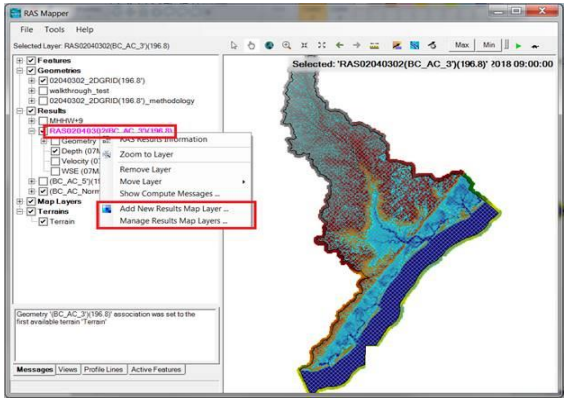
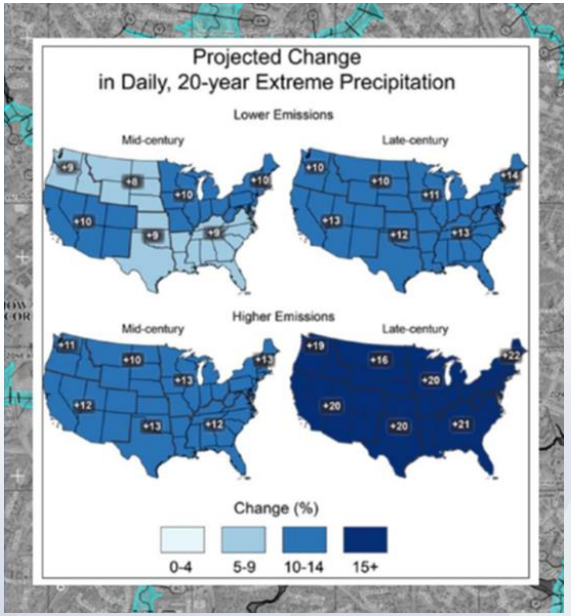


REGIONAL PLANNING AND FLOOD MODELING FOR RESILIENCE AND ENVIRONMENTAL IMPROVEMENT

Presented by:
Katherine Daly, PE, CFM
Michael Yaffe, AICP, PP, GISP, ENV SP



What is Resilient NJ?

RESILIENT NJ

New Jersey was awarded $10 million from HUD through the National Disaster Resilience competition.

The Resilient NJ program provides funding and technical assistance to multi-municipal regions within New Jersey's nine Most Impacted and Distressed counties affected by Superstorm Sandy to undertake a comprehensive planning process.

Planning Regions

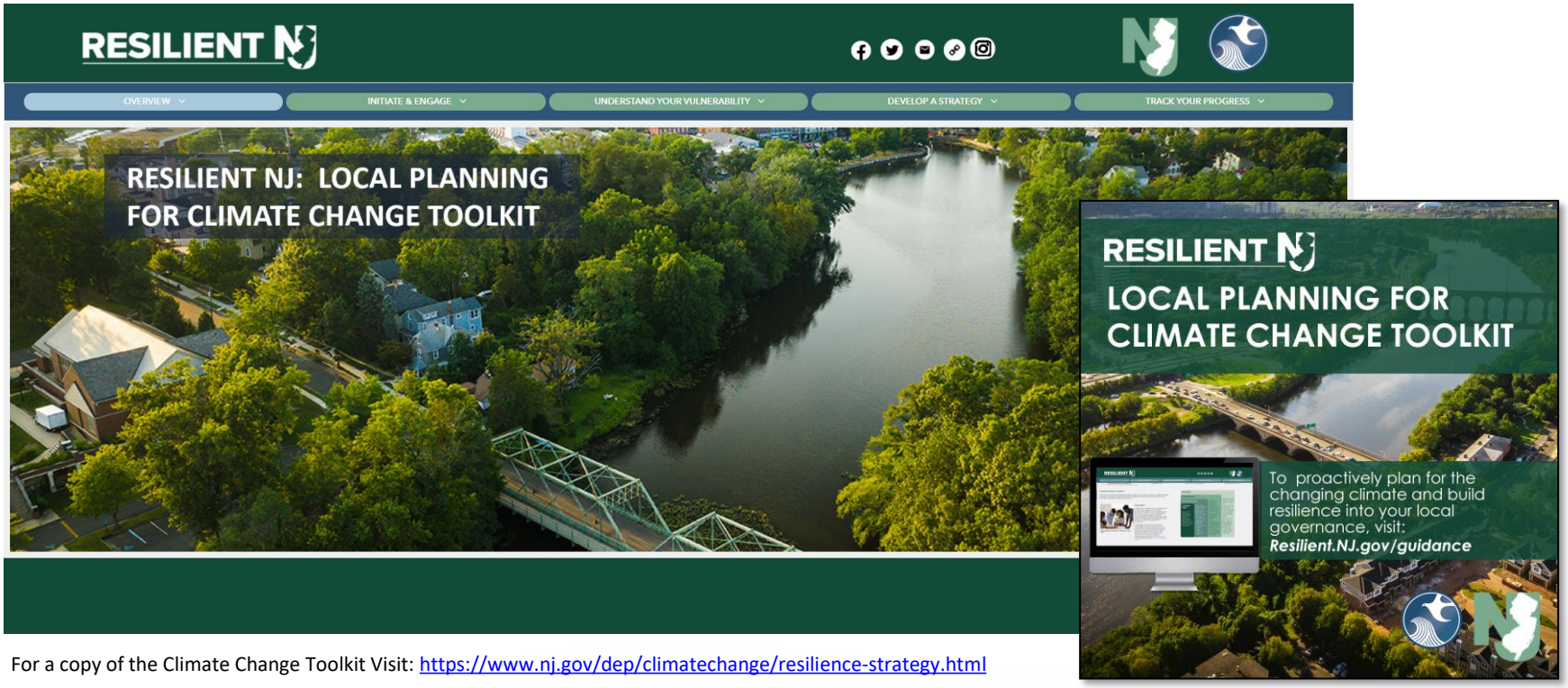
Jersey City, Bayonne, Hoboken, & Newark

Long Beach Township, Barnegat Light, Beach Haven, Harvey Cedars, Ship Bottom, & Surf City

Middlesex County, Perth Amboy, Woodbridge, Sayreville, South River, & Old Bridge

Ventnor, Brigantine, Atlantic City, Margate, Longport, Northfield, & Pleasantville

Resilient NJ: Climate Change Toolkit



For a copy of the Climate Change Toolkit Visit: https://www.nj.gov/dep/climatechange/resilience-strategy.html

U.S. Climate Resilience Toolkit

RESILIENT NJ IS NOW INCLUDED AS A TOOL WITHIN THE U.S. CLIMATE RESILIENCE TOOLKIT

United States Global Change Research Program

Resilient NJ – Regional Planning

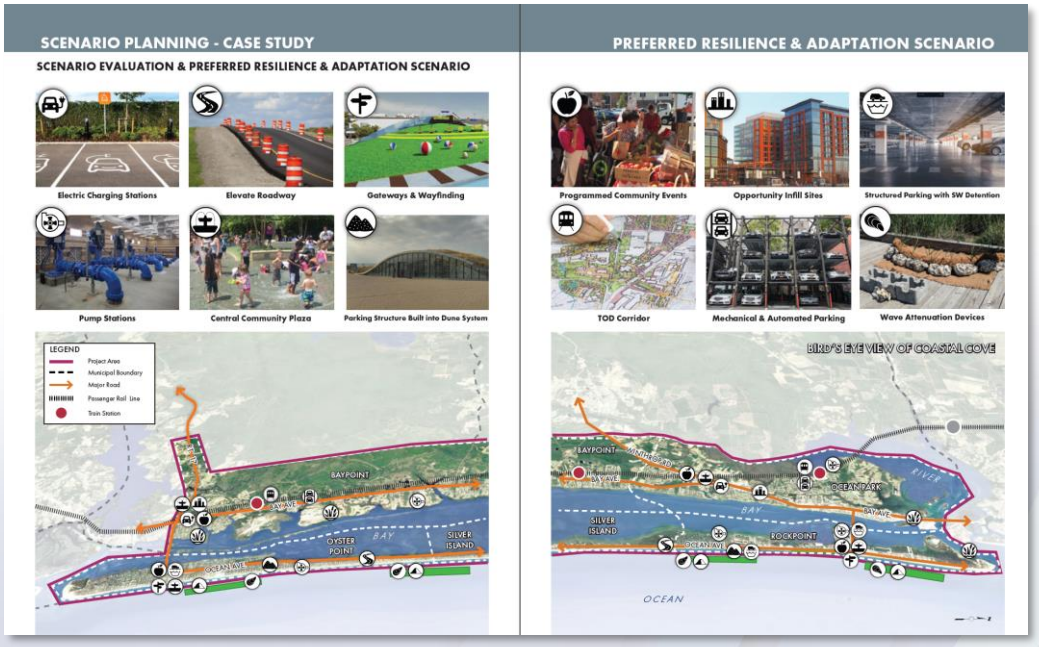
RESILIENT NJ

Vulnerability Assessment and Scenario Planning

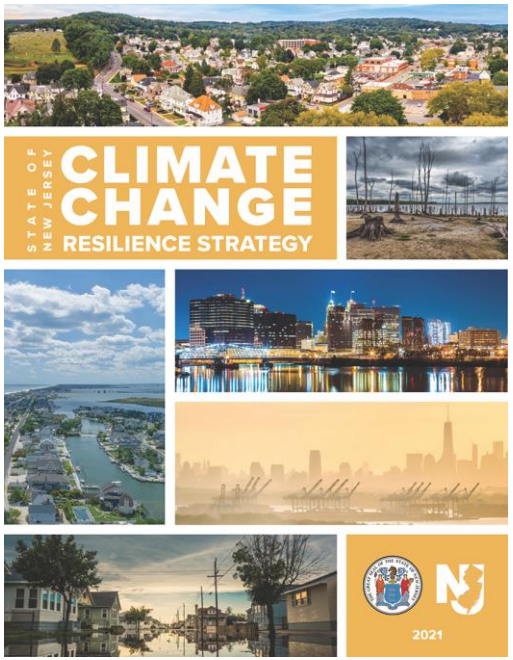
- Assessing Vulnerability
- Future Flooding Hazards
- Developing Scenarios
- Developing Actions
- Innovative Solutions with Multiple Benefits
- Evaluating Scenarios

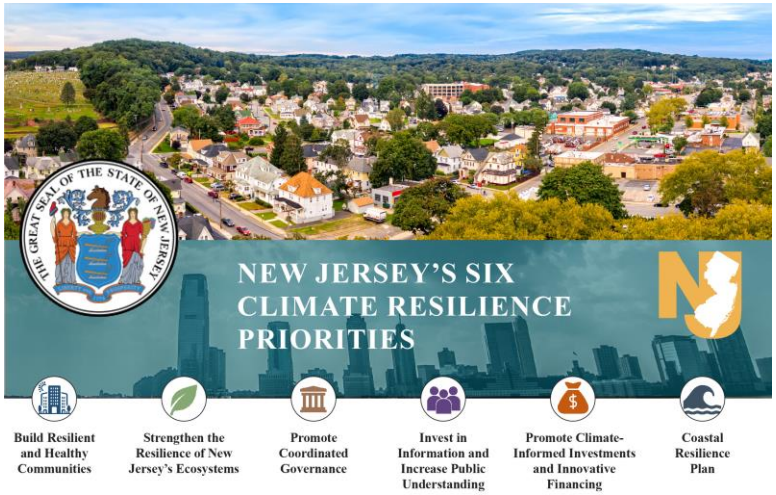
Resilience Indicators:

- Alignment with Vision
- Risk Reduction
- Cost Efficiency
- Regional Capacity
- Environmental Enhancement
- Adaptability Over Time
- Community Support
- Social, Cultural, and Economic Enhancement



Climate Change Resilience Strategy



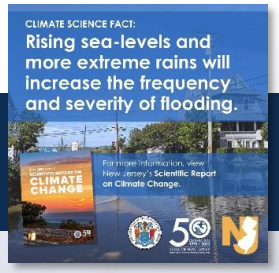


For a copy of the Strategy Visit:
https://www.nj.gov/dep/climatechange/resilience-strategy.html

For a copy of the Scientific Report Visit:
www.nj.gov/dep/climatechange/

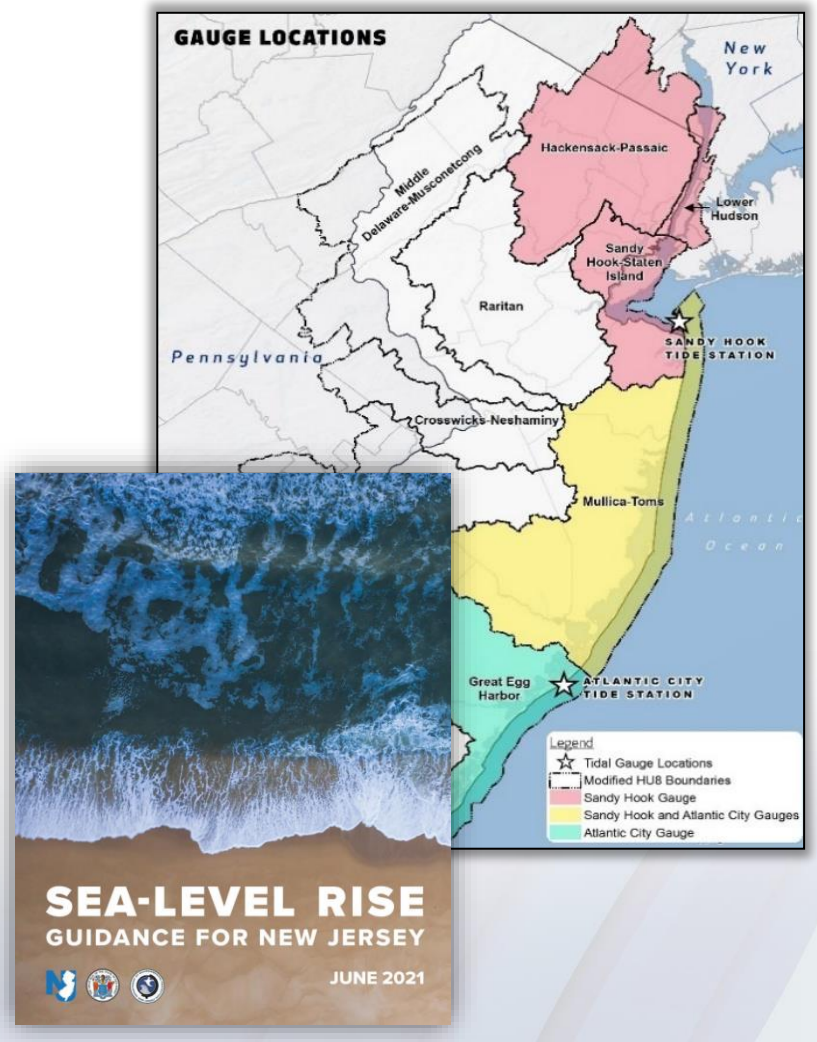
NCSL

NOTABLE DOCUMENT AWARD WINNER
FOR ENVIRONMENTAL PROTECTION
NATIONAL CONFERENCE OF STATE LEGISLATURES



Modeled Regions

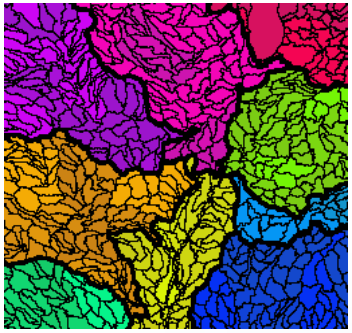
- Models based on readily available data
- 2-dimensional HUC-8 watershed level analysis originally intended for regional resilience planning
- Utilize HEC-HMS and HEC-RAS 5.0.7
- Built framework to be highly adaptable
  - Easily changed inputs for regional specific needs
  - Refinements possible for engineering level analysis



