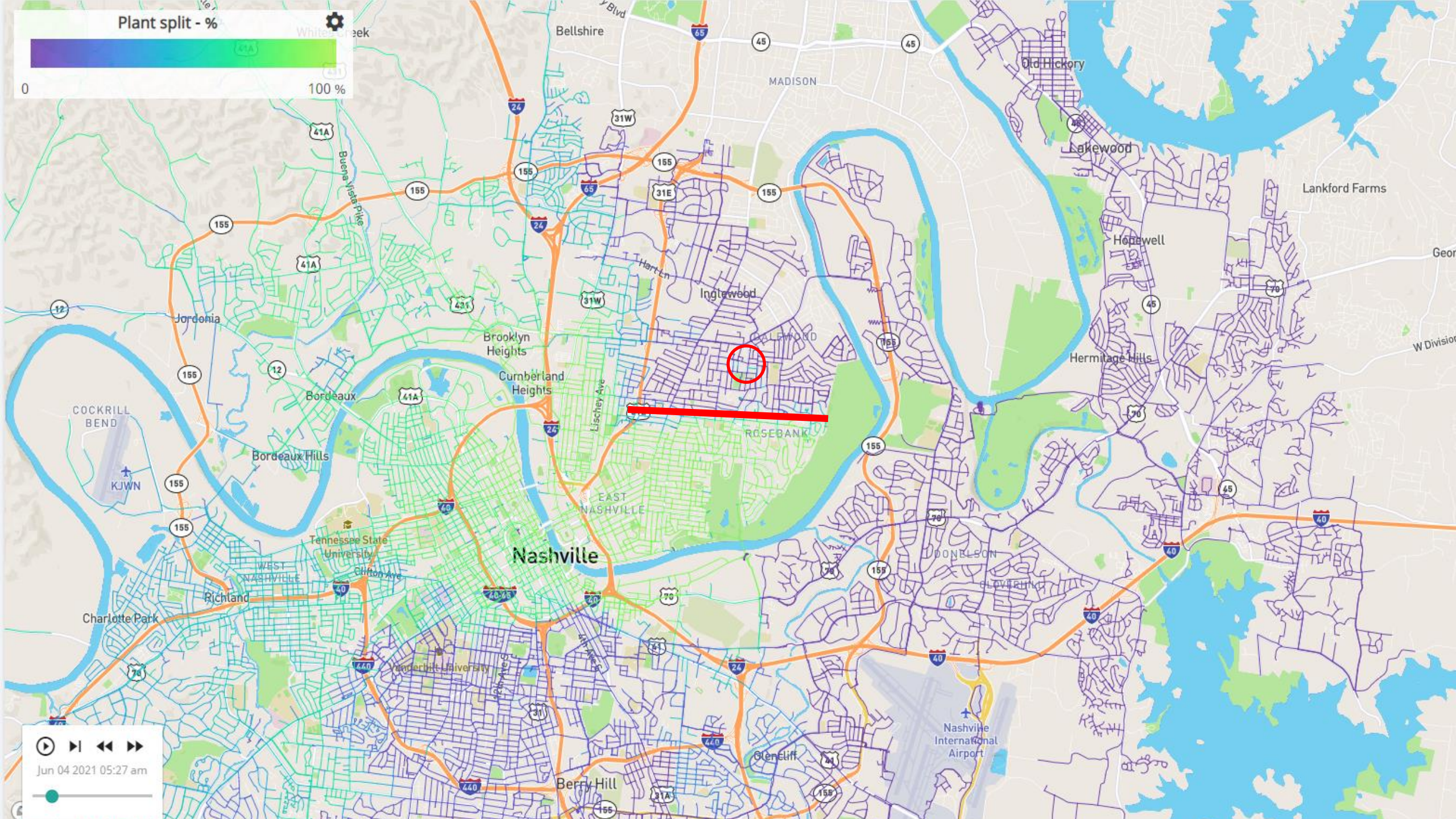
Two Rivers Golf Course

Two Rivers Ct

McAlpine Ave

Moss Rose Dr

Menees Ln

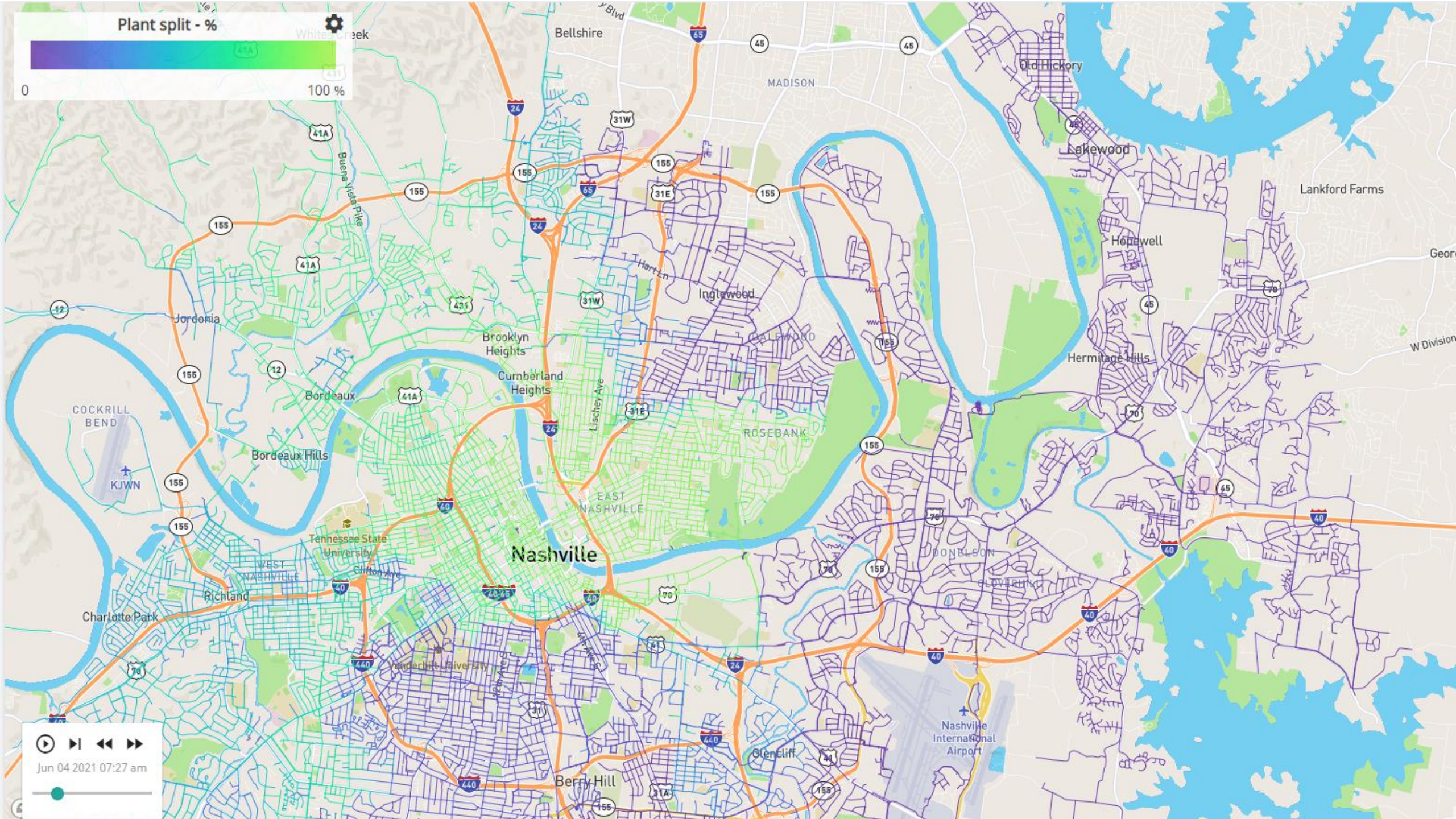


