2017 Ellicott City Hydrology & Hydraulic (H&H) Study

Prepared for Howard County Stormwater Management Division

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Discussion Items

- Background
- Existing Conditions and Model
- Conceptual Improvements
- Next steps

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Background

What does the flood model do?

- Determines quantity of water through the town
- Main St/Frederick Road From US 29 to the Patapsco River
  - Amount, depth, velocity of water
  - July 30, 2016 Storm
  - “Standard” storms like the “100-year”

Background

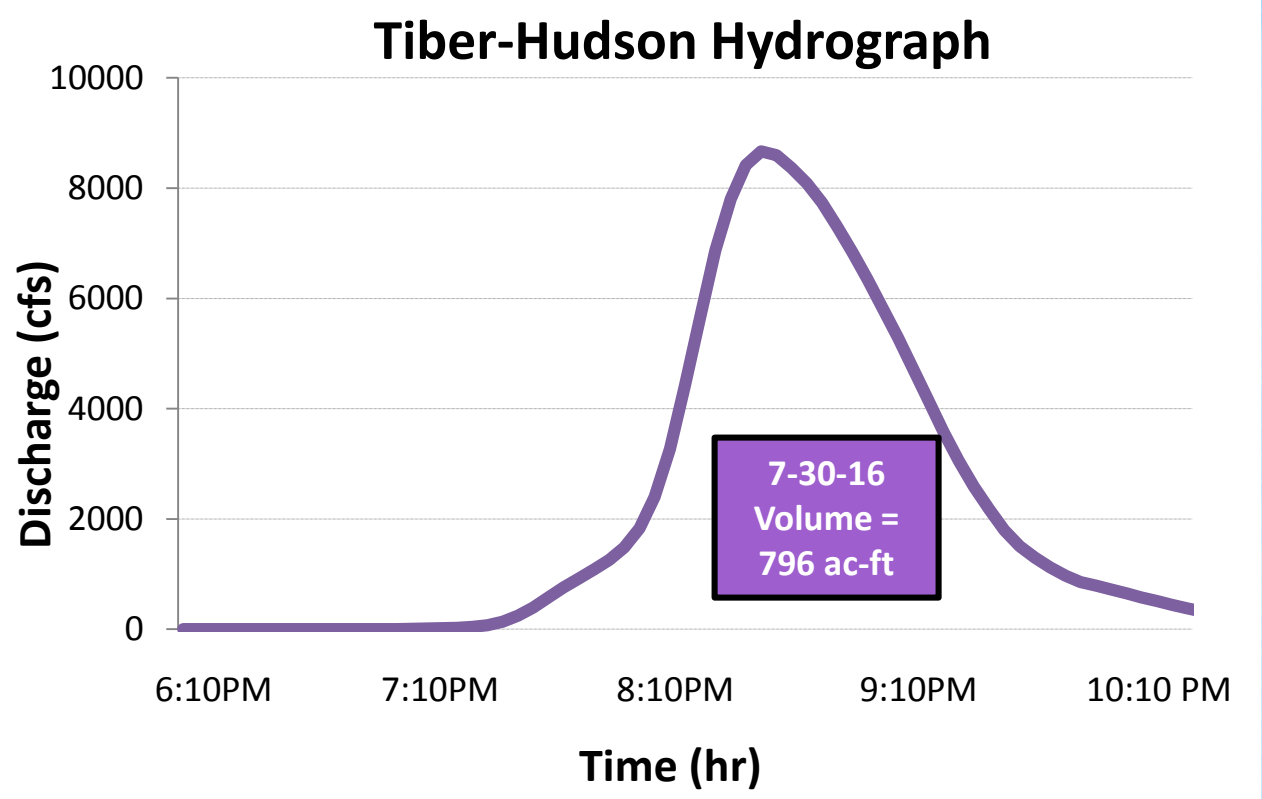
What is the “100-year Storm”?

- Has a 1% chance of happening in a given year (1 in 100)
  - 10 year storm has 10% chance (1 in 10)
  - 25 year storm has 4% chance (1 in 25)
- Can certainly happen more frequently
- The “1% Storm” is about 8.5 inches in 24 hours

Background

What is a “Hydrograph”?

- Demonstrates the peak flow over time of a storm event
- Distribution of flow intensity
- Peak flow in cubic feet per second (cfs)
- The area under the curve is the total storm volume in cubic feet (34.7 million!)…
- …or, often expressed in “acre-feet”



Background

How much is an acre-foot (ac-ft)?

- 1 foot of water over a 1 acre area (43,560 cubic feet)

For example…

- Parking Lot F (behind the Wine Bin)
- Approximately 1 acre in size
- 1 foot of water over Lot F = 1 acre-foot

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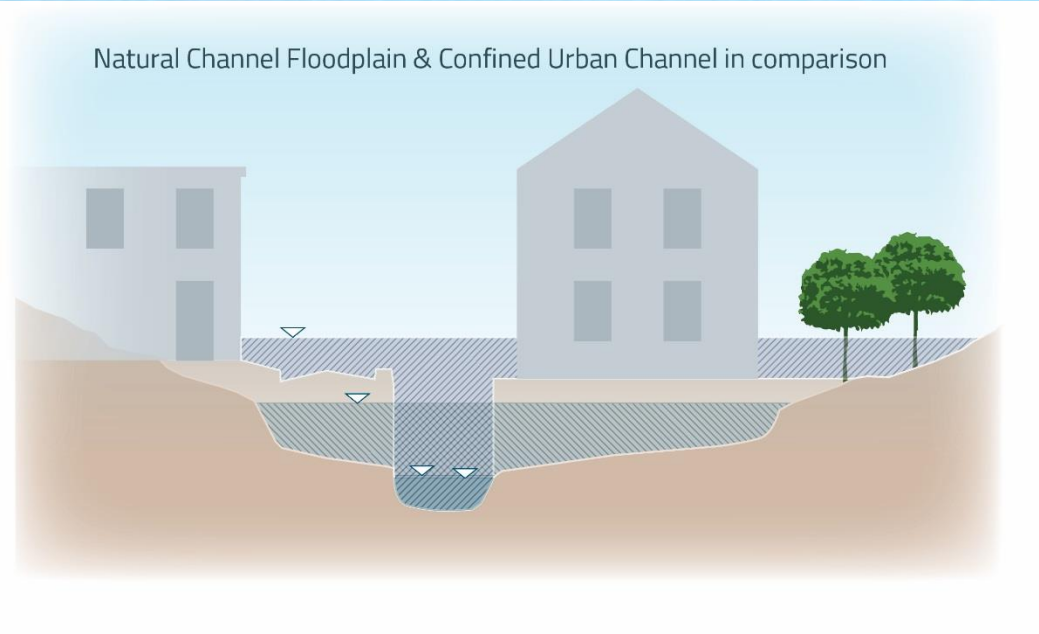
Background

Why does Ellicott City flood?

- "Built on a floodplain"



- Watershed development plays a role…but not the whole story

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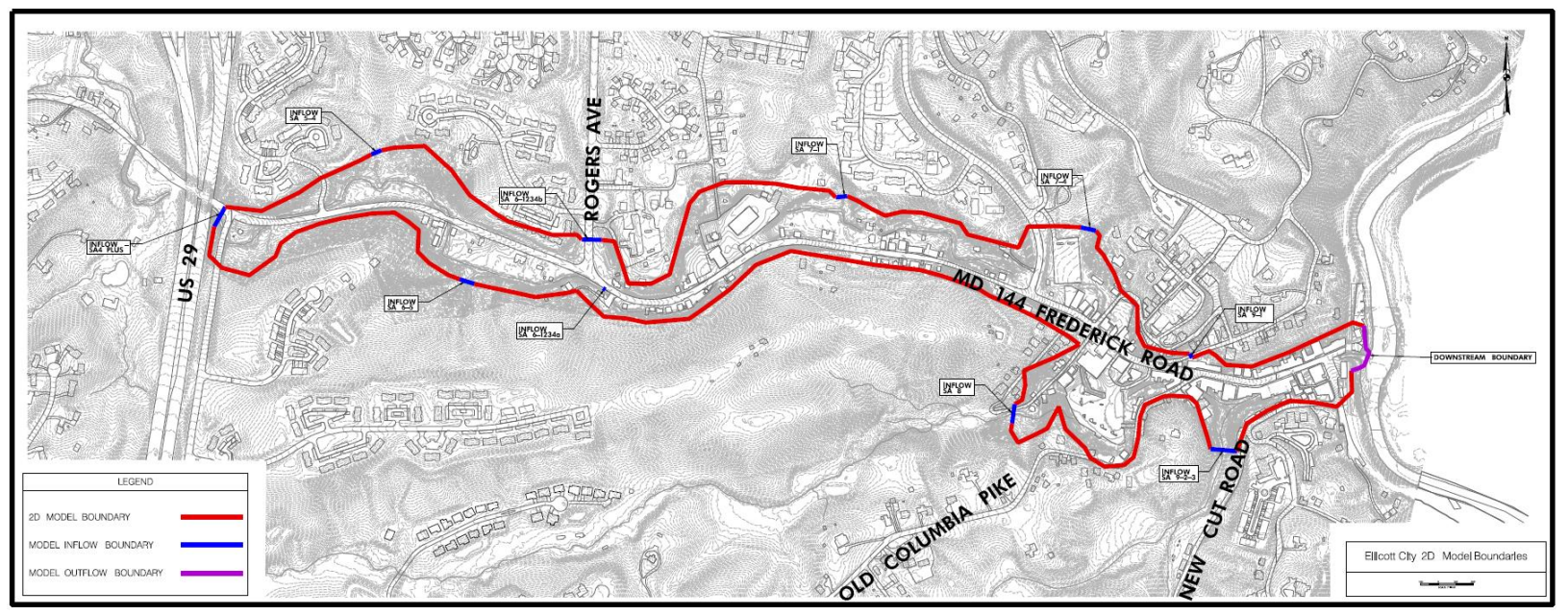
Modeling

2D Hydraulic Model from US 29 to Patapsco River

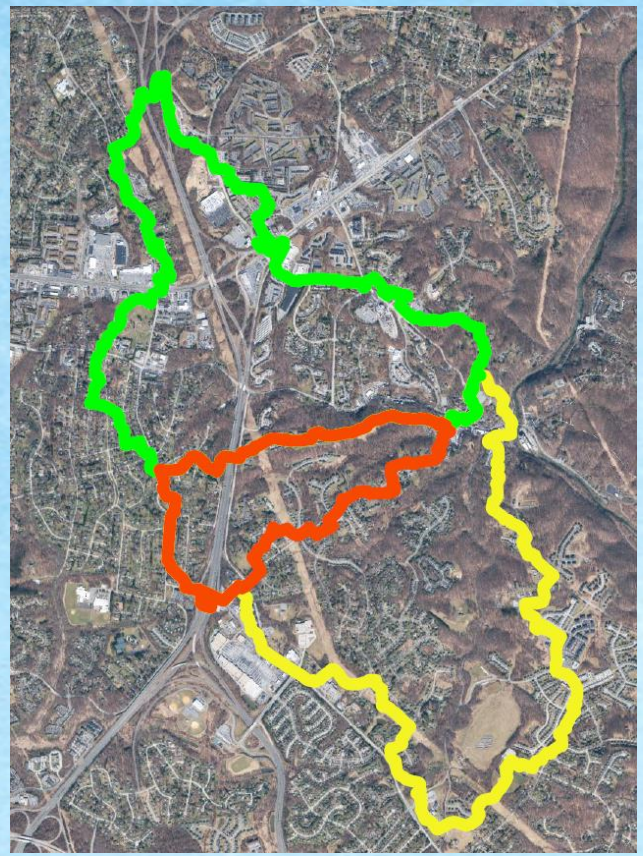
- Hudson Branch along Main St.
- Includes confluences with New Cut and Tiber Rivers



Watershed Hydrology

- Entire Tiber River Watershed – 3.7 sq.mi.
  - Hudson Branch – 1.55 sq.mi.
  - Tiber Branch – 0.54 sq.mi.
  - New Cut Branch (includes Autumn Hill Branch) – 1.55 sq.mi.

- Peak Flow Determination
  - 9 separate inflow points along Main St.
  - Considered 64 existing SWM BMPs
  - “Undeveloped” (All Woods) Scenario



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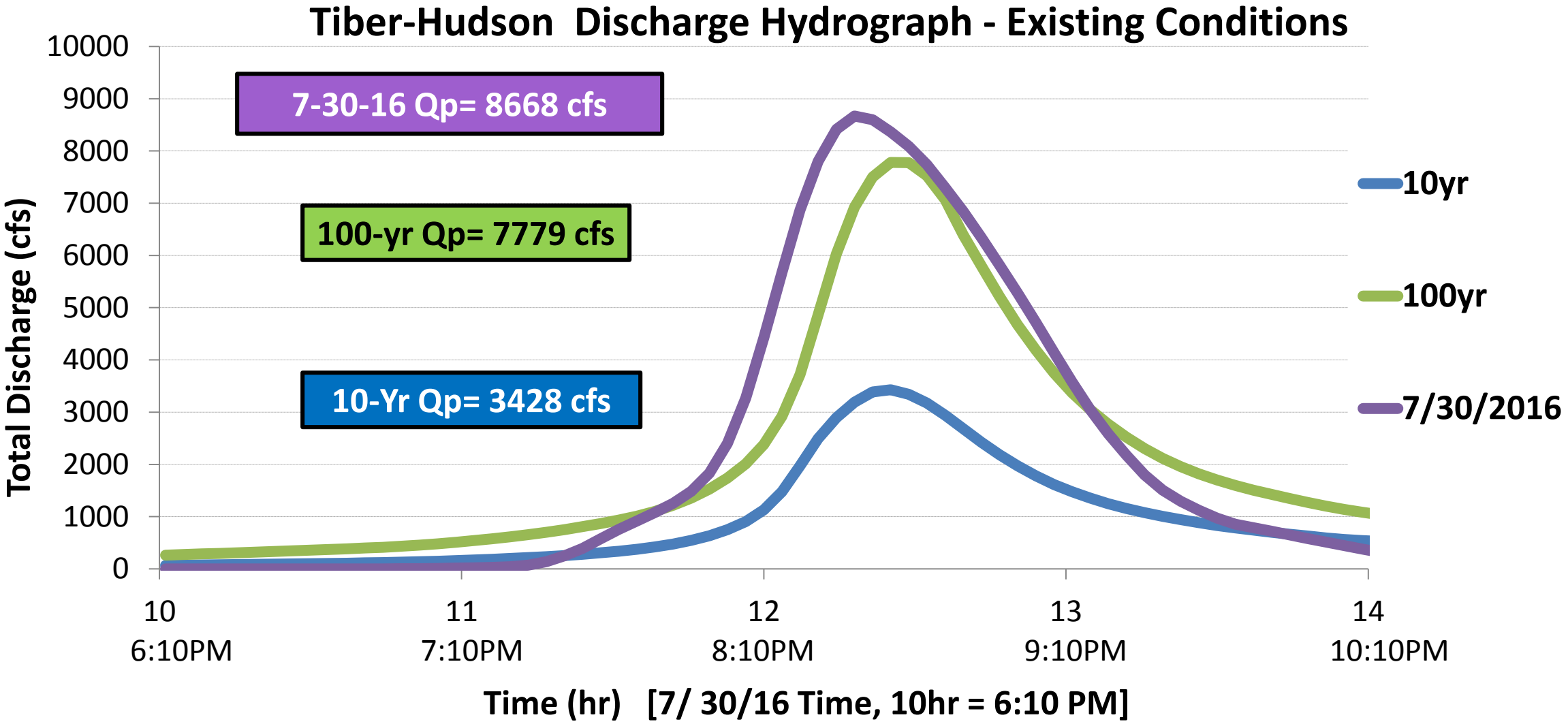
Watershed Hydrology