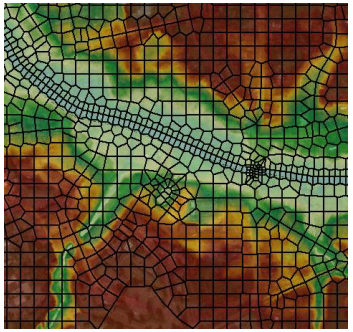
Process Overview – 2D Rain on Grid

Build Terrain & DEMs

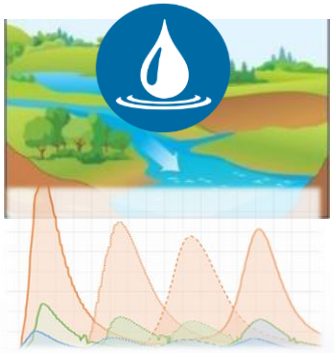
Develop Hydrology



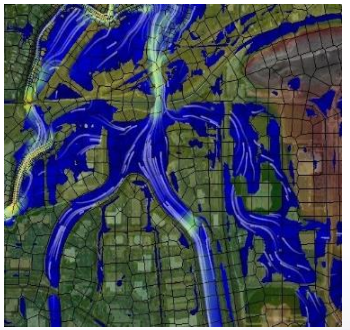
Mesh Creation & Refinements



Apply Rainfall



Mapping

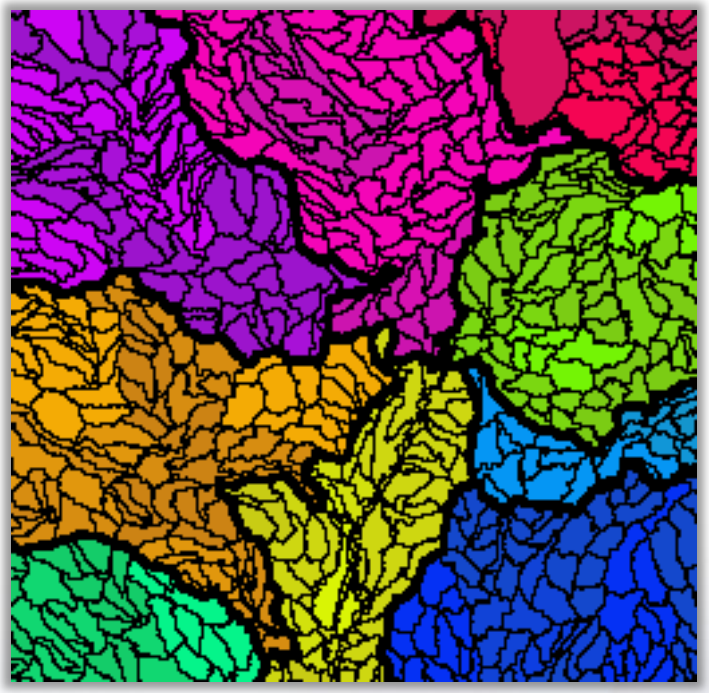


Build Terrain & DEMs

- Utilized available LiDAR data
- For Resilient NJ:
  - Hydrologically conditioned DEM using Arc Hydro Toolkit

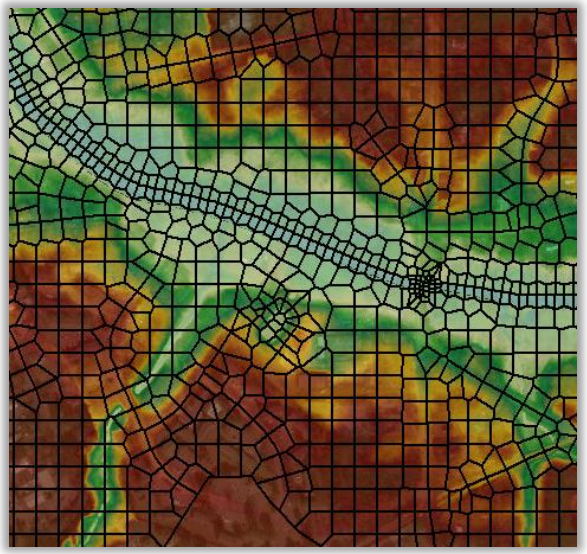
Develop Hydrology

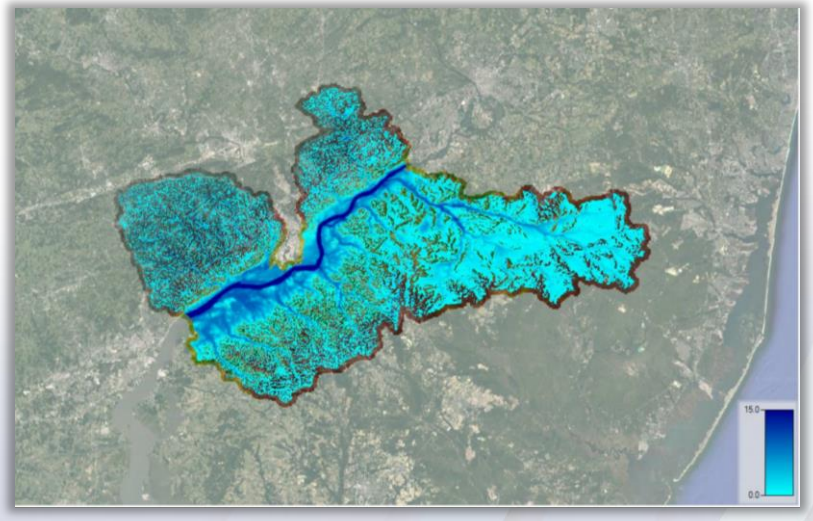
- SCS Type III rainfall distribution and precipitation depths derived from NOAA Atlas 14 rainfall data.
- Curve numbers (CN) developed based on the NJDEP 2015 Land Use/Land Cover layer.
- Determine excess precipitation hyetographs for the region.



Mesh Creation and Hydraulics

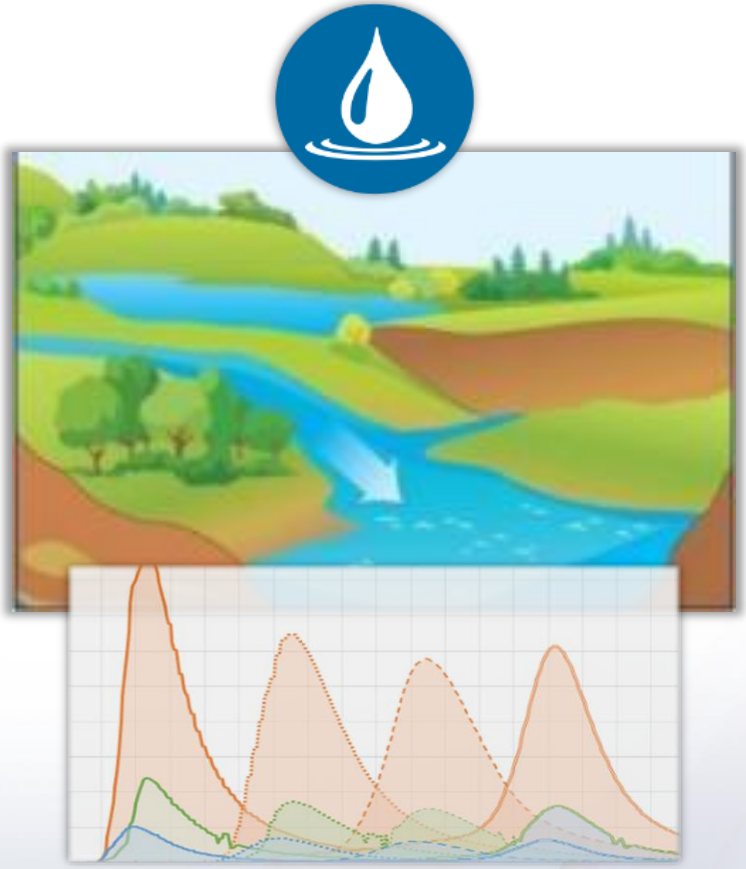
- Model mesh created using a nominal cell size of 200’ x 200’
- Existing Manning’s Ns values (based on 2015 NJDEP land use/land cover data) used.
- A Courant-based adjustable time-step was used.





Apply Rainfall and Boundary Condition Data

Flooding Condition	Type	
Current	a.	MHHW + 2% annual chance, 2-hour storm event
	a.	MHHW + 1% annual chance, 24-hour storm event
Future	a.	MHHW + SLR 2070 (2.4 ft)
	a.	MHHW + SLR 2070 (2.4 ft) + (2% annual chance, 2-hour storm event + 10% increase in rainfall)
	a.	MHHW + SLR 2070 (2.4 ft) + (1% annual chance, 24-hour storm event + 10% increase in rainfall)
	a.	MHHW + SLR 2070 (2.4 ft) + Superstorm Sandy in 2070 (High Water Mark = 8.3 ft)