Plant split - %



0

100 %



Jun 04 2021 07:27 am

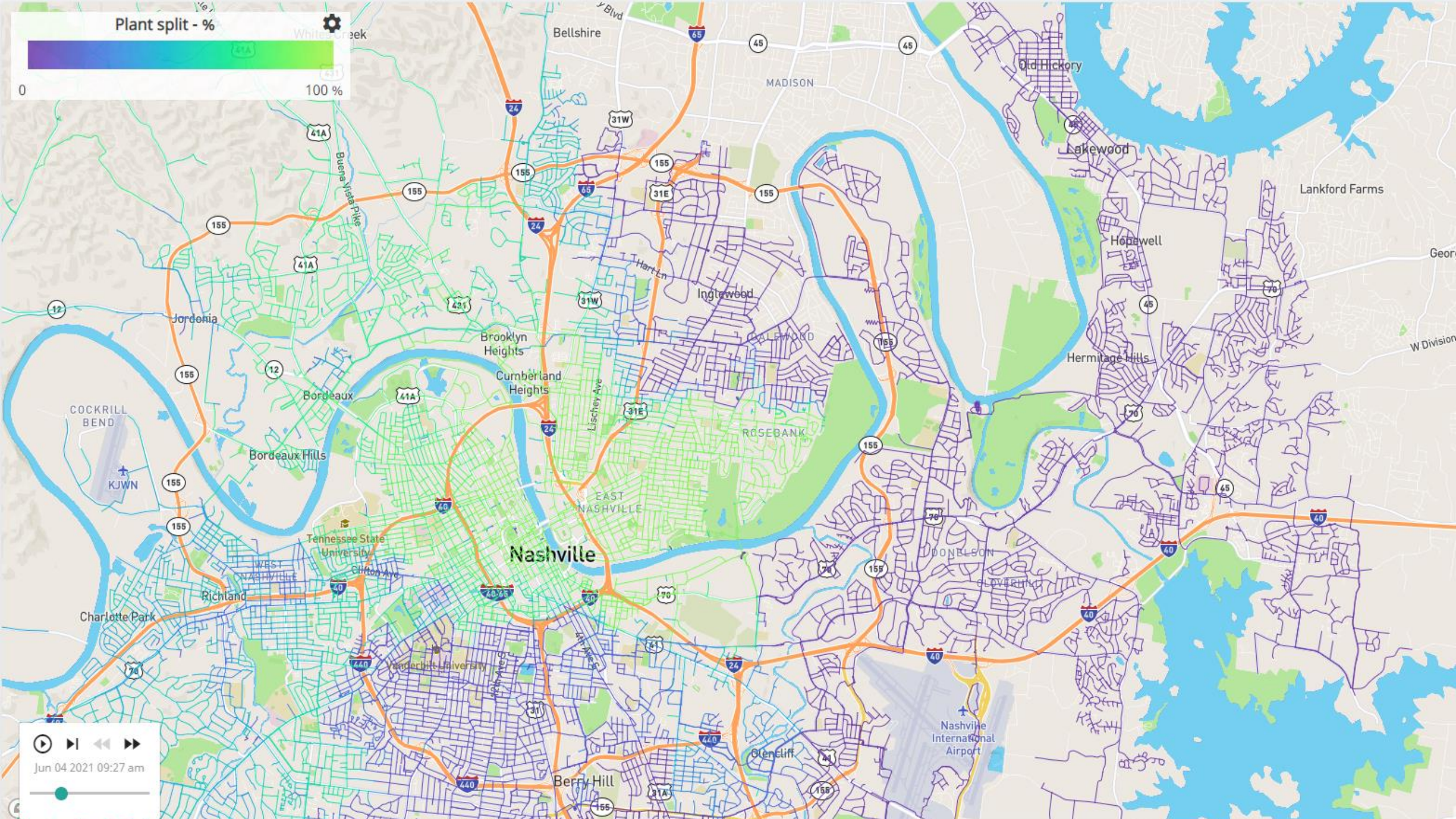


Plant split - %

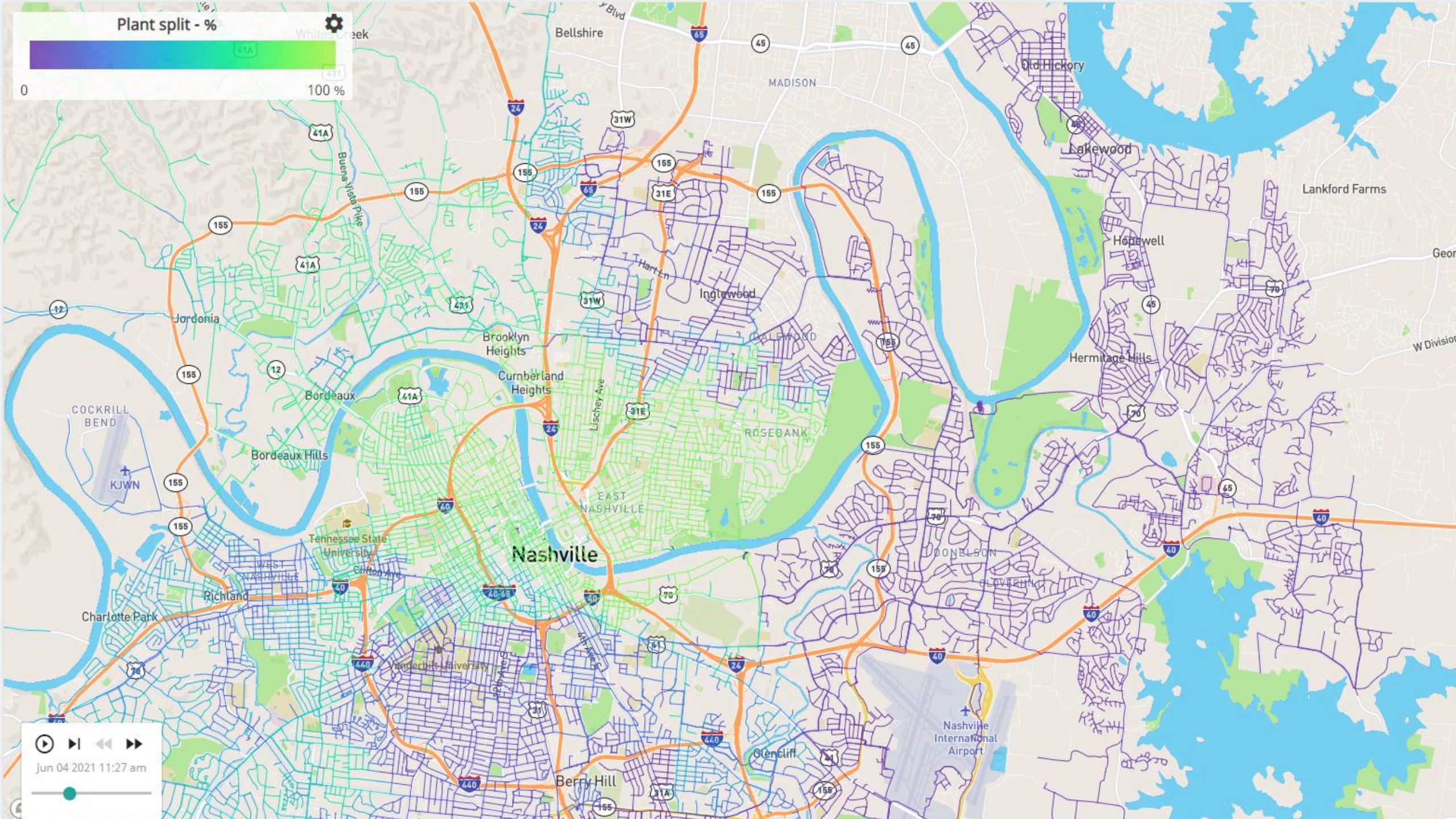


0

100 %