- Multiple Storm Scenarios
  - 100-year (a.k.a. 1%) 24-hour storm is the baseline
  - 10-year also examined
  - Recreated the 7/30/16 event (6.6 inches in 2+ hours)

- Used storm data from 7/30 to create and check the model
  - NWS rainfall data (3 minute intensity)
  - USGS channel measurements (to estimate flow)
  - Storm Reports and YouTube videos (to check model depth)

Storm Event Hydrographs – Peak Discharge



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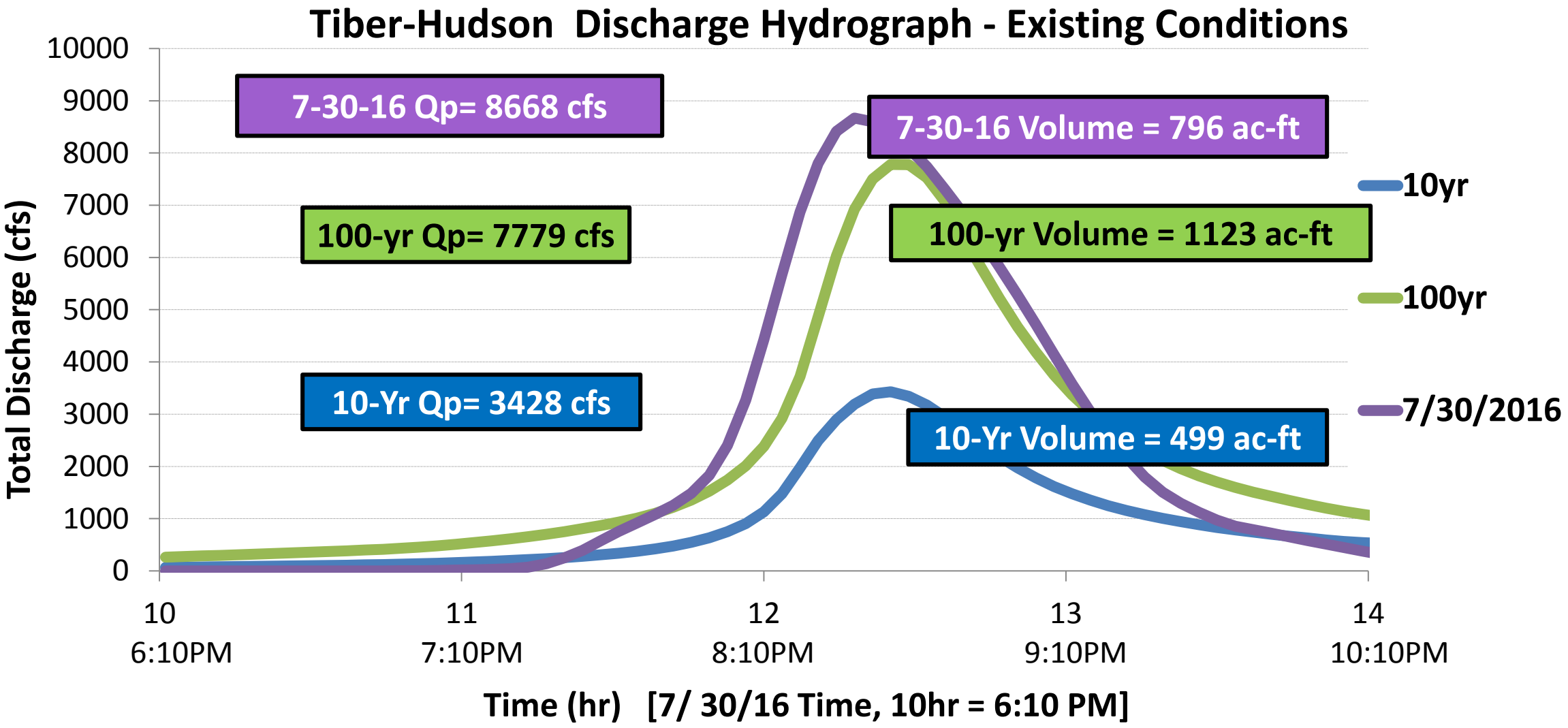
Storm Event Hydrographs – Runoff Volume



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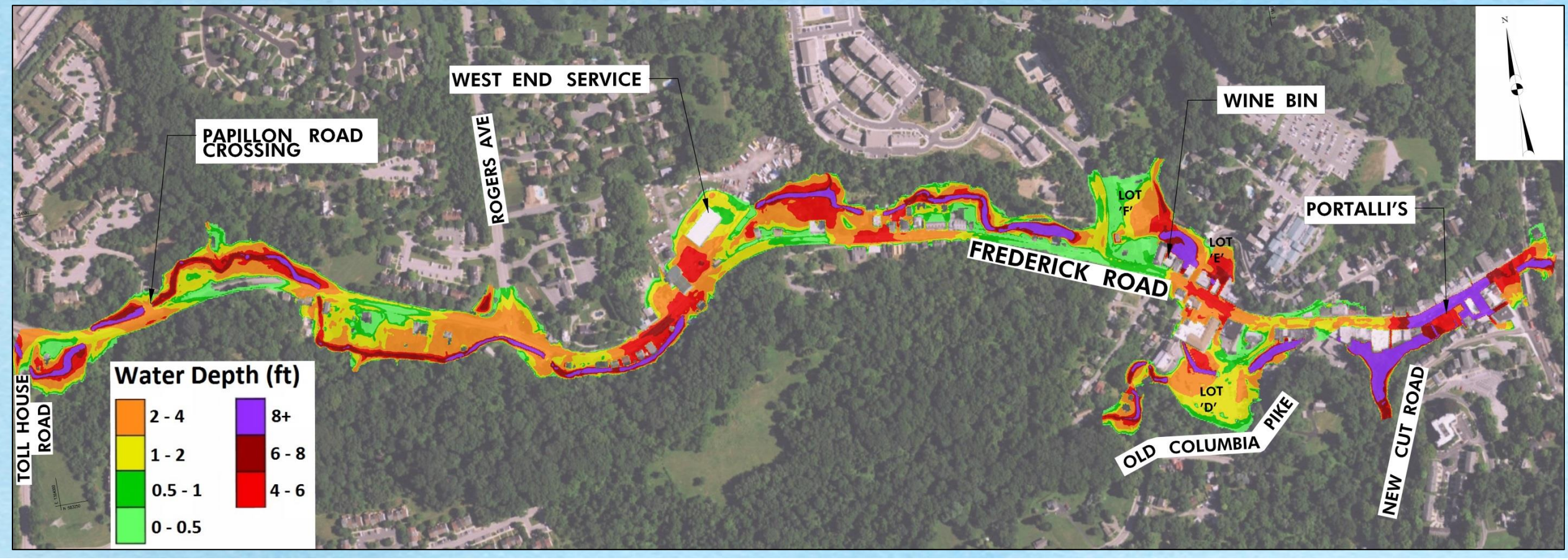
7/30/16 Hydraulic Analysis



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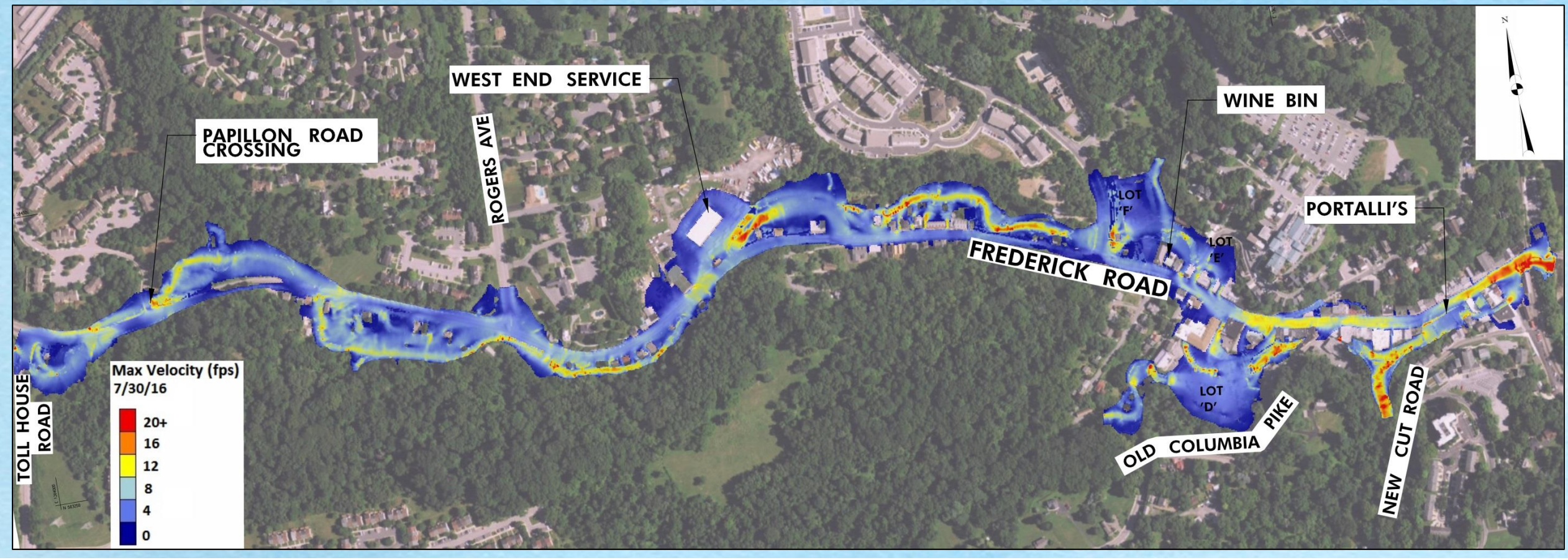
7/30/16 Hydraulic Analysis



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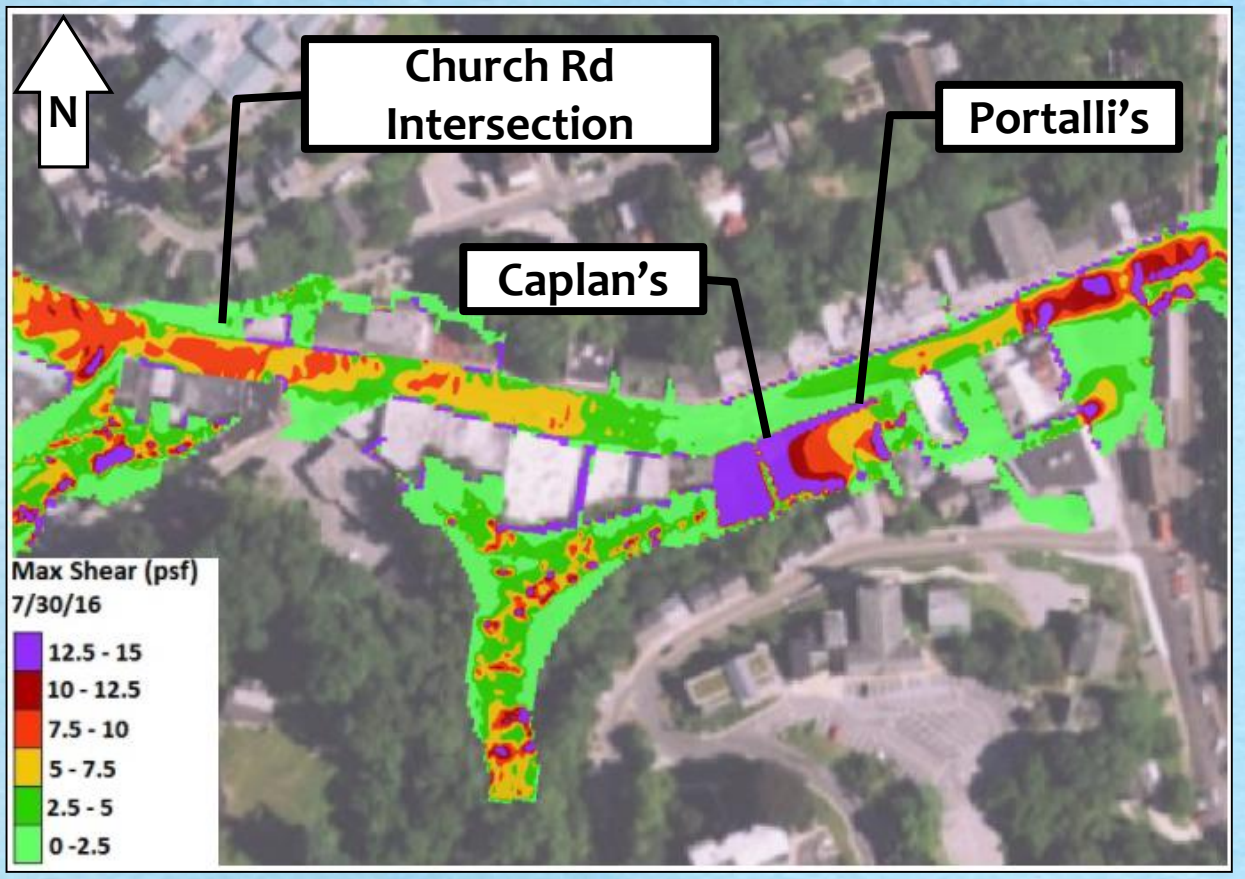
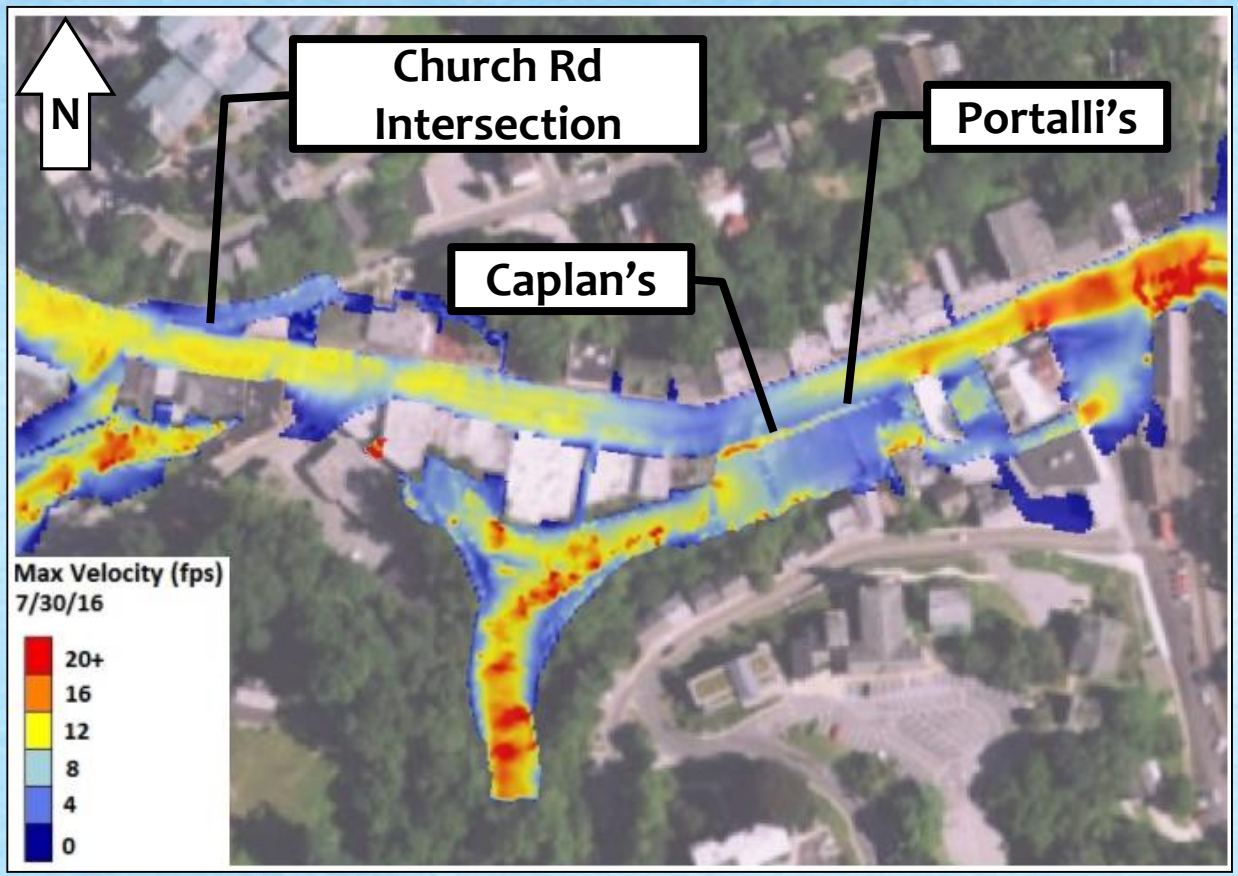
7/30/16 Hydraulic Analysis