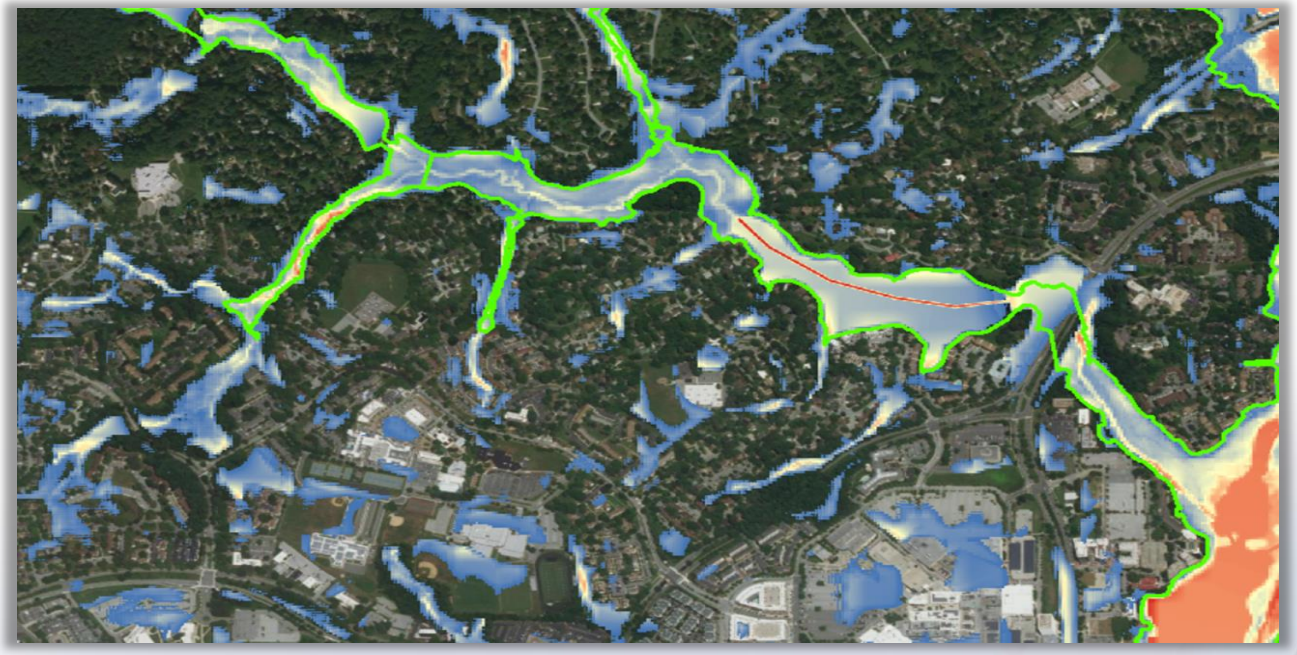


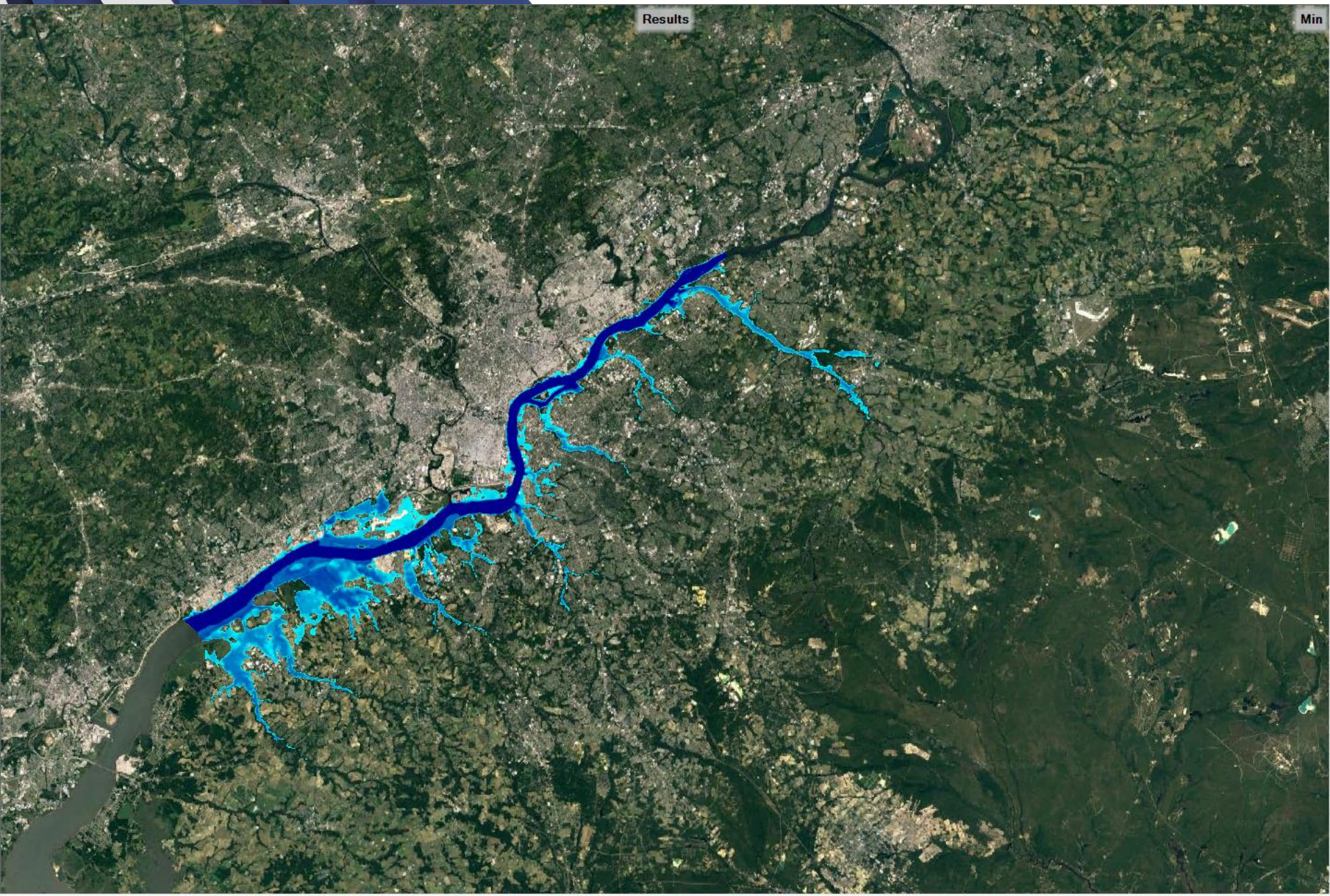
Mapping Output

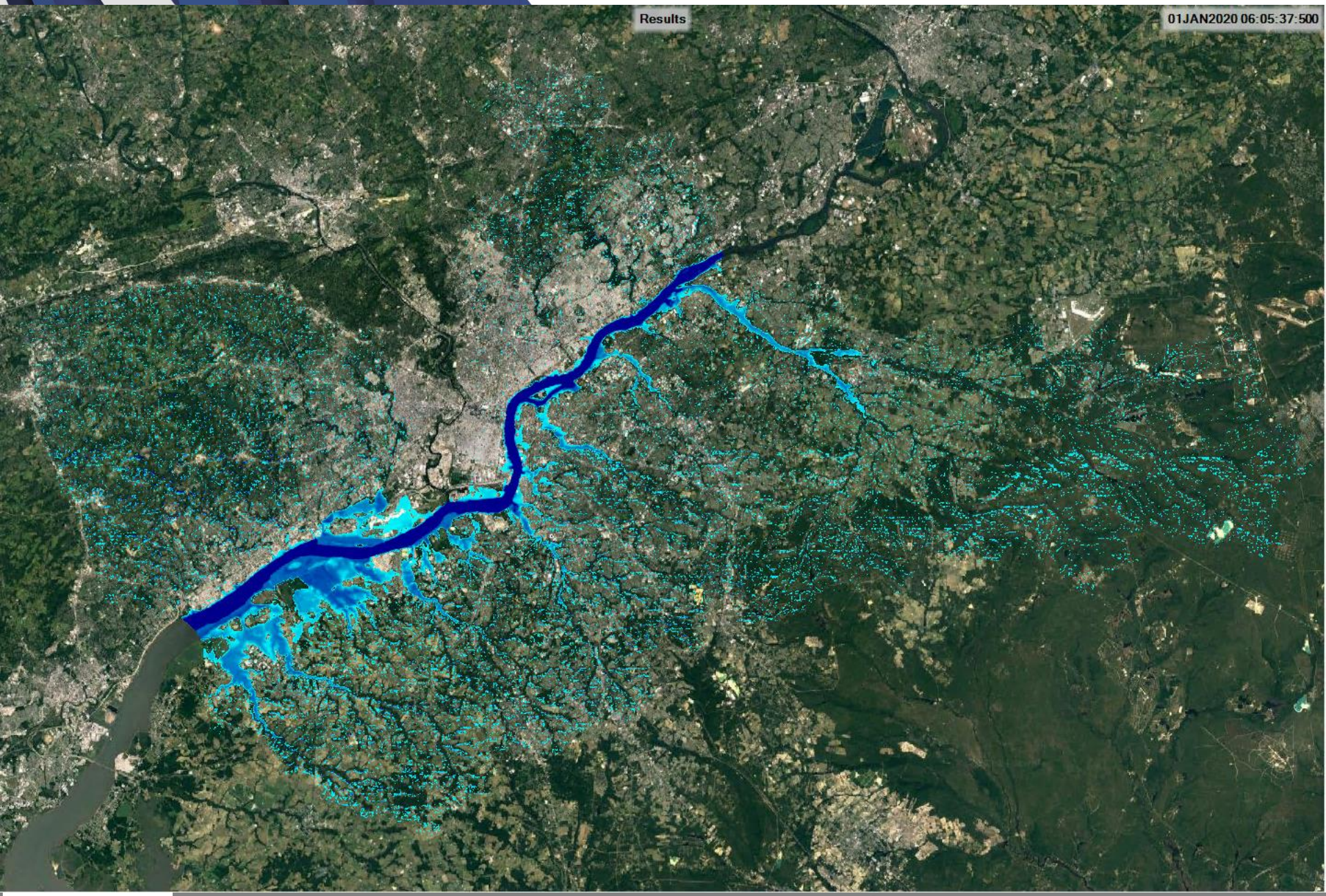
- Produce water surface elevation output and depth grids for loss assessments
- Floodplain outputs reviewed for disconnected floodplain polygons and general smoothing.

Calibration/Validation

- Gage data used for calibration and validation of discharges.
- Flood extents closely match FEMA SFHAs when modeling present day, 100-year event.




