EOR TASK ORDER 1:

Flood Modeling Update, Risk Assessment, and Alternatives Analysis for Commonwealth Ave & E. Glebe Rd, and Ashby St & E. Glebe Rd

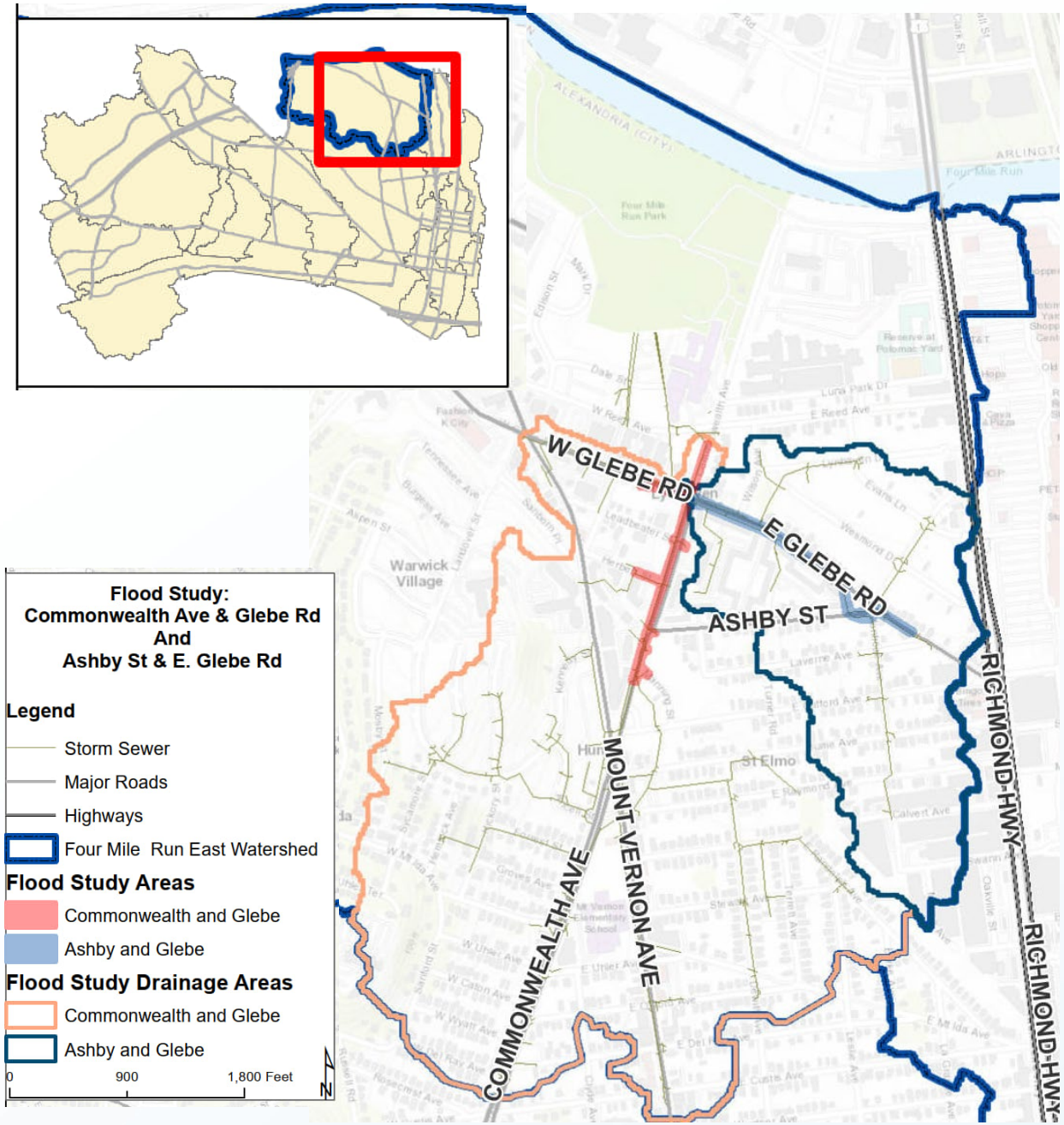
Ad Hoc Stormwater Utility and Flood Mitigation Advisory Group Meeting

December 15, 2022

Engineer of Record (EOR) Stormwater Management: Design and Construction Management – RFQU929

Presented to:
City of Alexandria, VA

Jacobs
Challenging today.
Reinventing tomorrow.



Project Goals

- Quantify flood inundation risk at two intersections
  - Commonwealth Ave & Glebe Road
  - Glebe Road & Ashby Street
- Develop concept plans for optimal set of feasible and cost-effective solutions to reduce flooding in these two intersections
- Conduct risk assessment to justify the project benefit