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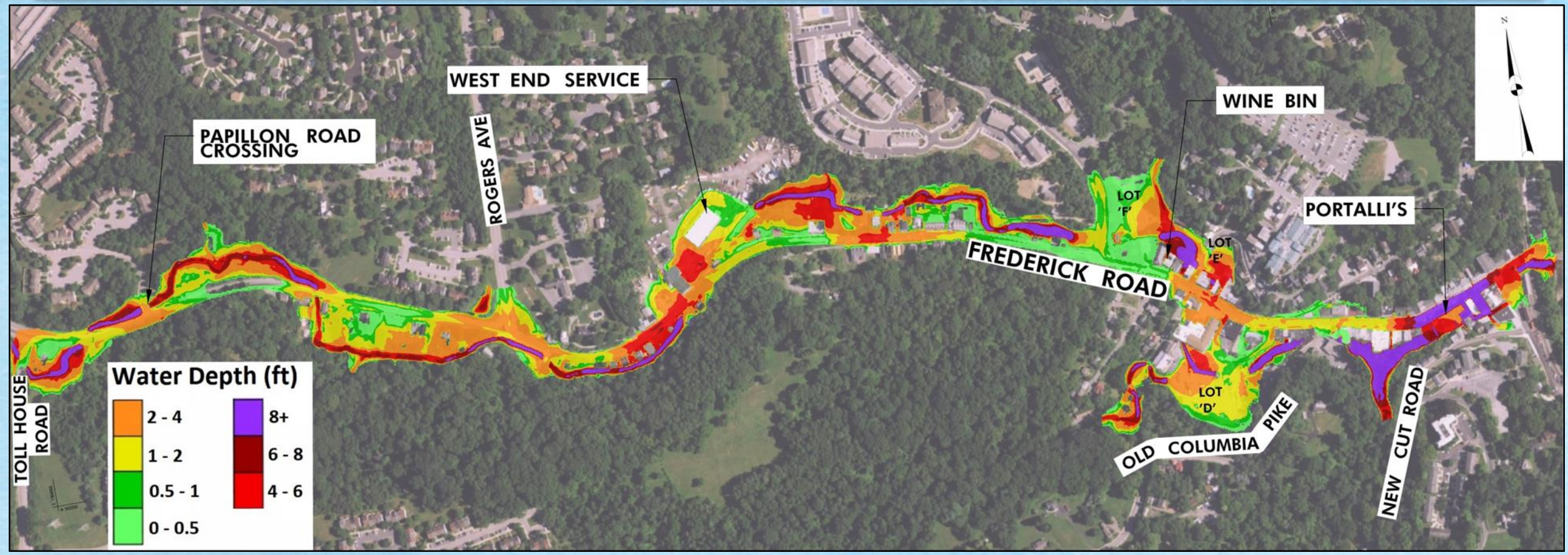
Modeling Results

100 yr – Existing



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Part 1 - Questions

QUESTIONS ON MODELING AND EXISTING CONDITIONS?

Mitigation Strategy

Improvement Concepts Reflect Public Input

- Stormwater Management (SWM) Improvements
  - Large online storage ponds
  - Underground Management
  - Analysis of Existing SWM Pond Expansion

- Capacity Improvements
  - Additional culverts along Main St. in West End
  - Supplemental Cross Culverts
  - Additional Flow Conveyance at Lower Main St.

Property Impacts are only conceptual at this point

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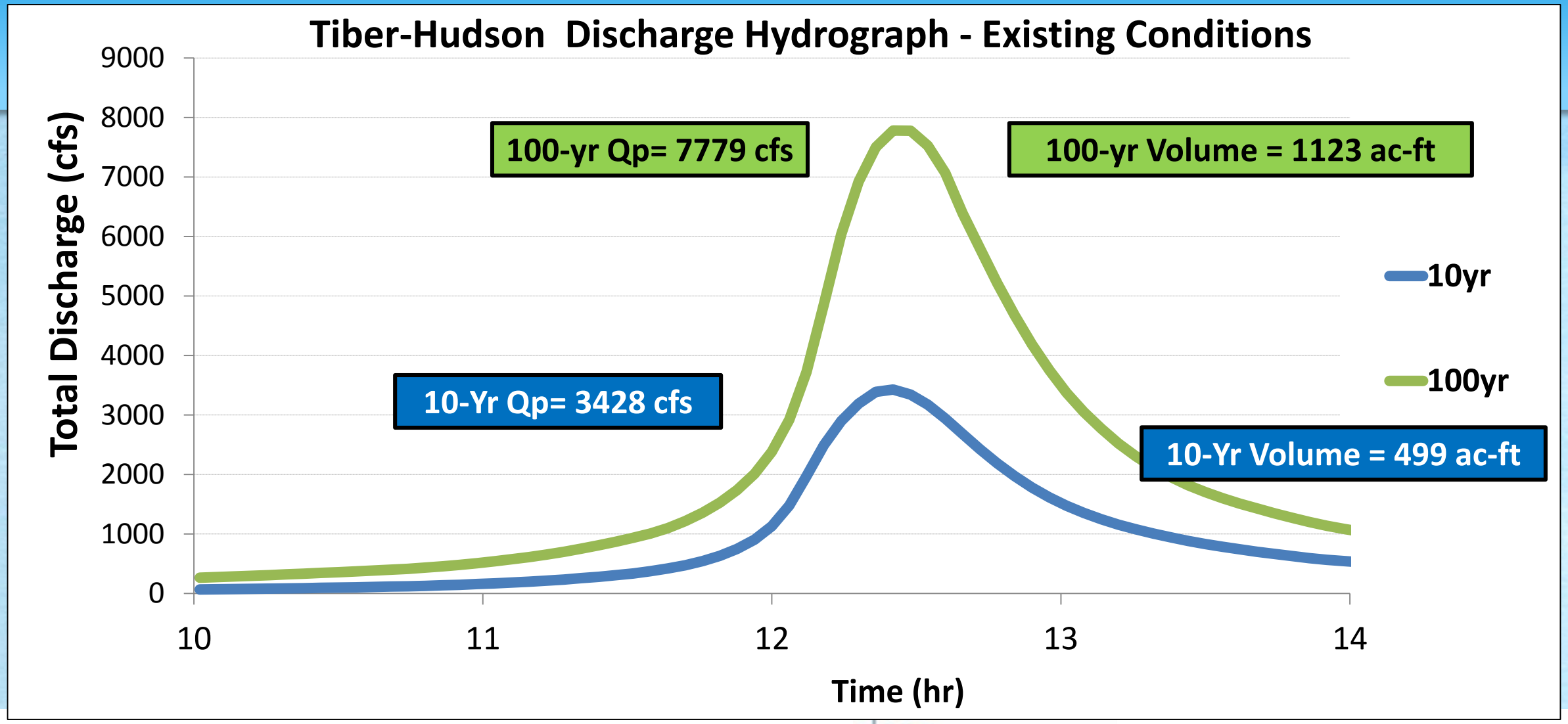
Storm Event Hydrographs – Runoff Volume



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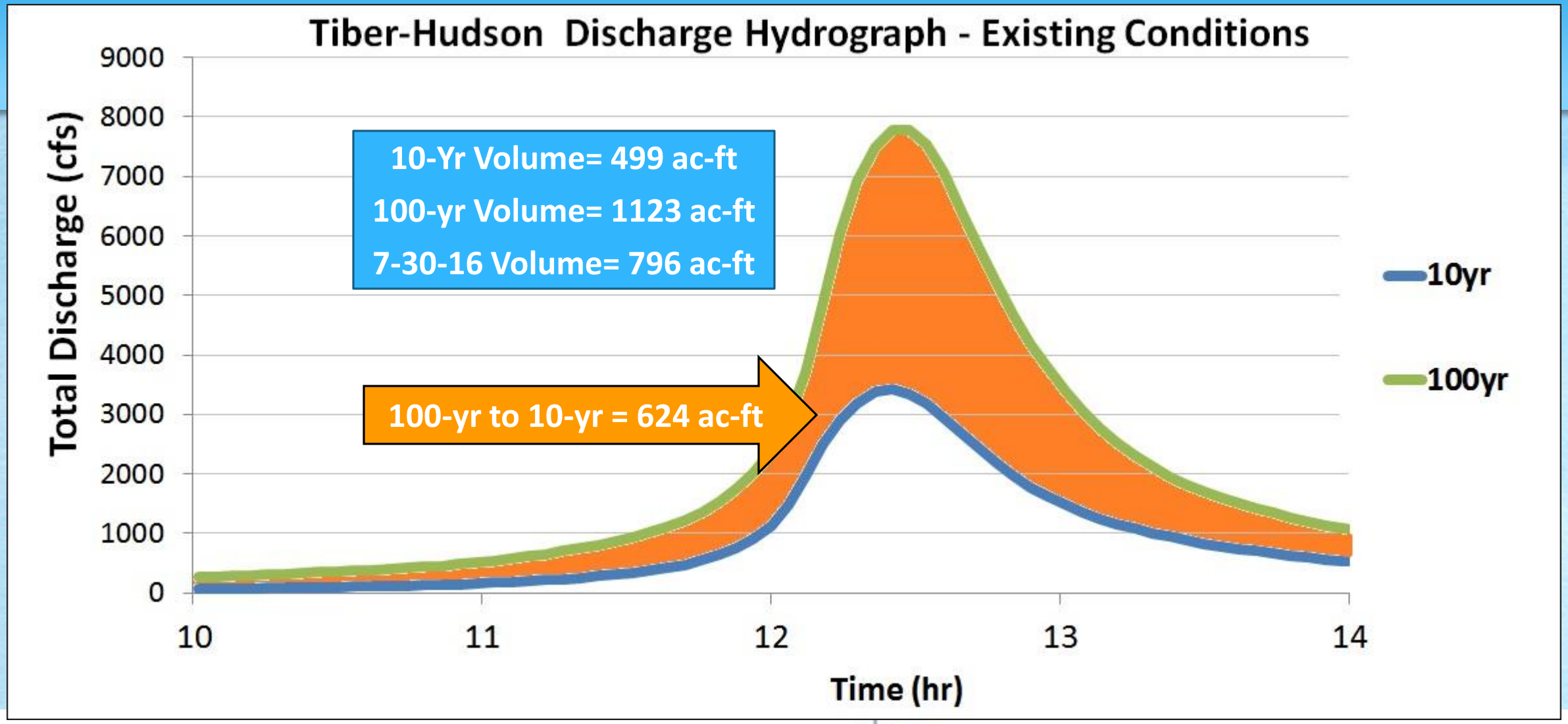
Storm Event Hydrographs – Peak Discharge



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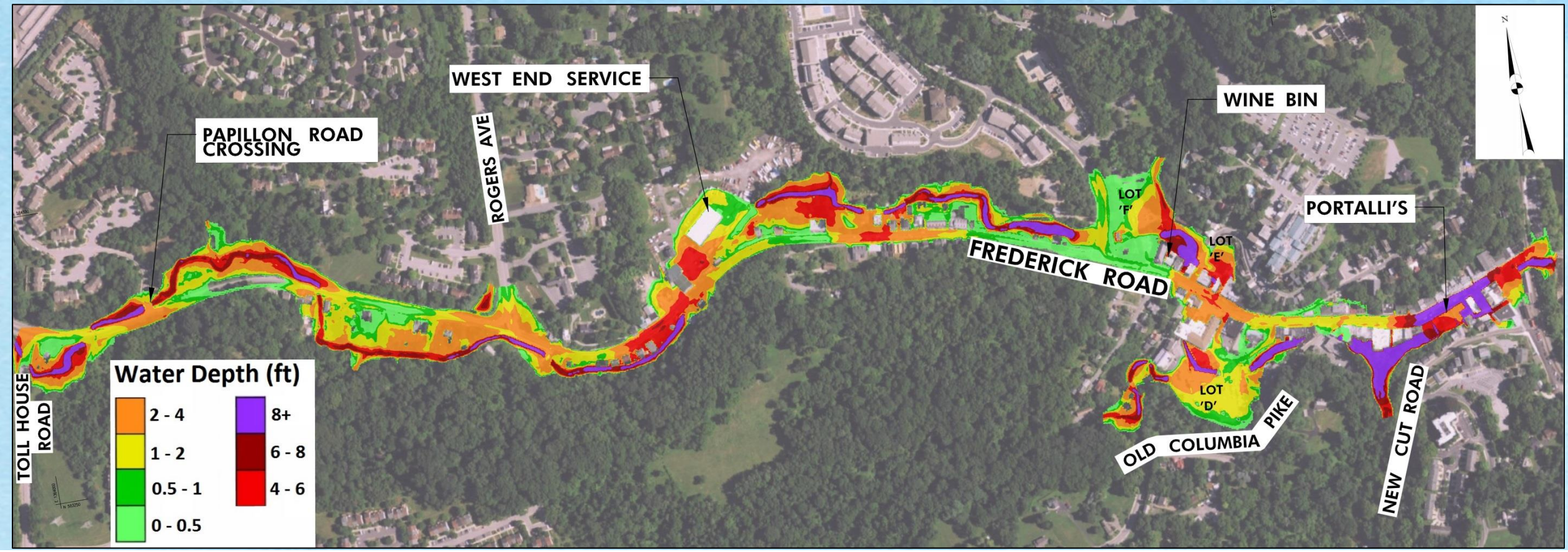
Modeling Results

100 yr – Existing



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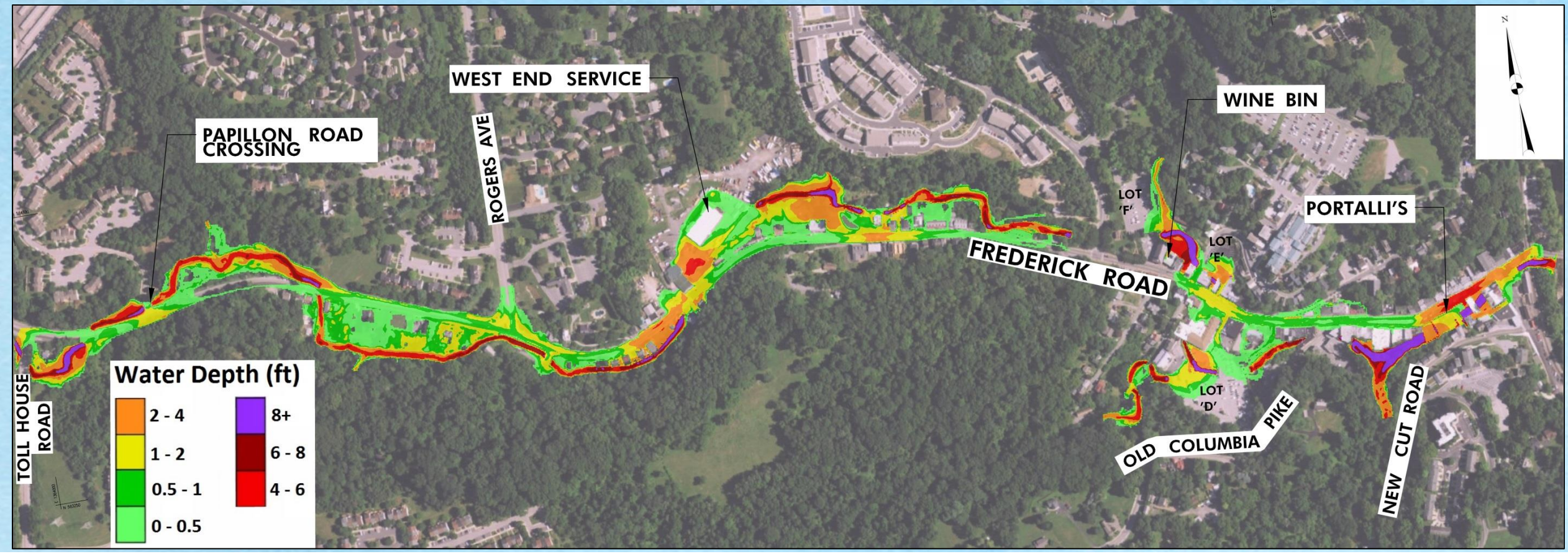
Modeling Results