Results
Min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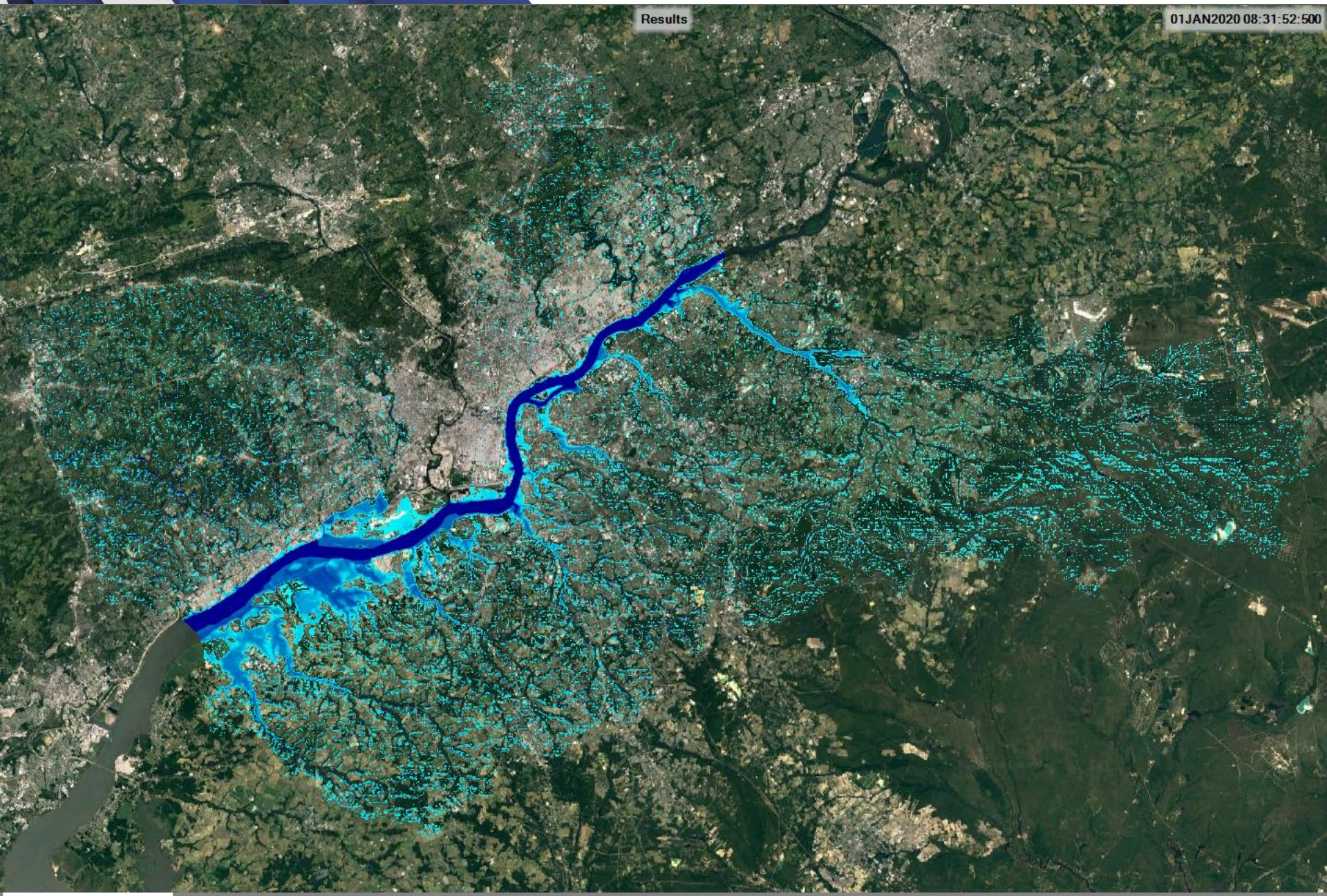
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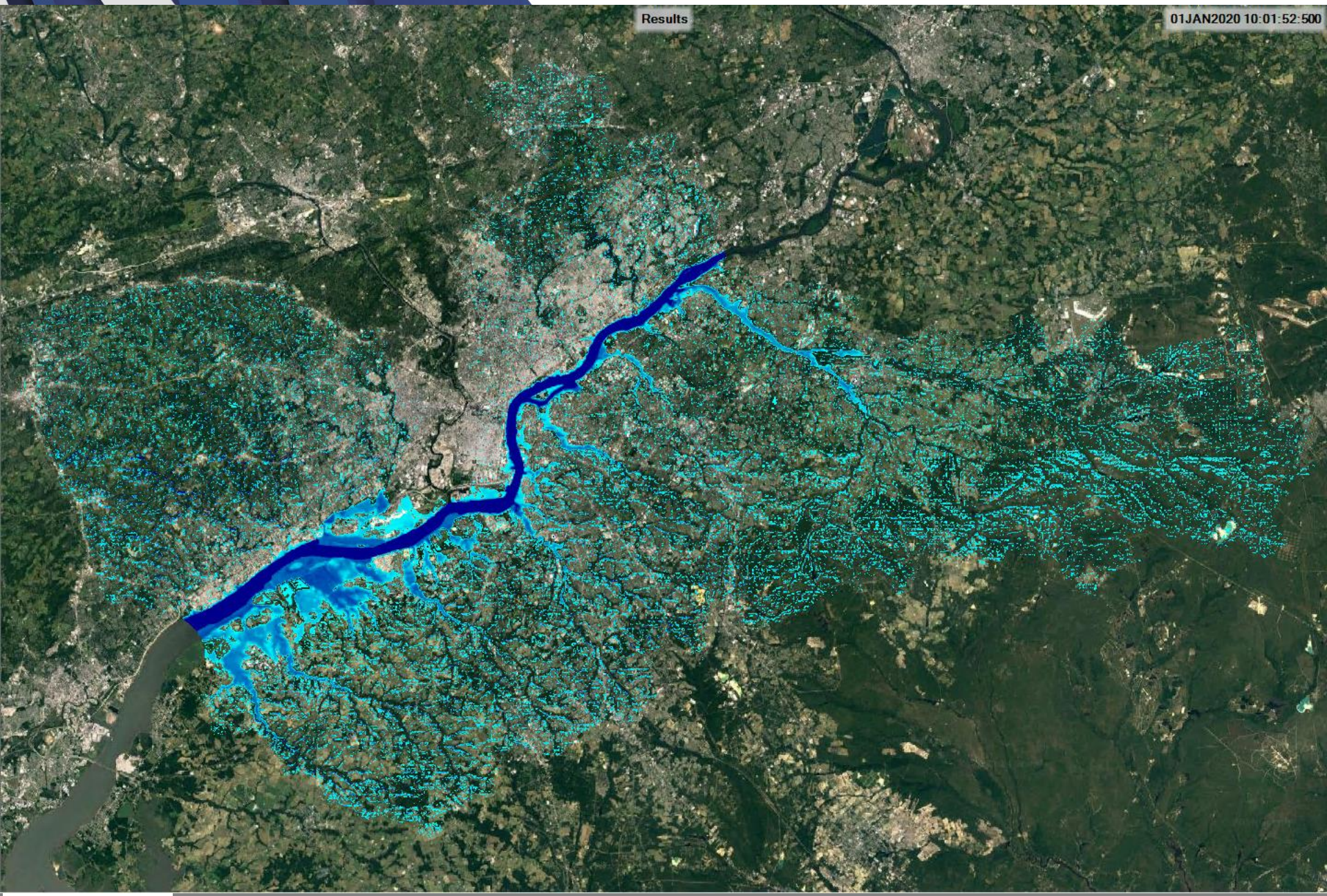
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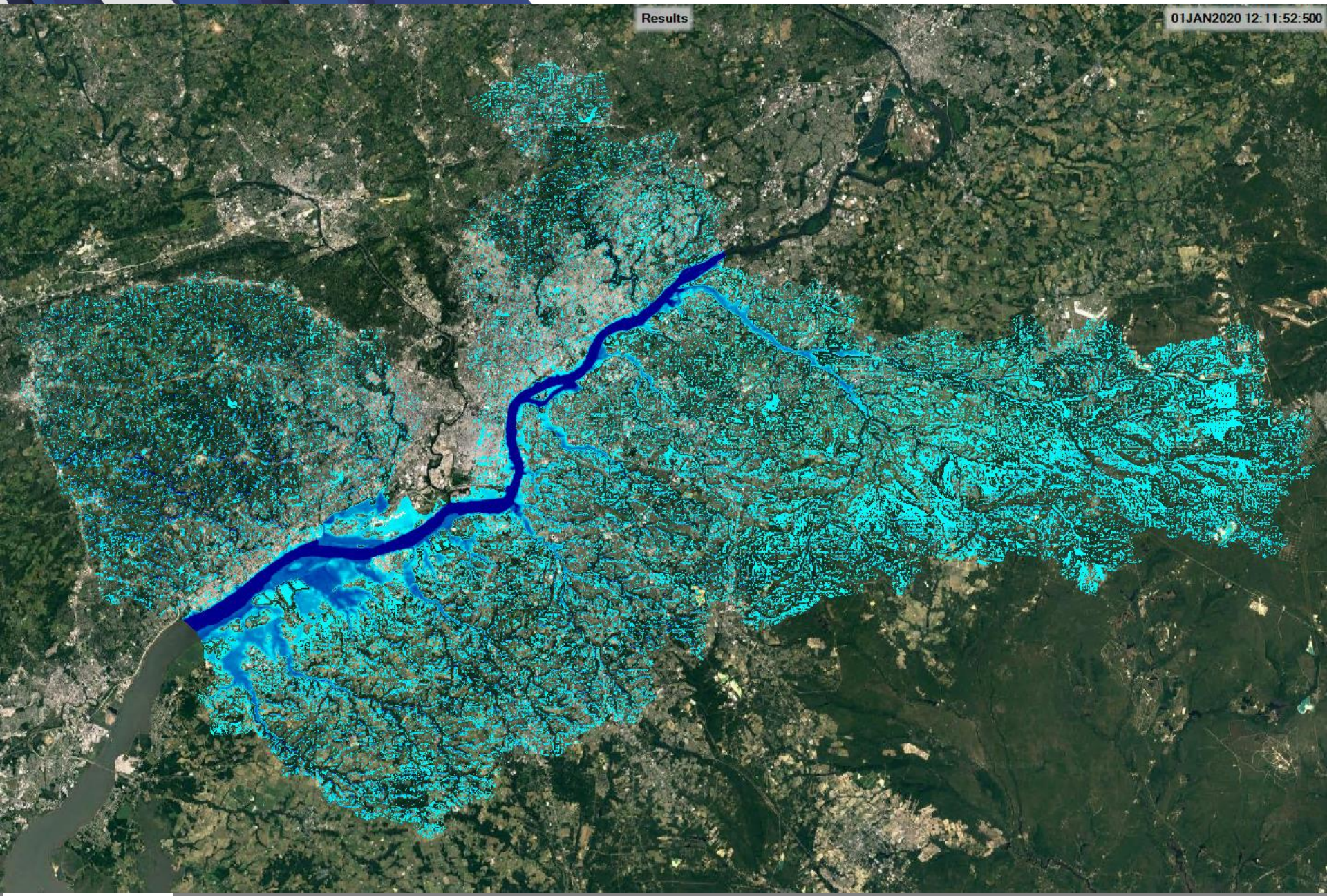
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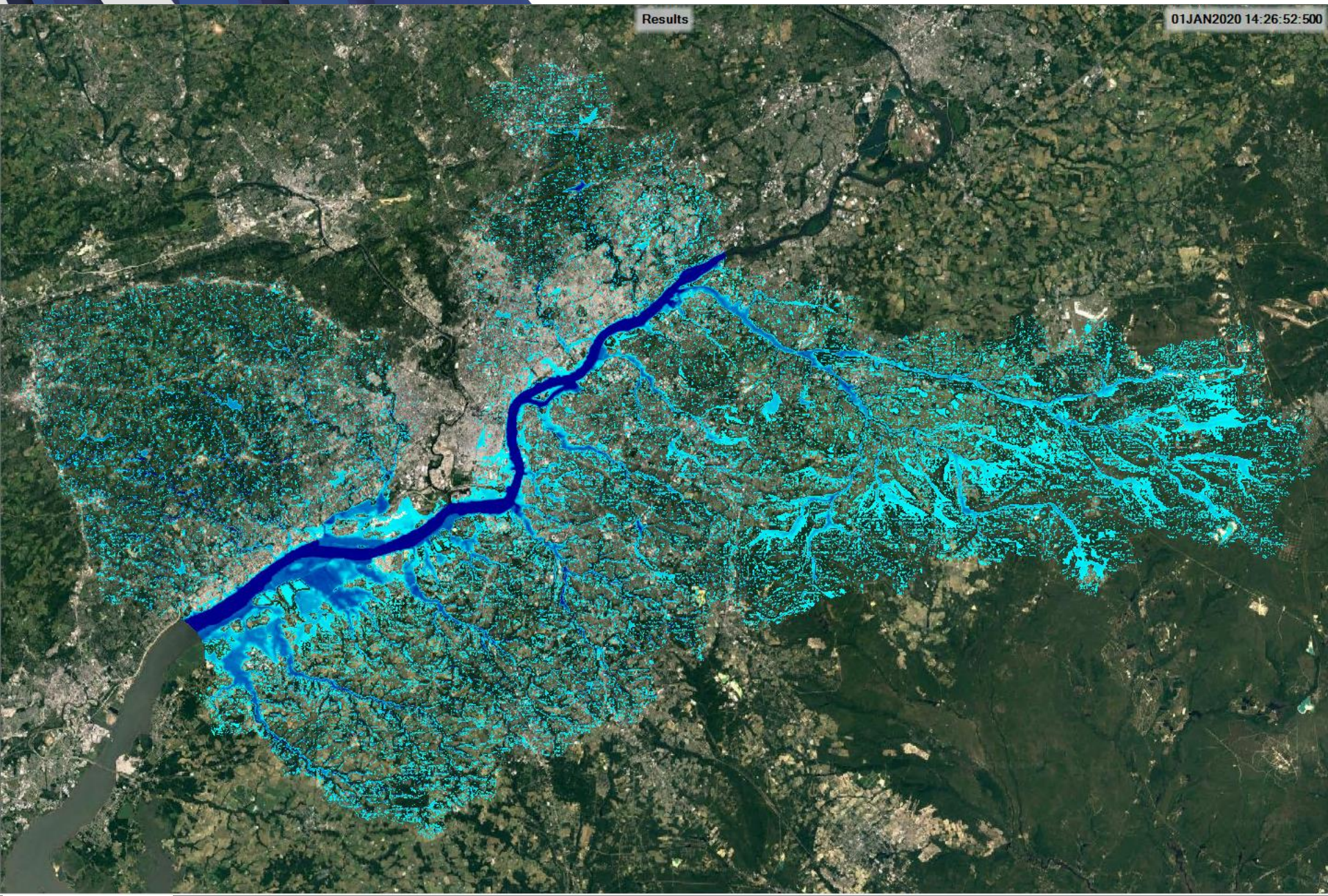
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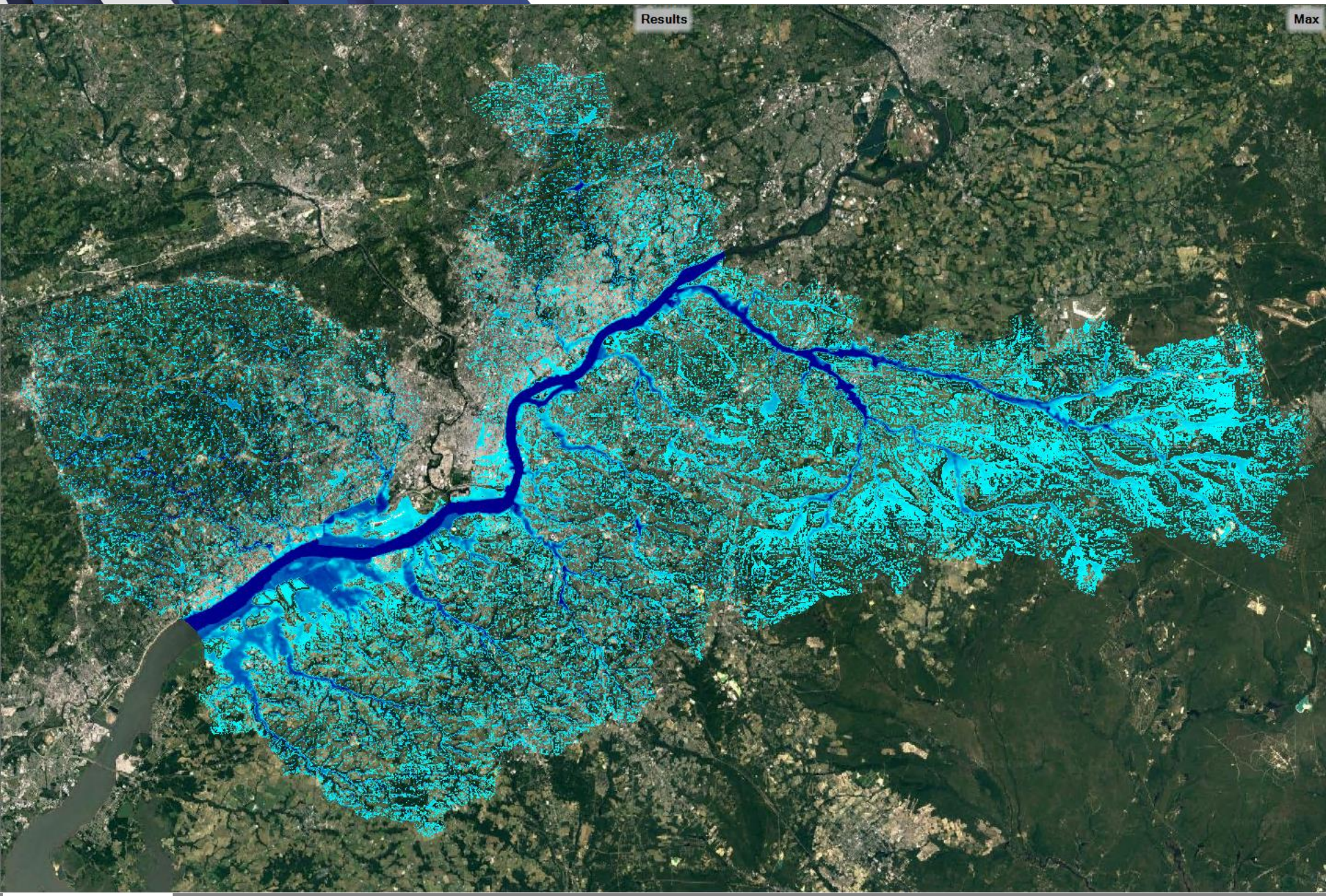
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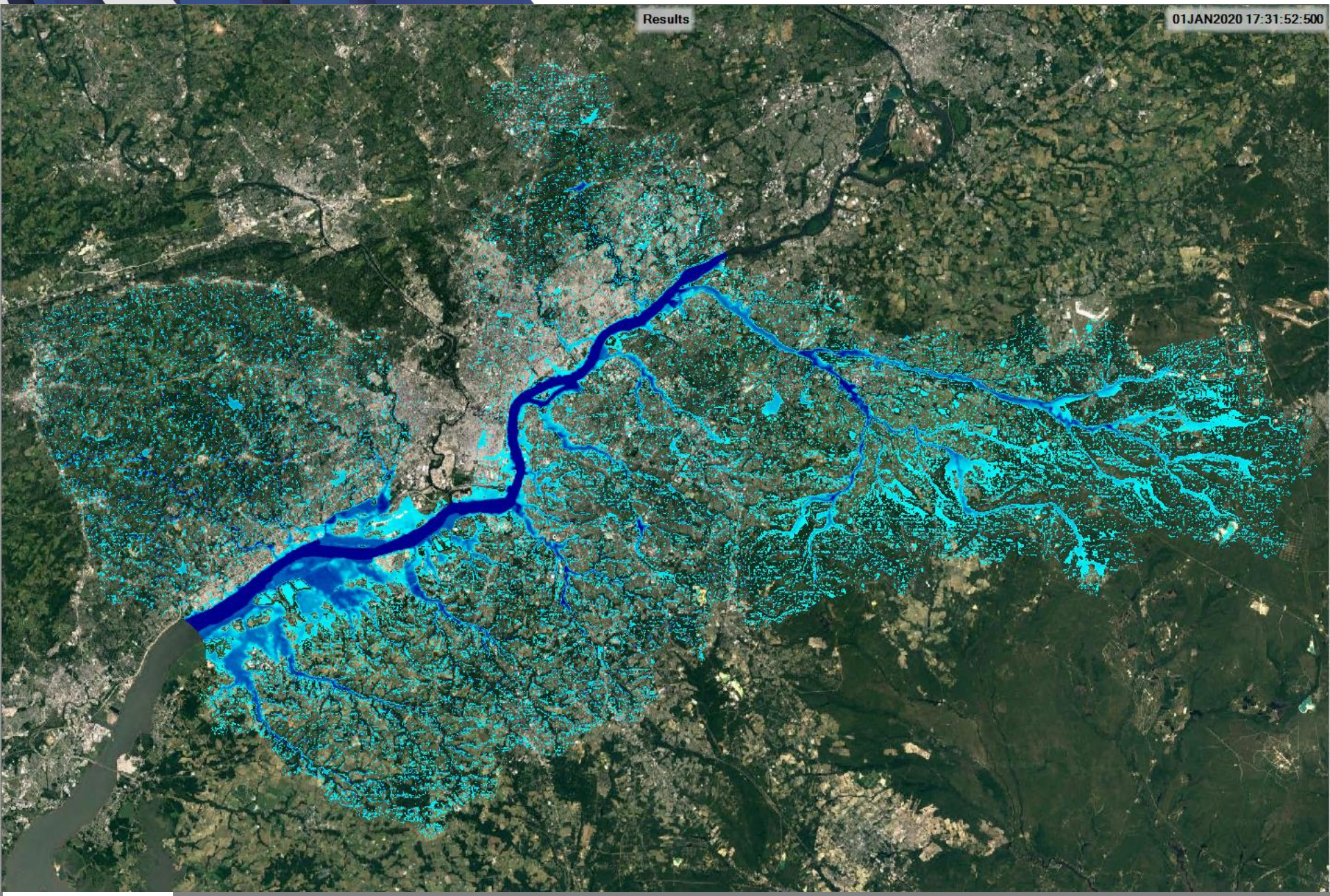
