

Flooding and Stormwater Hazard and Risk Management Analysis for the Towns of Brentwood and North Brentwood, Maryland

Funded and managed by the
Planning Assistance to Municipalities and Communities (PAMC) Program



May 1, 2025

Presented by: Tony Osei, E.I.T, MBA
Charles P. Johnson & Associates

DISCUSSION TOPICS

- ▶ Why was this analysis conducted
- ▶ How was the study performed
- ▶ Who participated in the study
- ▶ Where are the risks
- ▶ How were the storm return periods modeled
- ▶ What could happen
- ▶ What is at stake
- ▶ What should be done
- ▶ How can we prepare for the future
- ▶ Questions & Answers

Why was this analysis conducted?

- ▶ To assess riverine and severe storm flood risks
- ▶ To evaluate existing vulnerabilities
- ▶ To predict climate-related risks (2025–2044)
- ▶ To recommend strategies to mitigate future impacts
- ▶ Towns of Brentwood and North Brentwood are interested in exploring local strategies

How was the analysis performed?

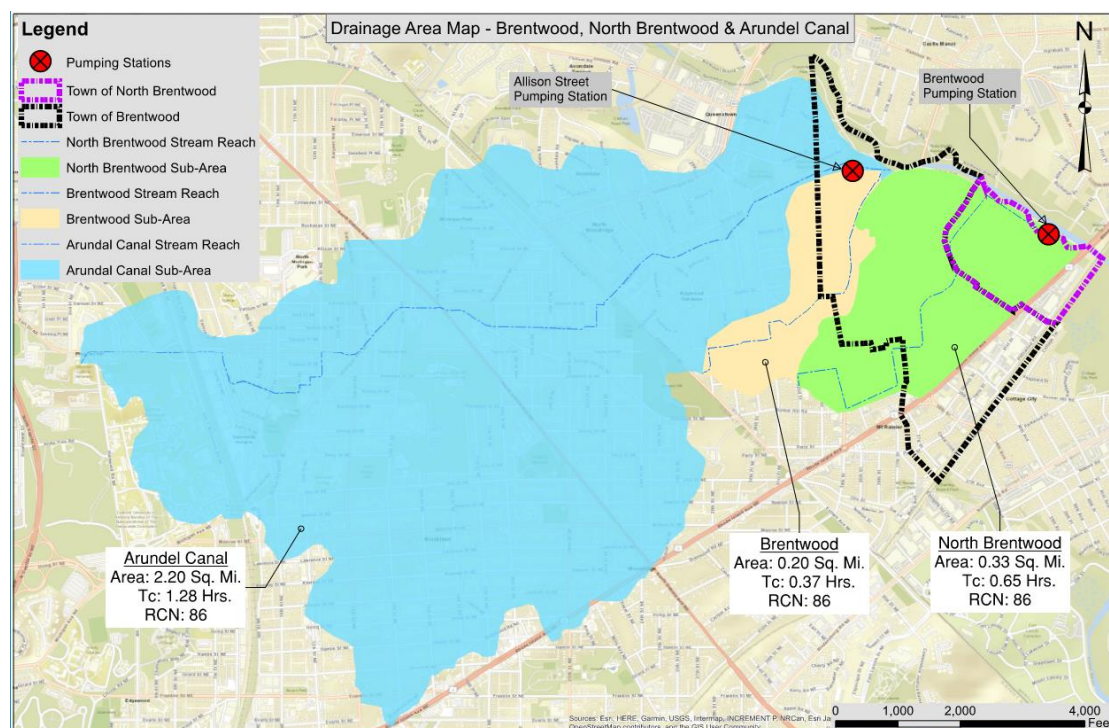
- ▶ Public engagement & field visits
- ▶ GIS & topographic analysis
- ▶ HEC-RAS 2D flood simulation
- ▶ HAZUS 6.1 (FEMA modeling)

Who participated in the study?

- ▶ Town Officials and M-NCPPC Prince George's County Planning Department
- ▶ Prince George's County
- ▶ Residents (Community interviews)
- ▶ Utility Companies
- ▶ Army Corps of Engineers

Where is the risk?

- ▶ Urban, low-lying area in Prince George's County
- ▶ Interior drainage area behind a levee system
- ▶ Adjacent to NW Branch Anacostia River



Contributing Drainage Area Maps for Brentwood, North Brentwood & the Arundel Canal

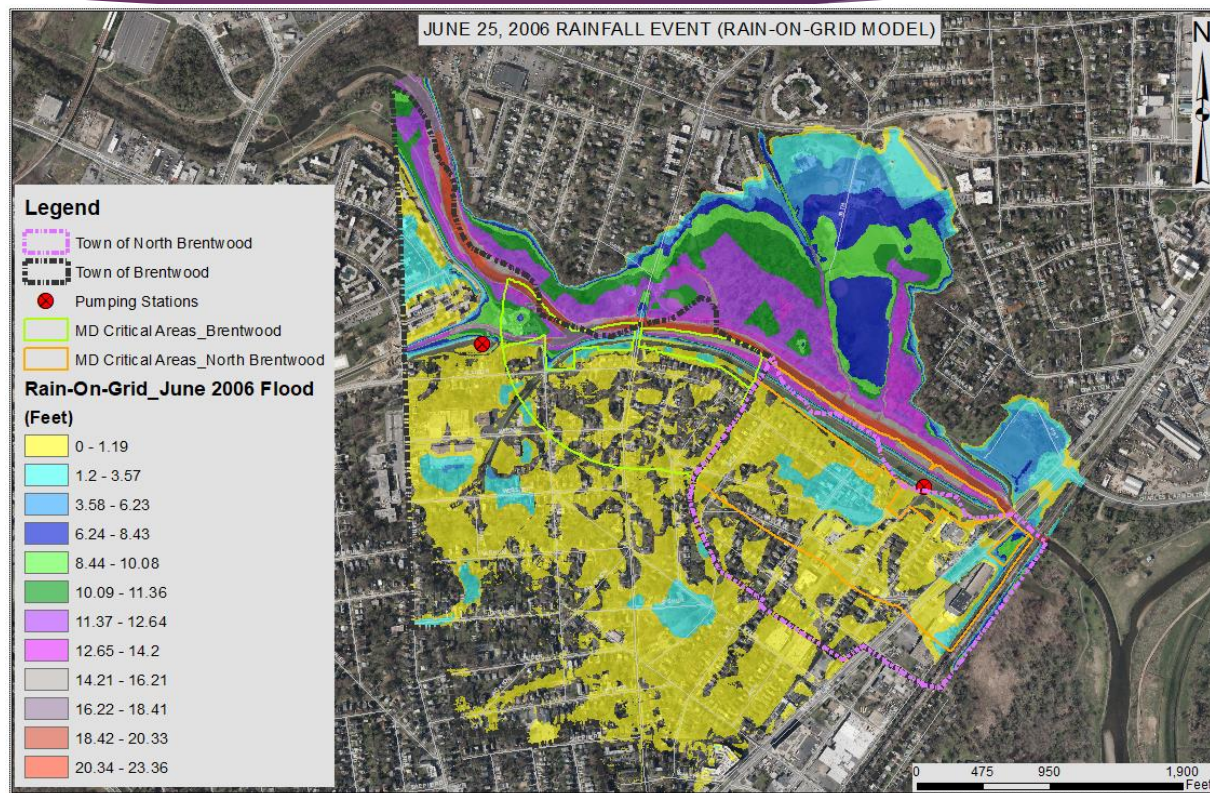
Sources: Base aerial by Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Source: Contributing Drainage Area Maps for Brentwood, North Brentwood & the Arundel Canal created by CPJ using GISHydroNXT and Autodesk Civil 3D software

Source: Town boundaries of Brentwood and North Brentwood created by CPJ using Esri aerial base map in ArcMap

Source: Pumping stations location created by CPJ in ArcMap using aerial imagery from imap on geodata.md.gov (user)

Where is the risk? – continued



Rain-On-Grid Model Flood Map for June 2006 Rainfall Event

Source: June 25, 2006 flood map created by CPJ using HEC-GEO-RAS and Esri ArcMap software programs

Source: Town boundaries of Brentwood and North Brentwood created by CPJ using Esri aerial base map in ArcMap

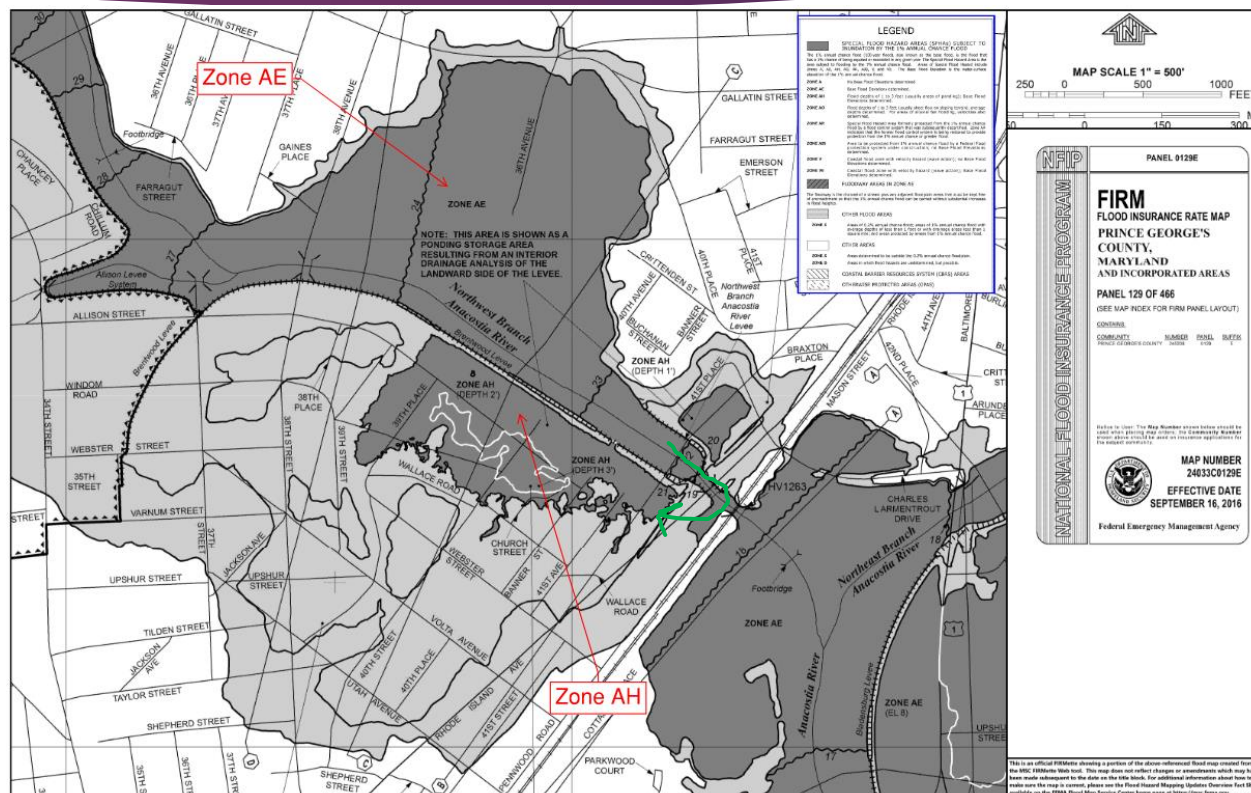
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Source: Maryland critical area zone boundary obtained from informational layers from Prince George's County GIS Data Portal

- ▶ June 2006 Historic Flood
- ▶ Rain-On-Grid Model Simulation
- ▶ Peak Discharge Assessment