10 yr – Existing



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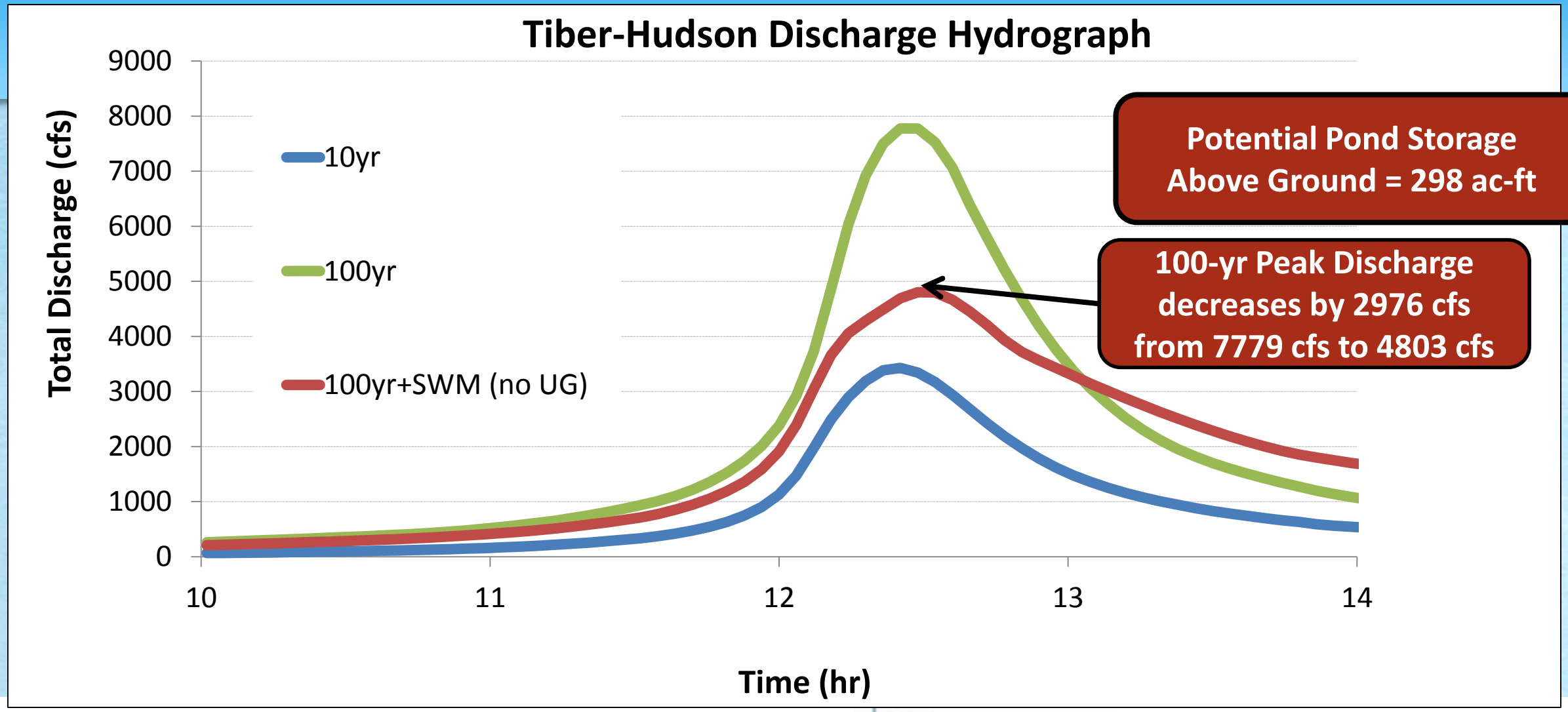
Potential SWM Hydrograph



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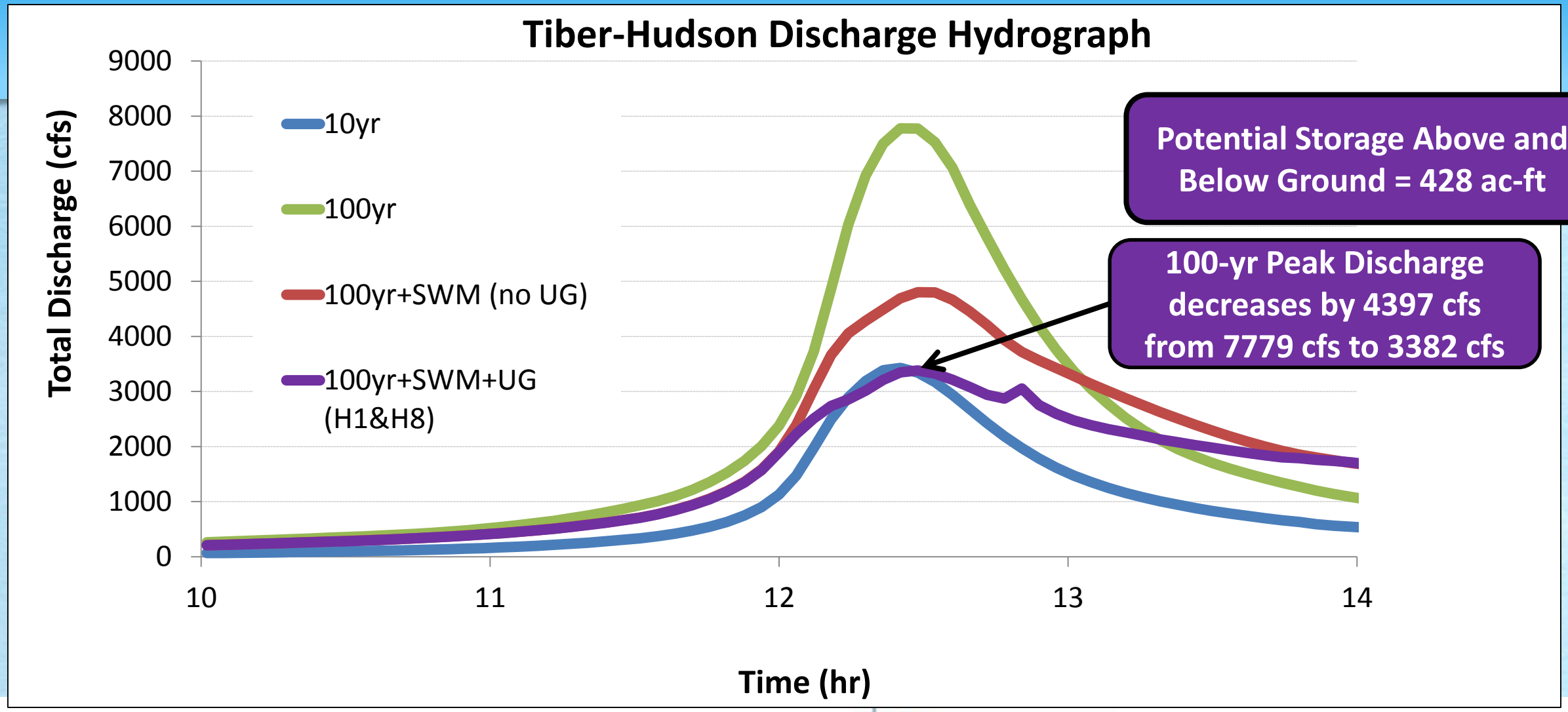
Potential SWM and UG Hydrograph



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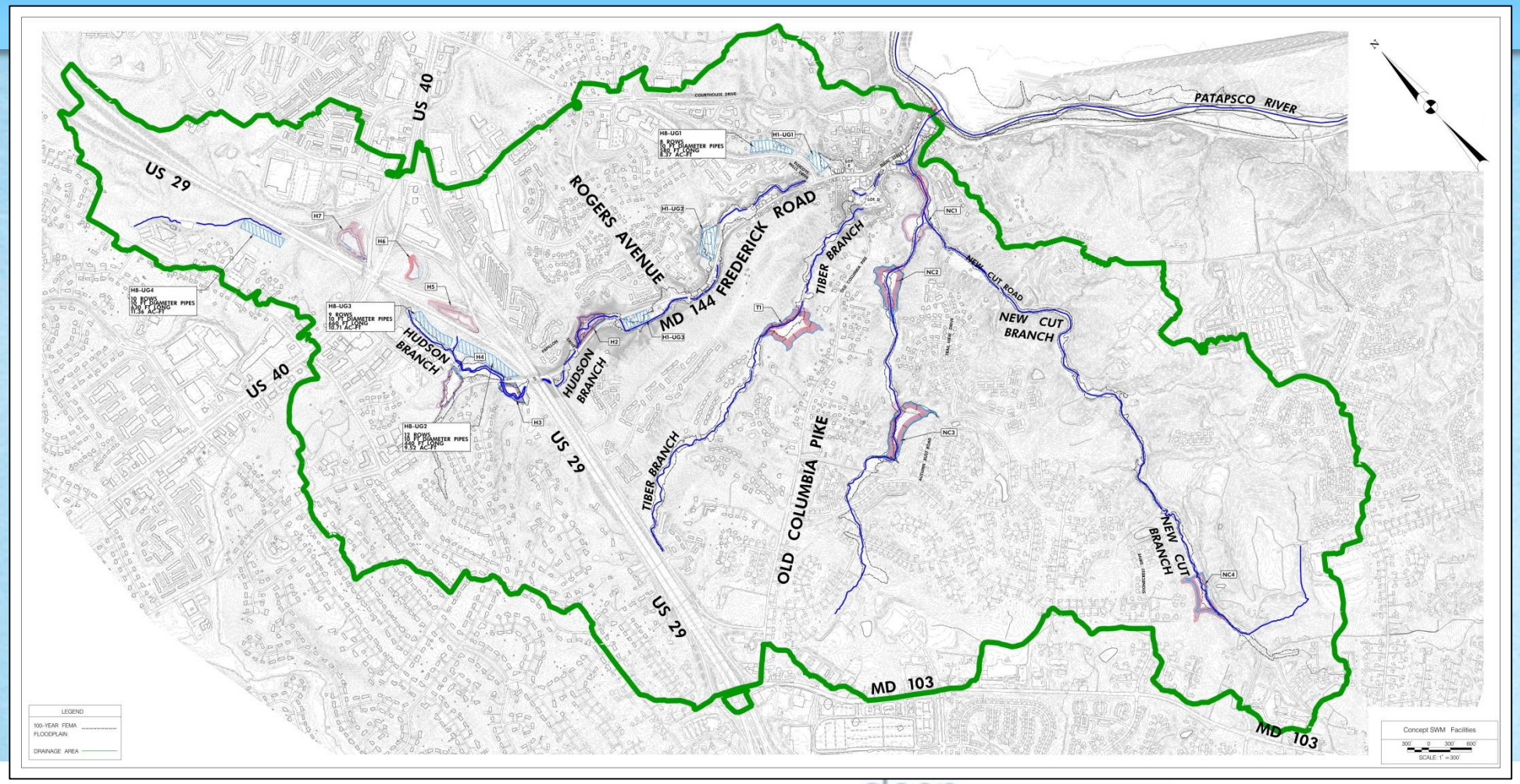
Potential SWM Concepts



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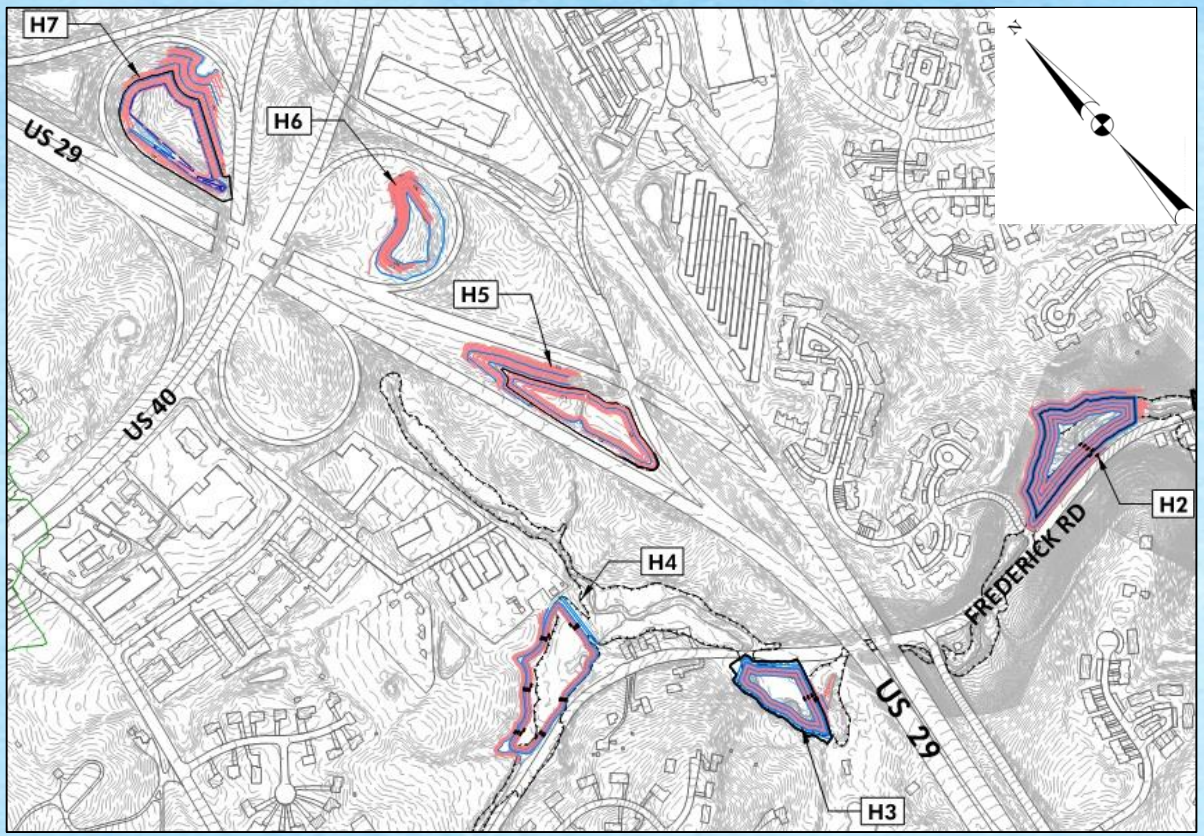
Potential SWM Pond Improvements