Jun 04 2021 09:27 am

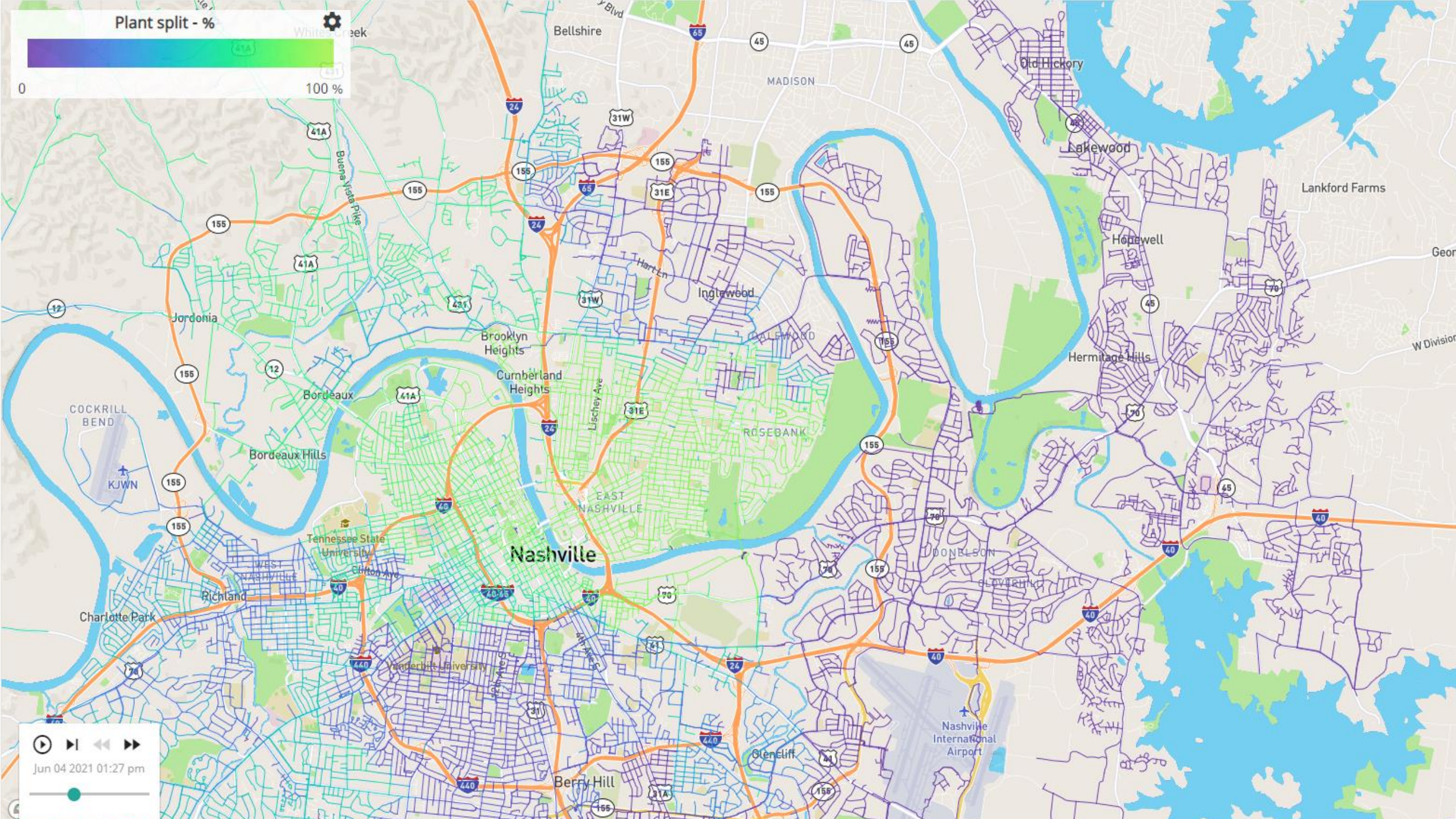


Plant split - %



0

100 %



Jun 04 2021 01:27 pm

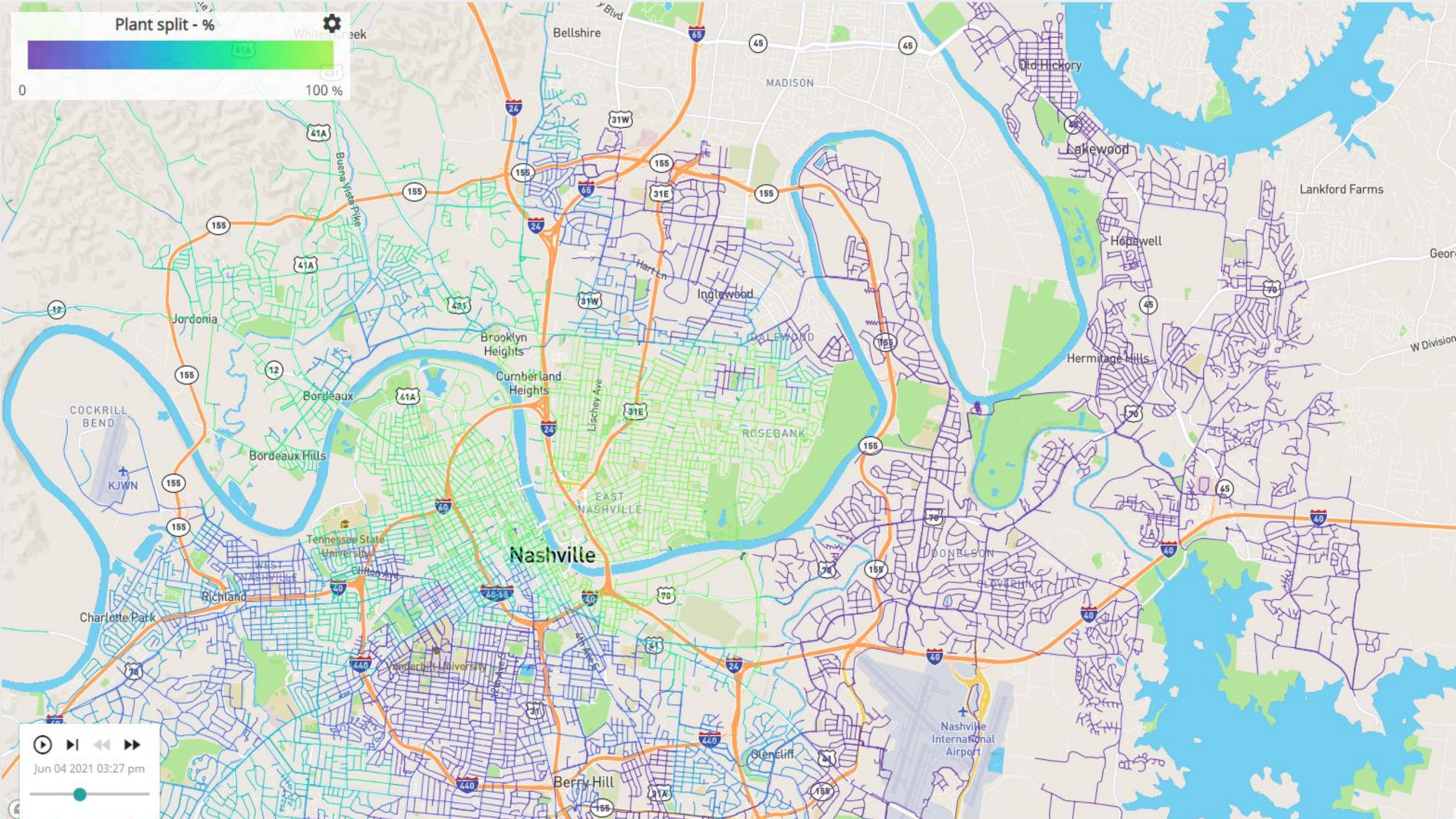