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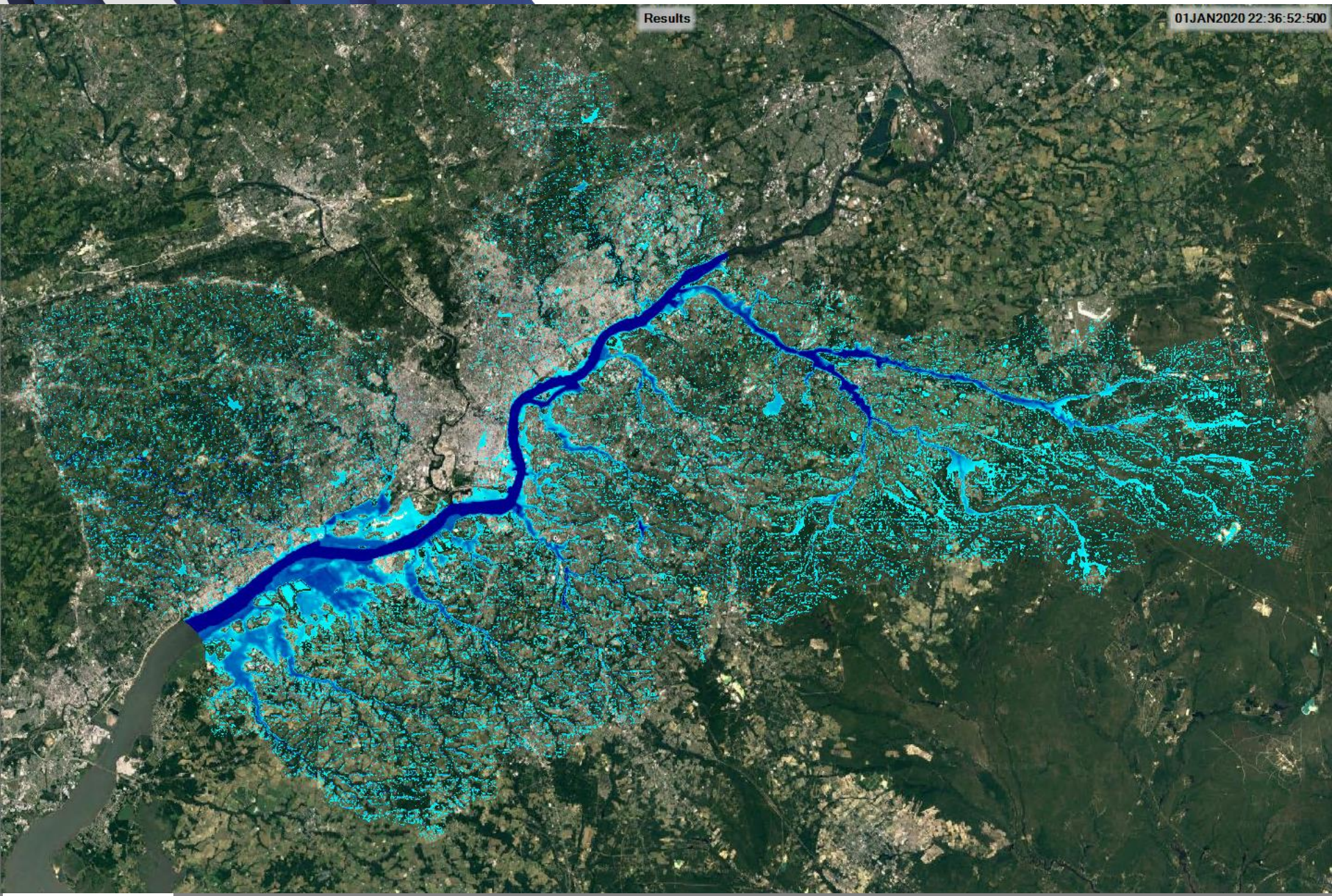
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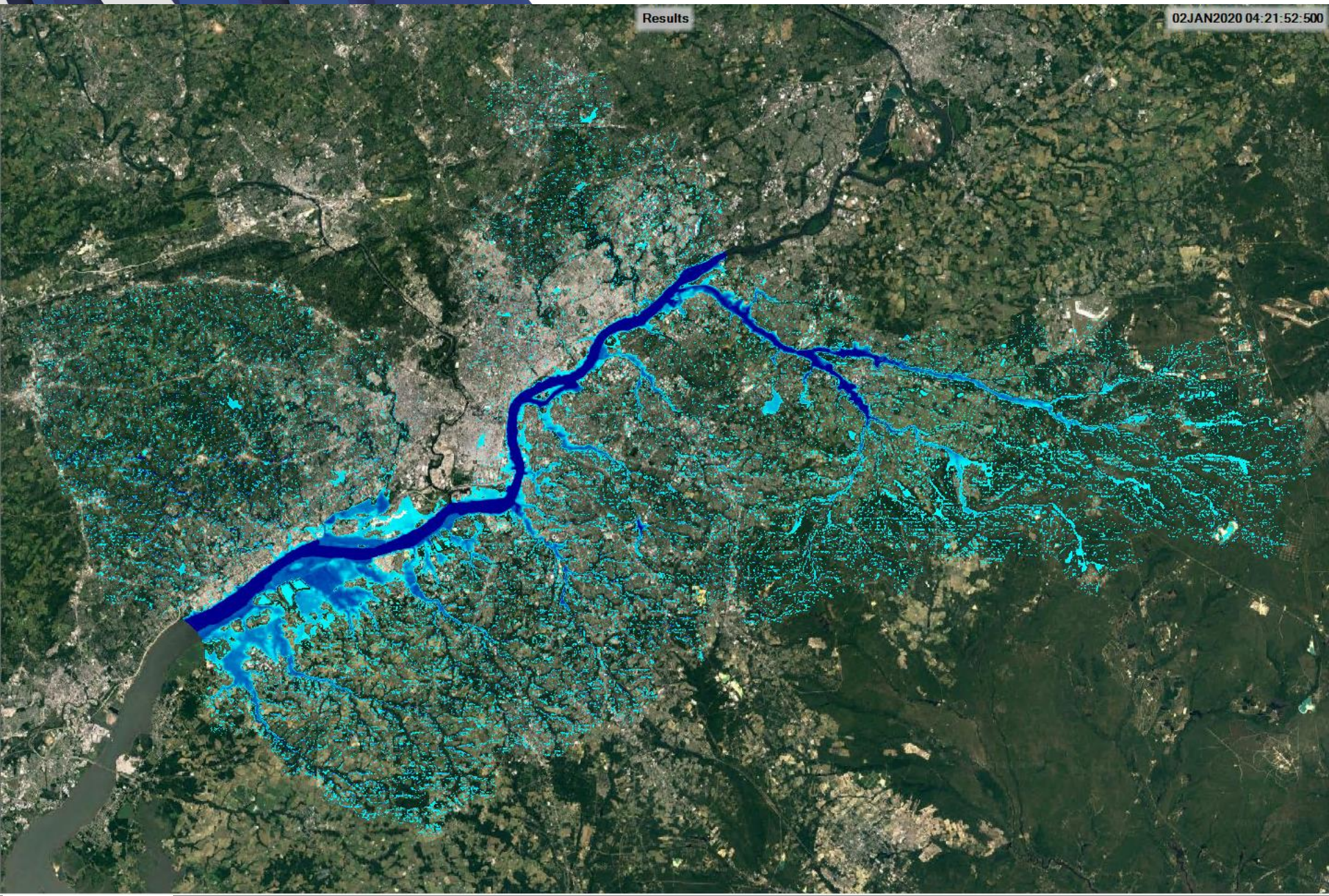
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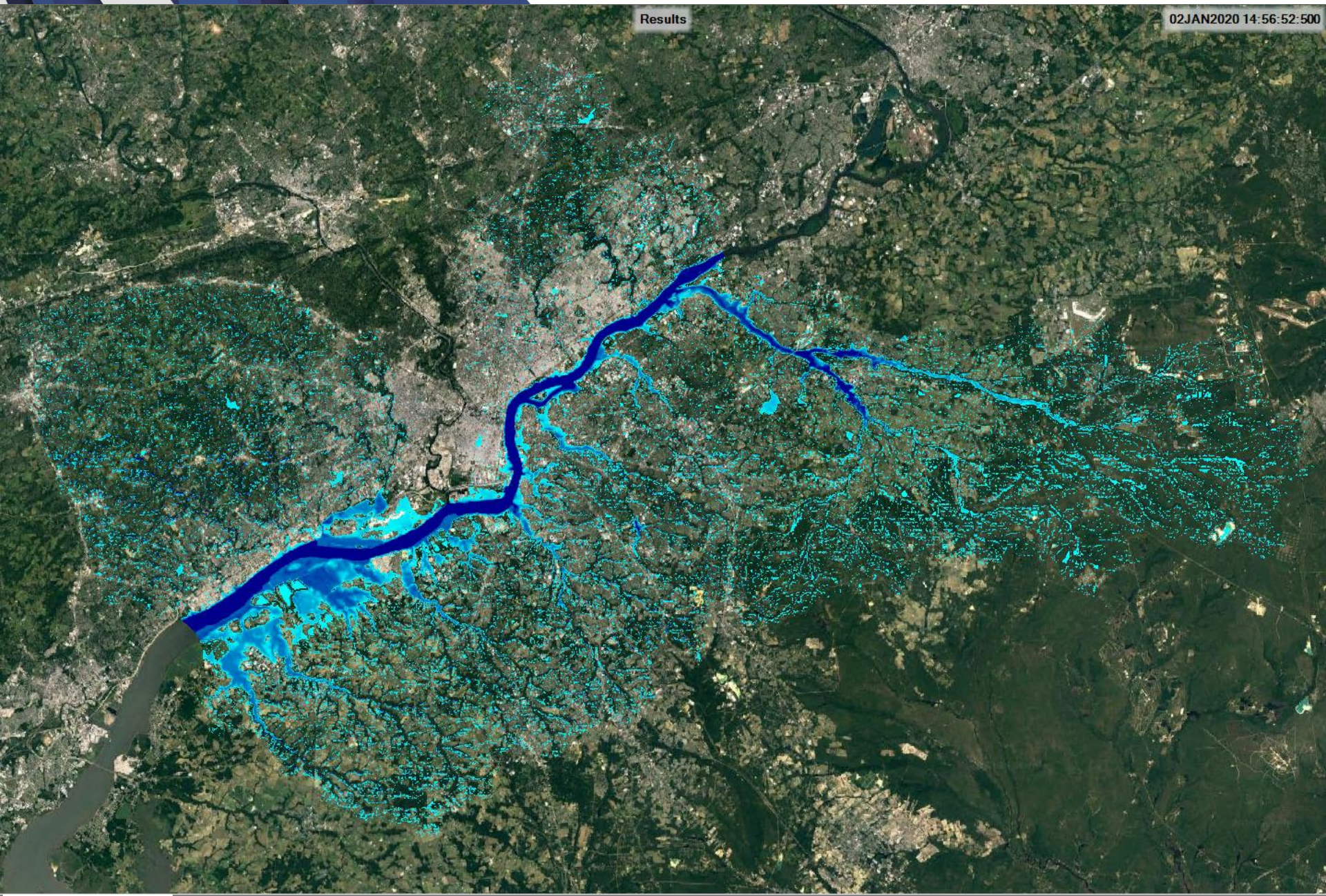
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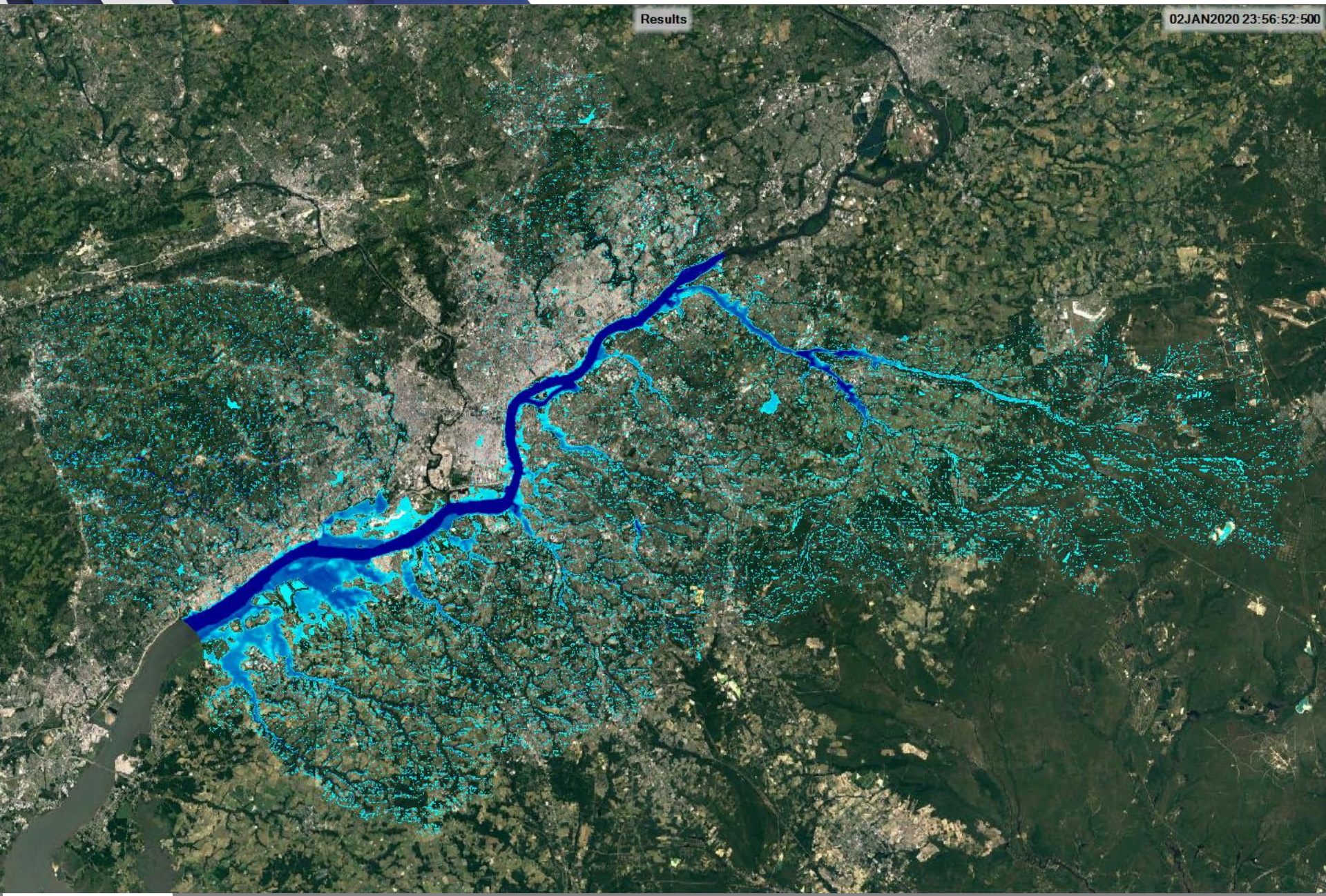
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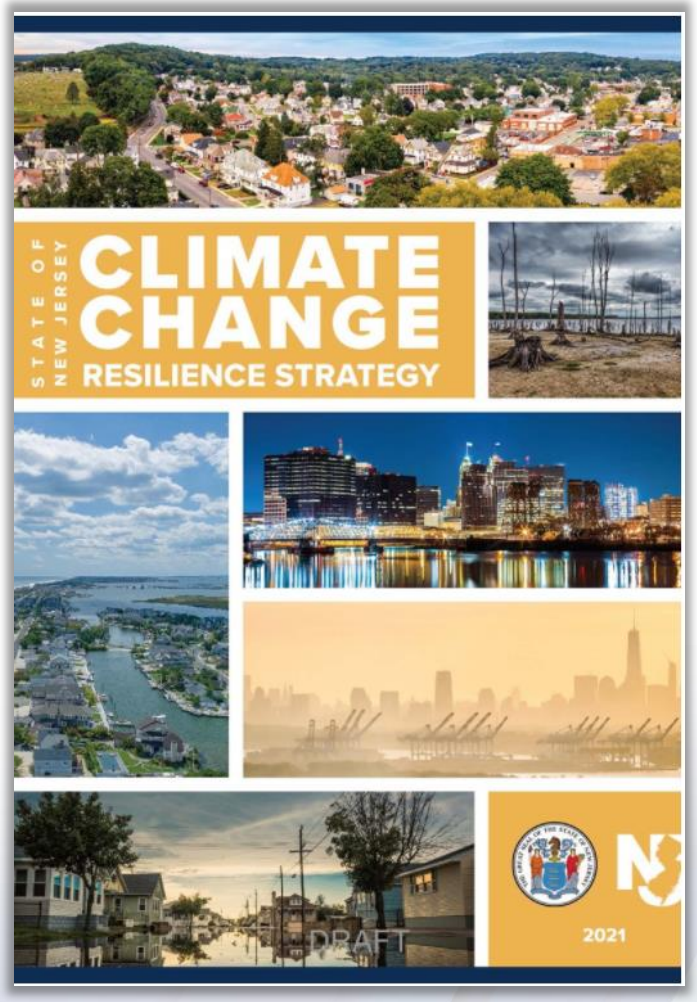
Adaptable Inputs