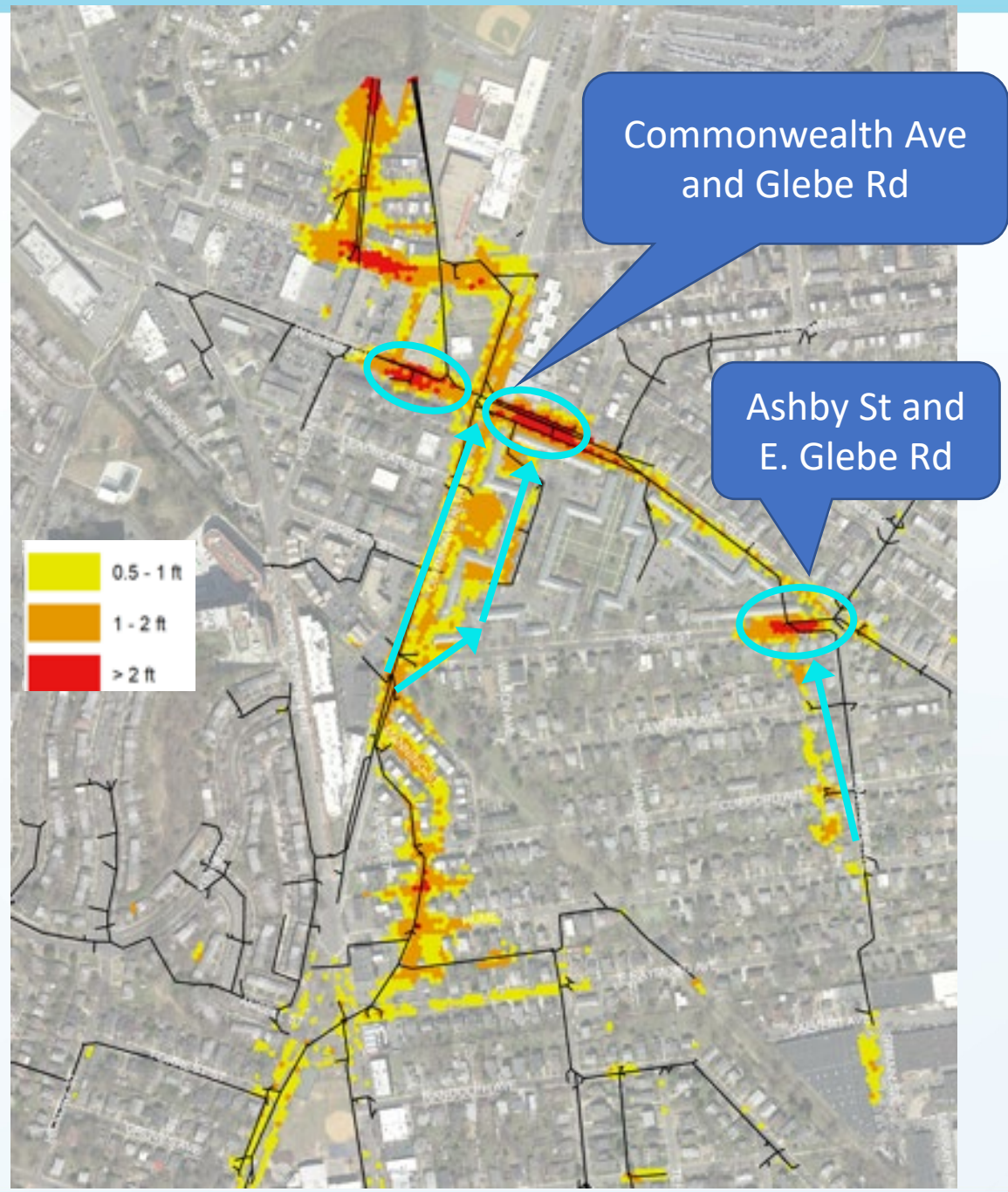
Project Approach:

- Update existing computer models (from 2016 CASSCA study) to study flooding at 2 intersections
- Use optimization to identify a preferred solution to reduce flooding
- Develop concept plans for the preferred solution for current and 2070 10-year storm
- Evaluate performance for the 25-year storm projected for 2070.
- Estimate monetary losses before and after the proposed solution to quantify project benefits
- Expand modeling and optimization to remainder of Four Mile Run East Watershed

Understanding of Current Flooding

- The existing storm sewer system was not sized to today's design standard (10-year design storm) due to old construction and climate change
- For larger storms that exceed pipe capacity, excess water flows on the surface either down streets, along low-lying parking areas or behind homes.
- Excess flow travels overland to low points where it pools until it drains to Four Mile Run. Low points include:
  - Ashby Street south of Glebe
  - Glebe east of Commonwealth
  - Glebe west of Commonwealth

Current condition flooding with 10-year design storm, showing overland flow down streets and through back yards and parking lots, ending up at two flooded intersections



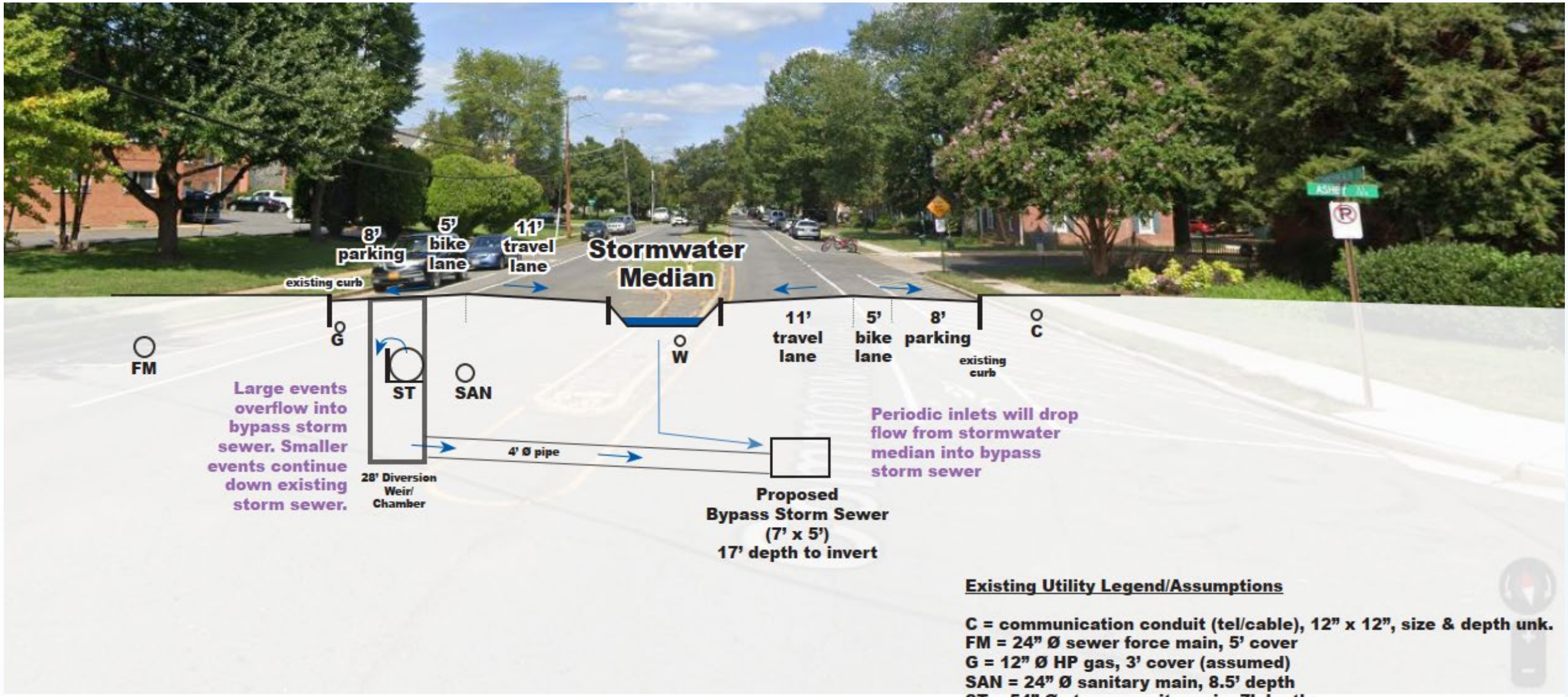
Proposed solution includes 1.5 miles of large storm sewer pipes, and green infrastructure