Plant split - %



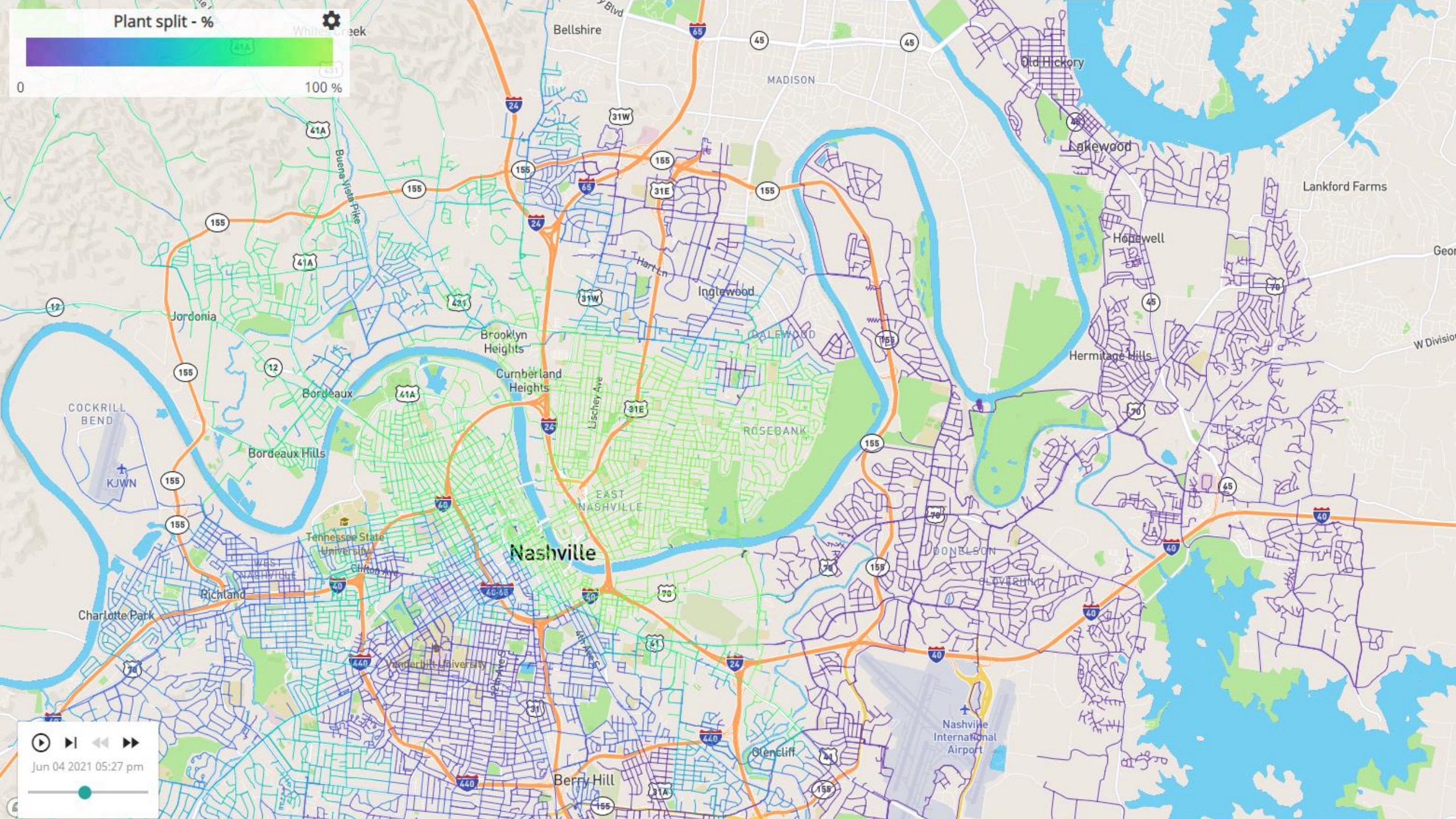
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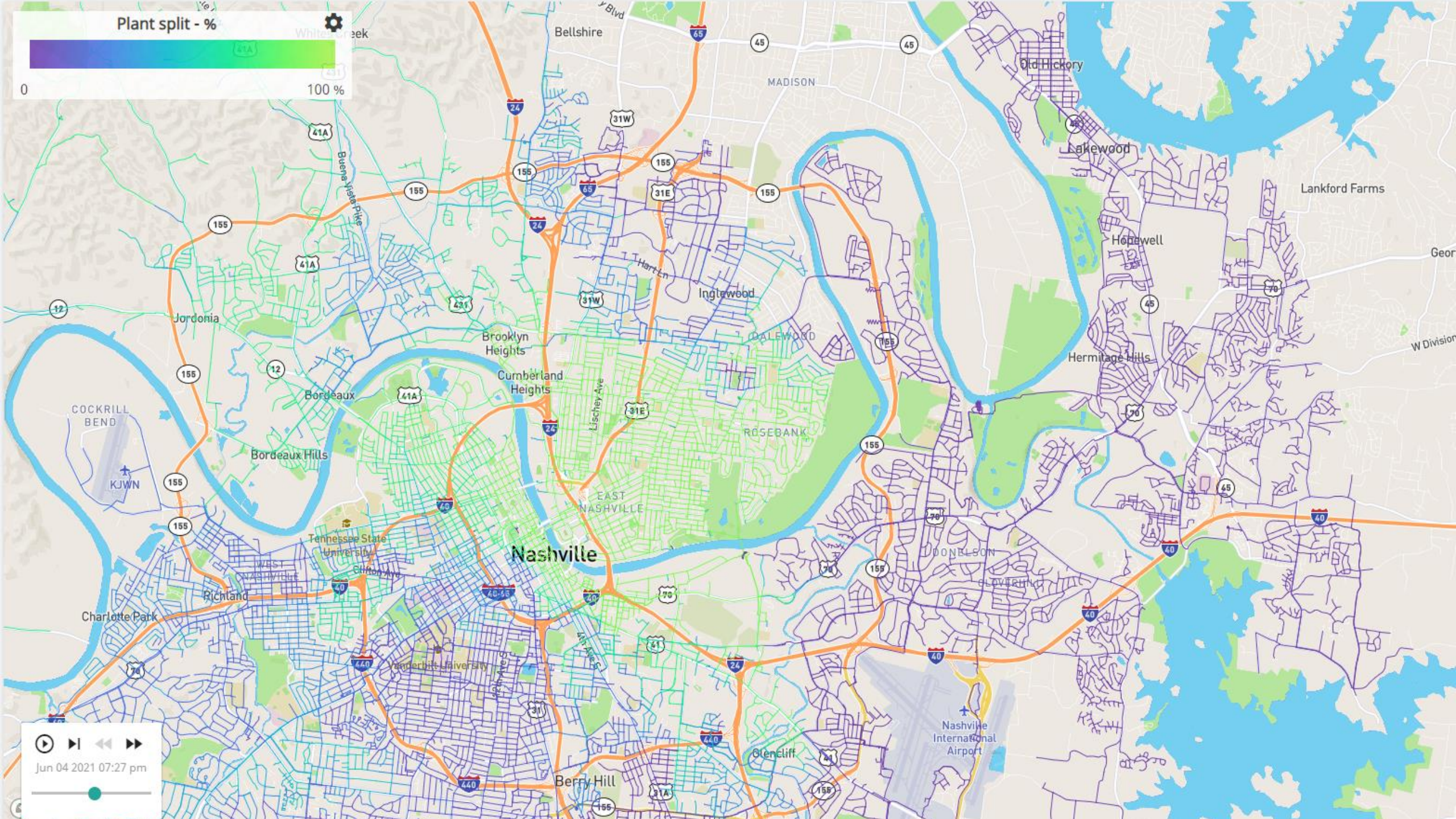
100 %