FEMA Risk ZONES AE & AH

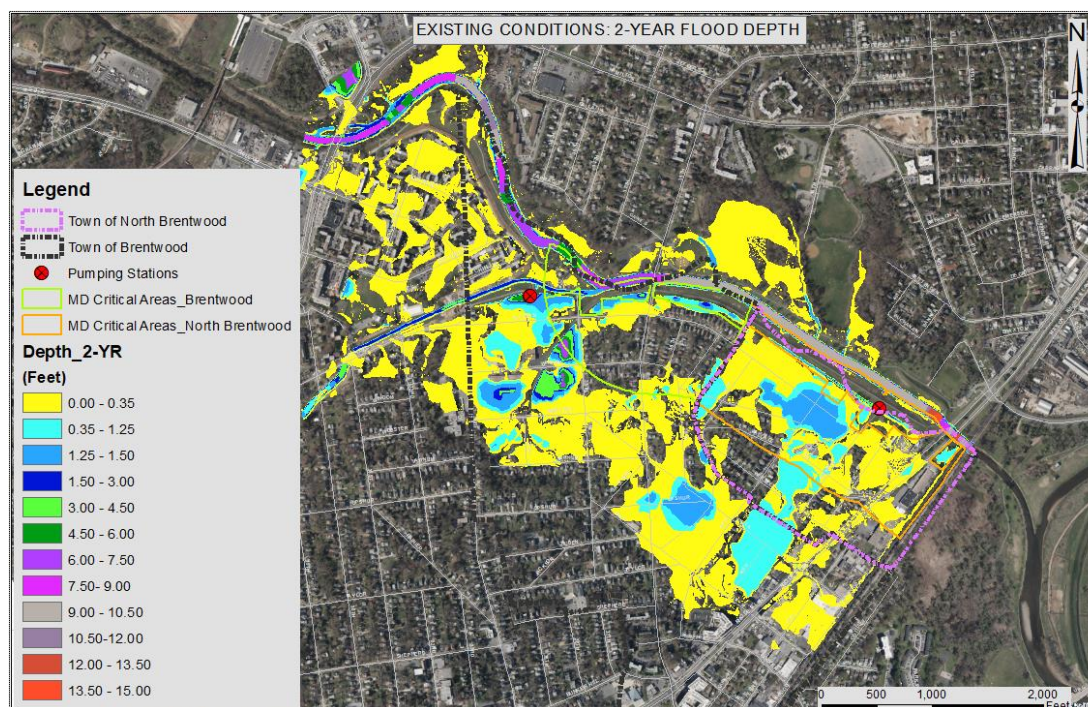
- ▶ FEMA Zones AE & AH
- ▶ FEMA Model Recap
- ▶ Potential 100-YR Risk Flood Risk



Published FEMA Flood Hazard Map Revised on September 19, 2016. Panel Number: 24033C0129E

Storm Return Periods Modeled

► 2-year event
Flood Map



Existing Conditions Flood Inundation Map for 2-yr Event Flood

Source: Flood map created by CPJ using HEC-GEO-RAS and Esri ArcMap software programs

Source: Critical facilities impacted by flooding created by CPJ in ArcMap using aerial imagery from imaps on geodata.md.gov (user)

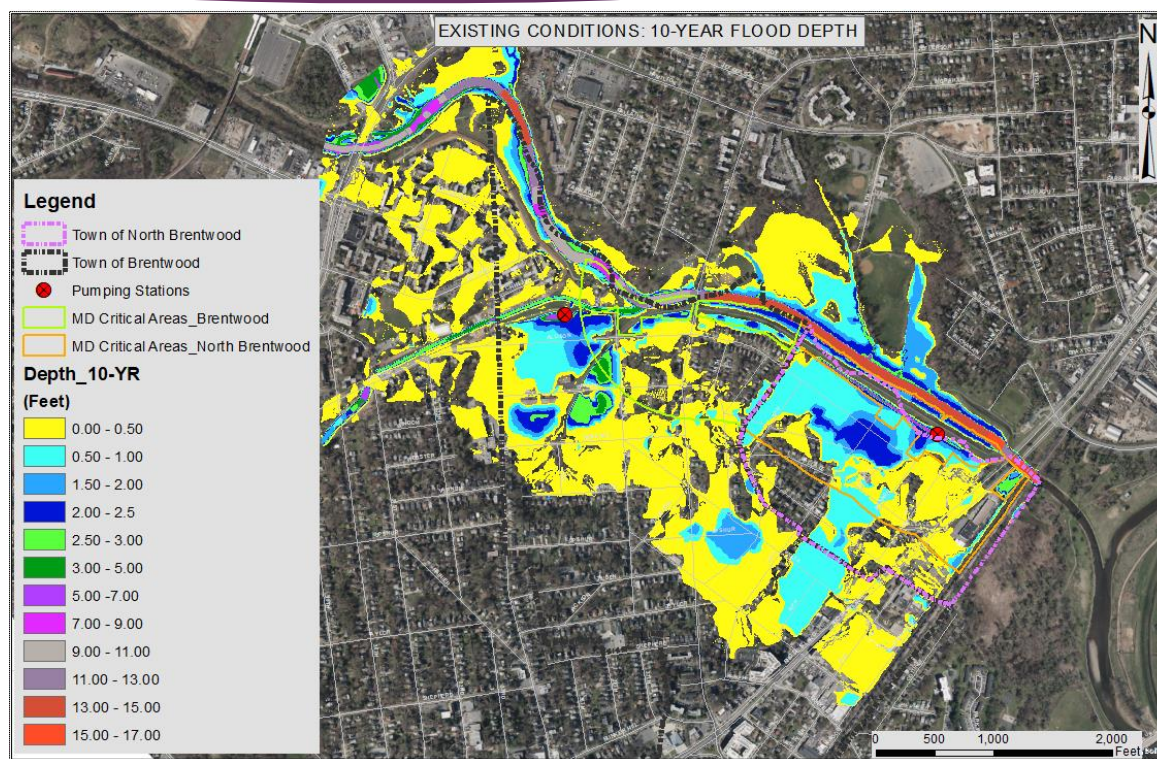
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Storm Return Periods Modeled- Continued

10-year event Flood Map



Existing Conditions Flood Inundation Map for 10-yr Event Flood

Source: Flood map created by CPJ using HEC-GEO-RAS and Esri ArcMap software programs

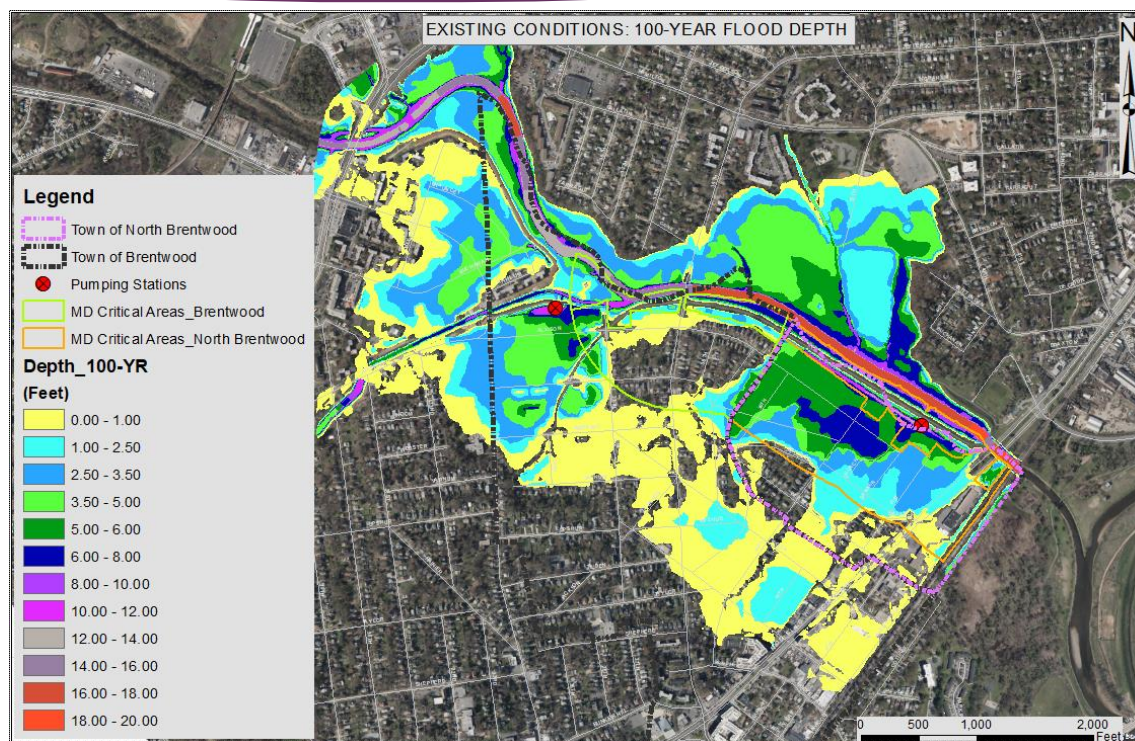
Source: Town boundaries for Brentwood and North Brentwood traced using Esri aerial base map in ArcMap

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Source: Maryland critical area zone boundary obtained from informational layers from Prince George's County GIS Data Portal

Storm Return Periods Modeled- Continued

► 100-year event
Flood Map



Existing Conditions Flood Inundation Map for 100-yr Event Flood

Source: Flood map created by CPJ using HEC-GEO-RAS and Esri ArcMap software programs

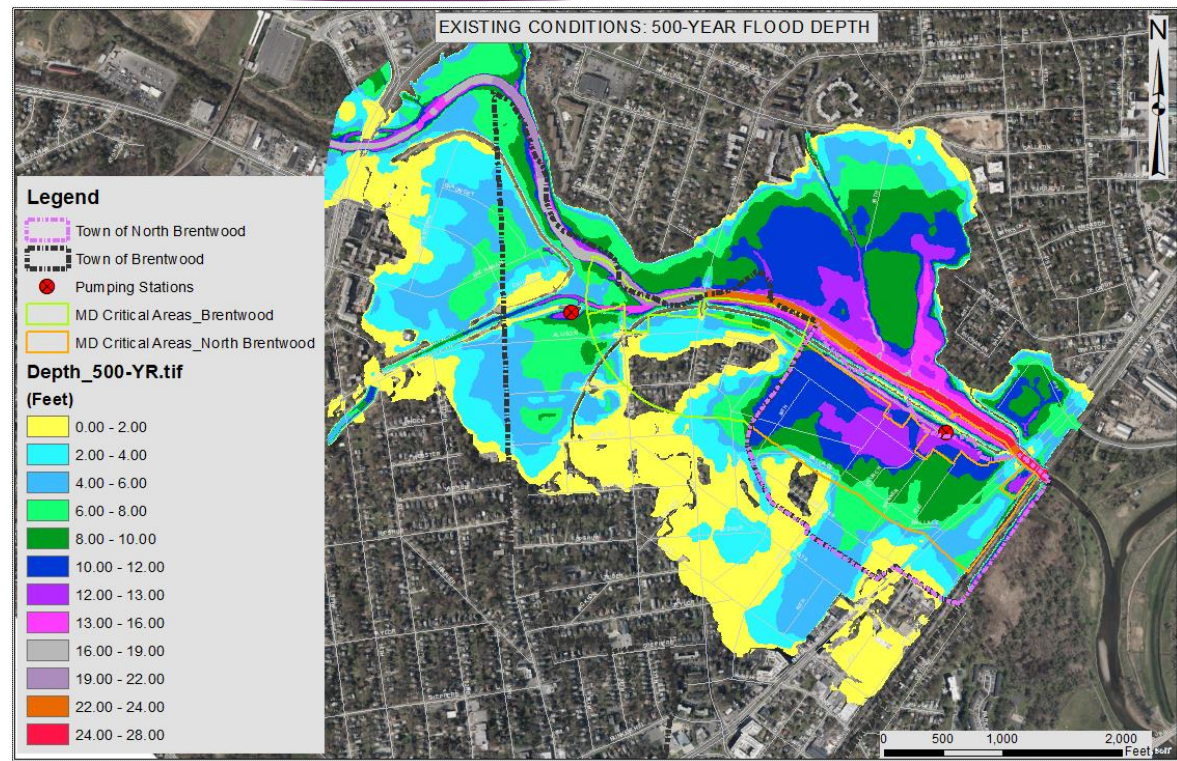
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Storm Return Periods Modeled- Continued

► 500-year event
Flood Map



Existing Conditions Flood Inundation Map for 500-yr Event Flood

Source: Flood map created by CPJ using HEC-GEO-RAS and Esri ArcMap software programs

Source: Town boundaries for Brentwood and North Brentwood traced using Esri aerial base map in ArcMap

Source: Pumping stations location created in ArcMap using aerial imagery from [imap on geodata.md.gov](http://imap.geodata.md.gov) (user)

Source: Maryland critical area zone boundary obtained from informational layers from Prince George's County GIS Data Portal

What Could Happen?