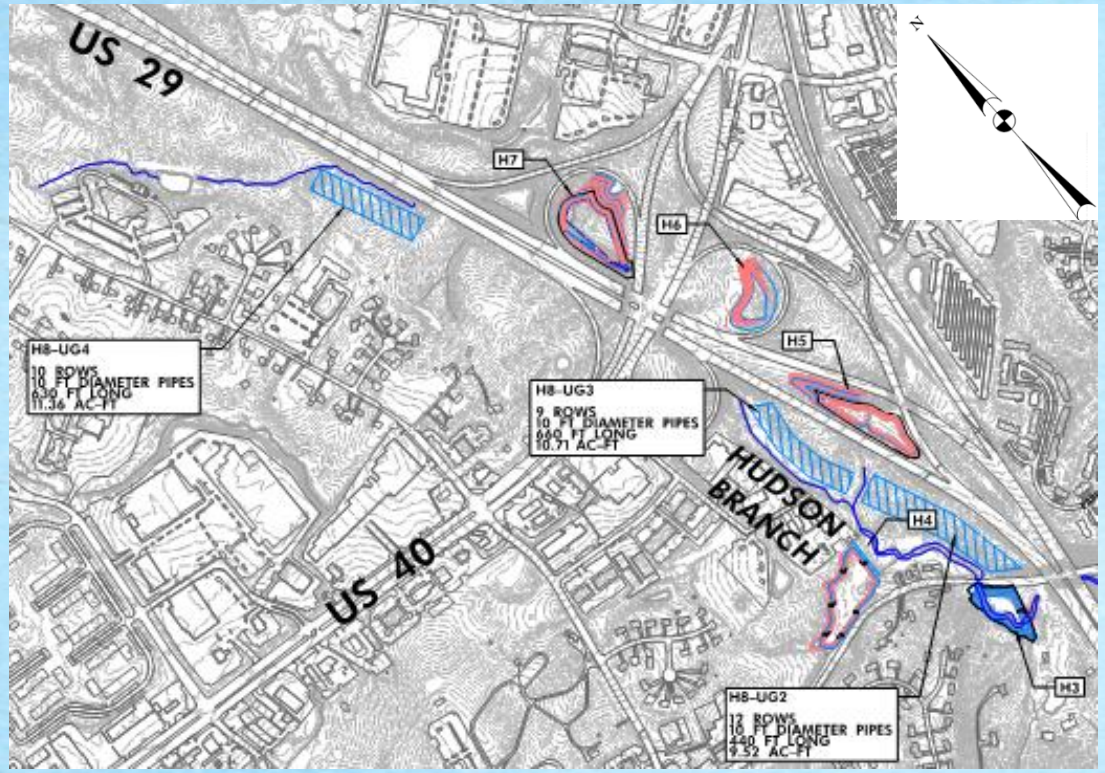
- Large Scale SWM Ponds
  - 1 large online facility in Tiber - 70 ac-ft *(T1)*
  - 4 large online facilities in New Cut – 153 ac-ft *(NC 1-4)*
  - 6 on and off-line facilities in Hudson – 75 ac-ft *(H 2-7)*



Potential Underground SWM Improvements

Additional Underground Management in Hudson Watershed

- ‘Pipe Farm’ – Roger Carter Ctr. *(H8 UG 1)*
  - ‘4600’ feet of 10’ diameter pipe – 8.4 ac-ft
- ‘Pipe Farm’ - BGE ROW along US 29 SB *(H8 UG 2-4)*
  - 3 locations
  - 3.3 miles of 10’ diameter pipe – 31.6 ac-ft



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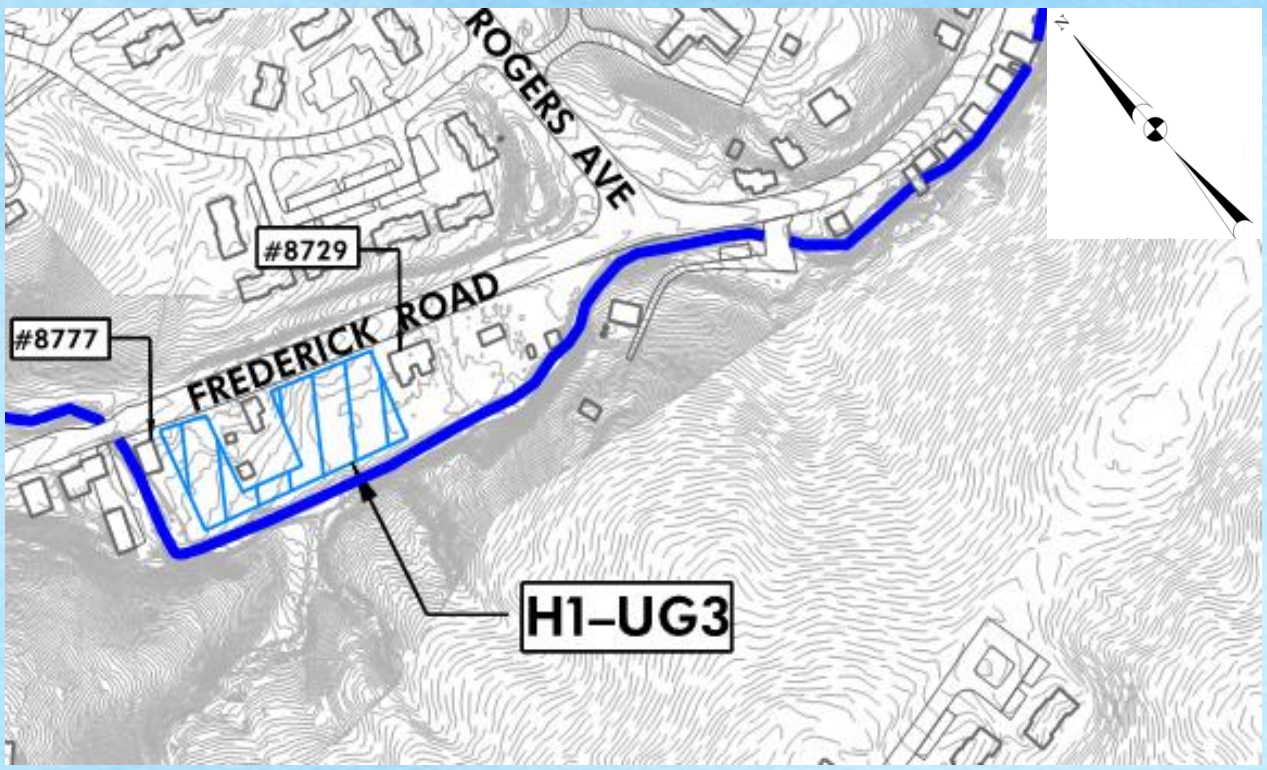
Potential Underground SWM Improvements

- Underground vaults – 90 ac-ft total
  - Under Lot 'F' *(H1 UG 1)*
  - Under West End lot *(H1 UG 2)*
  - Under yards between 8777 and 8729 Main St *(H1 UG 3)*



Total Volume of Proposed SWM Storage: 18 sites, 428 acre-feet

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Expansion of Existing SWM Ponds

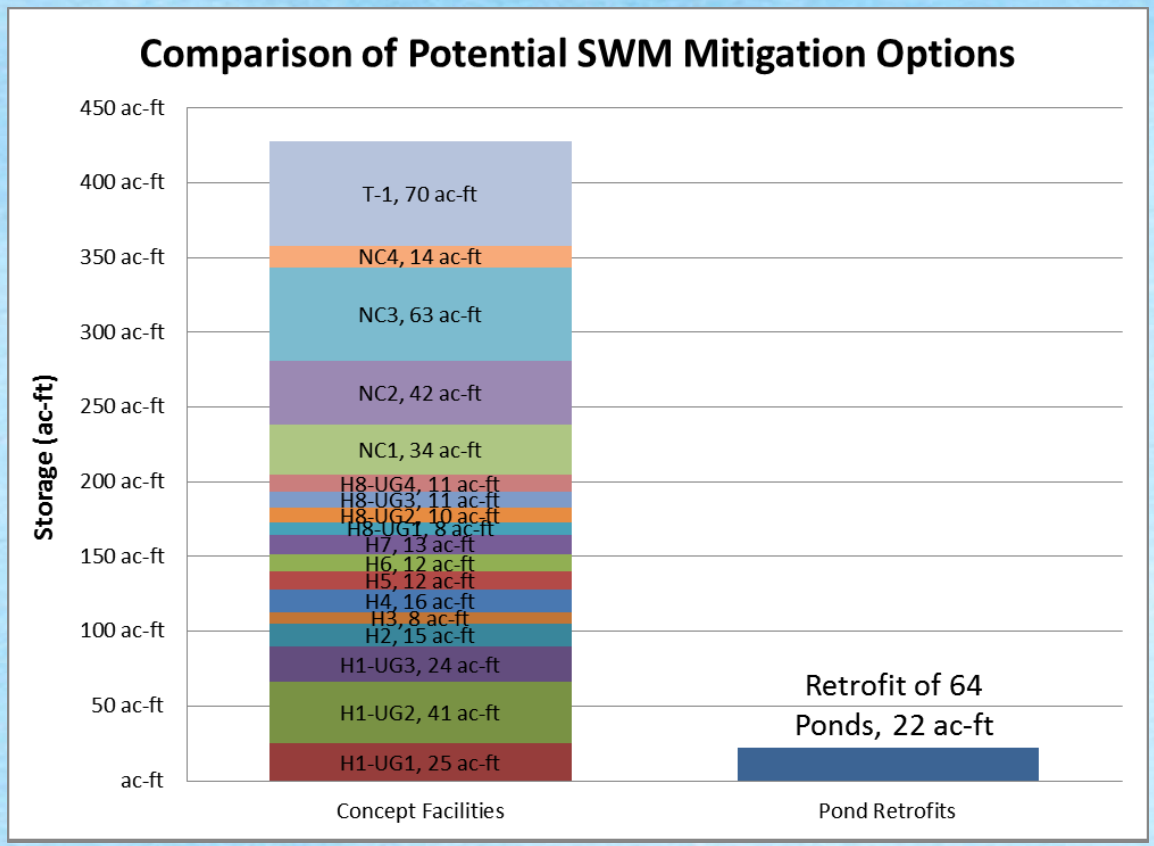
64 existing ponds in watershed

- Captures ~27% of watershed area
- Approx. 86 ac-ft of storage

Presume 25% expansion of storage

- Approx. 22 ac-ft addl storage

64 project sites yield increase of 22 ac-ft - (5% of 18 sites above)



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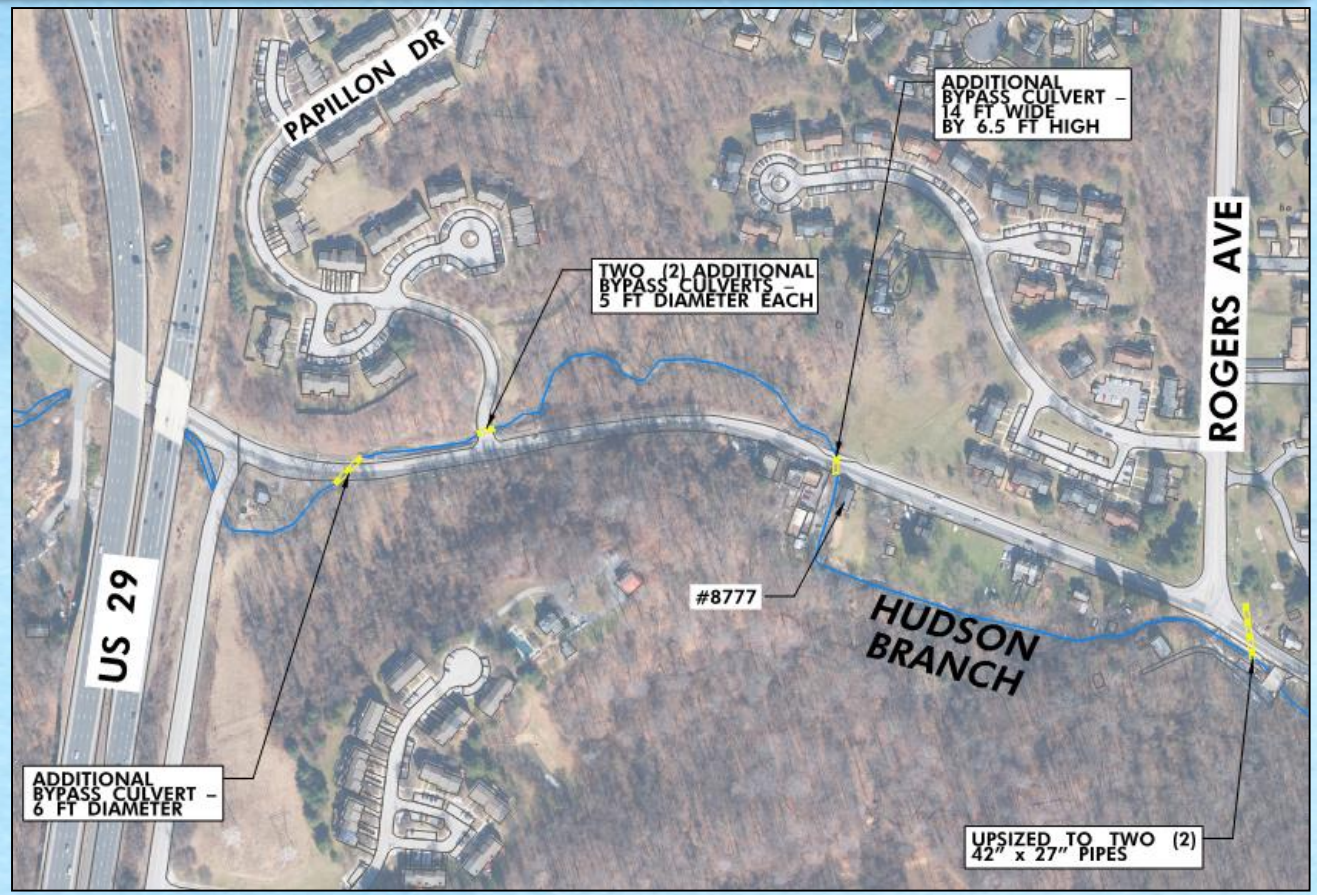
Potential Conveyance Improvements

Supplemental Cross Culverts

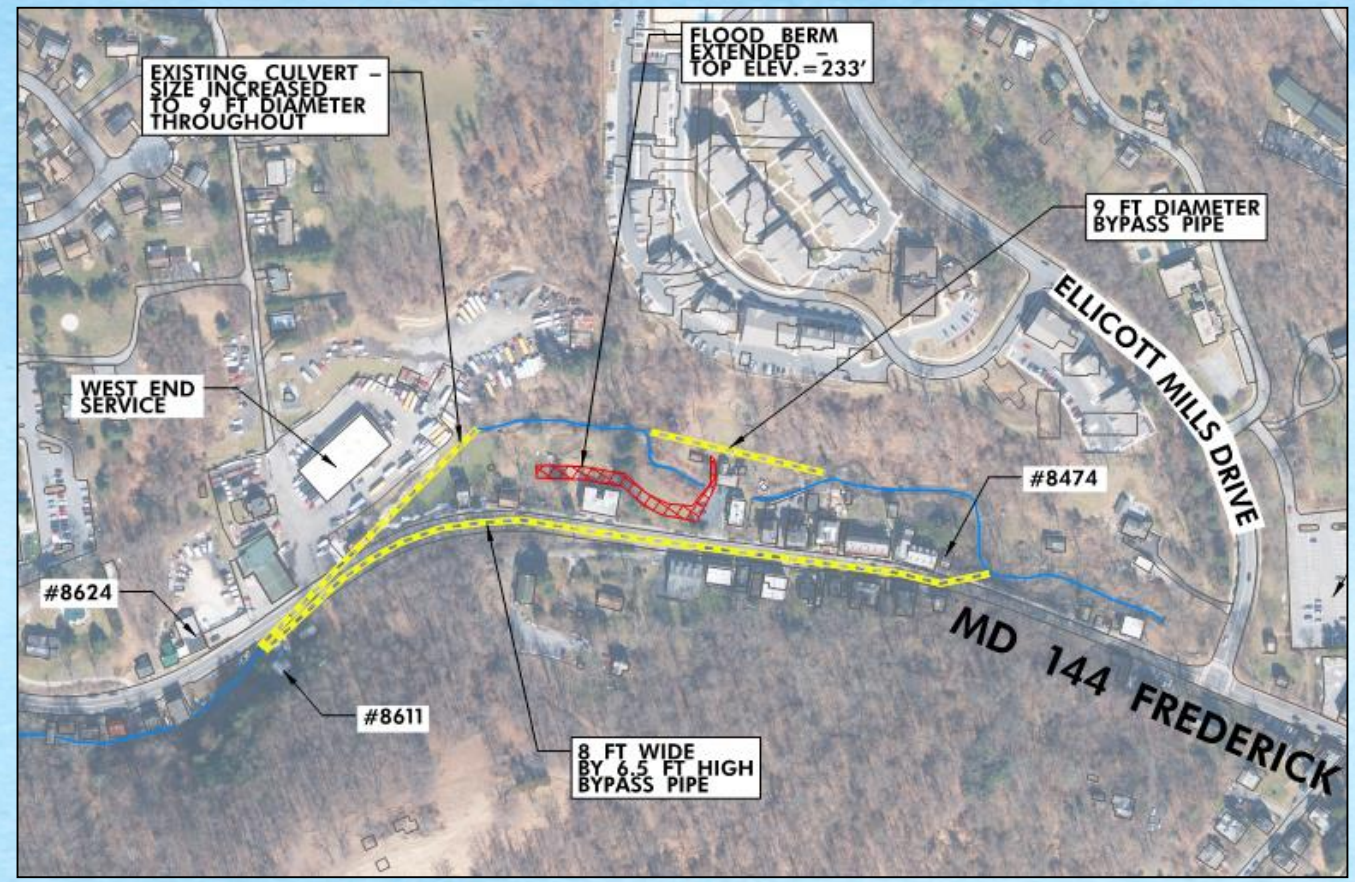
- 8800 Frederick Rd – Additional 6’ culvert
- Papillon Dr – 2 Additional 5’ culverts
- 8777 Frederick Rd – Additional 6.5’ x 14’ box culvert
- 8680 Frederick @ Rogers - 2 – 42” x 27” pipes
  - Carries flow from Rogers Ave across road into channel