- New bypass storm sewer on Commonwealth from Ashby to Four Mile Run, with stormwater swale
- New bypass storm sewer on Glebe from Commonwealth to Ashby
- Replacement/parallel pipe on Montrose from Calvert to Glebe
- Drainage structures & local conveyance upgrades

Legend

- Proposed Diversion Structure
- Proposed Parallel Storm Sewer or Replacement (size varies)
- Proposed Bypass Sewer (size varies)
- Proposed Green Infrastructure

Commonwealth Avenue Corridor Concept



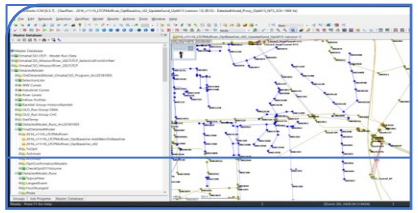
Existing Utility Legend/Assumptions

C = communication conduit (tel/cable), 12" x 12", size & depth unk.
FM = 24" Ø sewer force main, 5' cover
G = 12" Ø HP gas, 3' cover (assumed)
SAN = 24" Ø sanitary main, 8.5' depth
ST = 54" Ø storm gravity main, 7' depth
W = 6" Ø water main, 4' cover (assumed)

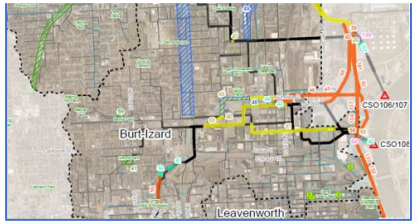
Optimization Approach Allows Evaluation of 1000s of Options

Leveraging the hydraulic model with cloud computing and advanced algorithms to systematically search for better solutions

Computer Model



Project Options



Performance Criteria

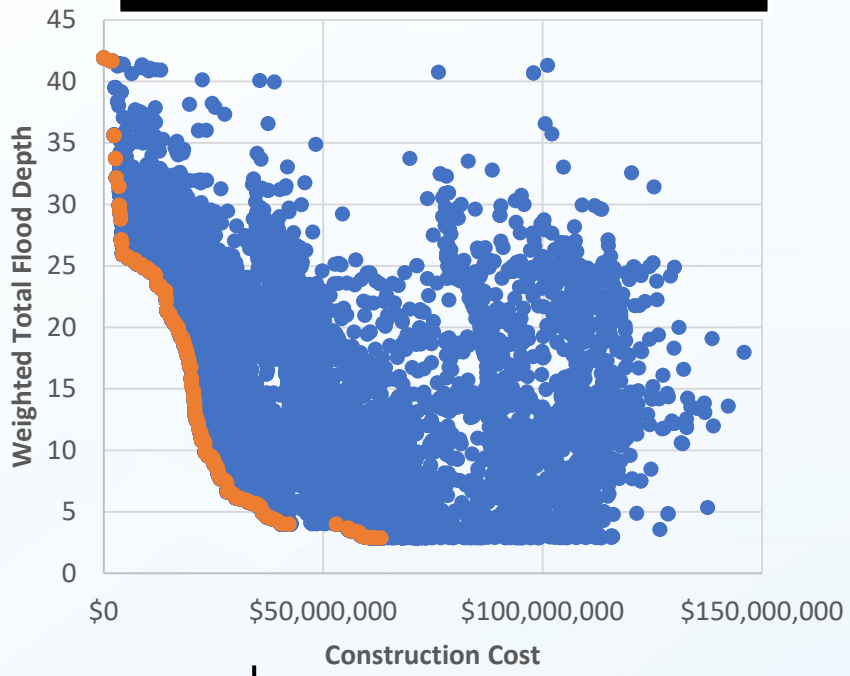
- Cost
- Flood Depths

Optimizer Software

- Automation
- Computational Power
- Algorithms

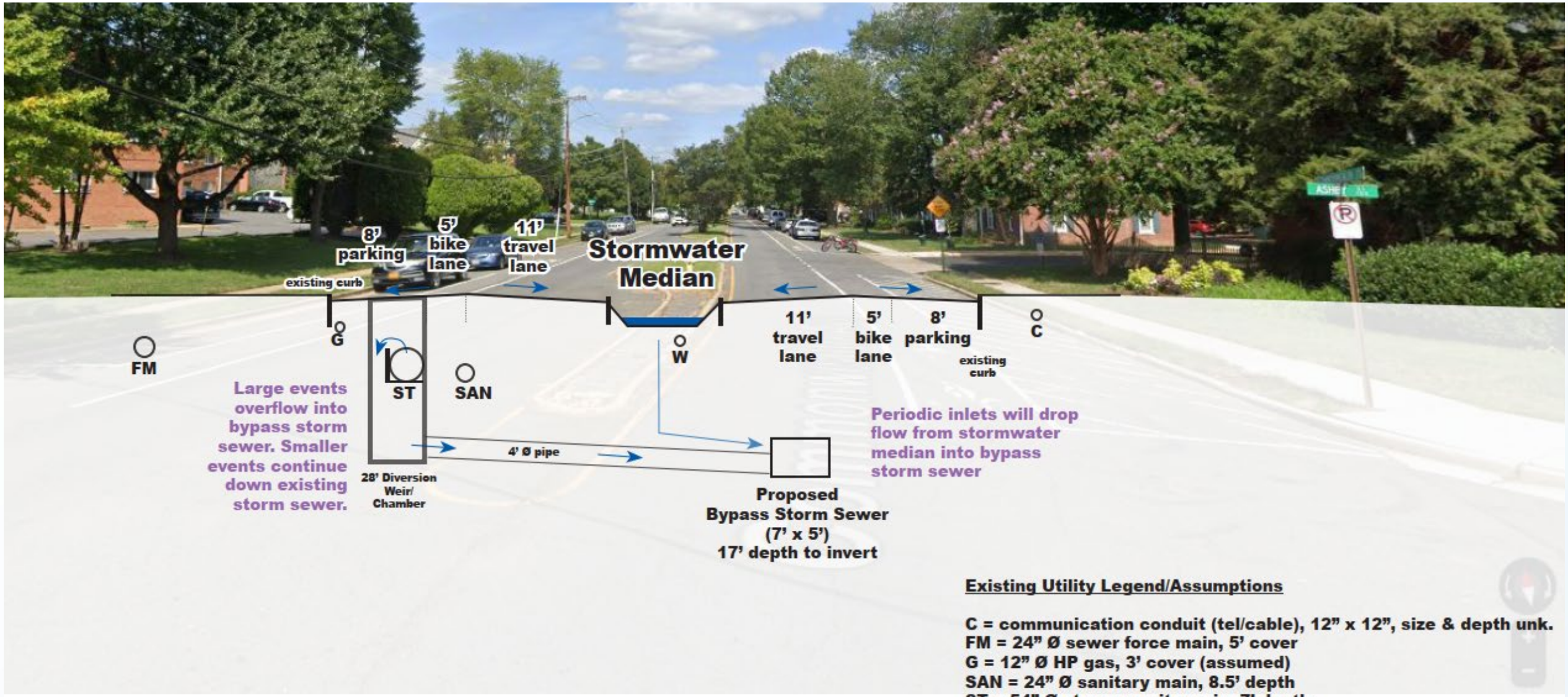
- Evaluates 100s of thousands of solutions (combinations of drainage pipe sizes and alignments, and storage sizes and locations)
- Identifies least cost solutions for each level of performance