Jun 04 2021 03:27 pm





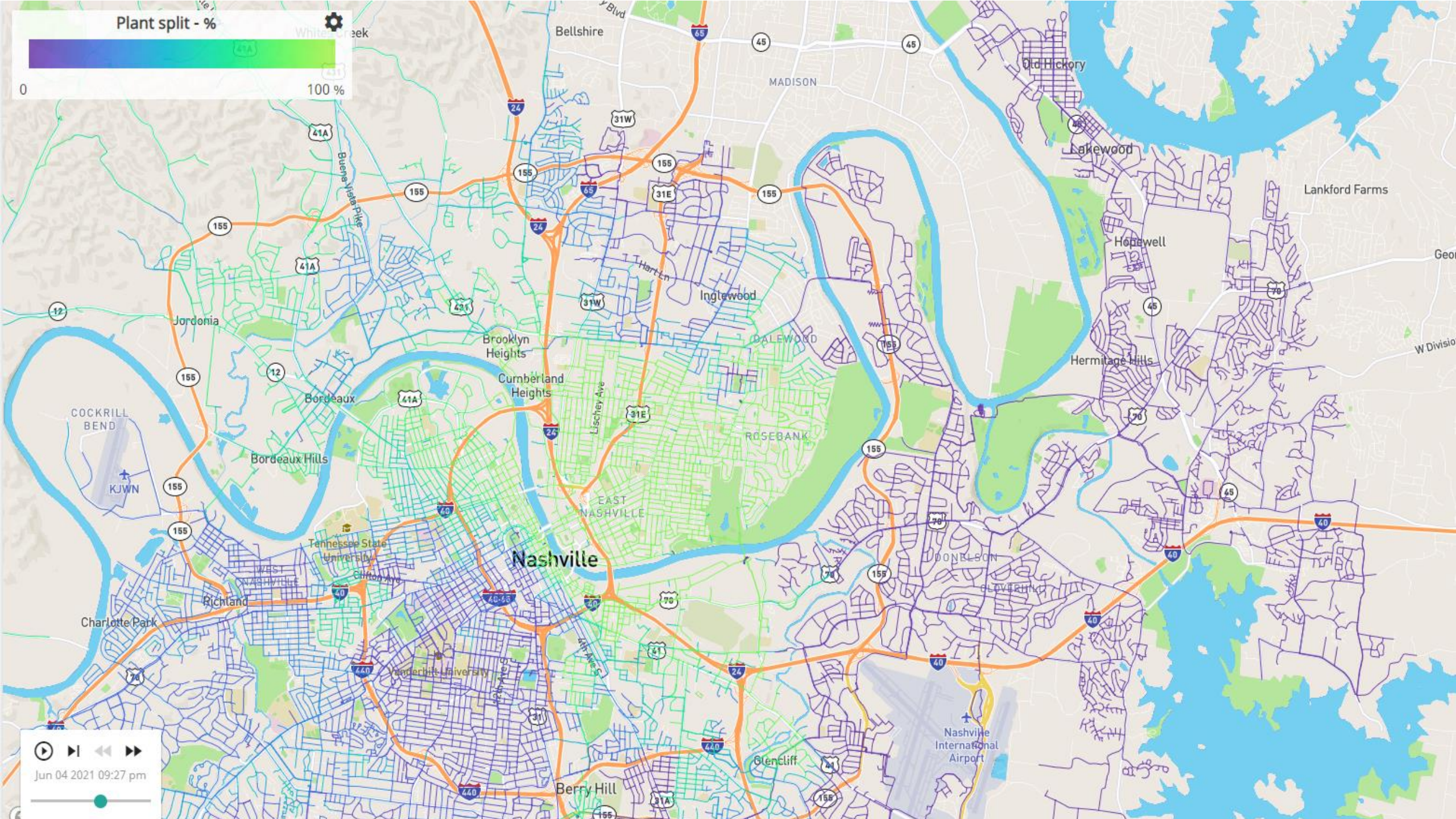


Plant split - %



0

100 %



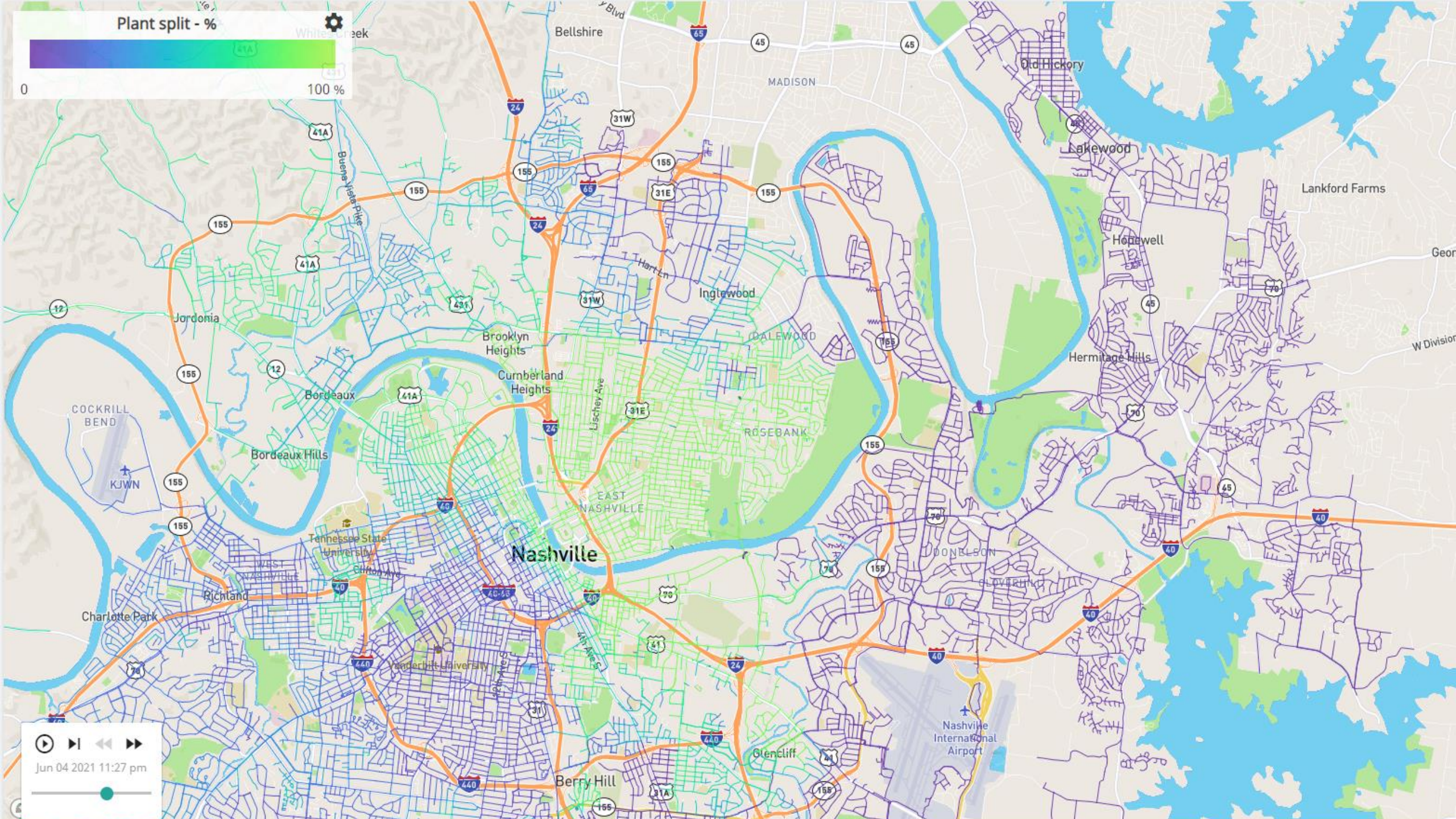