- ▶ 121 dwellings in Brentwood and 103 dwellings in North Brentwood at risk in a 100-year event
- ▶ 1,535 displaced people in Brentwood and 401 displaced people in North Brentwood in a 100-year event
- ▶ 68 displaced people needing shelter in Brentwood and 7 displaced people needing shelter in North Brentwood in a 100-year event
- ▶ Risk of levee overtopping or pump failure
- ▶ Flood depths greater than 3 feet in some areas

What Could Happen? - Continued

Table 22: Existing Conditions Building Value Exposure in the Floodplain

	Building Value Exposure in Floodplain		
	10-YR Storm	100-YR Storm	500-YR Storm
Brentwood	\$139,486,000	\$148,836,000	\$191,216,000
Total	\$139,486,000	\$148,836,000	\$191,216,000

	Building Value Exposure in Floodplain		
	10-YR Storm	100-YR Storm	500-YR Storm
North Brentwood	\$34,373,000	\$44,058,000	\$105,838,000
Total	\$34,373,000	\$44,058,000	\$105,838,000

What Could Happen? - Continued

Table 23: Future Conditions Building Value Exposure in the Floodplain

	Building Value Exposure in Floodplain		
	10-YR Storm	100-YR Storm	500-YR Storm
Brentwood	\$140,800,000	\$152,952,000	\$192,120,000
Total	\$140,800,000	\$152,952,000	\$192,120,000

	Building Value Exposure in Floodplain		
	10-YR Storm	100-YR Storm	500-YR Storm
North Brentwood	\$36,685,000	\$44,722,000	\$105,971,000
Total	\$36,685,000	\$44,722,000	\$105,971,000

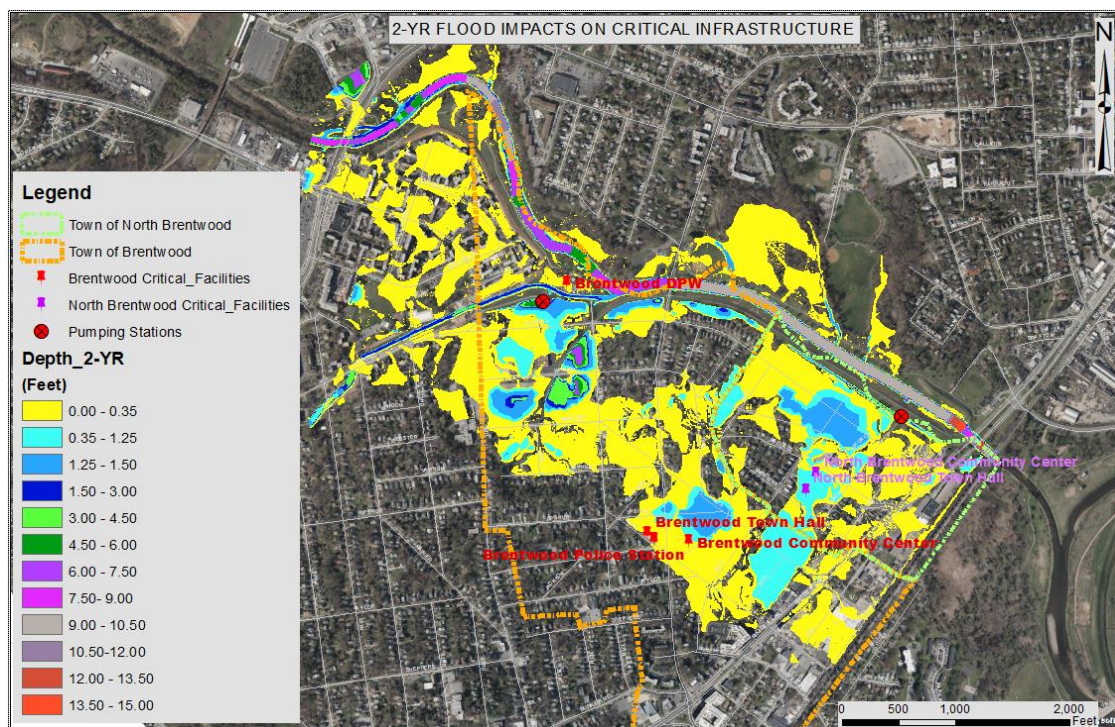
What is at Stake?

- ▶ Residential, commercial and industrial real estate & property
- ▶ Vulnerable populations in flood-prone zones:
 - Potential loss of life
 - Displaced population
 - Population displaced and needing shelter / a place to stay
 - Loss of wages
- ▶ Critical facilities:
 - Emergency services - Police station, firehouse (Brentwood)
 - Government - Town Hall (Brentwood & N. Brentwood)
 - Recreational - Community center (N. Brentwood)

What is at Stake? - Continued

Critical facilities:

- ▶ 2-Yr Storm Impacts



Source: Flood map created by CPJ using HEC-GEO-RAS and Esri ArcMap software programs

Source: Critical facilities impacted by flooding created by CPJ in ArcMap using aerial imagery from imap on geodata.md.gov (user)

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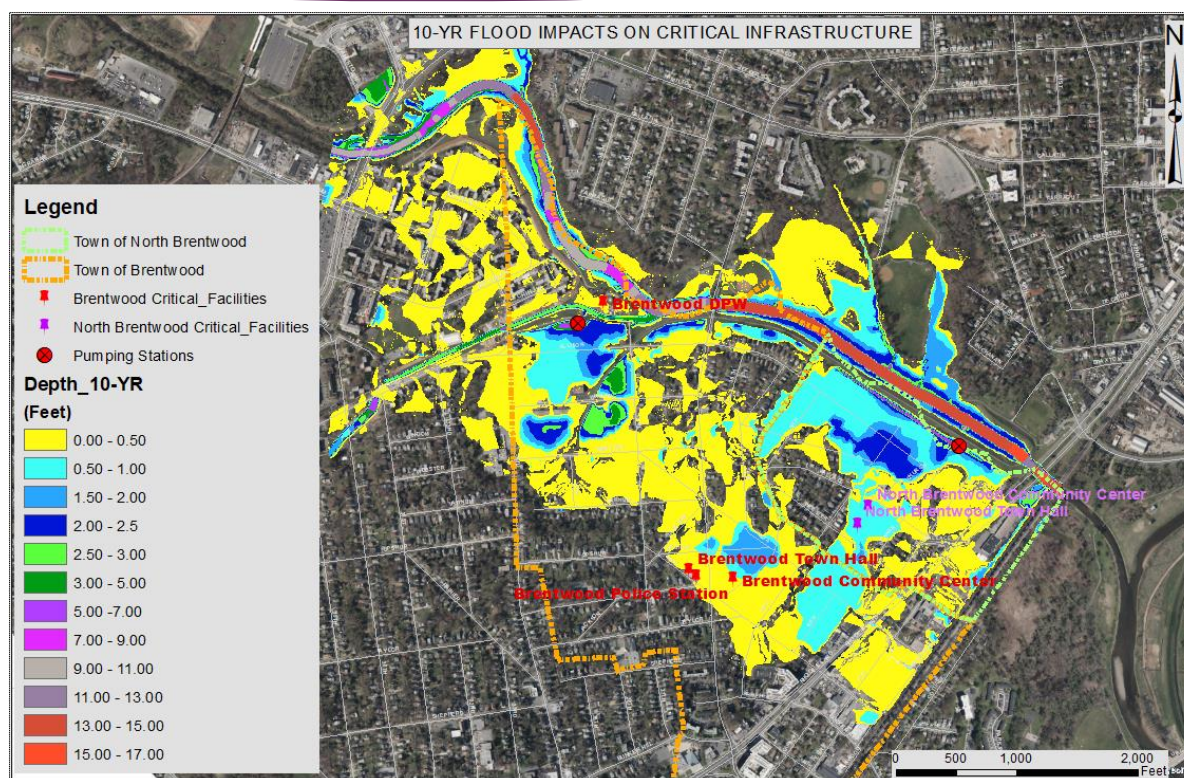
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What is at Stake? - Continued

Critical facilities:

- ▶ 10-Yr Storm Impacts



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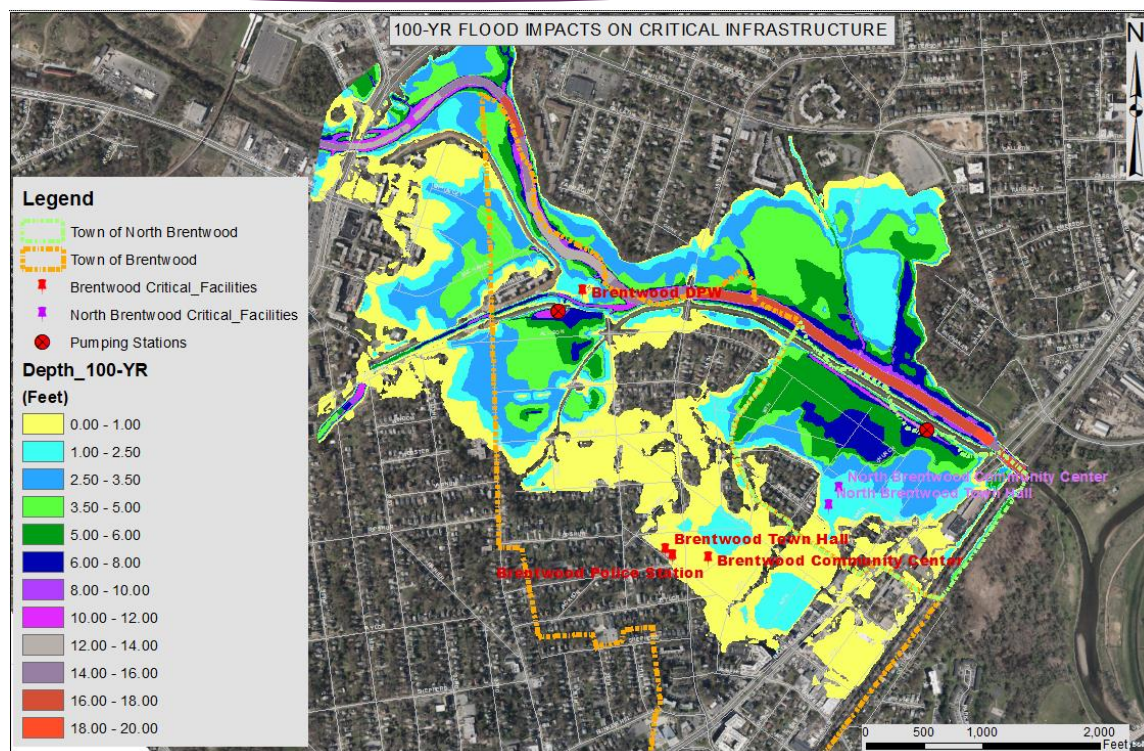
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What is at Stake? - Continued

Critical facilities:

- ▶ 100-Yr Storm Impacts



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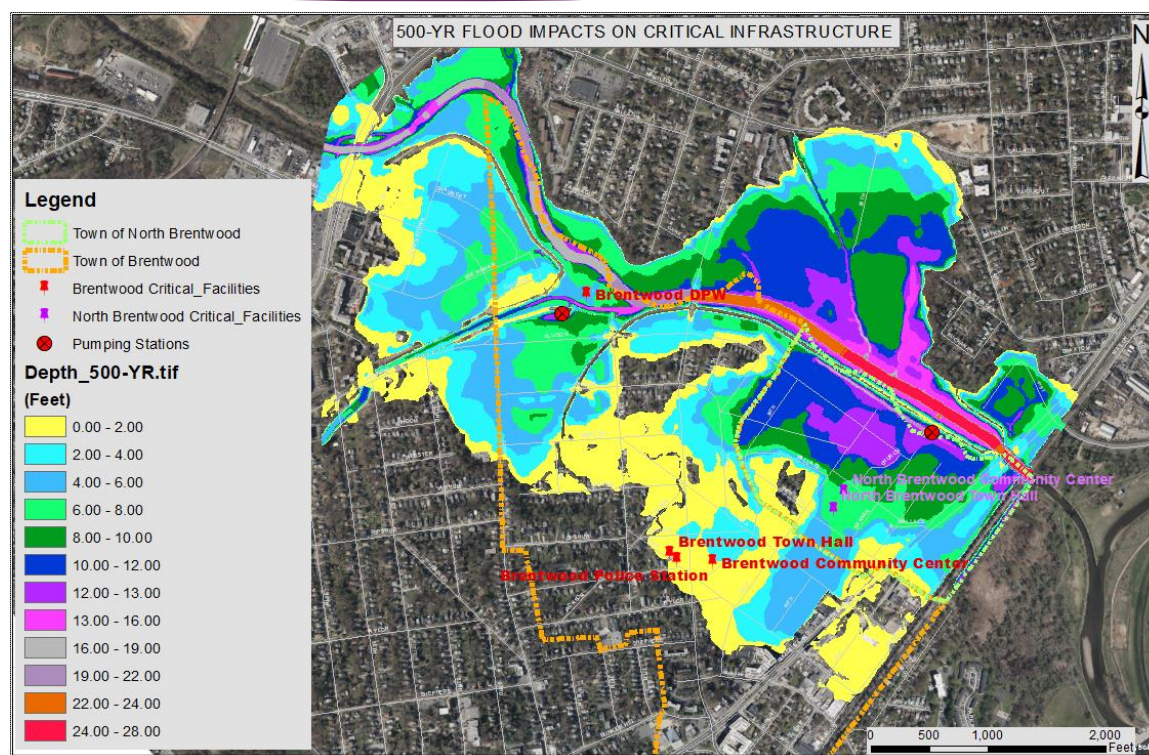
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What is at Stake? - Continued