Results



Validate high-performing solutions

Commonwealth Avenue Corridor Concept

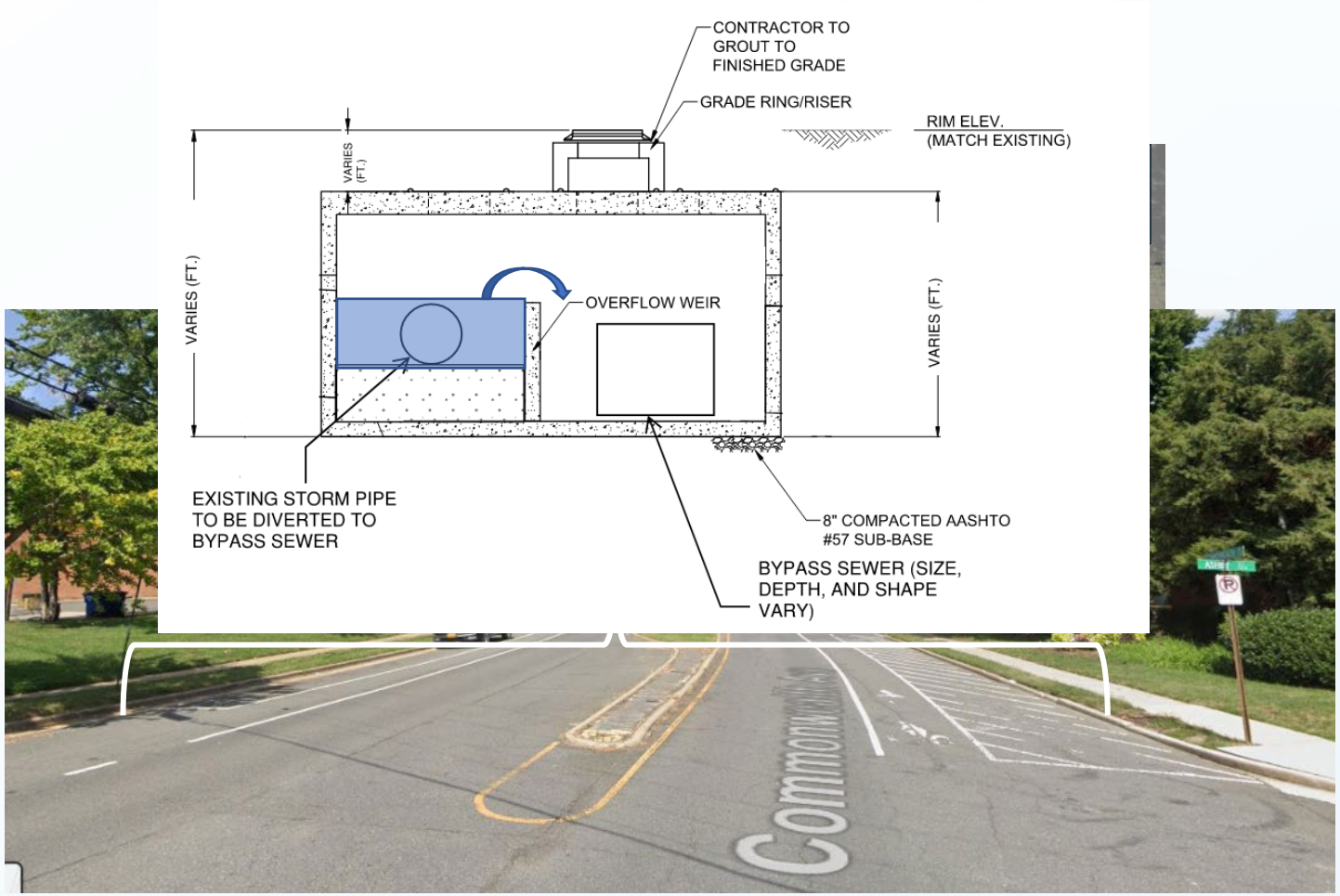


Existing Utility Legend/Assumptions

C = communication conduit (tel/cable), 12" x 12", size & depth unk.
FM = 24" Ø sewer force main, 5' cover
G = 12" Ø HP gas, 3' cover (assumed)
SAN = 24" Ø sanitary main, 8.5' depth
ST = 54" Ø storm gravity main, 7' depth
W = 6" Ø water main, 4' cover (assumed)