Jun 04 2021 09:27 pm

Plant split - %

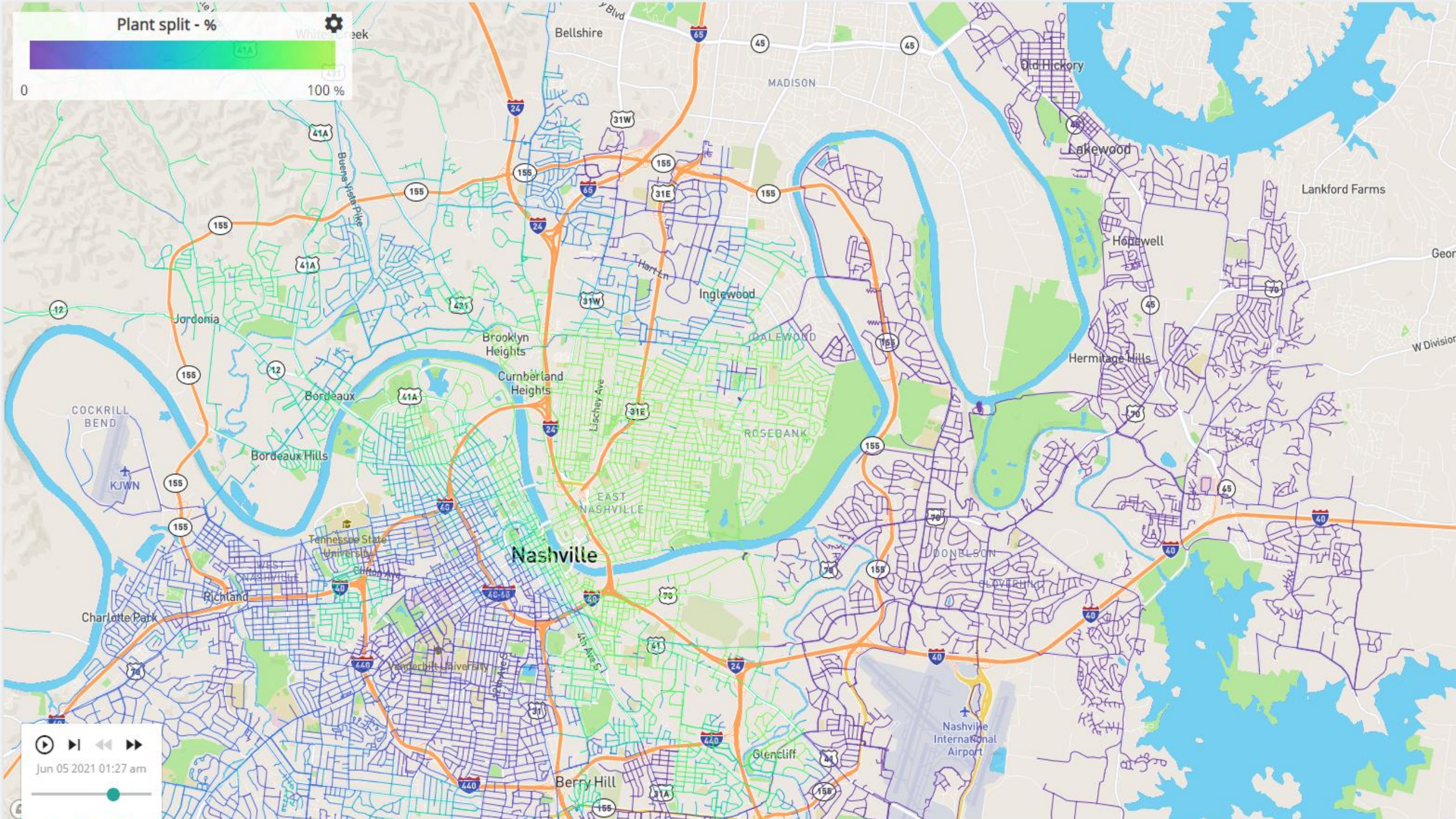


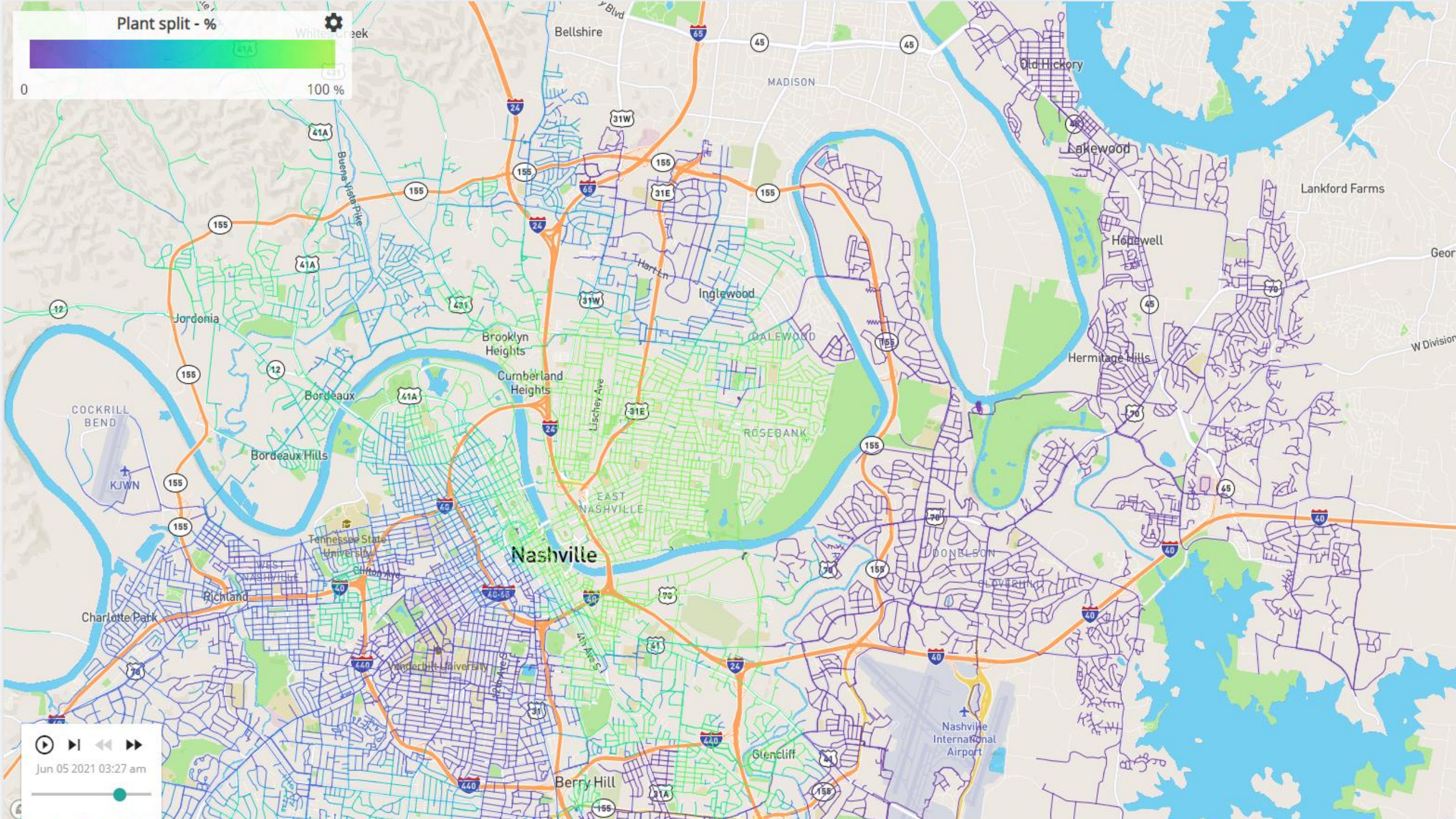