Inputs easily adaptable for resiliency or other project needs

- Utilizing these methods for:
  - NJDOT
  - Camden County, NJ
  - Columbia Association, Maryland
- Inputs related to climate change:
  - Projected increases in precipitation
  - Sea Level Rise
  - Surge Events

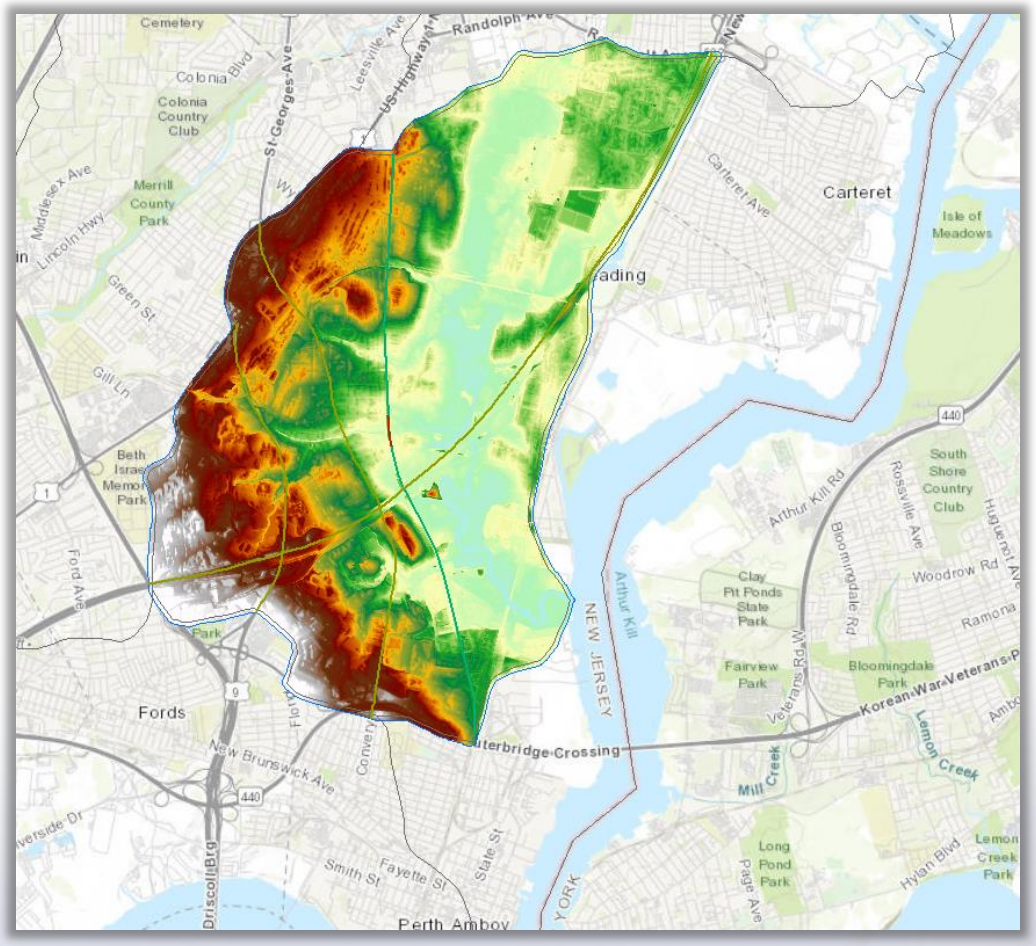


Potential Refinements

- Smaller cell size in select areas
  - Developed areas
  - Complex flow paths
  - Steeper terrain
- Breaklines
  - Roads
  - Railroads
  - Bridges
  - Streams
- Structure openings
  - Approximated with modifications to the mesh and/or terrain.
- Spatially varied precipitation
- Storm sewer representation