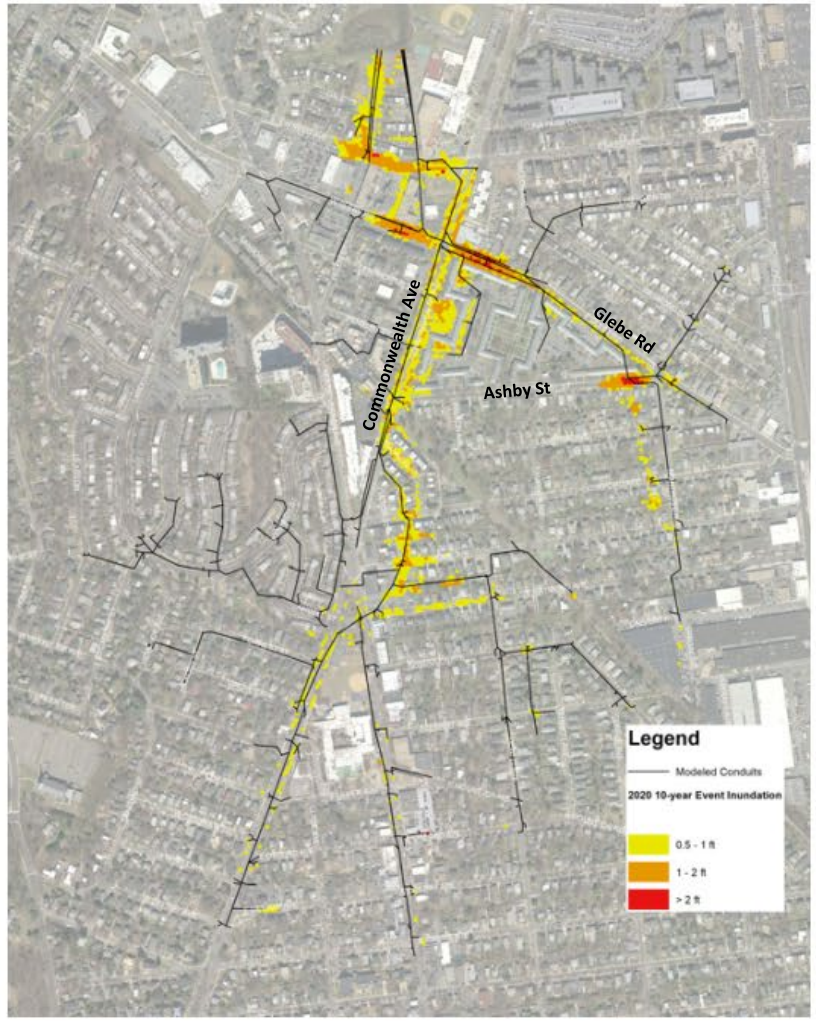
Proposed Design Assumptions

- Divert excess flow from existing storm sewers into new relief sewers in a diversion structure
- Capture surface flow from upstream system
- Locate new drainage system, and green stormwater infrastructure in the public right-of-way.
- Limit of disturbance within the street – no work outside road (e.g., sidewalks, streetlights, vegetation.)
- Avoid existing utilities where possible, but assume that some utility relocation will be required
- Add extra protection when feasible.