Critical facilities:

- ▶ 500-Yr Storm Impacts



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Recommendations

- ▶ Reassess FEMA mapping with 2D model & survey data
- ▶ Review pumping station capacity
- ▶ Improve storm inlet maintenance
- ▶ Educate public on forecasts & storm preparedness

Preparing for the Future

- ▶ Climate models predict 1.6 inches more rain annually by 2044
- ▶ Increased intensity, especially in winter
- ▶ Education & Improved Infrastructure = Resilience

Questions & Contact

Contact Info:

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- ▶ Project Manager, M-NCPPC
- ▶ 301-780-2233, Anusree.nair@ppd.mncppc.org

Storm Drain Adequacy Analysis

Towns of Brentwood and North Brentwood

Funded and managed by the **PLANNING ASSISTANCE TO MUNICIPALITIES AND COMMUNITIES (PAMC)** program



Presented by:
Kim Truong, PE

Charles P. Johnson &
Associates

May 1, 2025

Agenda

- Objective
- Introduction
- Methodology
- Results
- Conclusions/
Recommendations



Photo courtesy: Ms. Jacqueline Goodall and the Town of North Brentwood

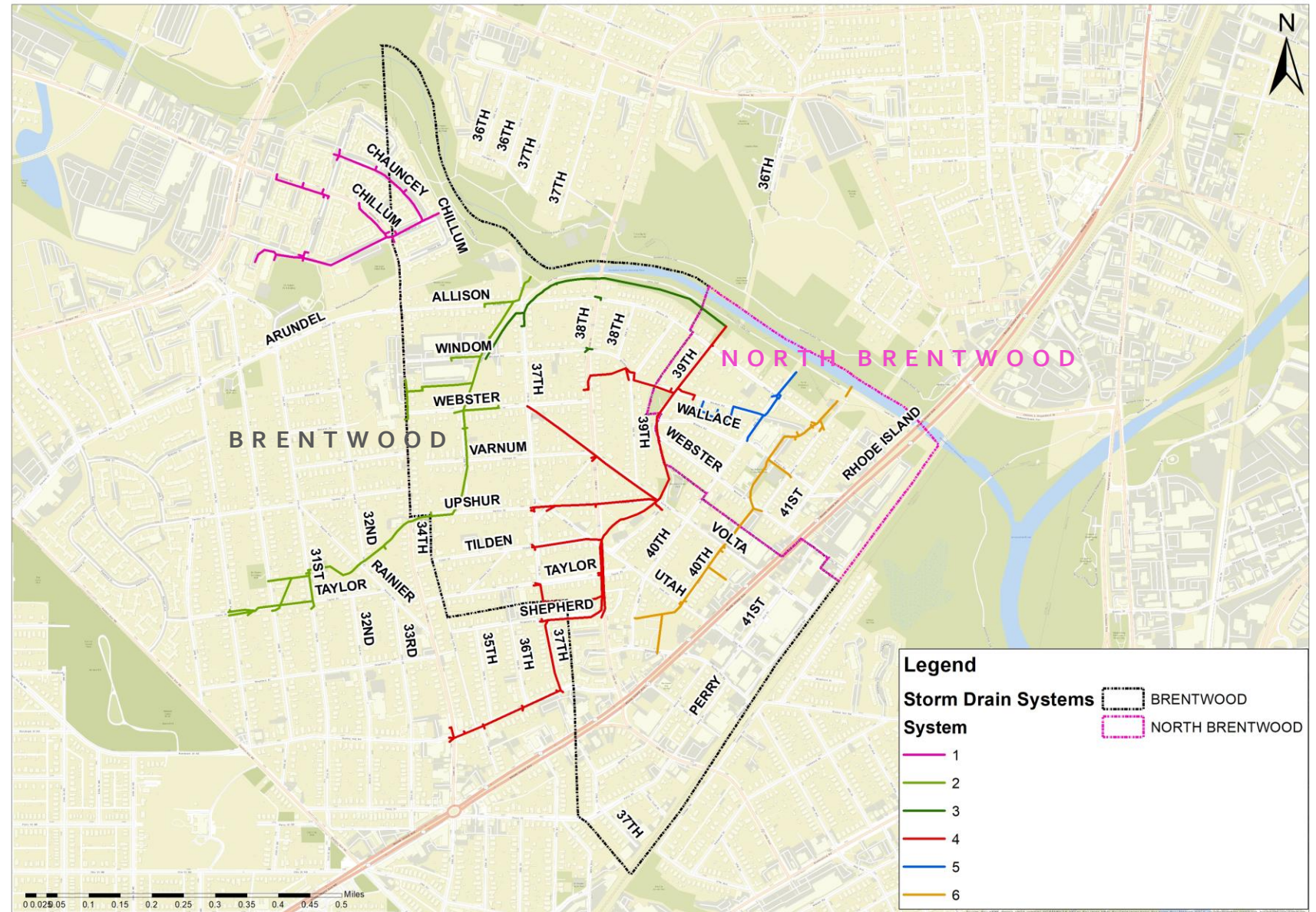
Objectives

- Determine adequacy of storm drain system to convey 10-year and 100-year storm runoff
 - Where are the inlets and pipes too small?
- Provide recommendations on how to improve functionality based on findings
 - What can be done do to make the system work more effectively and reduce flooding?

Introduction

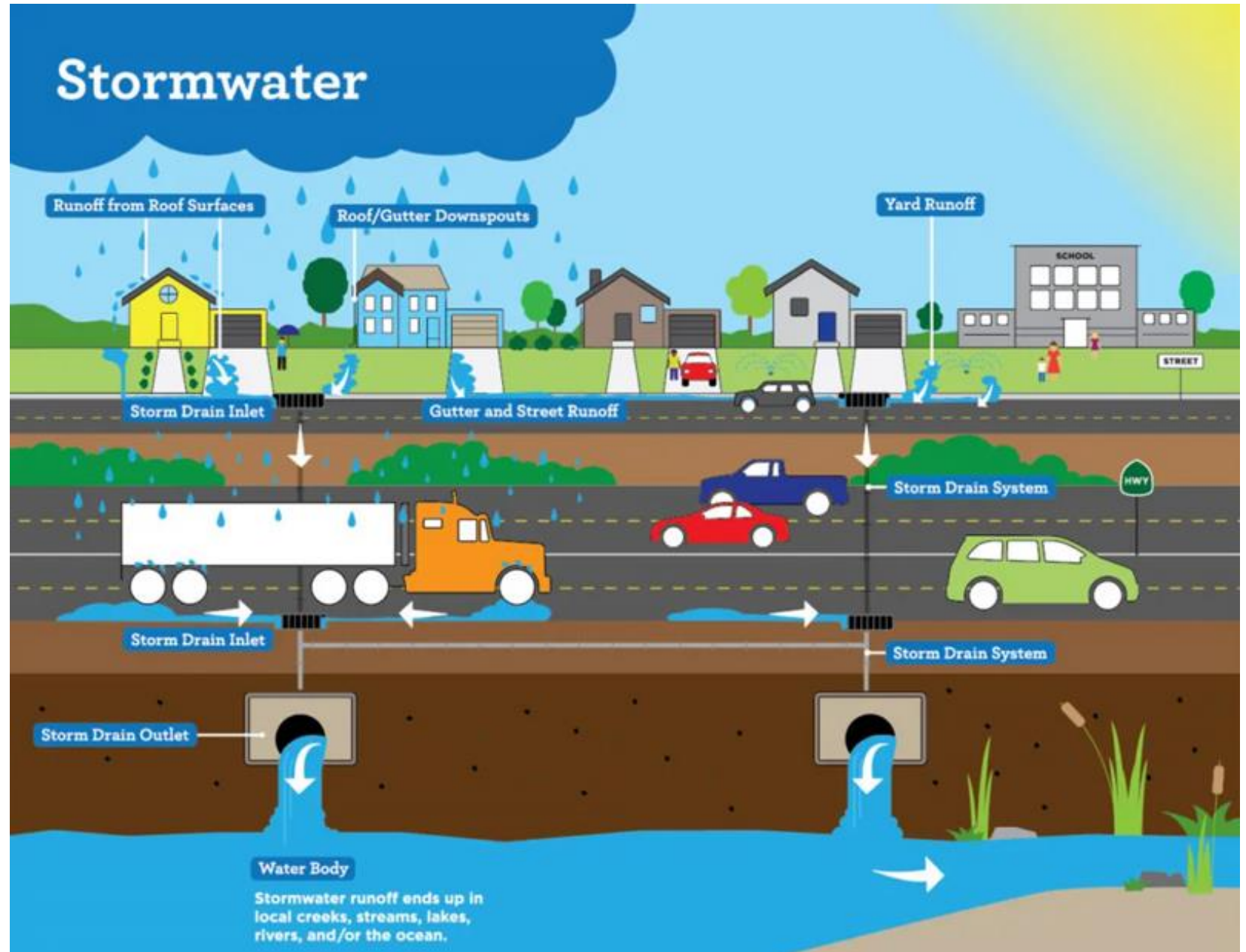
Study Area

- Six distinct storm drain systems across Brentwood and North Brentwood
- Drain toward the Northwest Branch Anacostia River



Storm drain system components

Inlets →
Pipes →
Outfalls →
Body of water



Source: <https://www.suwanee.com/services/public-works-services/stormwater-utility>

Inlets

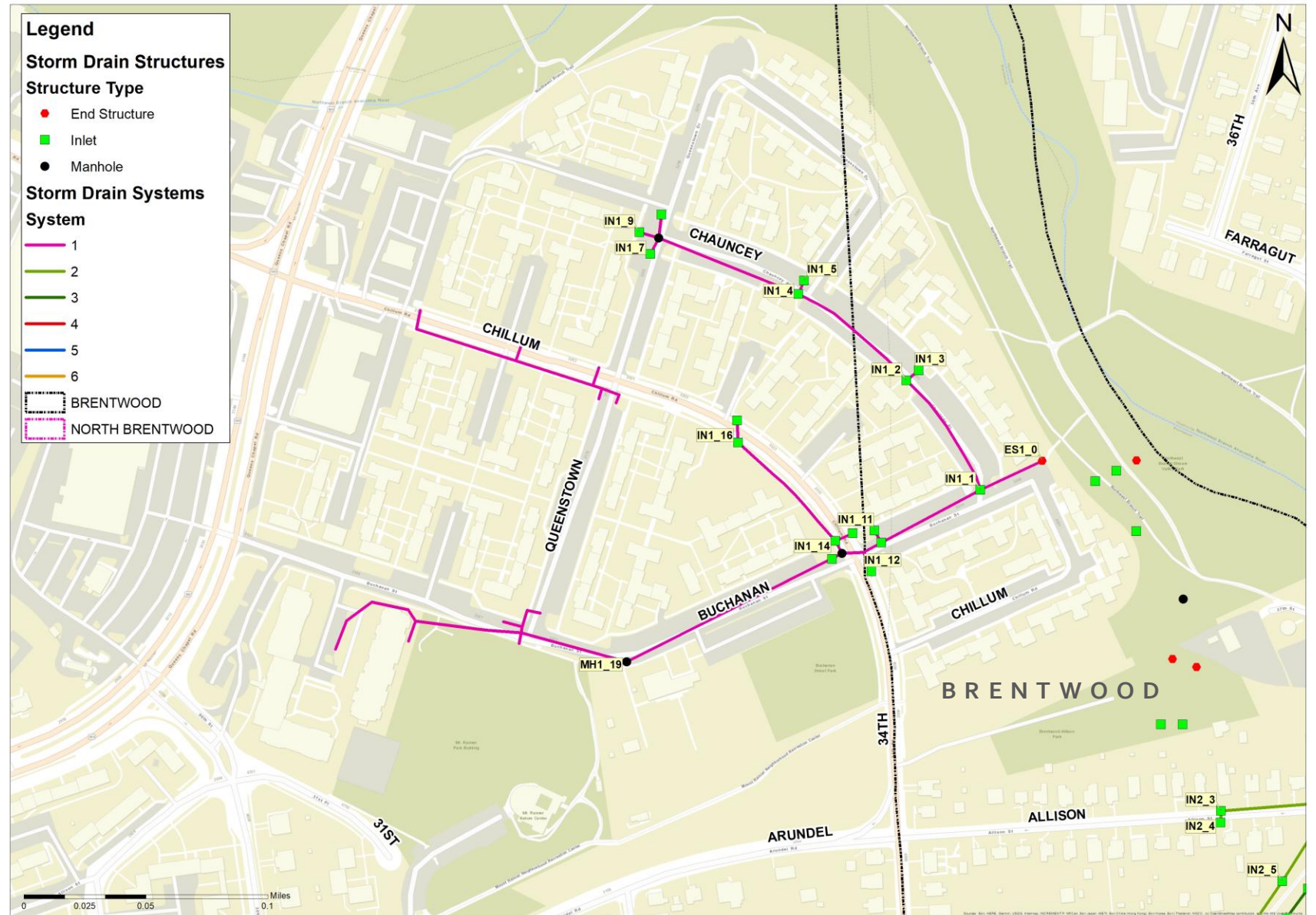
- Curb opening inlet
- Grate inlet
- Combination curb opening and grate inlet
- Yard inlet
- On-grade or in-sump