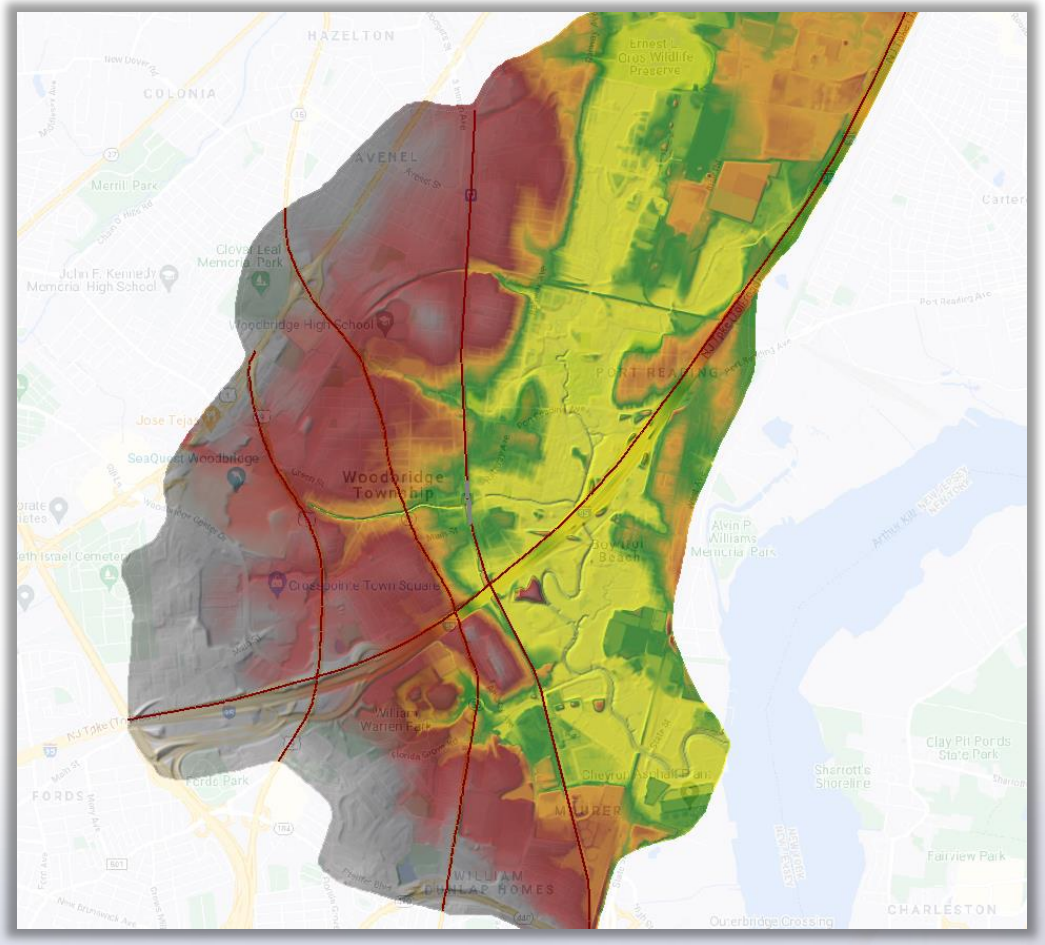
Sensitivity Analysis

Northern NJ Study Area

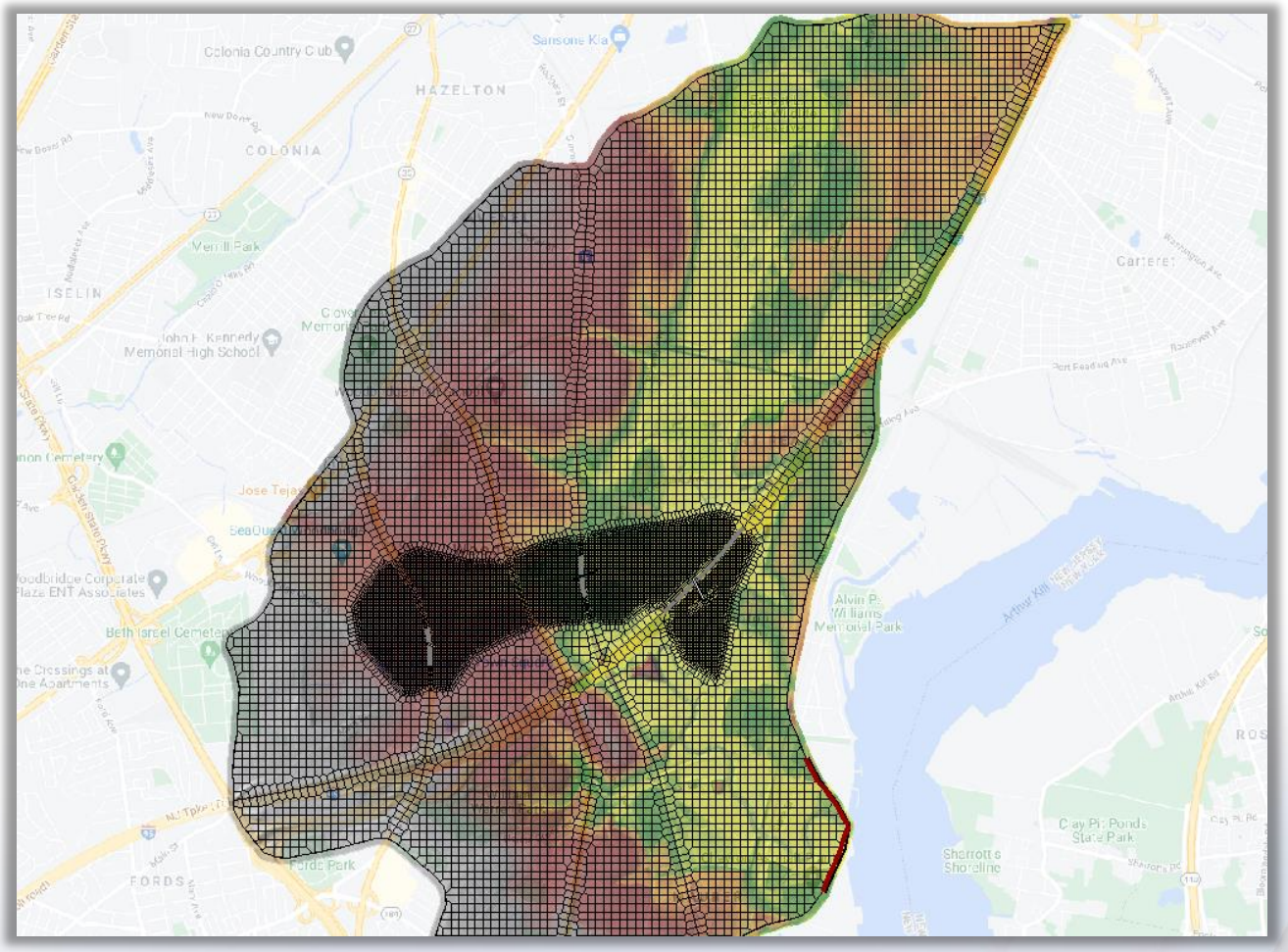


Breaklines

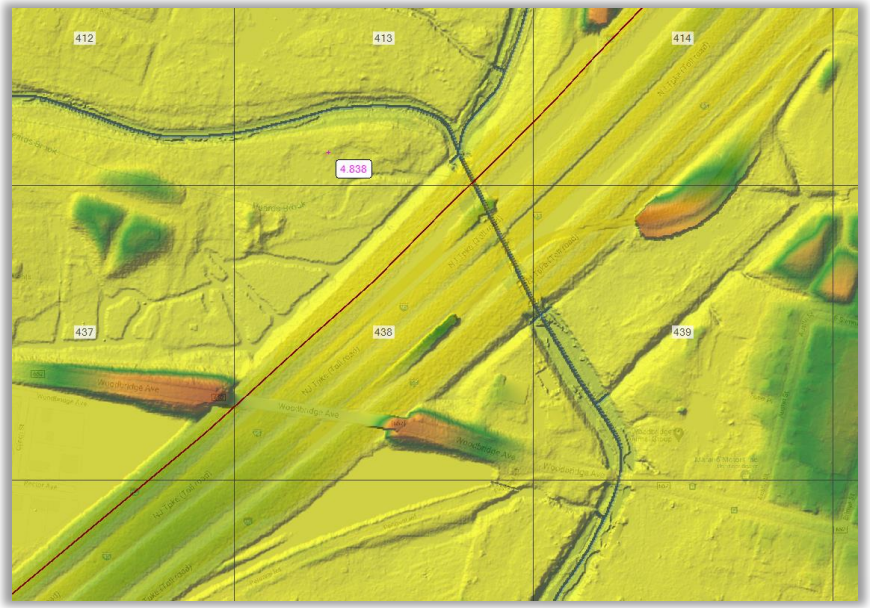
Breaklines at Major Roadways and Rail



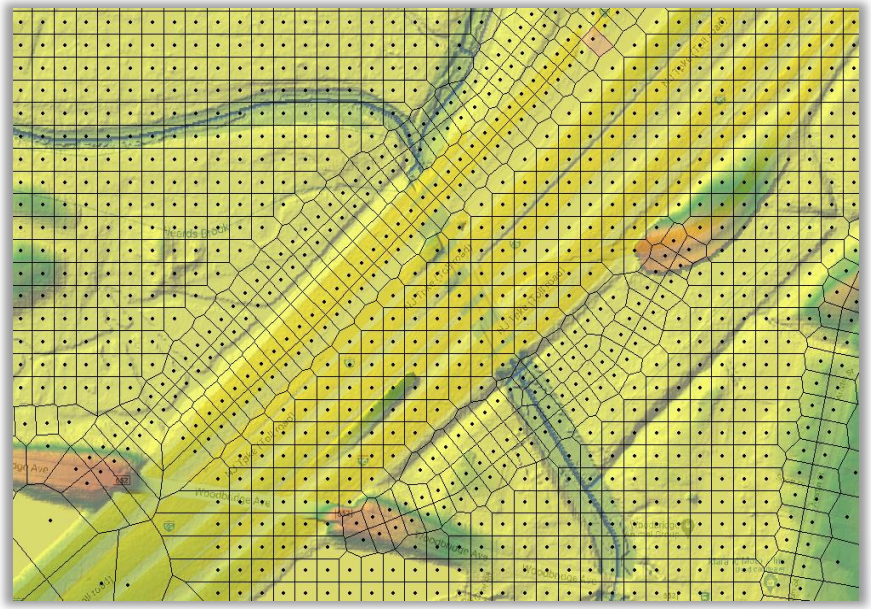
Grid Refinement



Structure Data Inputs

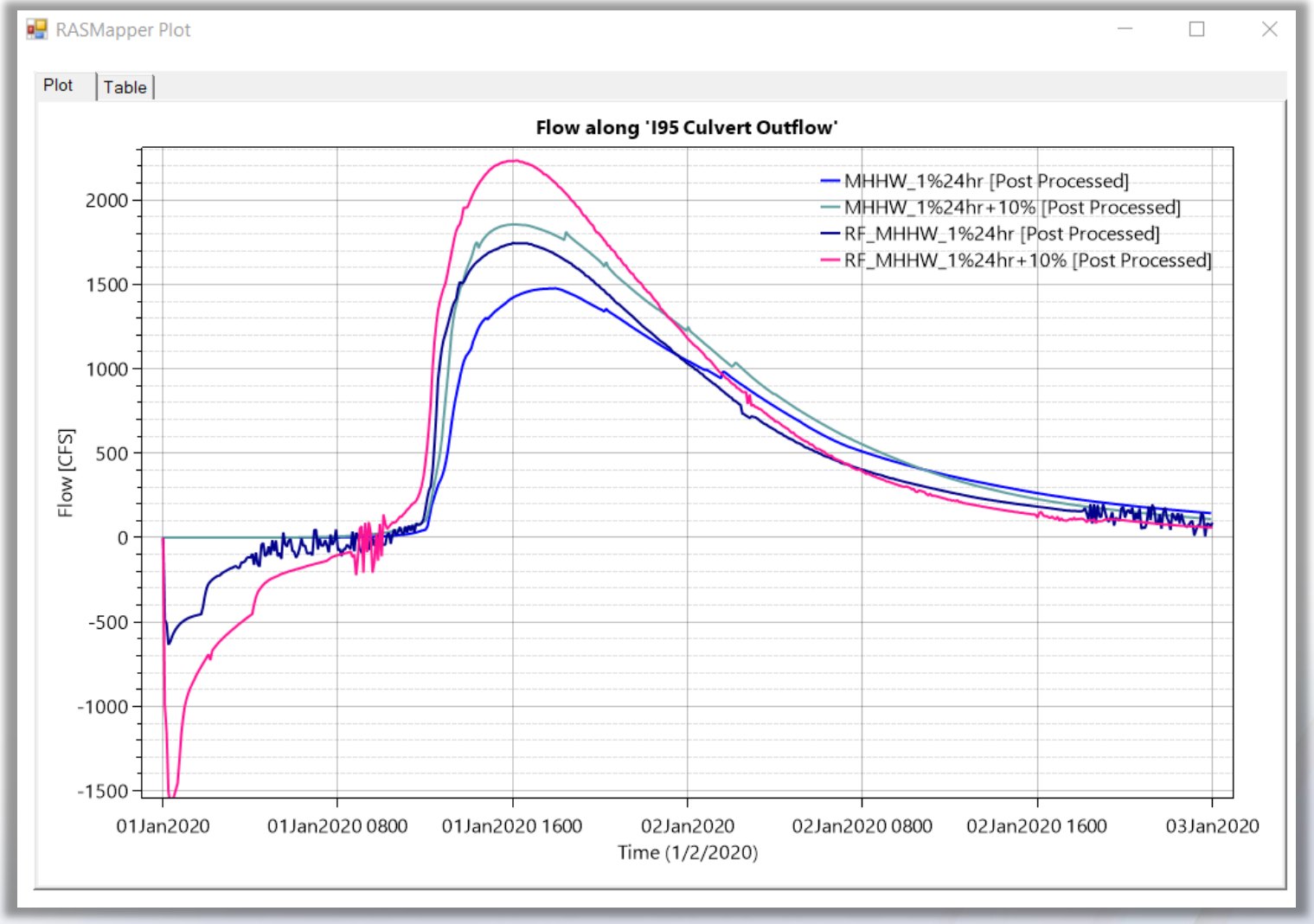


I95 culvert before refinement



I95 culvert after refinement

Impacts on Flow through Structures



Impacts on Elevation through Structures

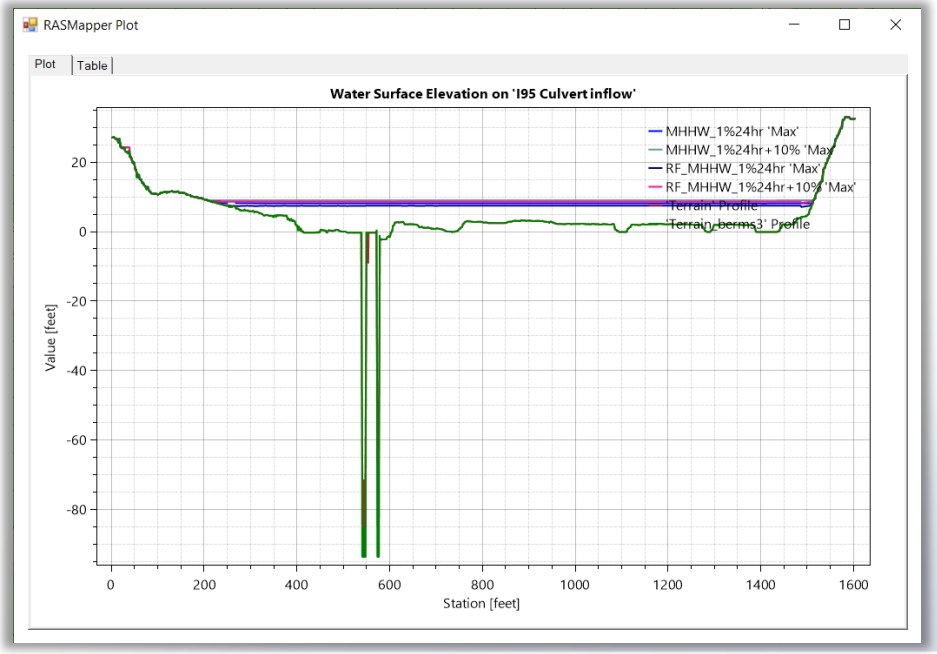
WSE Comparison:

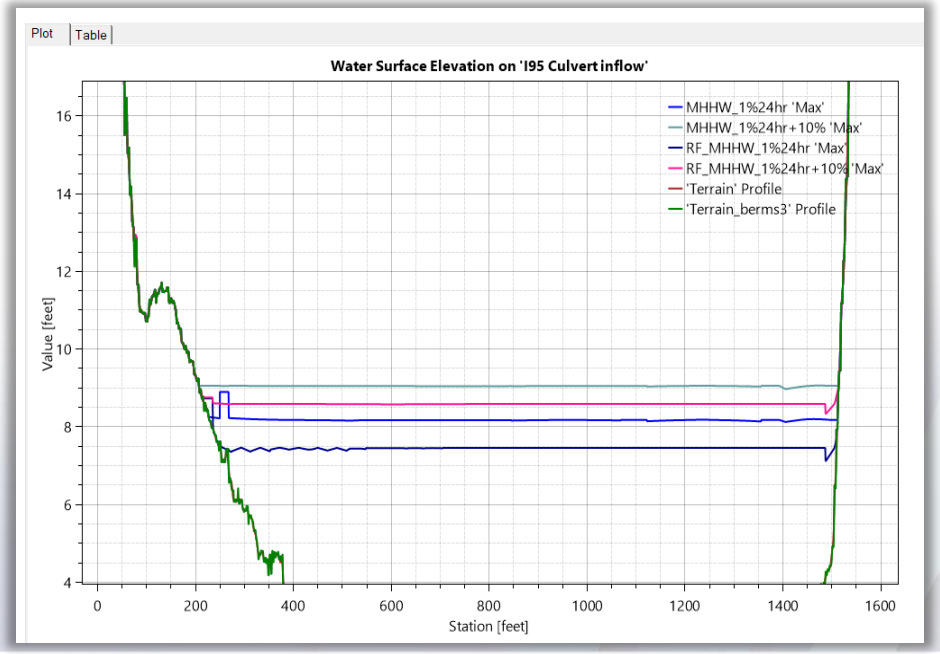
MHHW 1%24hr+10%: 9.05

RF_MHHW_1%24hr+10%: 8.59

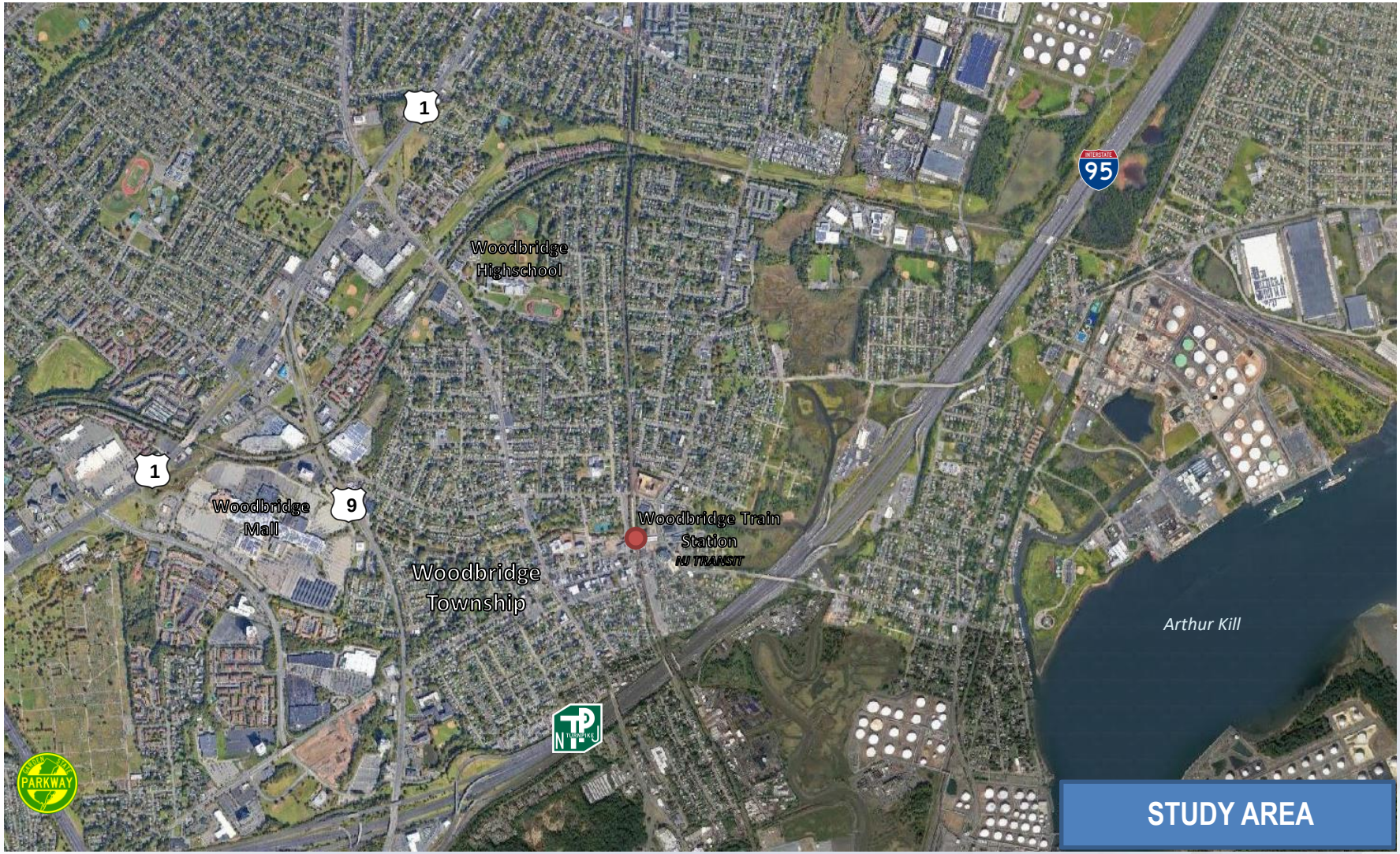
MHHW 1%24hr: 8.18

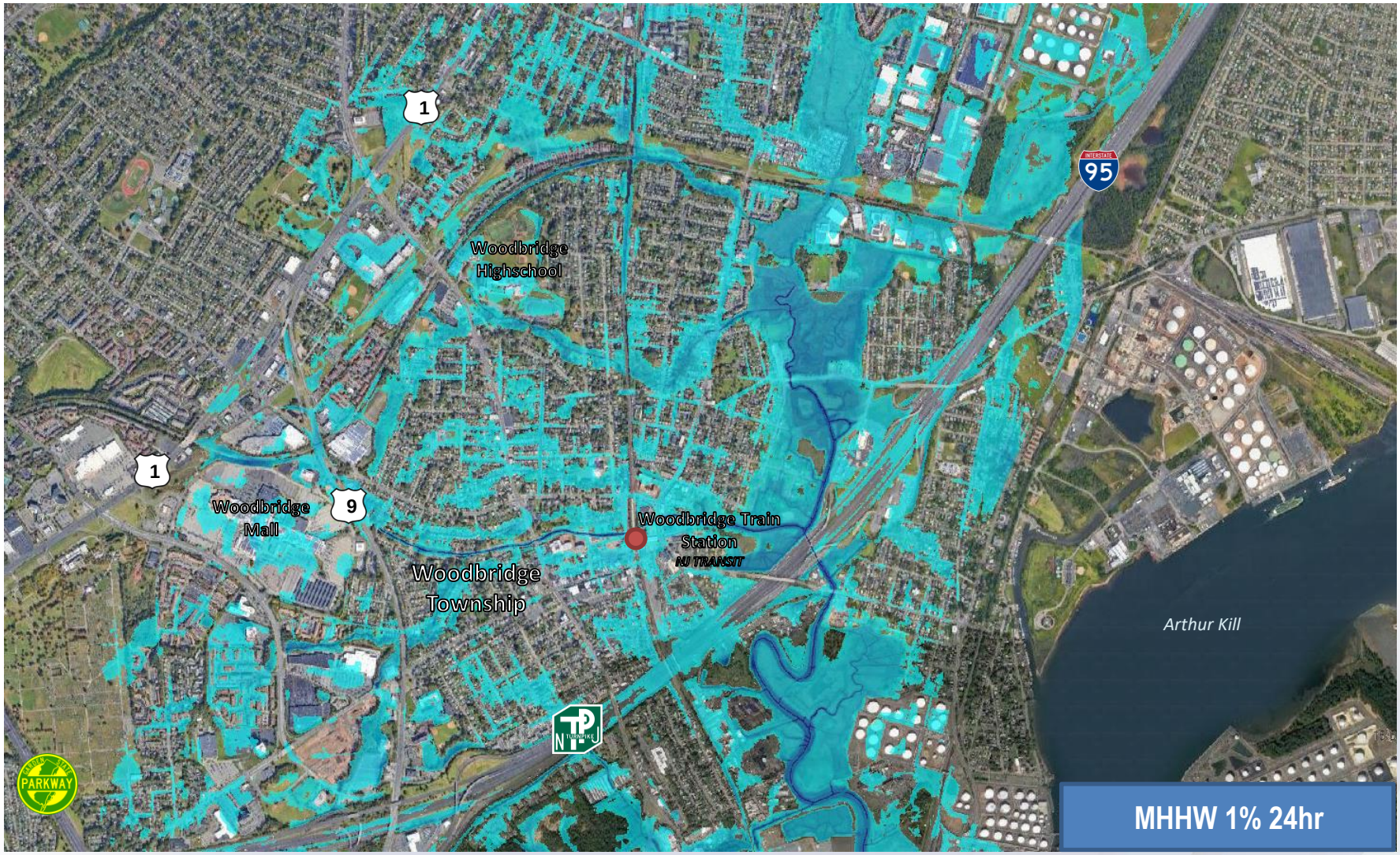
RF_MHHW_1%24hr: 7.46





Impacts on Floodplains


1
95
Woodbridge
Highschool
1
Woodbridge
Mall
9
Woodbridge Train
Station
NJ TRANSIT
Woodbridge
Township
Arthur Kill
PARKWAY
STUDY AREA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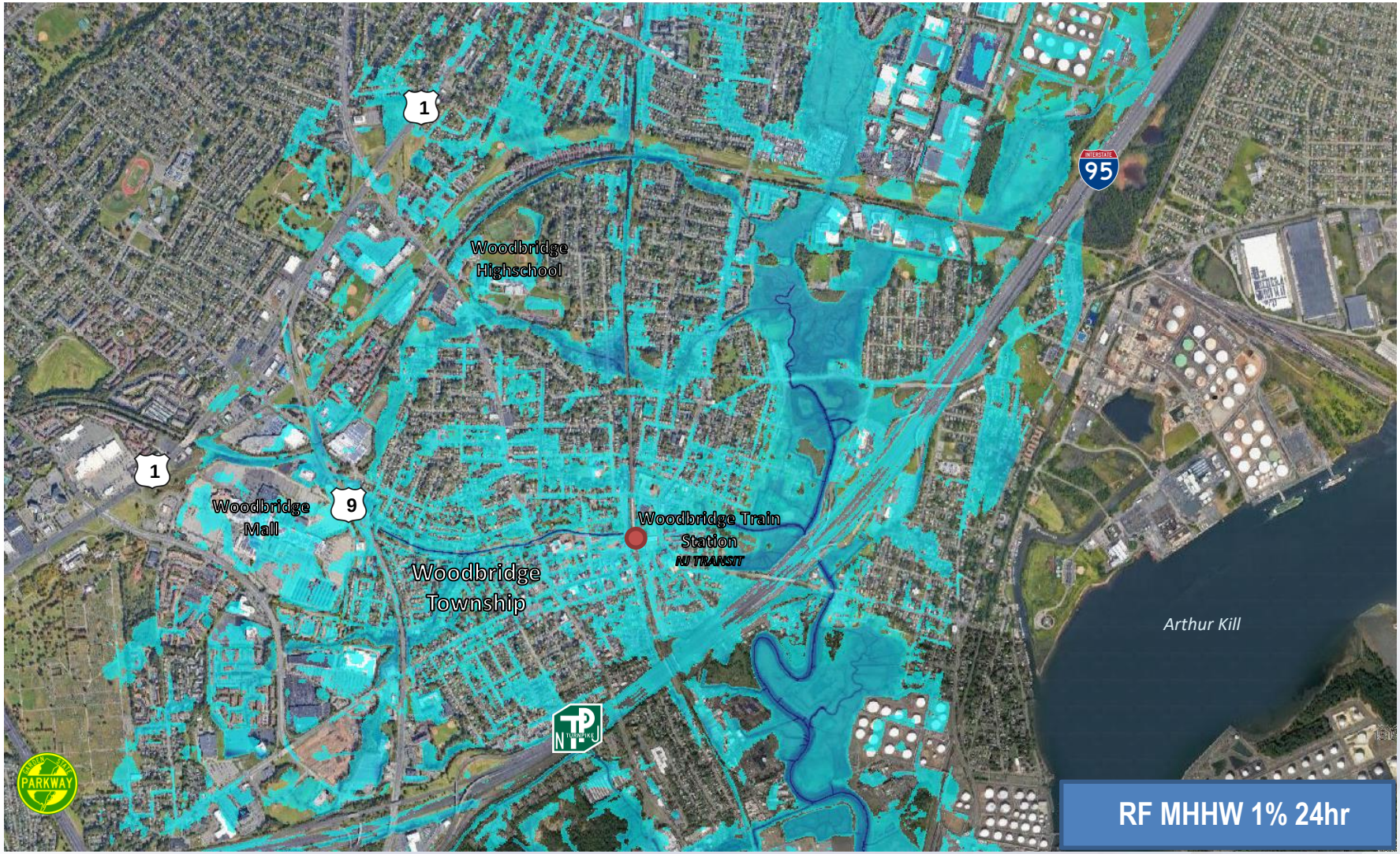
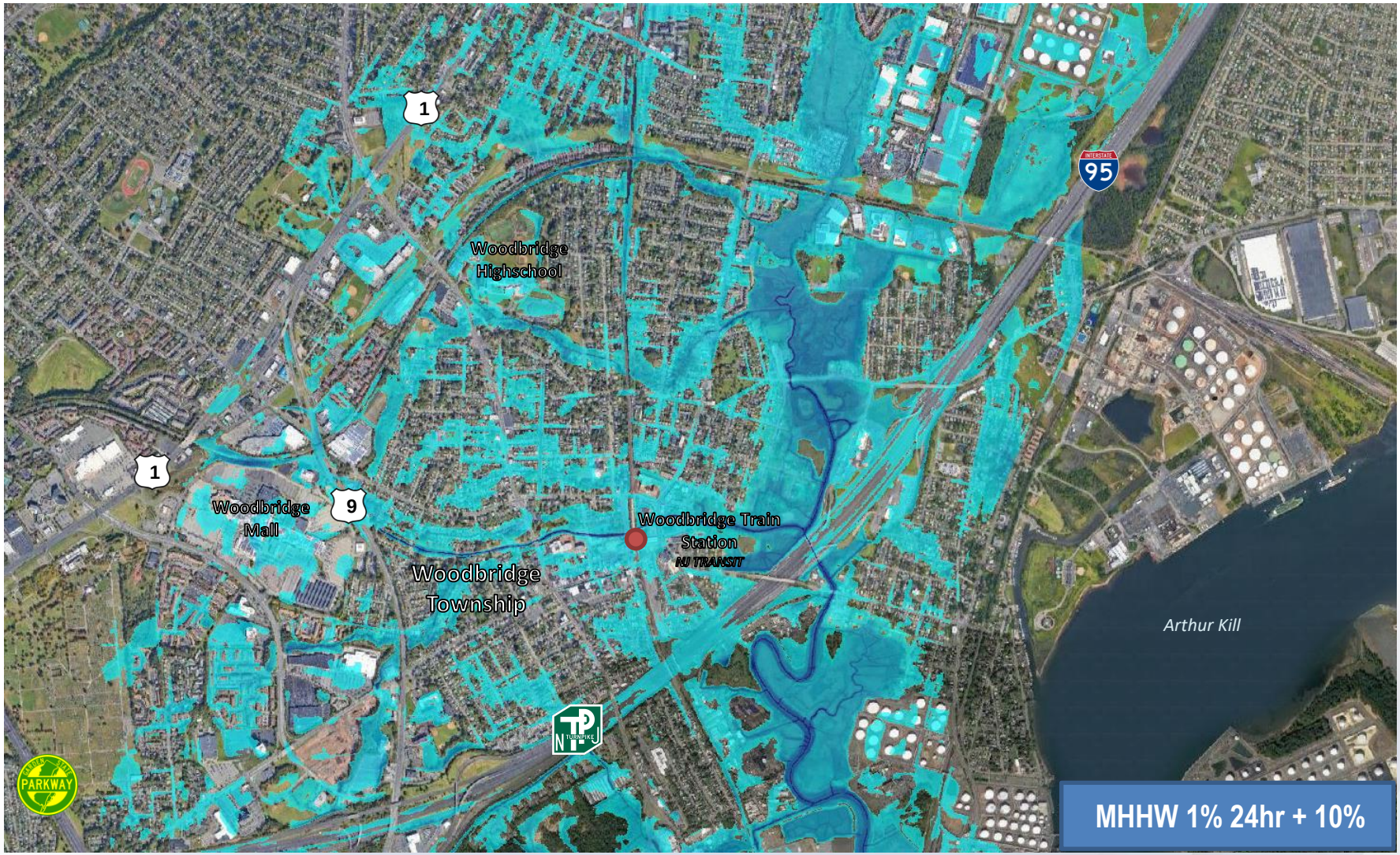
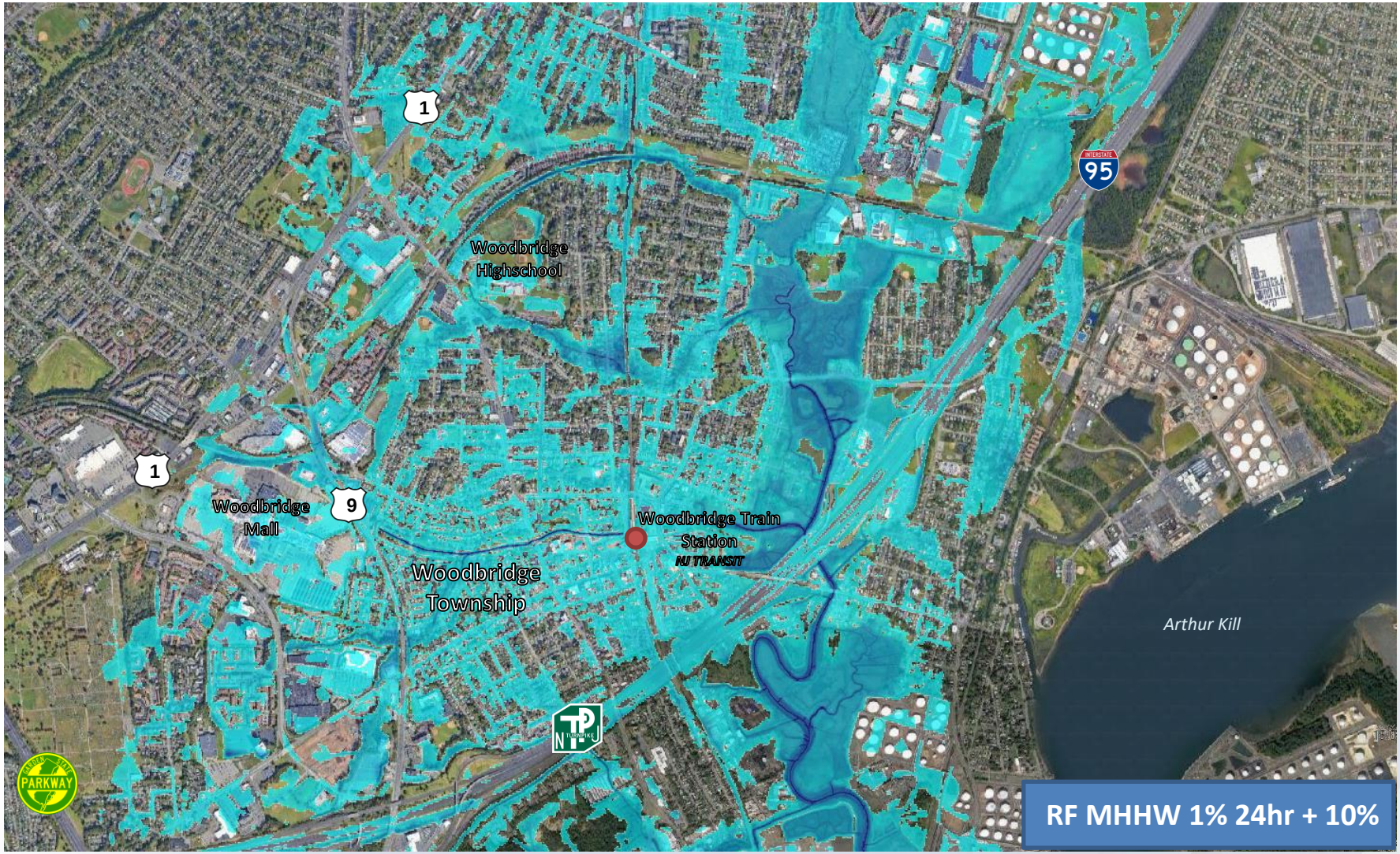
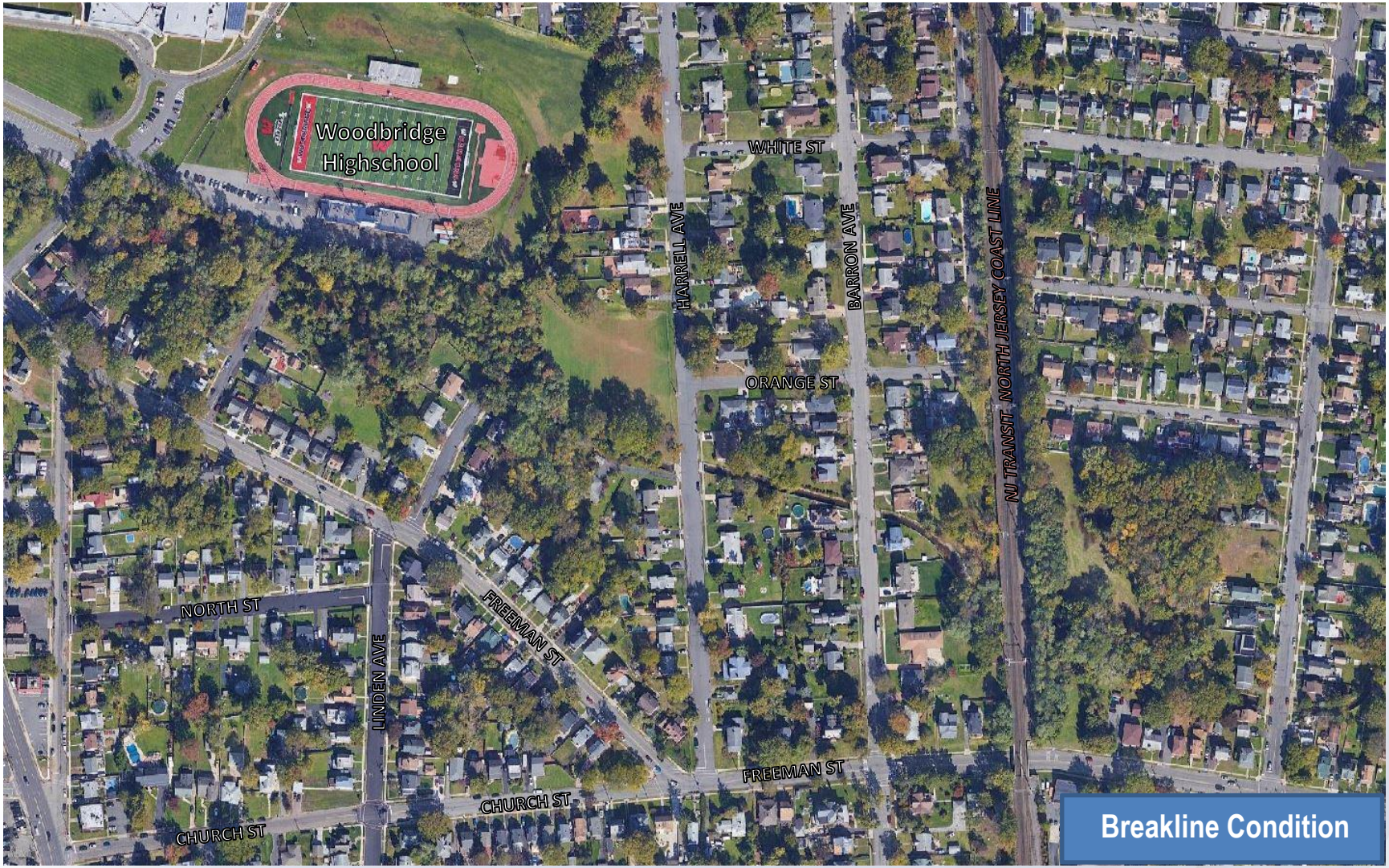
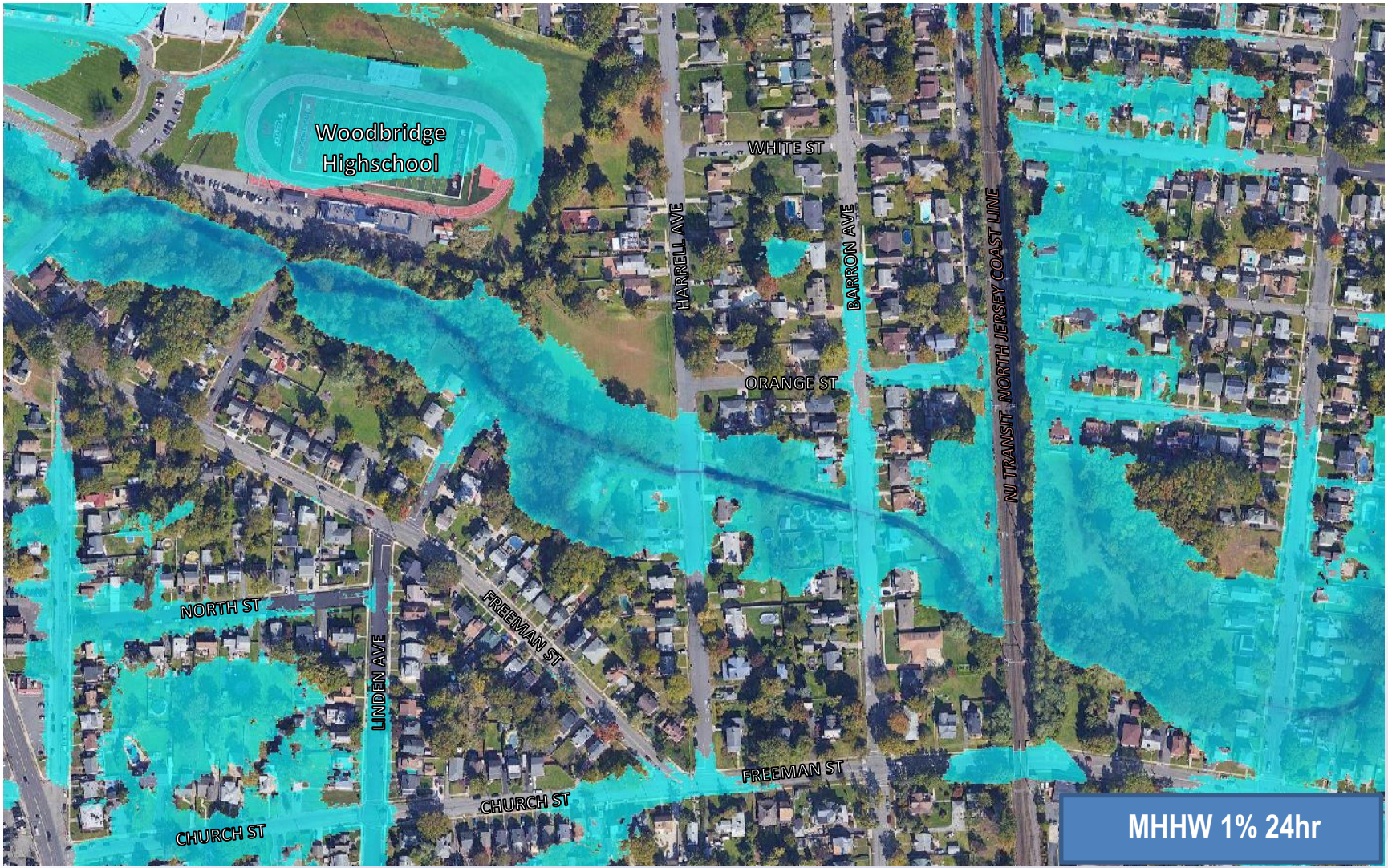
95
Woodbridge Highschool
1
Woodbridge Mall
9
Woodbridge Train Station
NJ TRANSIT
Woodbridge Township
Arthur Kill
PARKWAY
MHHW 1% 24hr


1
95
Woodbridge Highschool
1
Woodbridge Mall
9
Woodbridge Train Station
NJ TRANSIT
Woodbridge Township
Arthur Kill
PARKWAY
RF MHHW 1% 24hr


1
95
Woodbridge
Highschool
1
Woodbridge
Mall
9
Woodbridge Train
Station
NJ TRANSIT
Woodbridge
Township
Arthur Kill
PARKWAY
MHHW 1% 24hr + 10%


1
95
Woodbridge Highschool
1
Woodbridge Mall
9
Woodbridge Train Station
NJ TRANSIT
Woodbridge Township
Arthur Kill
PARKWAY
RF MHHW 1% 24hr + 10%


Woodbridge Highschool
WHITE ST
HARRELL AVE
BARRON AVE
NJ TRANSIT NORTH JERSEY COAST LINE
ORANGE ST
NORTH ST
LINDEN AVE
FREEMAN ST
FREEMAN ST
CHURCH ST
CHURCH ST
Breakline Condition


Woodbridge Highschool
WHITE ST
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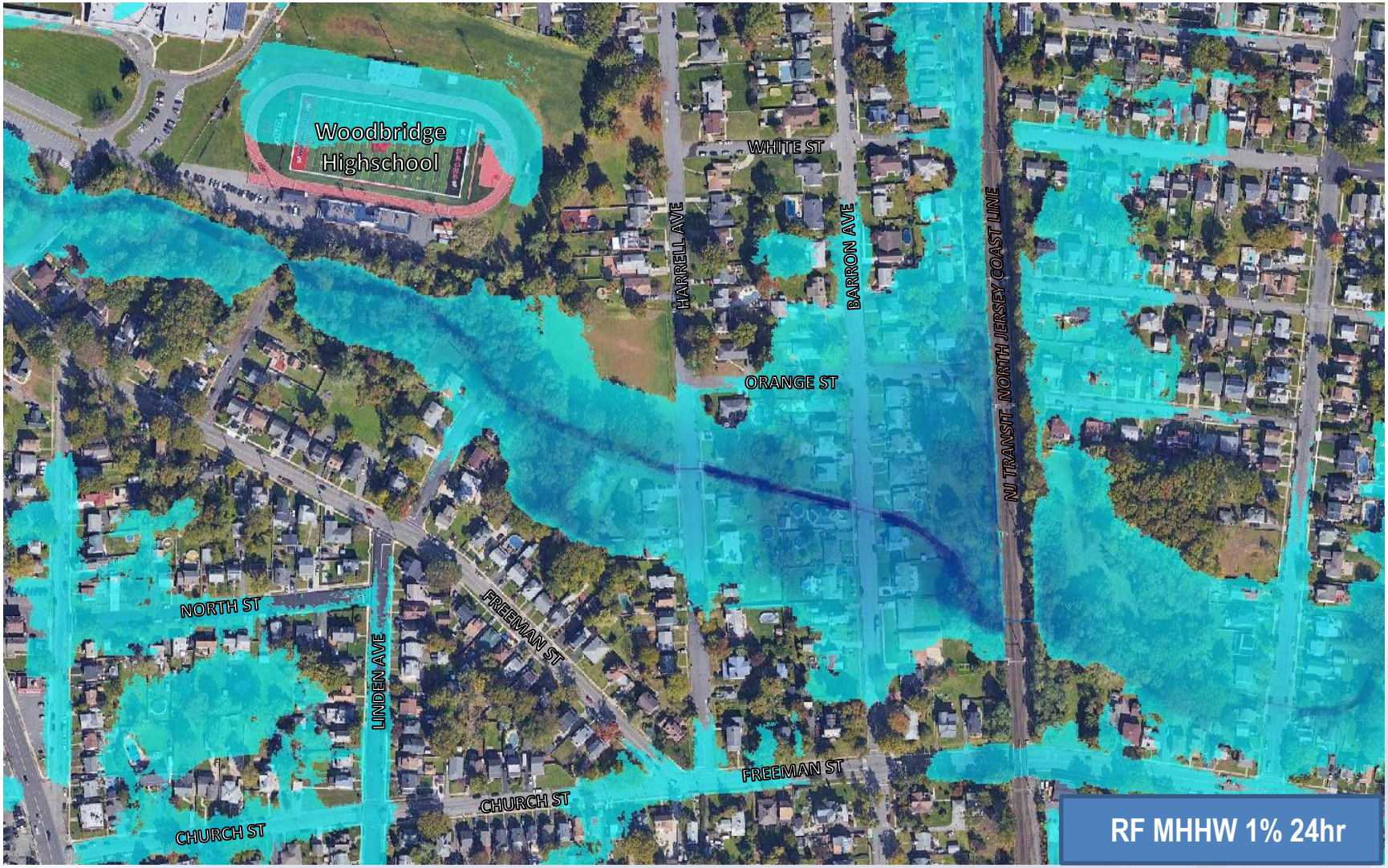
ORANGE ST
NORTH ST
LINDEN AVE
FREEMAN ST
FREEMAN ST
CHURCH ST
CHURCH ST
MHHW 1% 24hr


Woodbridge
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FREEMAN ST
CHURCH ST
CHURCH ST
RF MHHW 1% 24hr

Michael Baker
INTERNATIONAL

We Make a Difference

QUESTIONS?

Thank you!

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Michael Yaffe: Michael.Yaffe@mbakerintl.com