Potential Conveyance Improvements

Bypass Supplemental Culverts

- 8611 Frederick Rd
  - Restore Existing culvert to 9’ diameter
  - Supplemental 6’ x 8.5’culvert along roadway
    - Outfalls to channel d/s of #8470
- 8532/34 Frederick Rd – 9’ bypass culvert
  - Combined w/ flood berm #8572 to #8534



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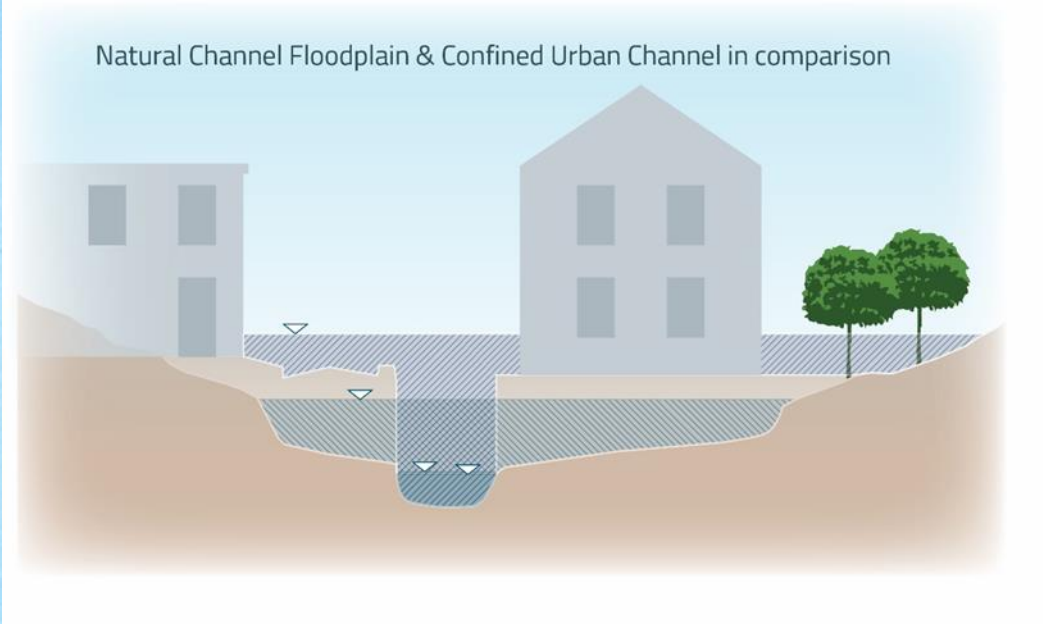
Impact of Development

Watershed modeled with “No Development” - 100% woods, same Main St Configuration

- Reduction of flows ~45% over current development
- BUT… still significant flooding on roadway at that level
- Lack of natural floodplain conveyance, town built over stream

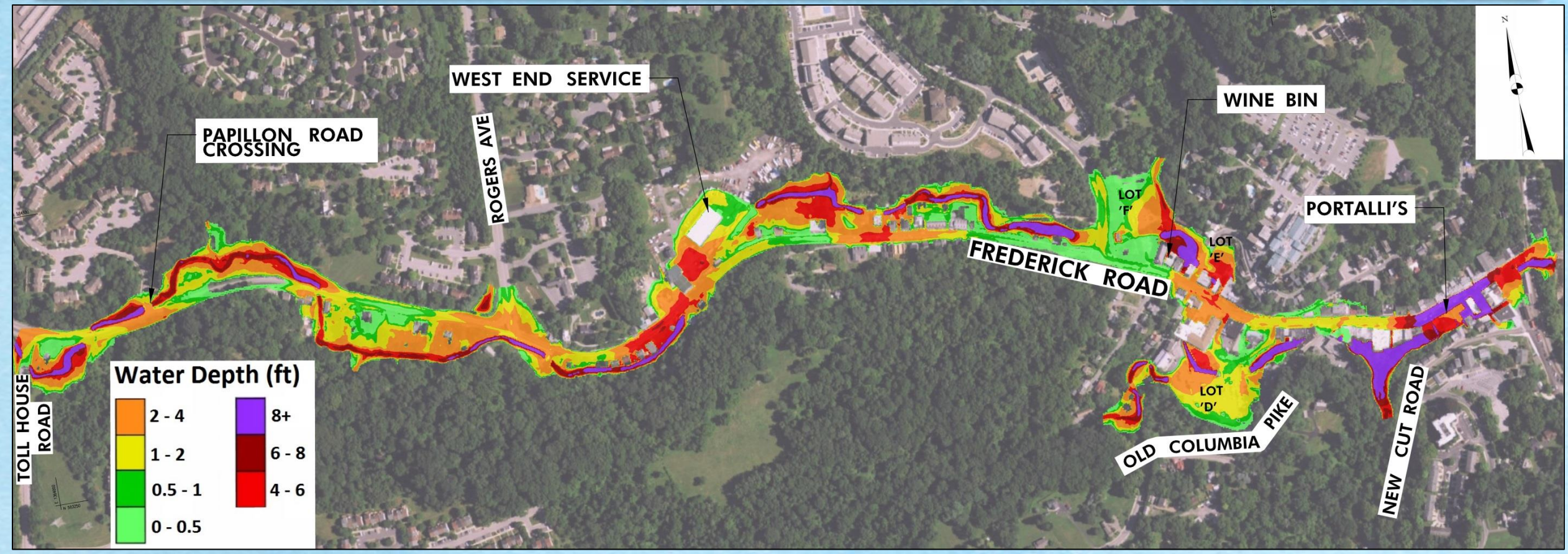
Development (and management of runoff) matters…

…but its not the whole issue



Modeling Results

100 yr – Existing



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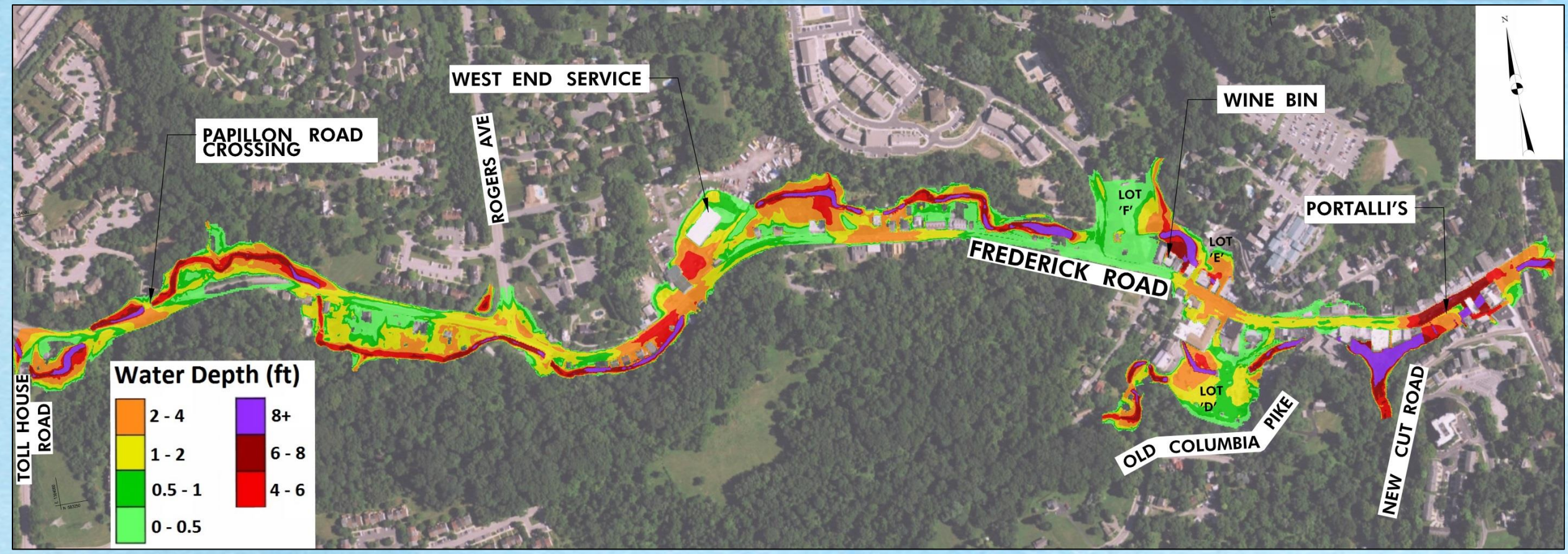
Modeling Results

100 yr – Undeveloped Condition



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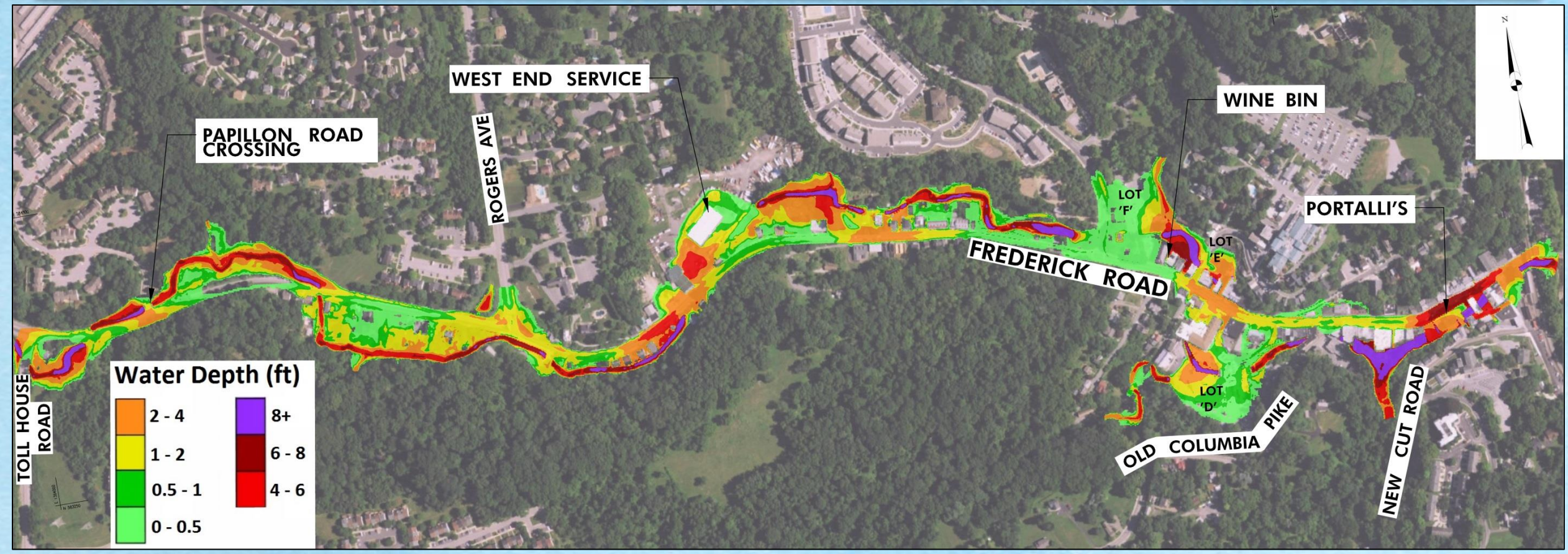
Modeling Results

100 yr – Potential SWM – Ponds Only



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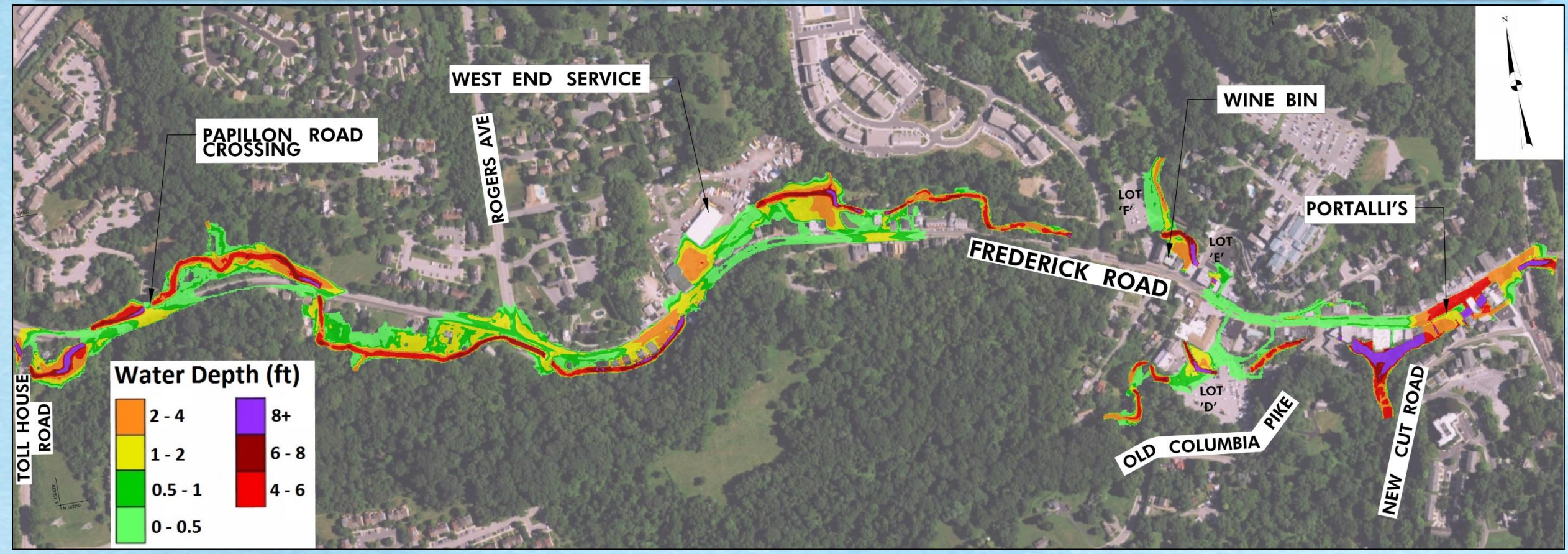
Modeling Results