Pipes and Outfalls

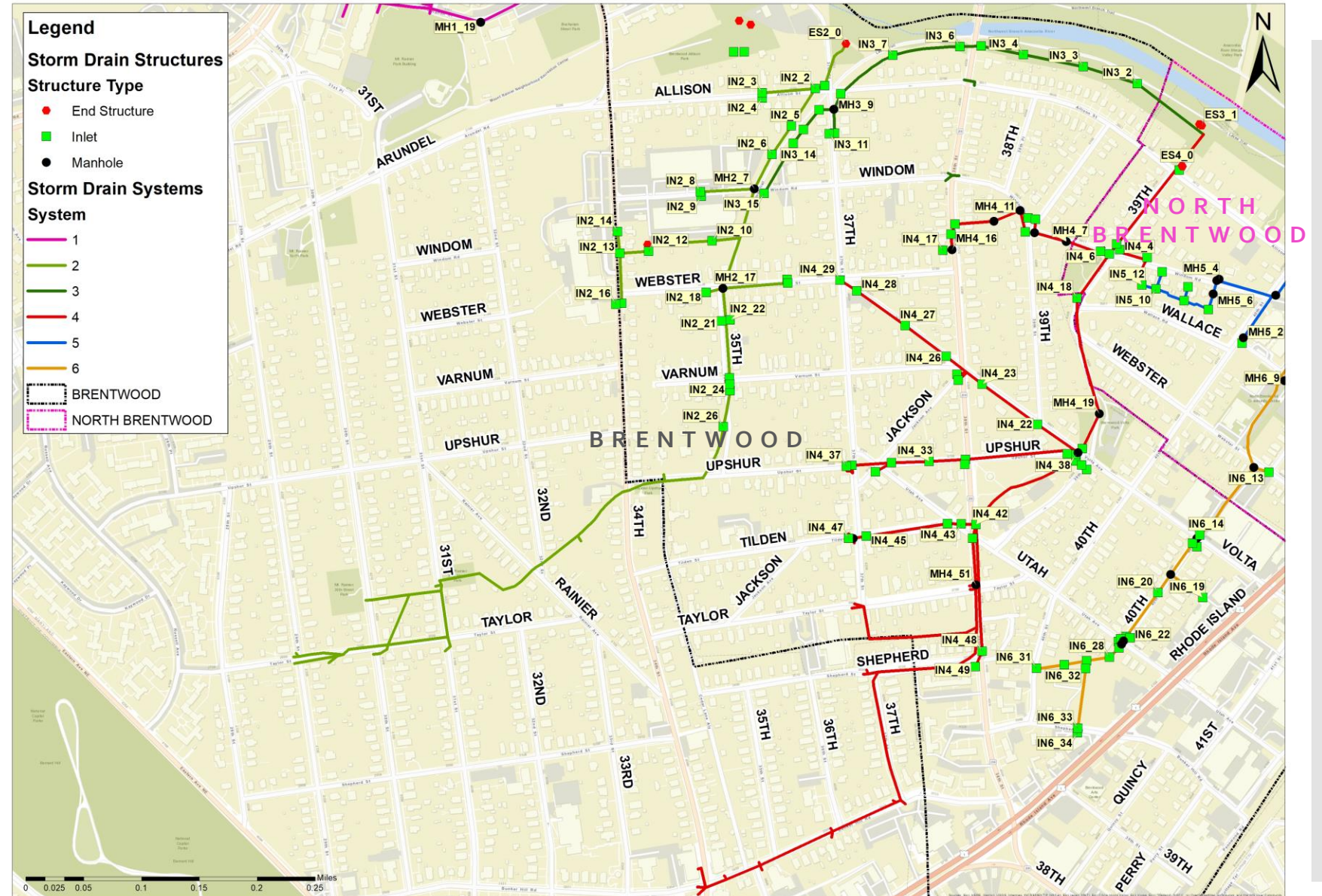


System 1



Source: Base aerial by Esri, Maxar, Earthstar Geographics, and the GIS User Community. Informational layers provided by Prince George's County through the Clean Water Partnership. Map created by CPJ.

System 2



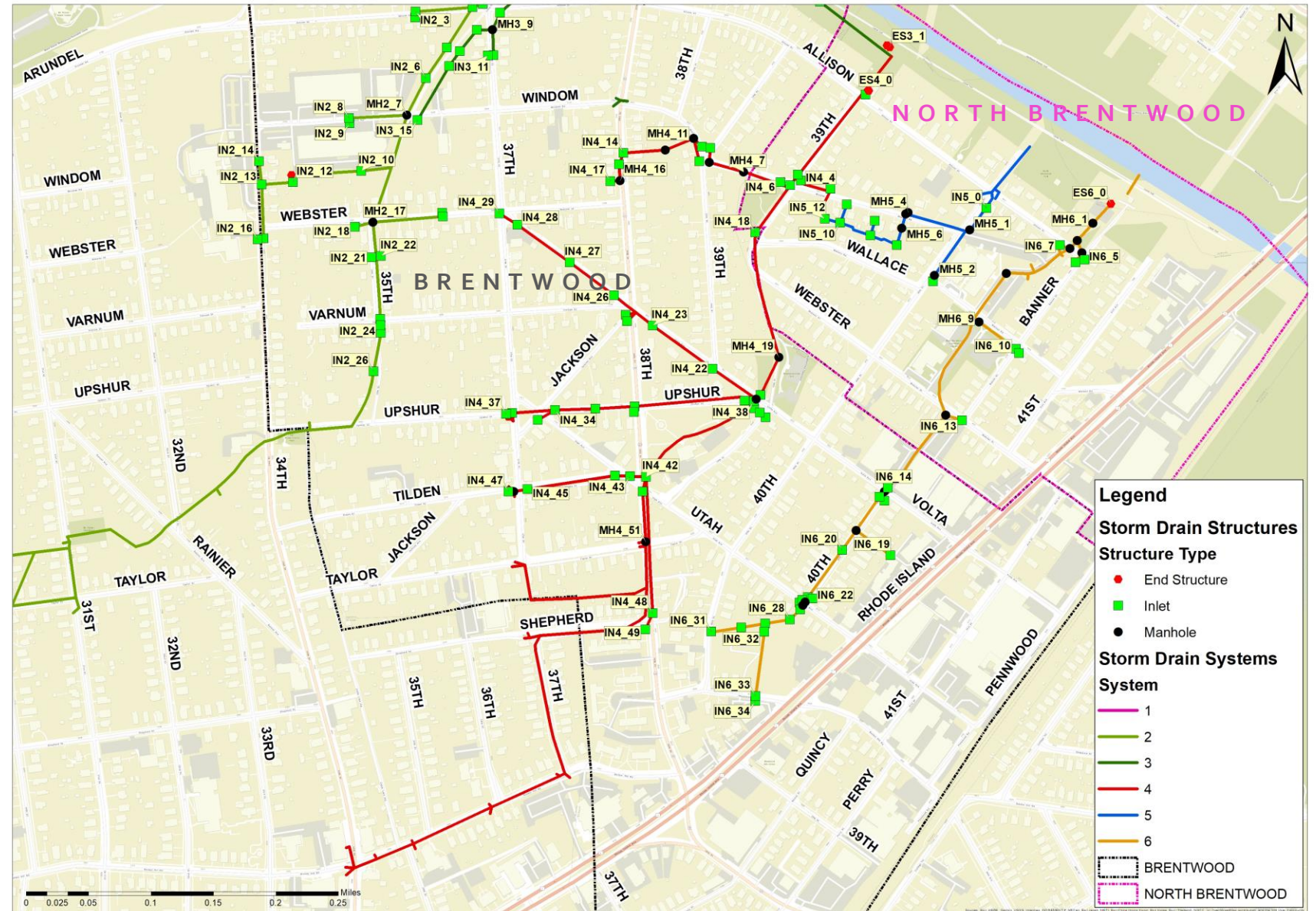
Source: Base aerial by Esri, Maxar, Earthstar Geographics, and the GIS User Community. Informational layers provided by Prince George's County through the Clean Water Partnership . Map created by CPJ.

System 3



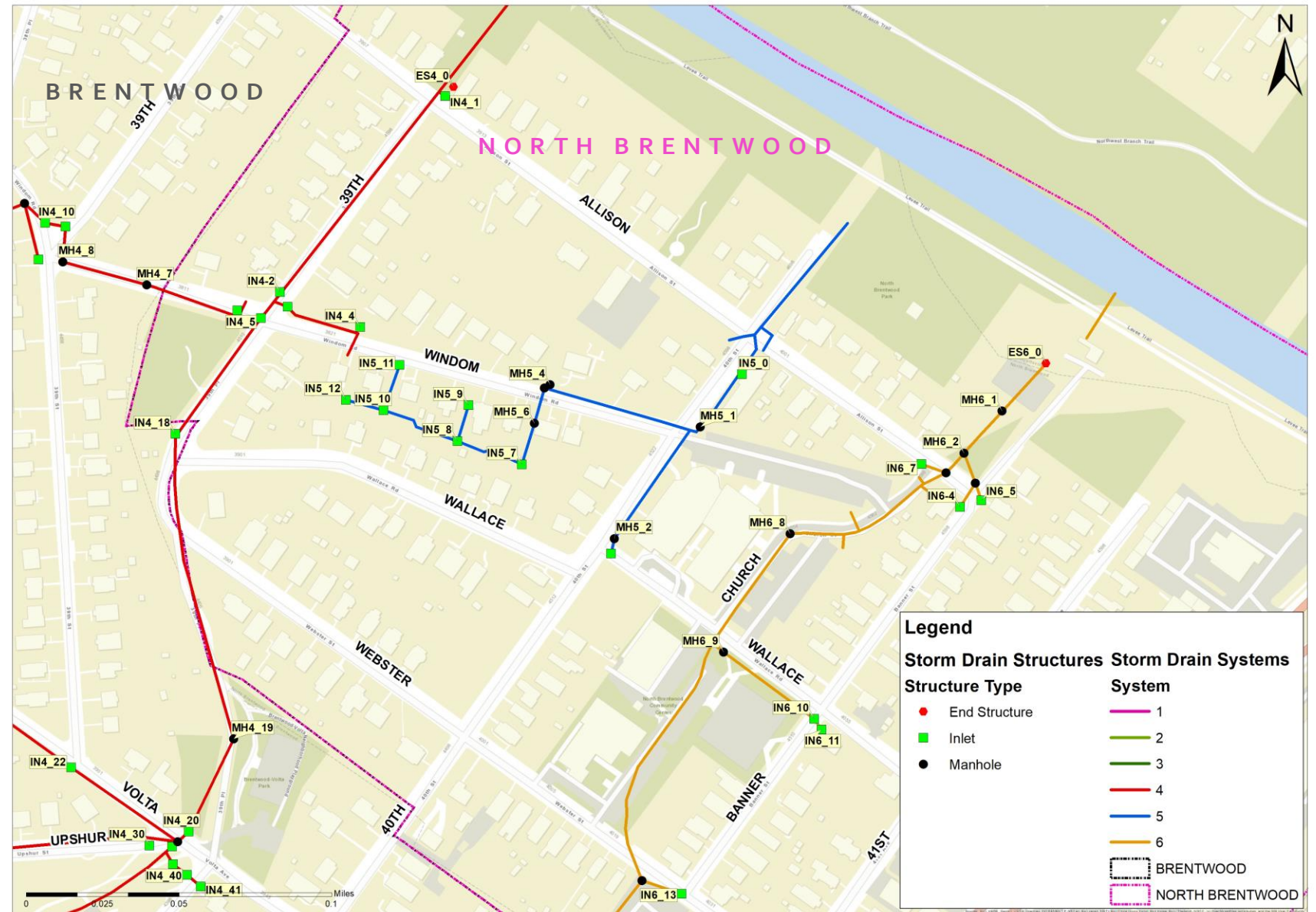
Source: Base aerial by Esri, Maxar, Earthstar Geographics, and the GIS User Community. Informational layers provided by Prince George's County through the Clean Water Partnership. Map created by CPJ.