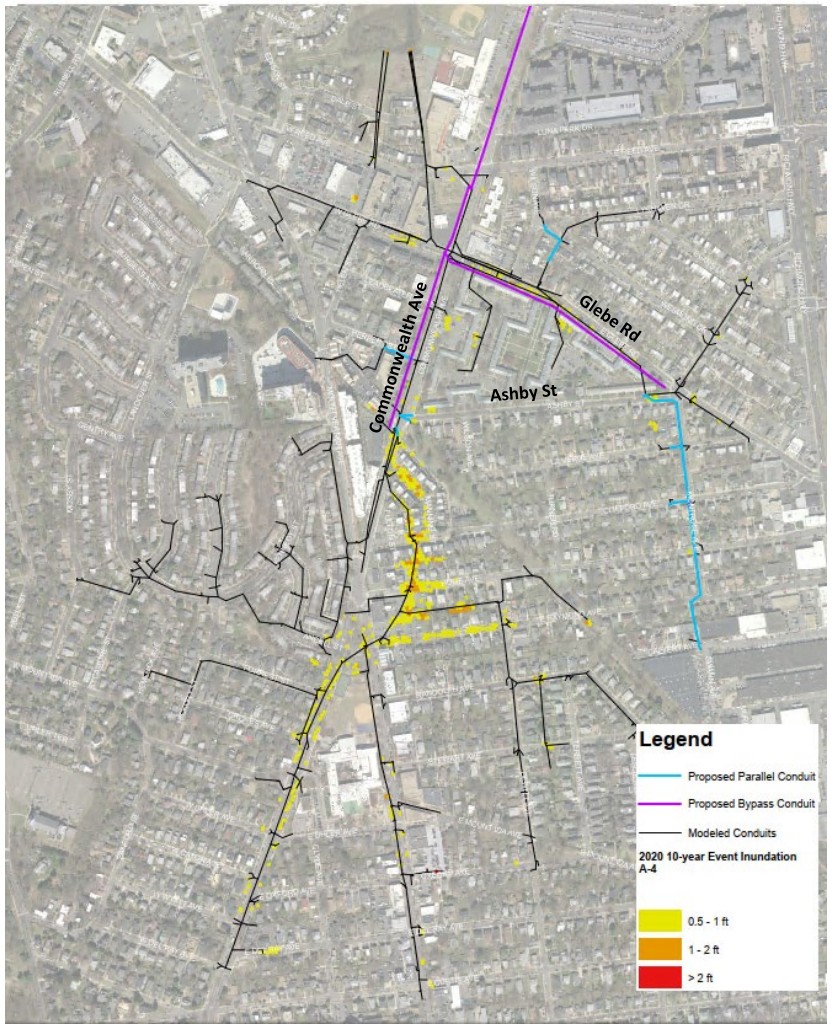


Both size alternatives resolve current 10-year flooding

Current Storm Sewers with Current 10-Year Storm



Alternative A-4 with Current 10-Year Storm



Alternative A-4 Upsized with Current 10-Year Storm

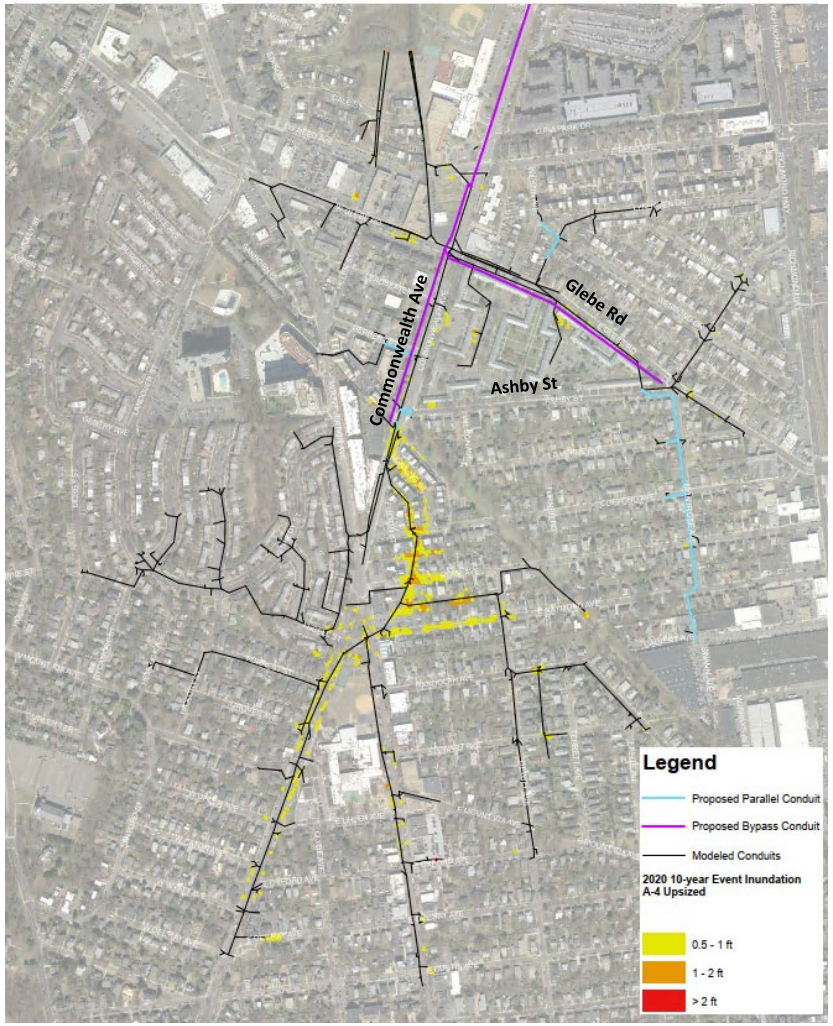
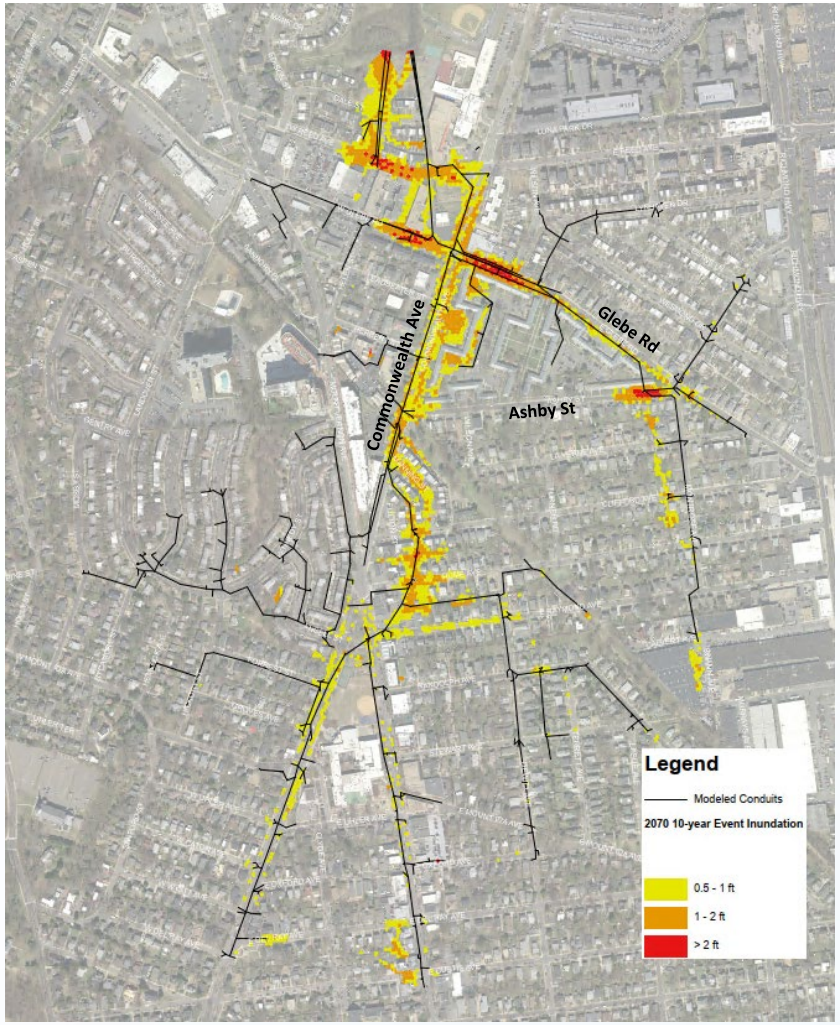


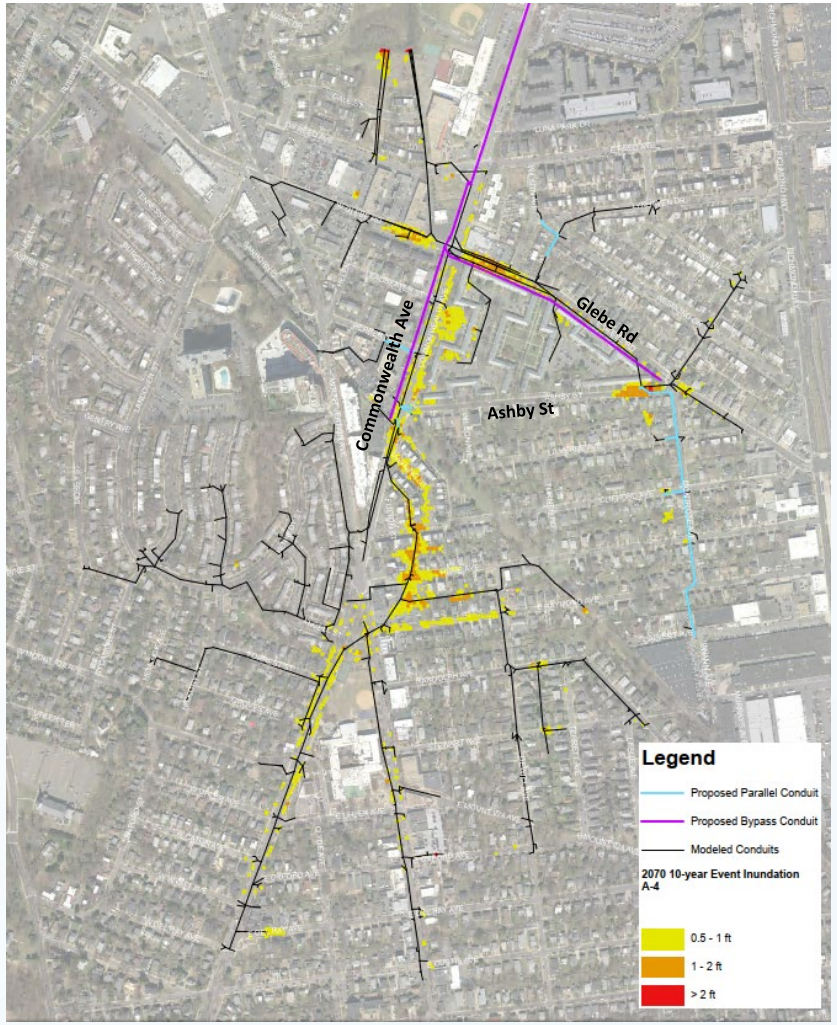
Figure 16. Current (Year 2020) 10-Year Storm Predicted Flood Inundation under Current Conditions and Preferred Alternatives