100 yr – Potential SWM Ponds + Underground



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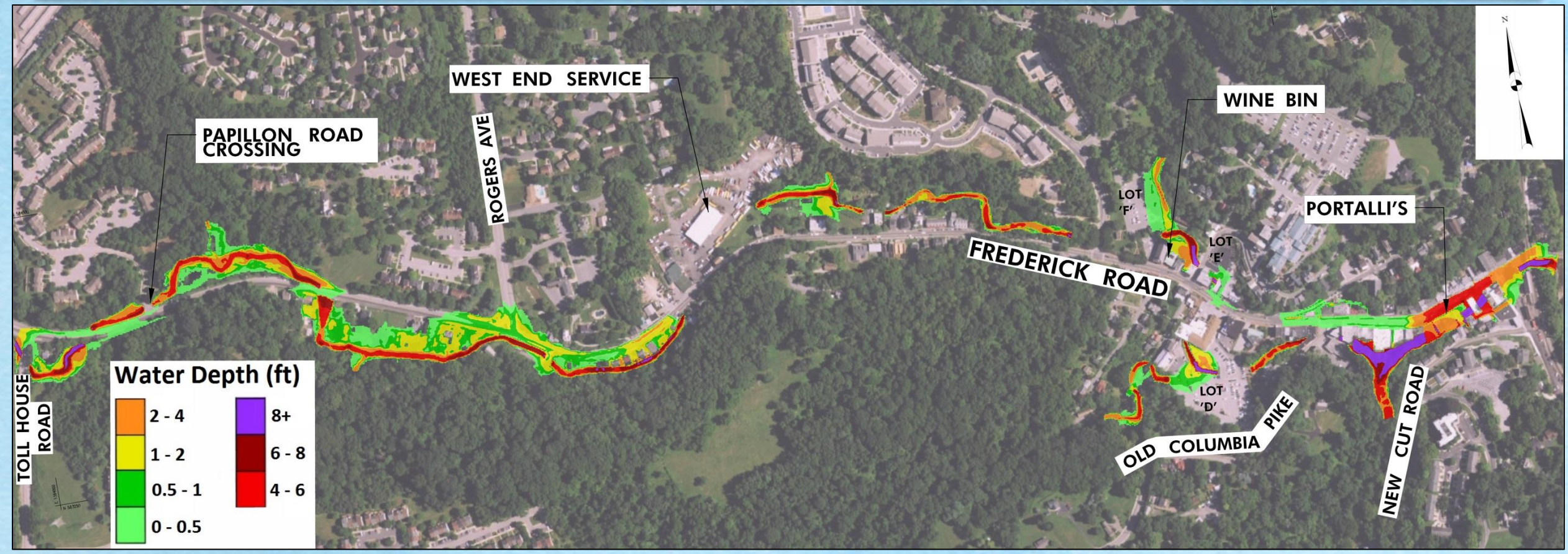
Modeling Results

100 yr – Potential Total SWM + Conveyance Improvements



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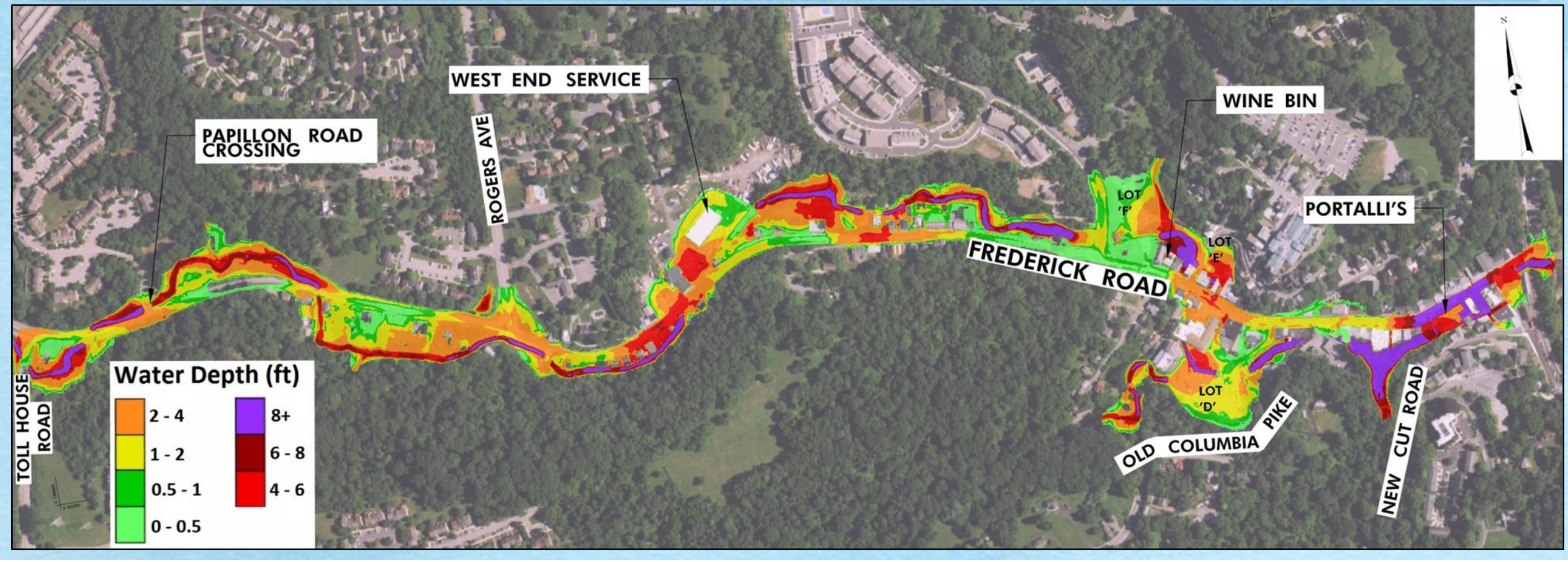
Modeling Results

100 yr – Existing



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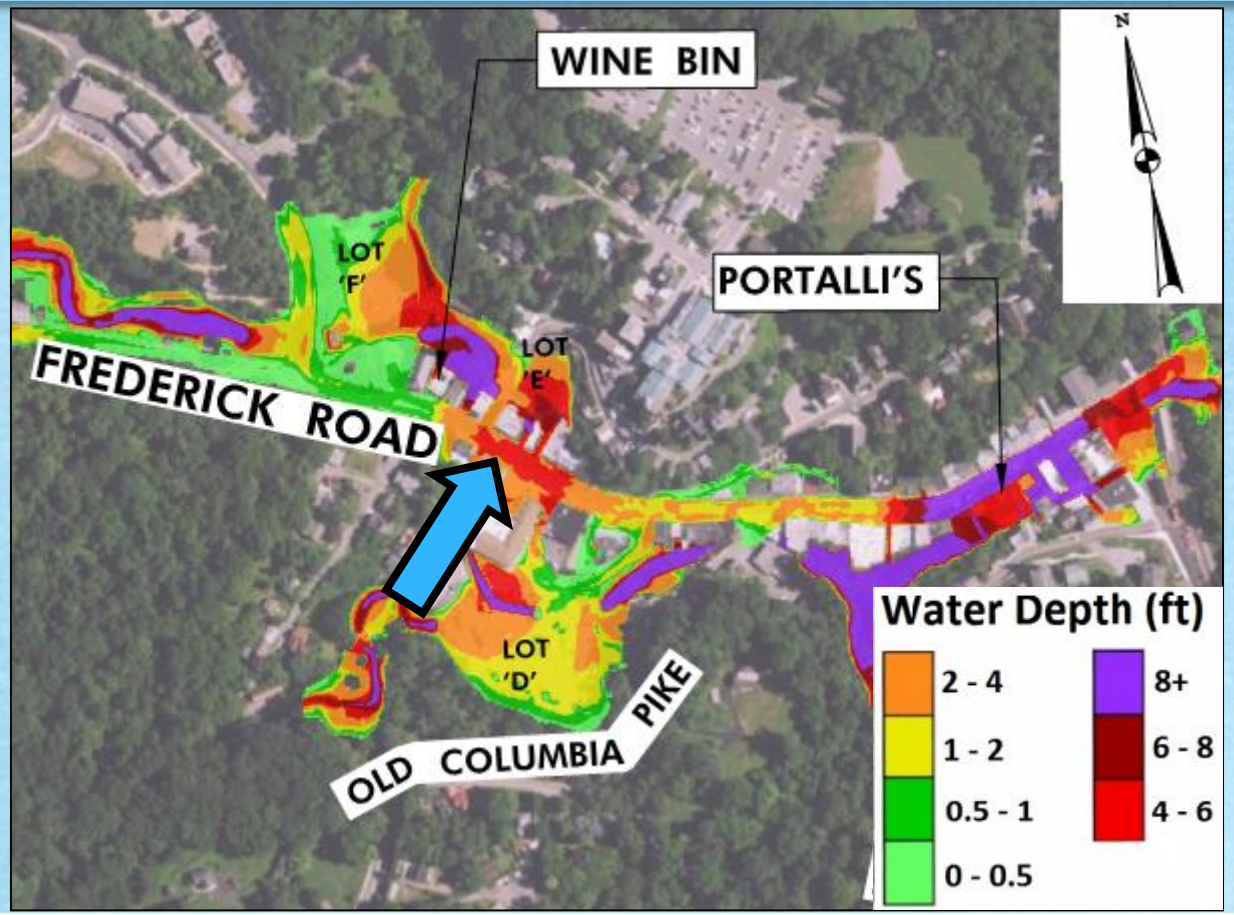
Modeling Results

Flooding Impact at Brewery



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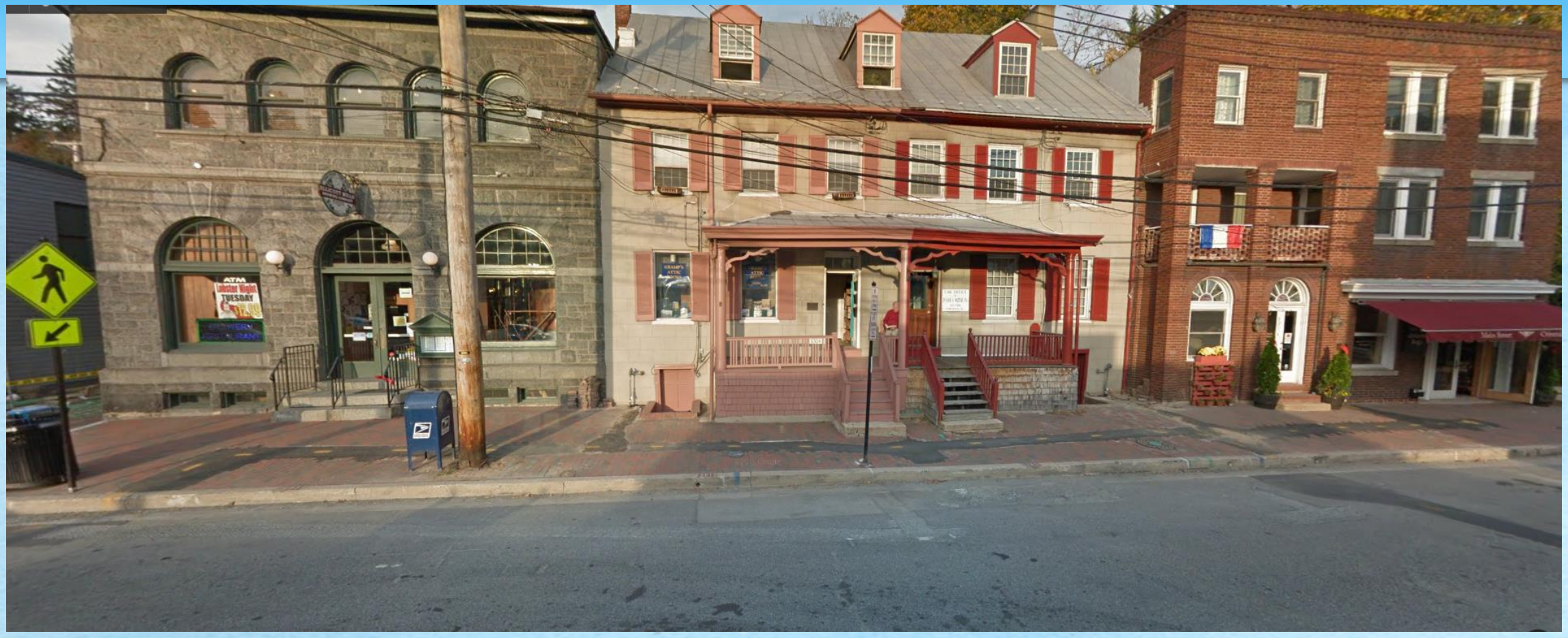
Flooding Impact at Brewery



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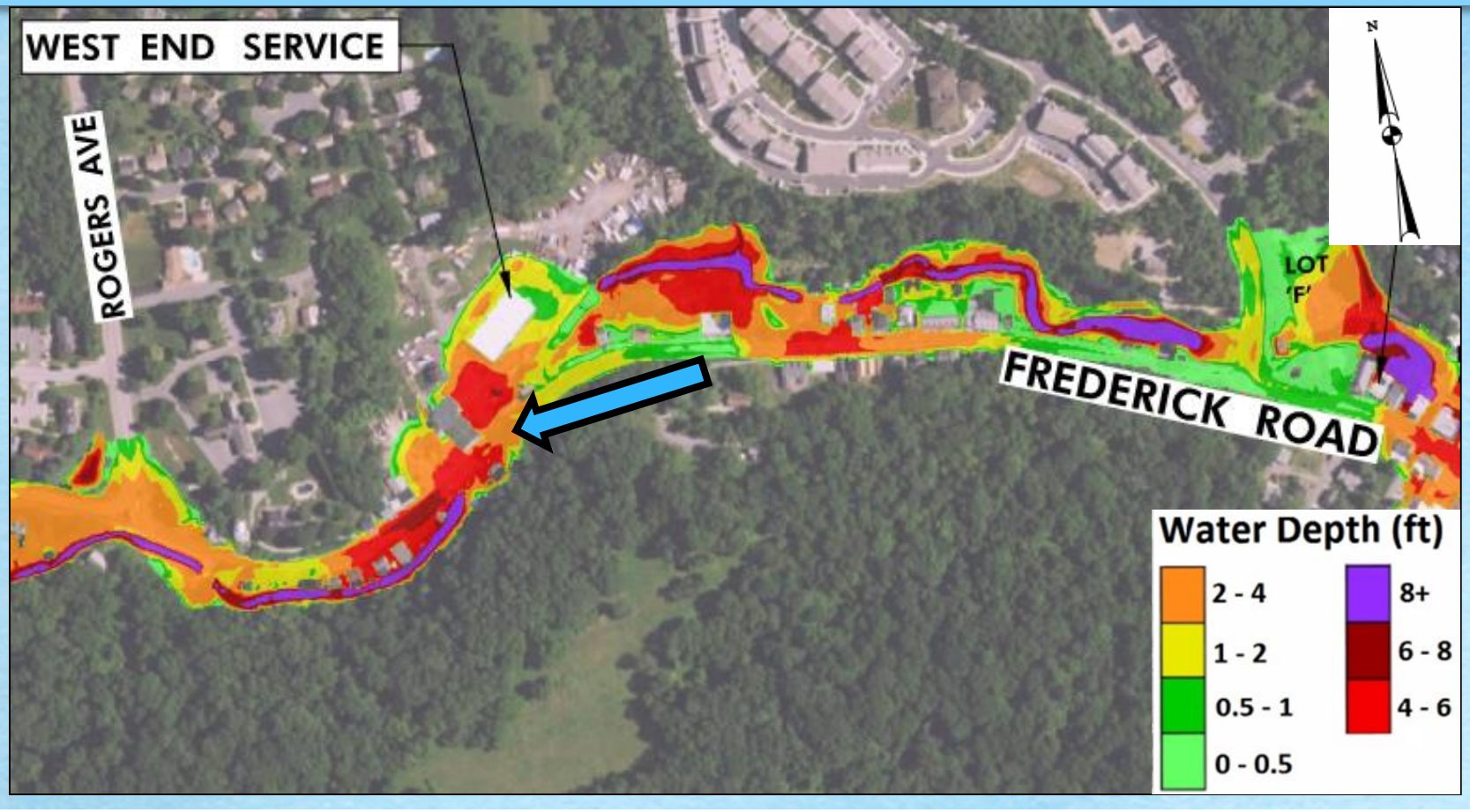
Modeling Results