System 4



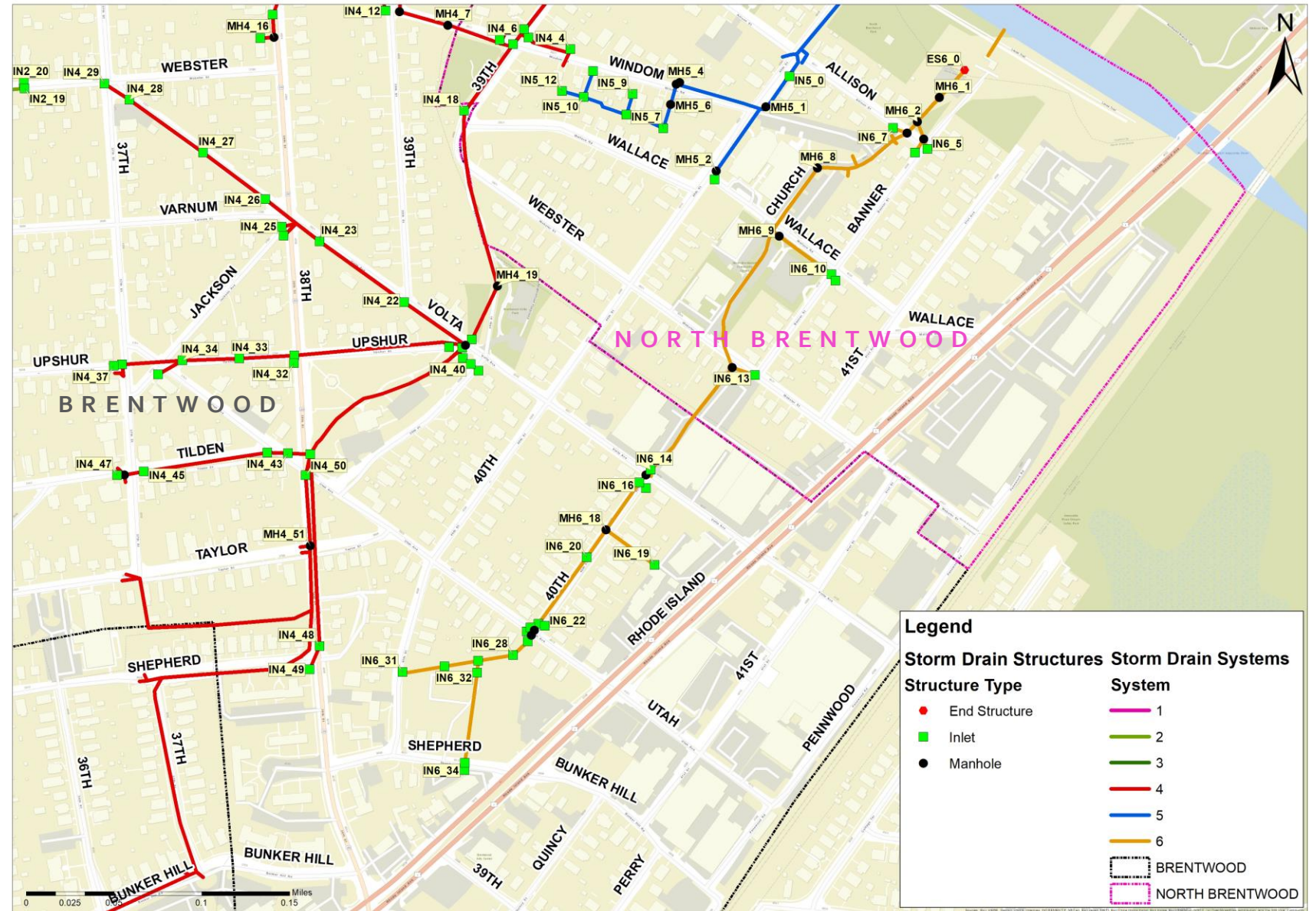
Source: Base aerial by Esri, Maxar, Earthstar Geographics, and the GIS User Community. Informational layers provided by Prince George's County through the Clean Water Partnership. Map created by CPJ.

System 5



Source: Base aerial by Esri, Maxar, Earthstar Geographics, and the GIS User Community. Informational layers provided by Prince George's County through the Clean Water Partnership. Map created by CPJ.

System 6



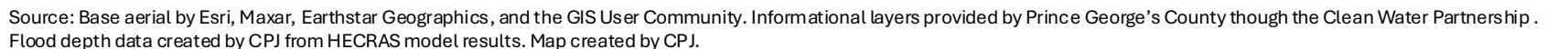
Source: Base aerial by Esri, Maxar, Earthstar Geographics, and the GIS User Community. Informational layers provided by Prince George's County through the Clean Water Partnership. Map created by CPJ.

How is it determined
where the system
is inadequate?

1. Narrow focus
2. Review available data
3. Collect field data
4. Geospatial Analysis
5. Hydraulic and
Hydrologic Calculations
6. Hydraulic Modeling

Methodology

- Preliminary flood modeling
- Stakeholder interviews
- Selected 40 inlets across 5 systems
- Focusing on:
 - **System 2** and **System 3** on 35th St. near Webster St. and Windom Rd.
 - **System 4** near Upshur St. and Volta Ave.
 - **System 5** and **System 6** on 40th St. near Wallace Rd. and Windom Rd.



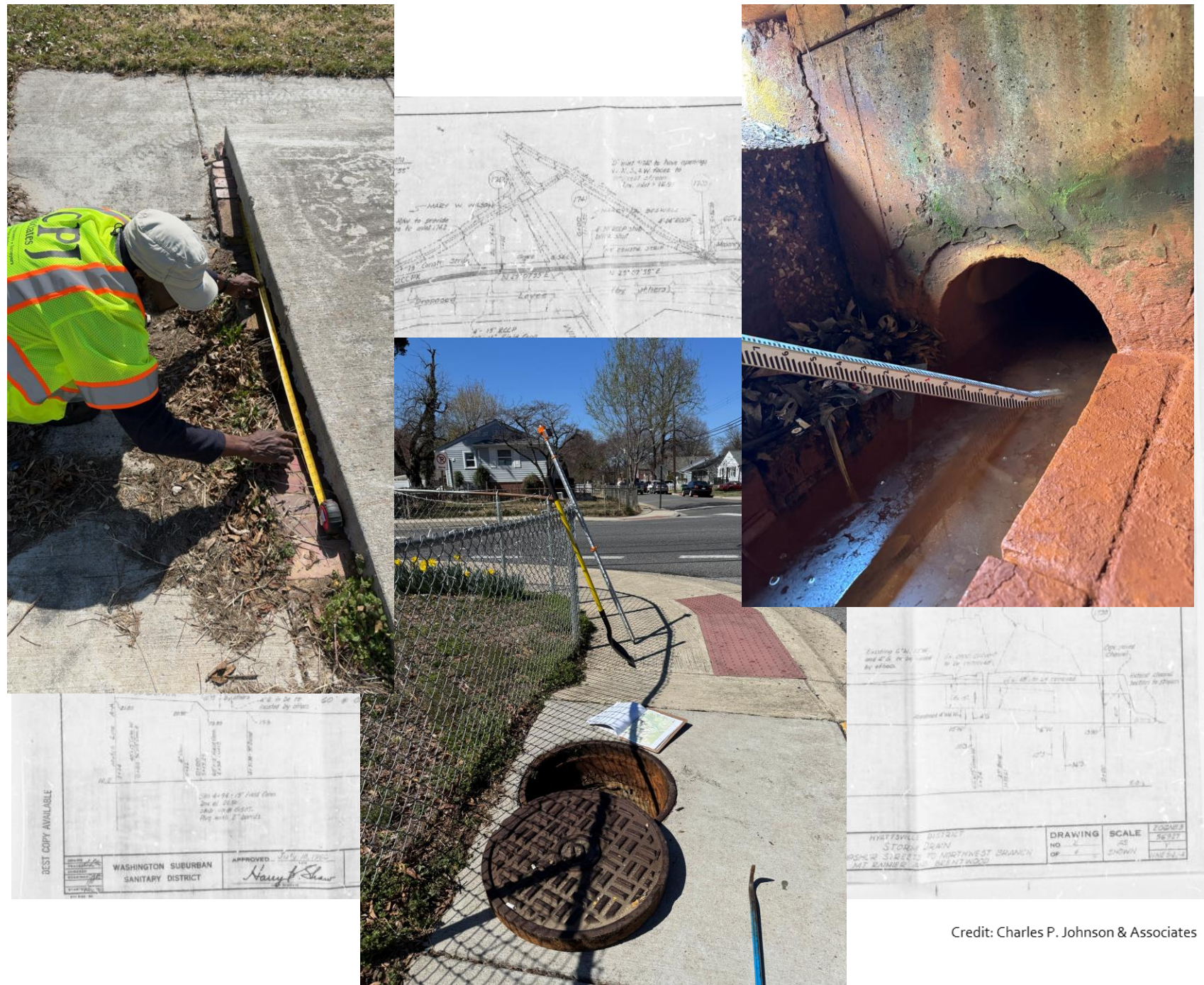
Review and Collect Structure Data

Important Data:

1. Type of inlet
2. Size of inlet openings
3. Location of inlet
4. Size of pipe
5. Pipe material
6. Upstream and downstream invert elevation of each pipe

Available Data:

- As-builts
- County data



Credit: Charles P. Johnson & Associates

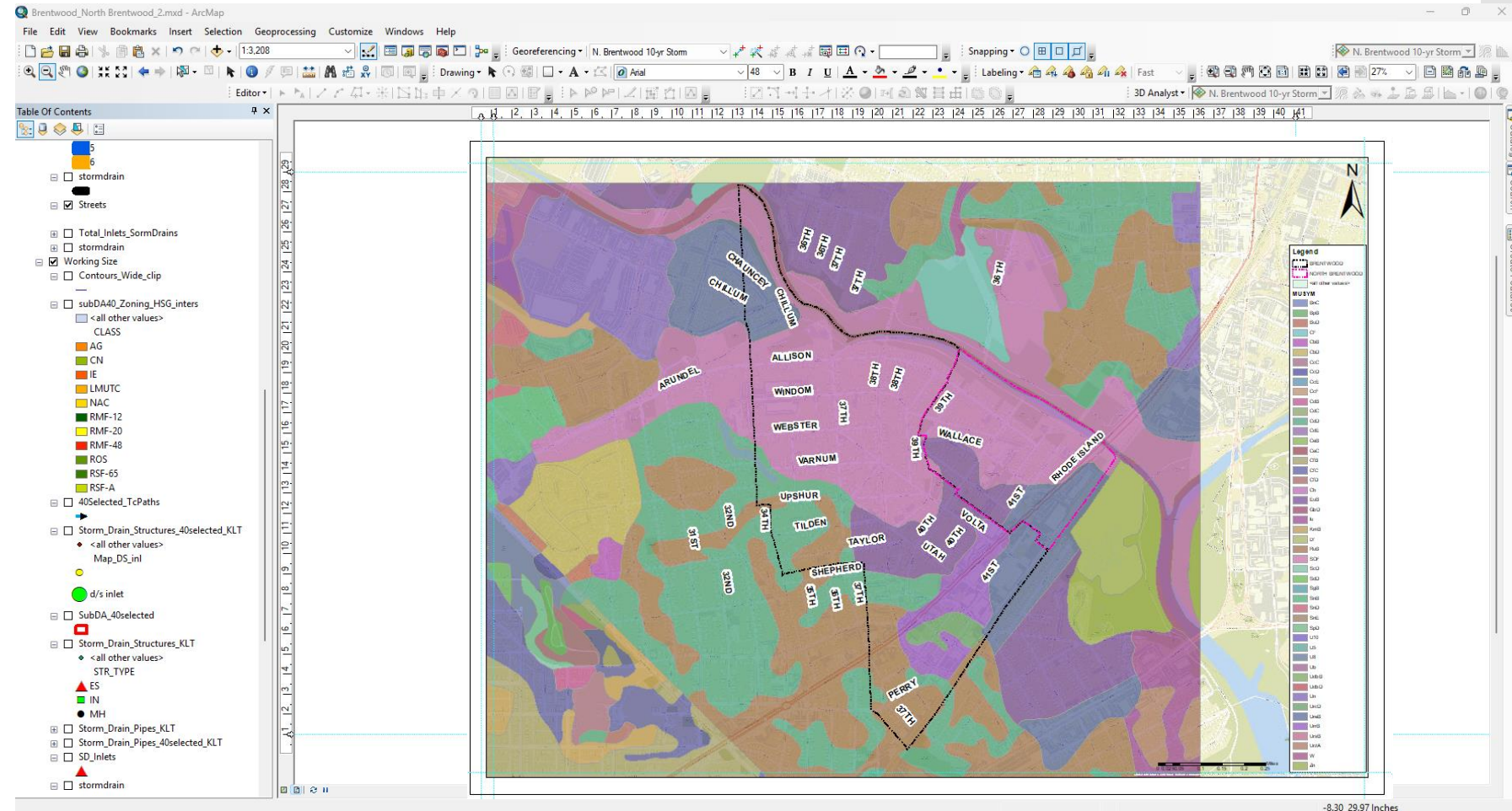
Review and Collect Geospatial Data

County Data:

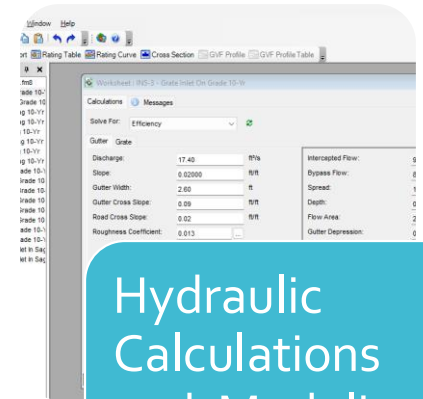
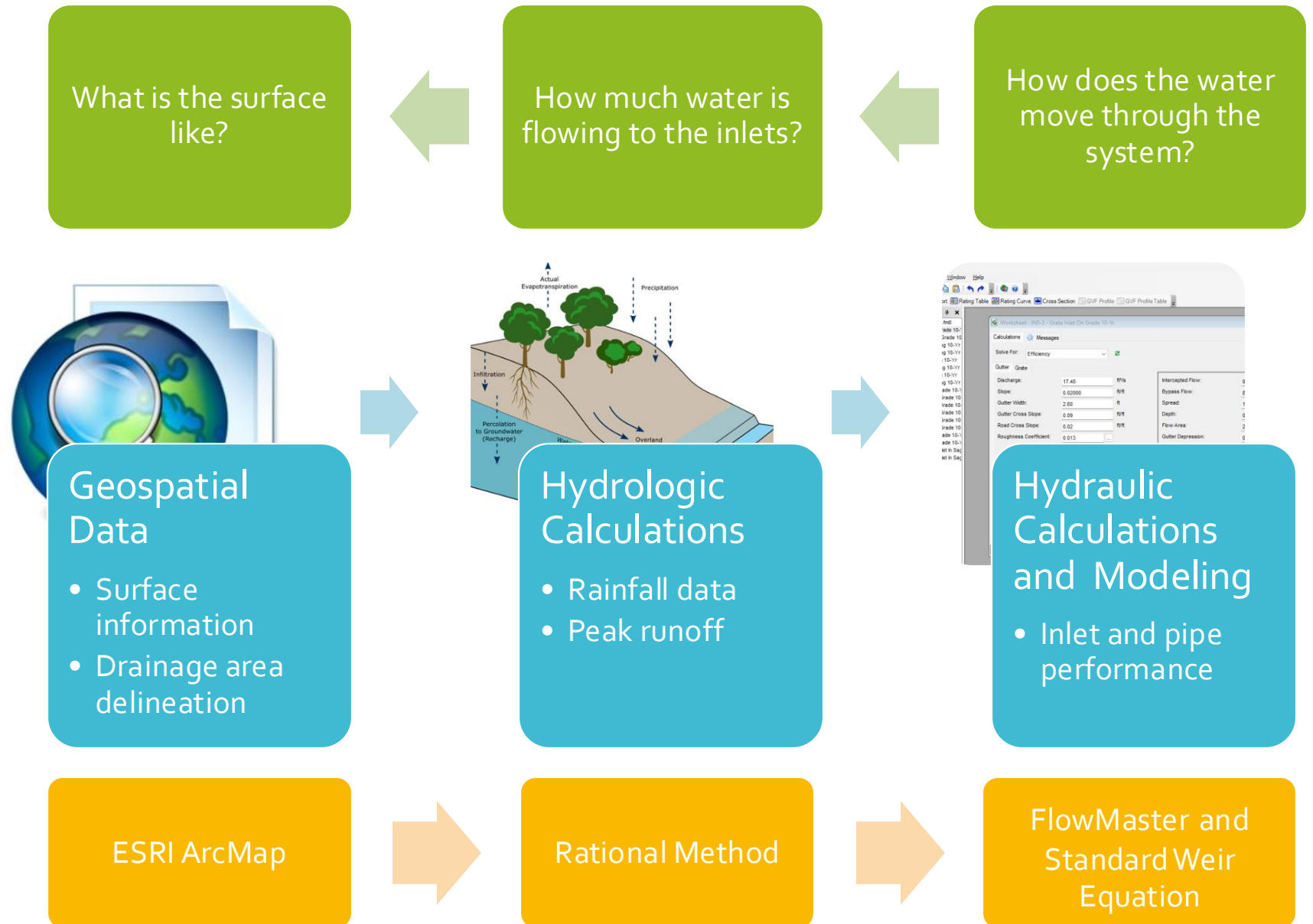
- Zoning data
- Topography
- Storm drain network
- Imagery

USDA Data:

- Hydrologic Soil Data



Data → Results



Limitations and Assumptions

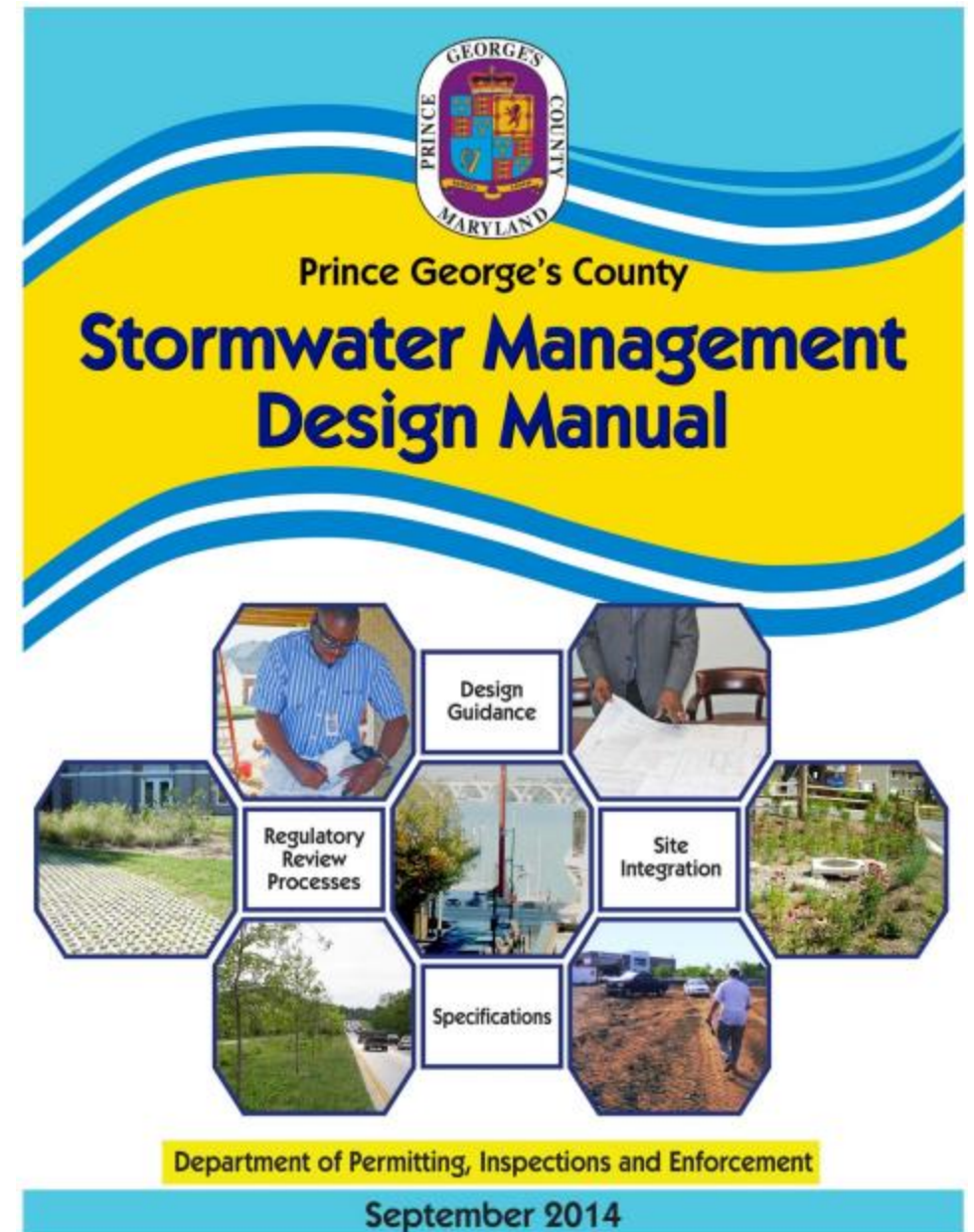
- Could not locate some inlet structures
- Could not access some inlet structures
- No data for some inlet structures
- Measurements were not taken by a survey crew
- Analysis only includes a portion of the overall system

Results

What is “adequate”?

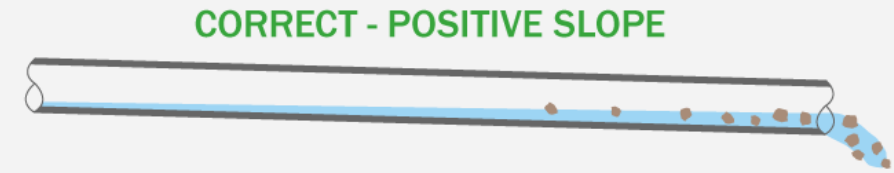
Prince George's County Requirements:

- Pipes
 - ...convey the 100-yr storm...with **no surcharge** out of system...
- Inlets
 - ...water spread is **less than 10 feet**...
 - ...at **least 70% interception** of 10-yr storm...



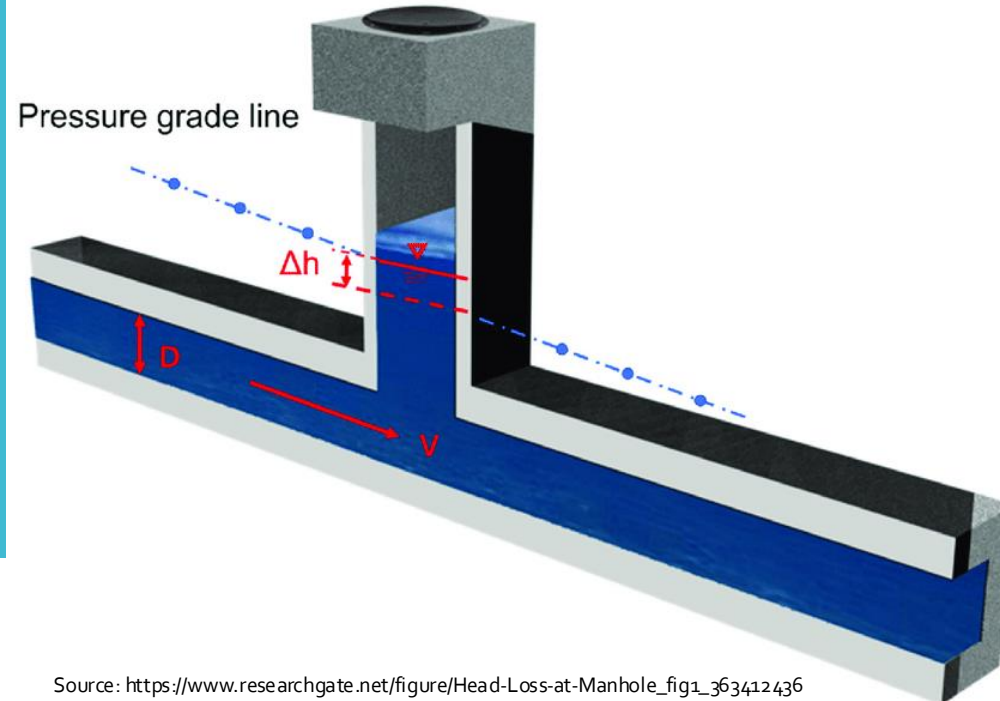
Pipes:

Minimum pipe slope



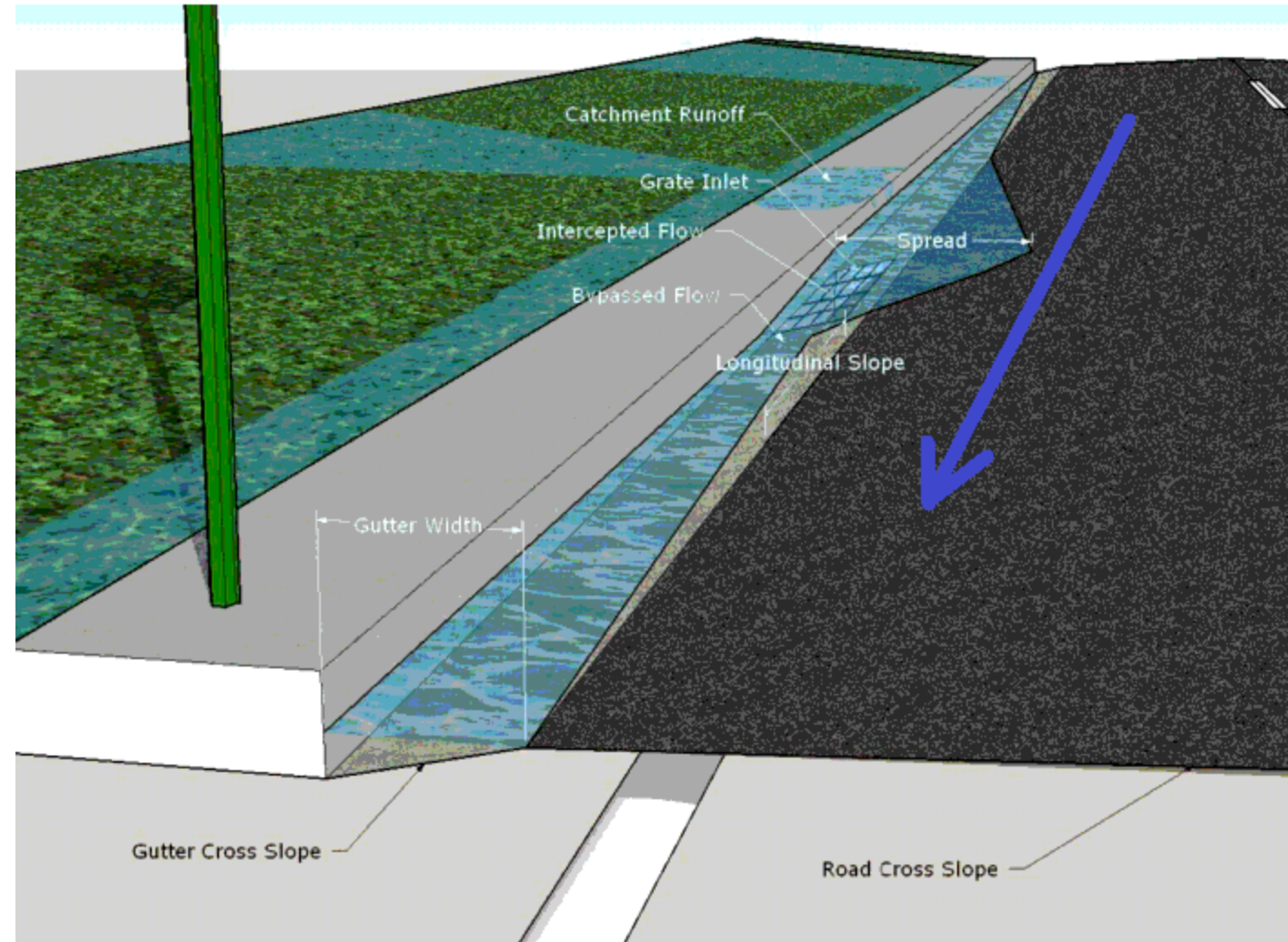
Archtoolbox

Source: <https://www.archtoolbox.com/pipe-slope/>



Source: https://www.researchgate.net/figure/Head-Loss-at-Manhole_fig1_363412436

Inlets: Spread and Interception



Source: https://bentleysystems.service-now.com/community?id=kb_article&sysparm_article=KB0057264

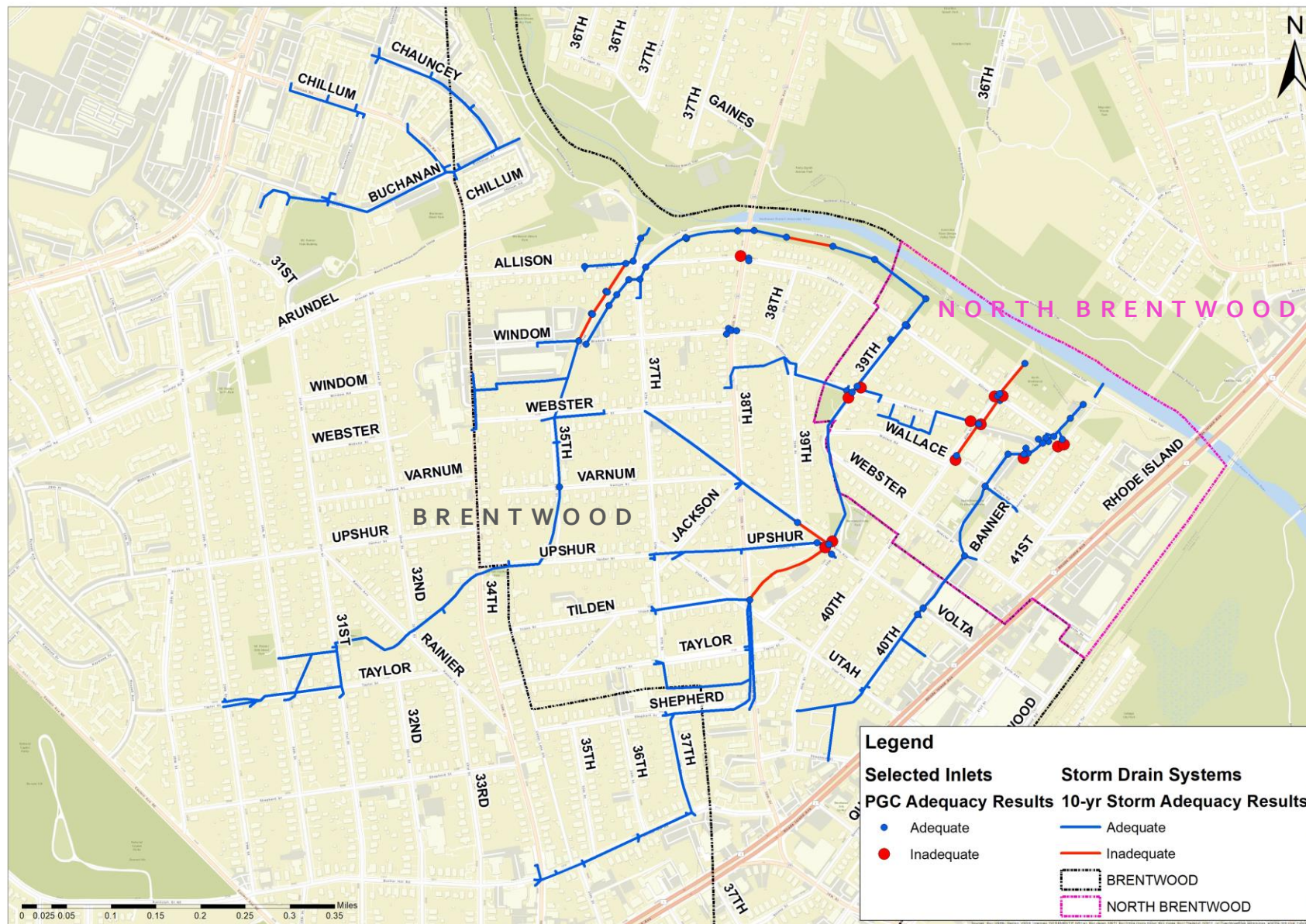
Results

17 out of 56 pipes (30%)
inadequate during 10-yr storm

19 out of 56 pipes (34%)
inadequate during 100-yr storm

14 out of 18 inlets (78%)
inadequate during 10-yr storm

All yard inlets are adequate



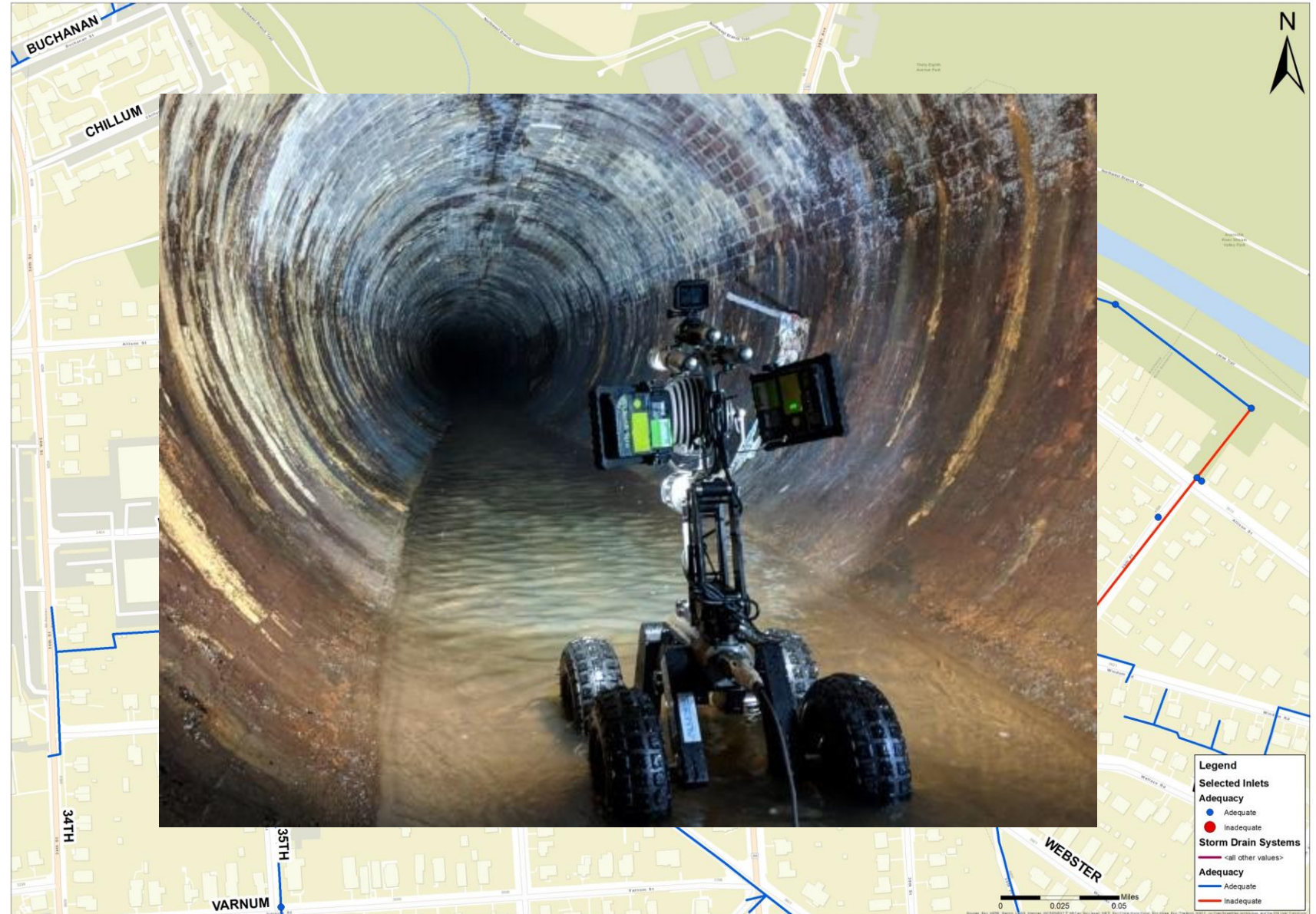
Conclusions and Recommendations

Storm Drain System

Focus on areas where pipes and inlets are both inadequate

Perform full survey and CCTV of system

Update inventory



Map Source: Base aerial by Esri, Maxar, Earthstar Geographics, and the GIS User Community. Informational layers provided by Prince George's County through the Clean Water Partnership . Adequacy data compiled from CPJ analysis. Map created by CPJ.

Image source: <https://www.allpipetechnologies.com.au/reason-why-a-cctv-drain-inspection-is-the-right-option-for-your-pipes/>

System Maintenance

Regular targeted
maintenance

Repairs

Litter reduction campaign

Resident outreach



General

Review pump station operations and triggers

Further investigation into areas experiencing issues outside of modeled areas



Questions?

- Kim Truong, PE ktruong@cpja.com , CPJ
- Antony (Tony) Osei, EIT, MBA aosei@cpja.com , CPJ
- Anusree Nair, anusree.nair@ppd.mncppc.org, M-NCPPC