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100 %

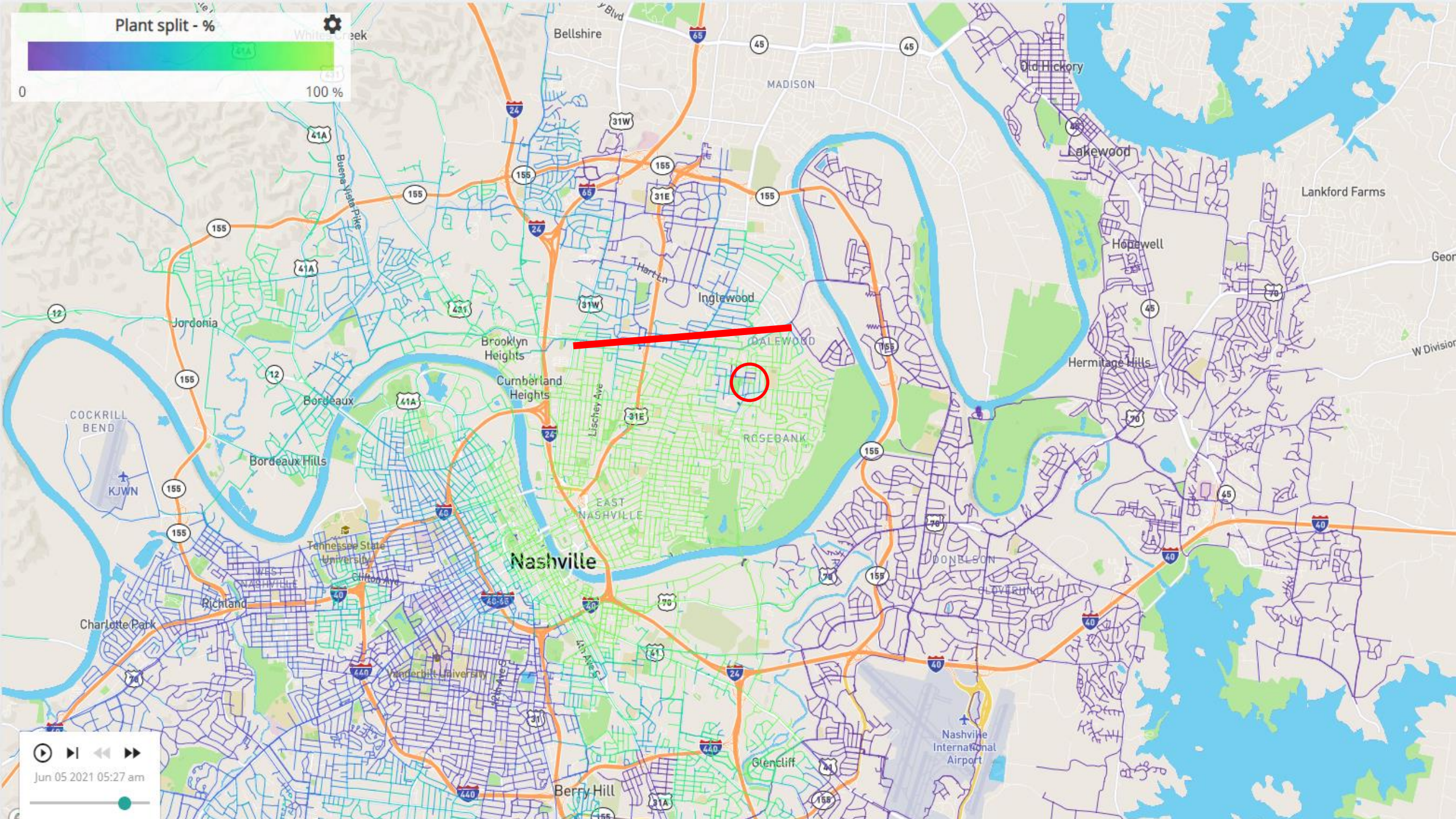
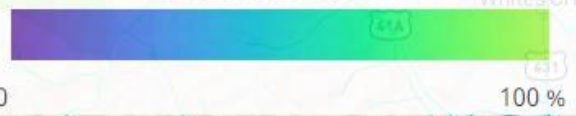