Upsized alternative resolves future (2070)10-year flooding

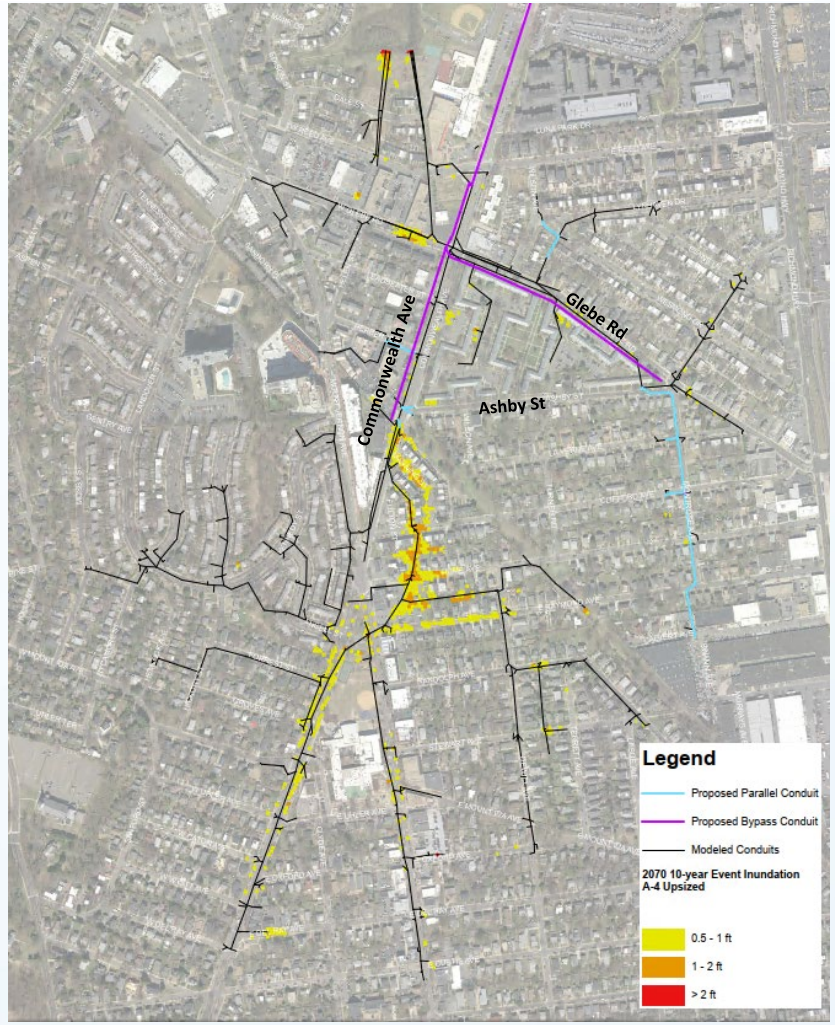
Current Storm Sewers with Future 10-Year Storm