Jun 04 2021 11:27 pm

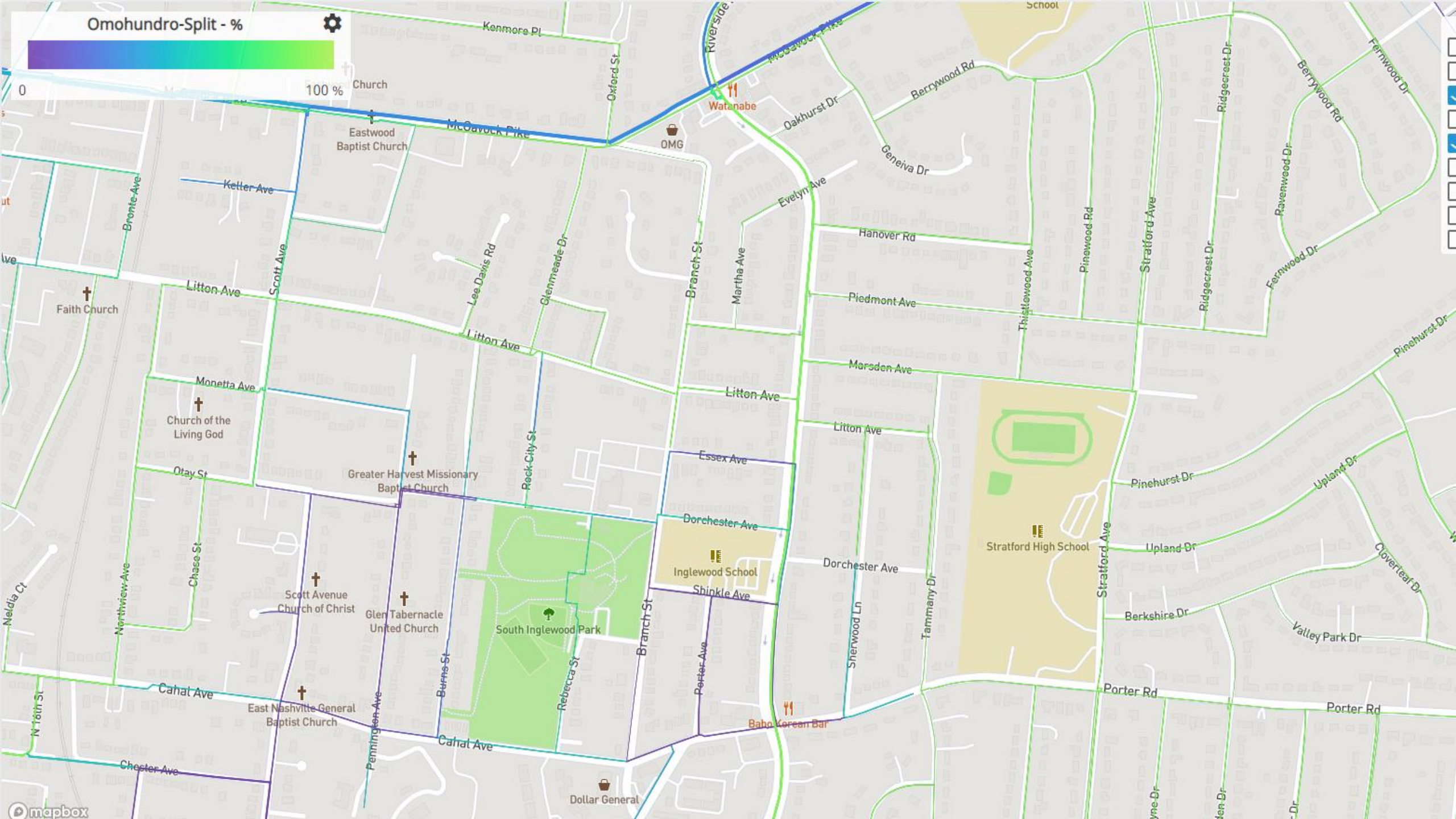




Plant split - %



Jun 05 2021 05:27 am



Case Example: Improving Operational Response Plans with Source Tracing

MWS feeds Powder Activated Carbon (PAC) for taste and odor

Old

- Taste and odor complaint on Litton
 - Increase PAC at both plants
- Taste and odor complaint on Essex
 - Increase PAC at both plants

New

- Taste and odor complaint on Litton
 - Increase PAC at Omohundro
- Taste and odor complaint on Essex
 - Flushing exercise

Key Takeaway: WNO helps you properly respond to water quality complaints by informing on the source and age of the water

Xylem's Solutions are Constantly Improving

- Next phase → develop additional predictive capabilities on top of the existing simulation engine
- Further exploration → optimization engines to help operational decision making and improve operational efficiency

Digital enablement presents immense opportunities to improve the way we operate and maintain our water distribution systems



Let's redefine what's
possible for water
together



Acknowledgements

Justin Bowling, P.E. – MWS
Samantha White – MWS
Jim Uber, Ph.D. – Xylem
Sam Hatchett – Xylem
Marcelo Cusacovich, P.E. – Xylem
Srinivas Kulkarni – Xylem