Alternative A-4 with Future 10-Year Storm

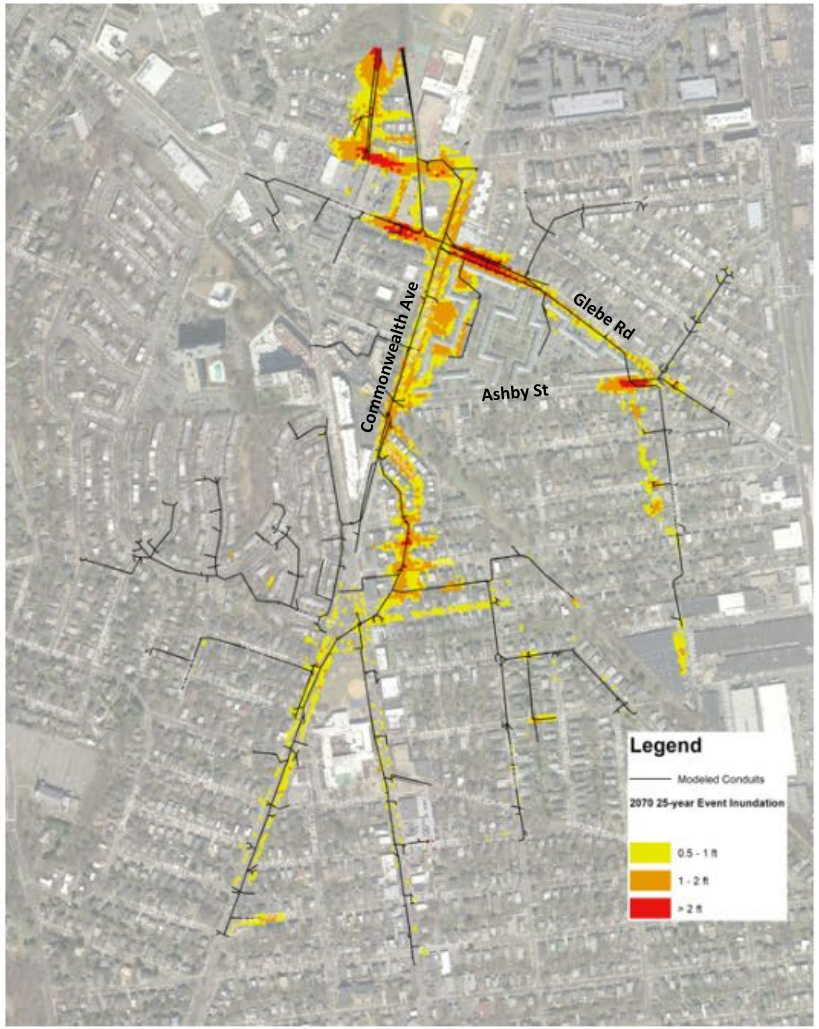


Alternative A-4 Upsized with Future 10-Year Storm

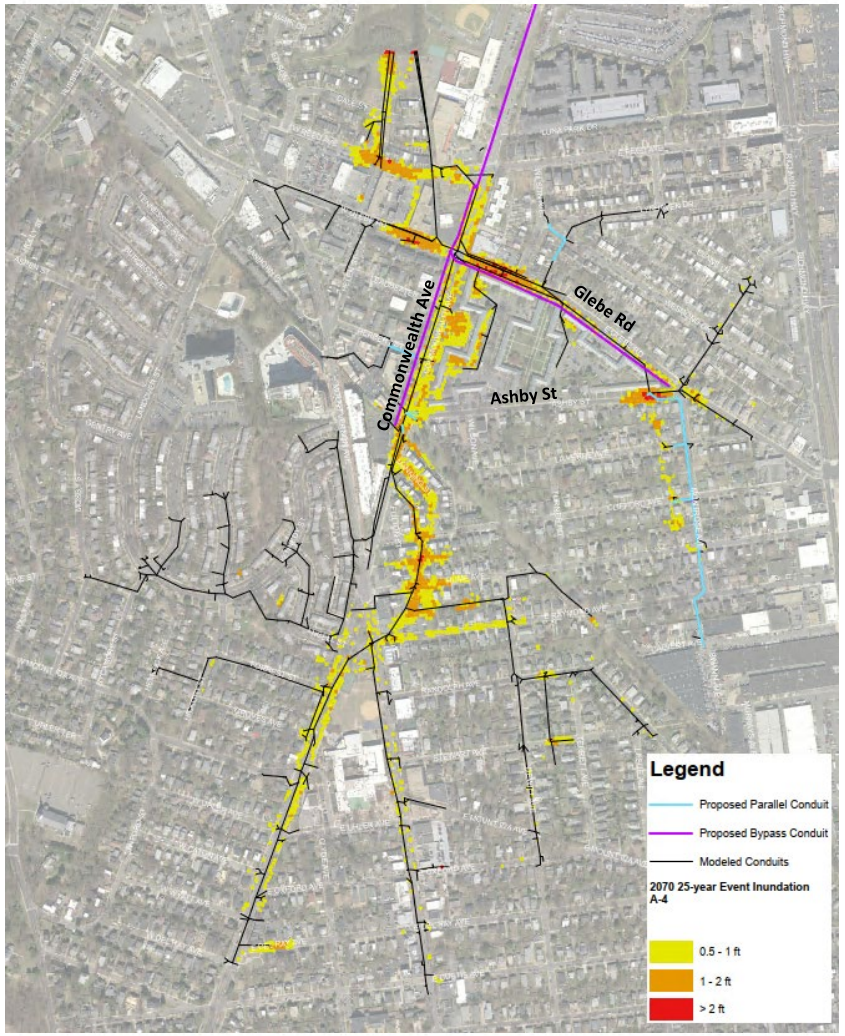


Upsized version provides additional service for the larger storm events (2070 25-year storm)

Current Storm Sewers with Projected 25-Year Storm



Alternative A-4 with Projected 25-Year Storm



Alternative A-4 Upsized with Projected 25-Year Storm

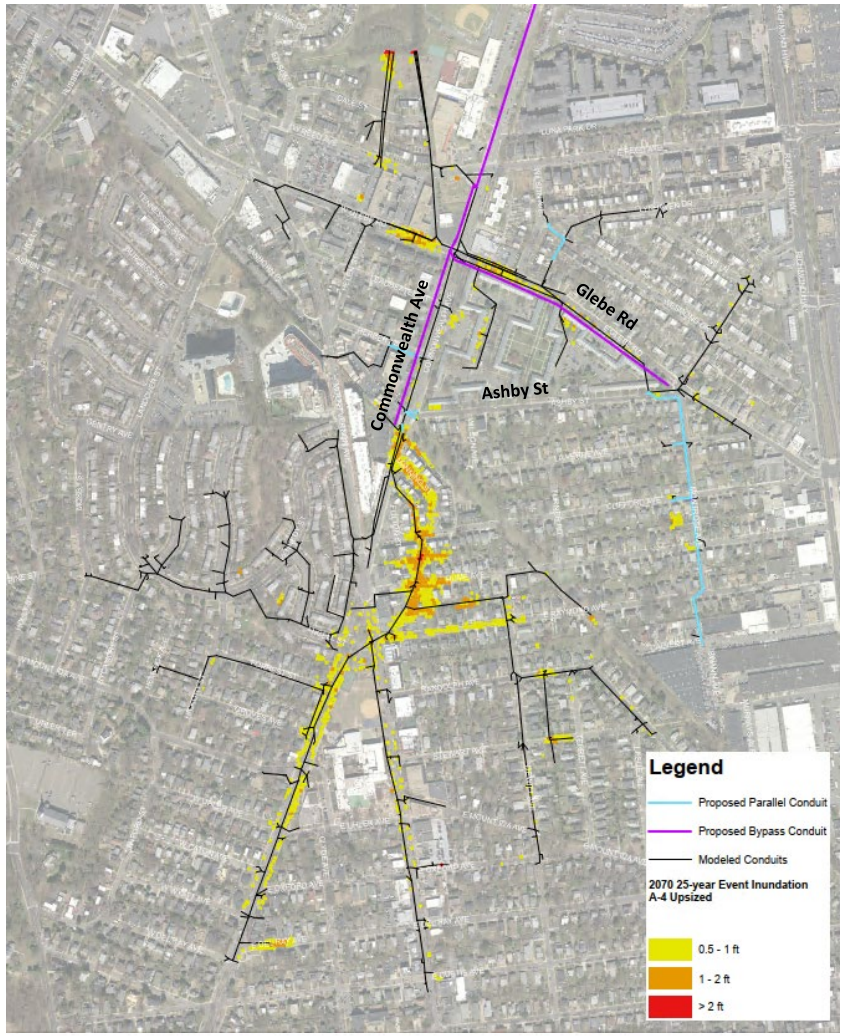


Figure 17. Future (Year 2070) 25-Year Storm Predicted Flood Inundation under Current Conditions and Preferred Alternatives

Benefit-cost analysis justifies the proposed project, including increasing the size to the extent feasible within site constraints

	Alternative A4	Alternative A-4 Upsized
Total Cost (PV)	$34.0M ($29M-$44M)	$35.2M ($30M-$46M)
Total Benefits (PV)	$43.6M	$48.4M
Net Present Value (NPV)	$9.6M	13.2M
Benefit-Cost Ratio	1.3	1.4

Presented in 2022 Dollars
NPV = Net Present Value, calculated over 50-year planning horizon, assuming 50-year service life for underground systems (pipes, inlets and diversion structures), and a 20-year service life for green infrastructure systems above ground.

Considerations Moving Into Detailed Design

Balance of stakeholder wants and needs

- City
  - Minimize flooding at planned cost (anticipate and control changes)
  - Control schedule – Start early on long schedule items e.g., utilities and permitting
  - Minimize additional maintenance requirements
  - Resilience for the future
- Citizens
  - Minimize flooding & maximize resilience
  - Minimize construction impacts – duration and extent
    - Traffic, parking, access to homes, noise
- Contractor
  - Provide flexibility to maximize productivity
    - Work hours
    - Work areas & staging areas
    - Construction methods

Next Step

- **Design Definition.** Refine the definition of what the design requirements are and what will be included and not included in the proposed design
- **Data Collection**
  - Topographic survey
  - Subsurface utility locations
  - Geotechnical investigations
- **Follow-on Projects.** Identification and prioritization of projects upstream of the problem area and in the remainder of Four Mile Run East Watershed.

Extra Slides