Flooding Impact at West End Service



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Flooding Impact at West End Service

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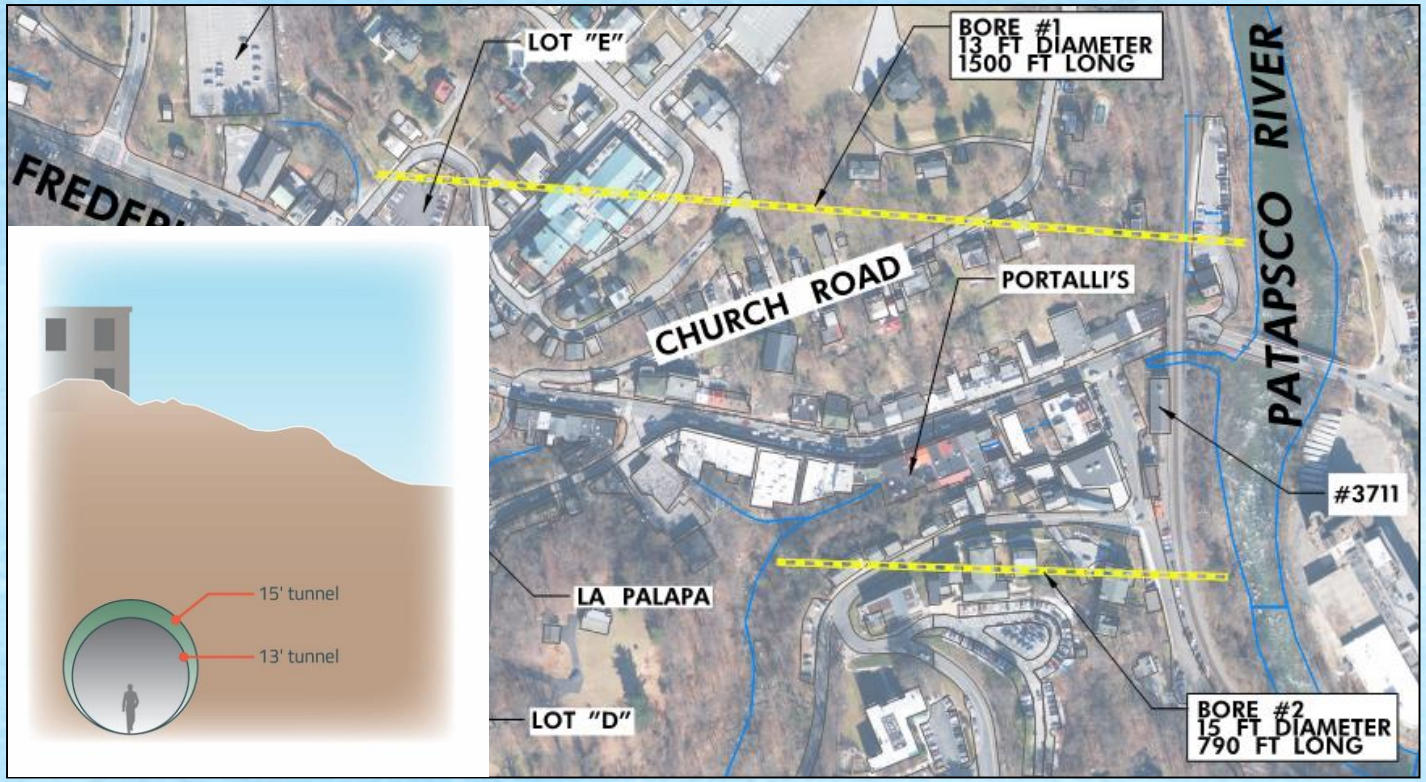
Tunnel Bore Conveyance

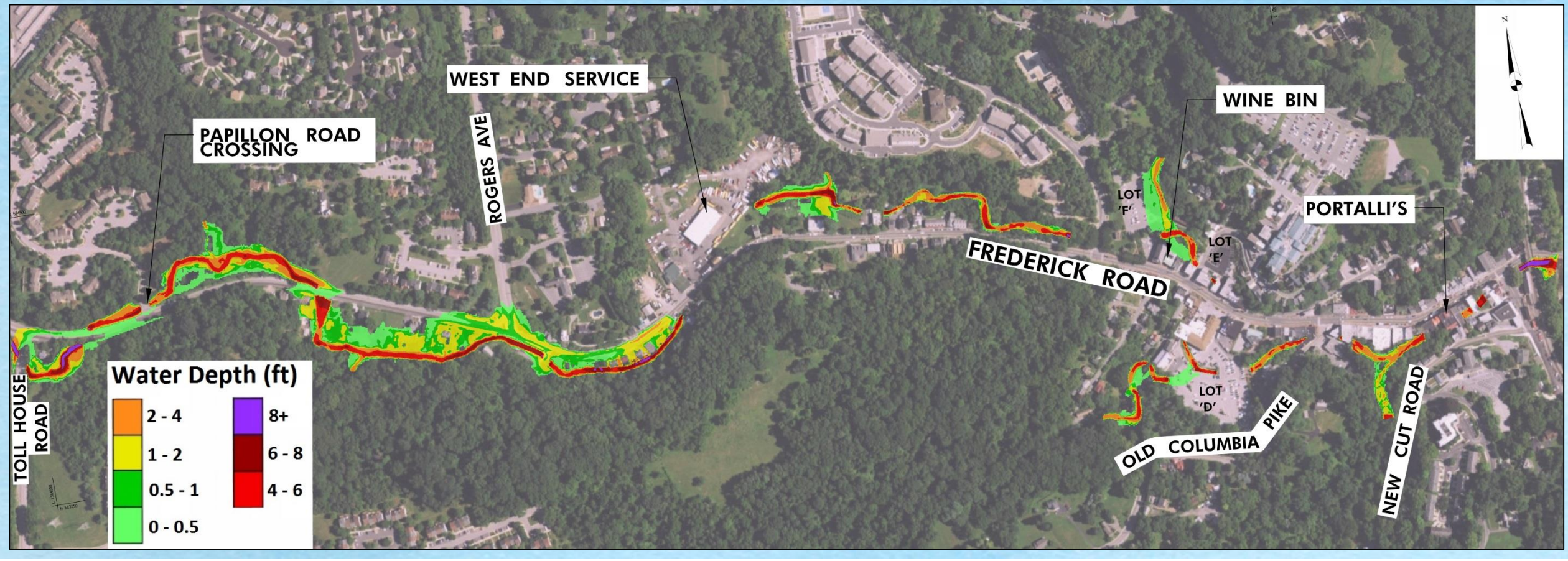
Lower Main Street Bypass Tunnel Bores

- Upstream of Lot ‘E’
  - Carries Hudson overflow to Patapsco
  - 1500’ long, 13’ diameter
- Upstream of New Cut Rd
  - Carries New Cut overflow to Patapsco
  - 790’ long, 15’ diameter



Modeling Results

100 yr – Potential Total SWM + Conveyance + Bores



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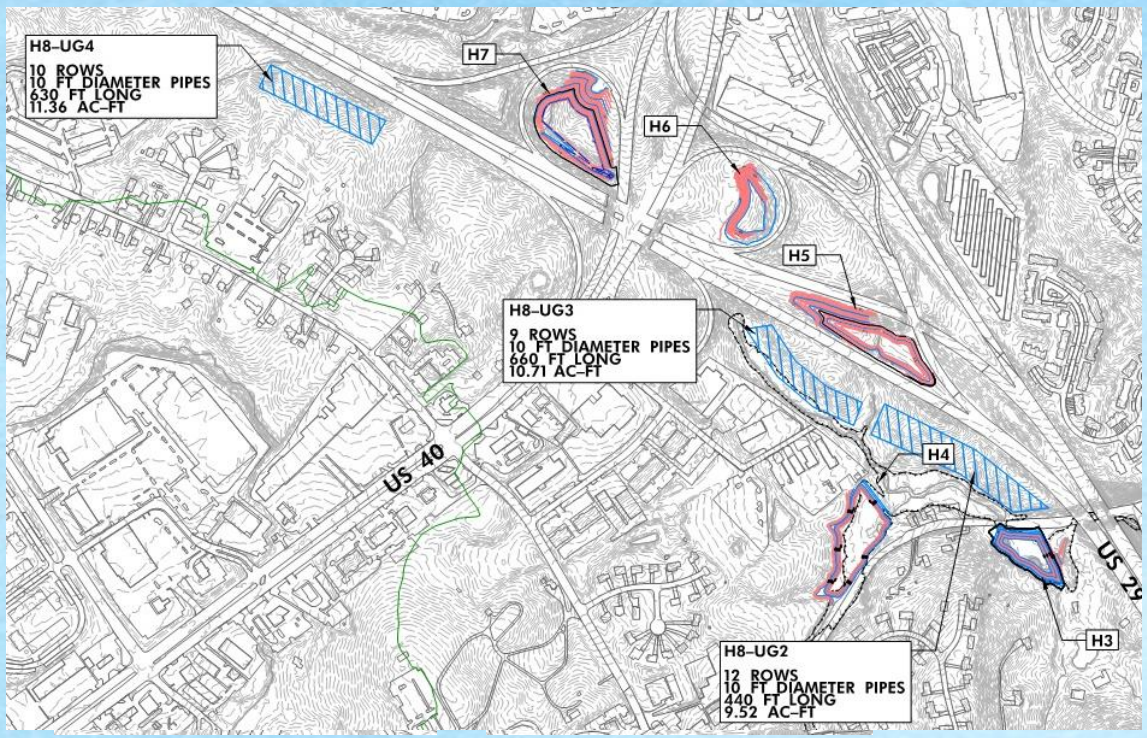
Recommended Initial Improvements

Of 18 sites, most effective were prioritized as initial steps towards improvement

- Tiber Pond (T1)
- Upstream Pond in New Cut (NC3)
- Loop Ramp of 29/40 in Hudson (H7)

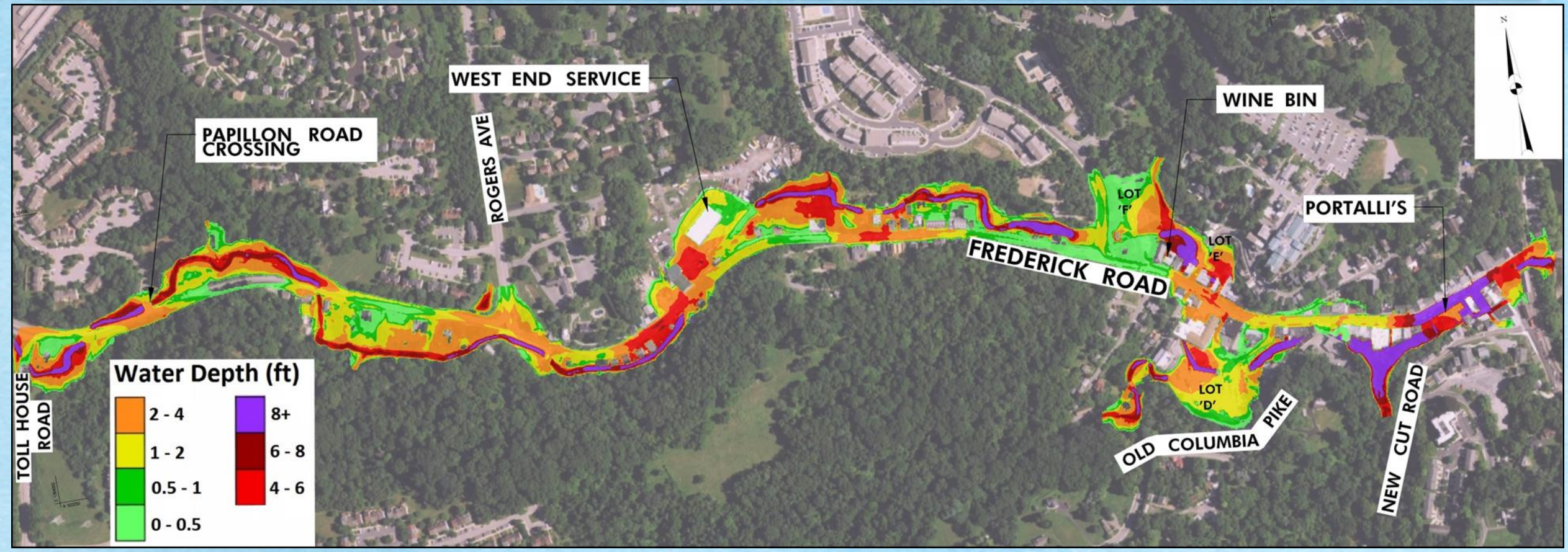
- Underground Pipe Farms in Hudson (UG8)

- Conveyance (Pipe / Culvert) Improvements concurrent with SWM



Modeling Results

100 yr – Existing



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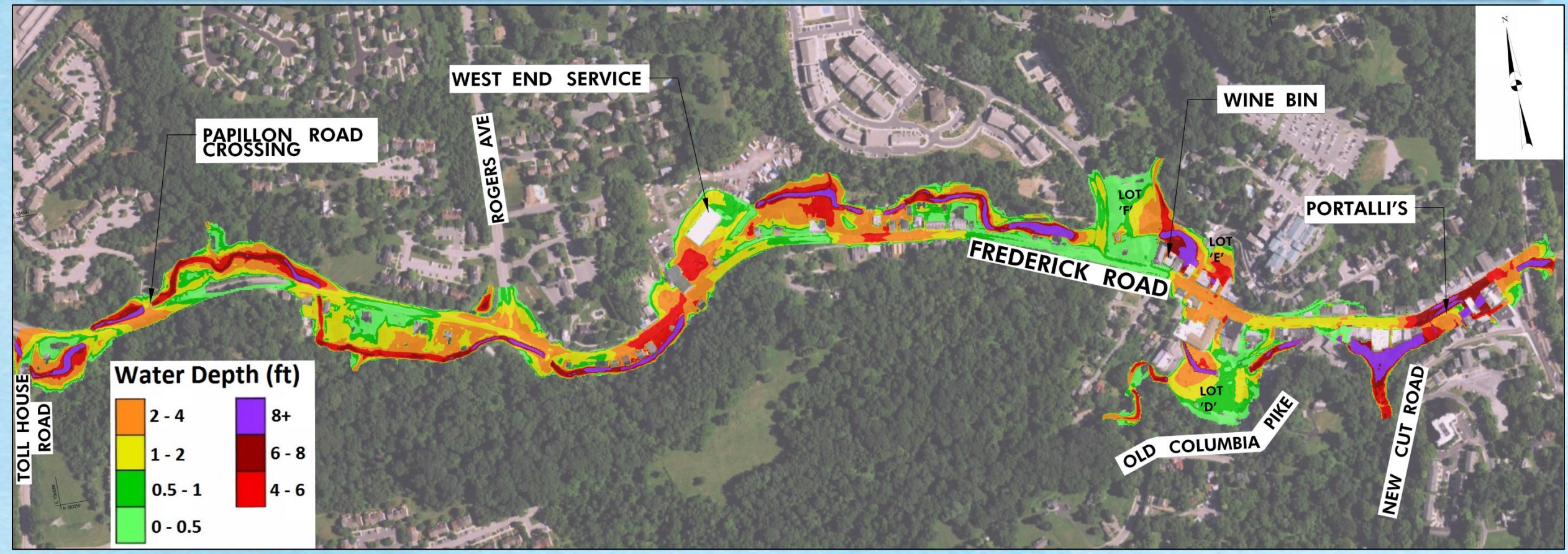
Modeling Results

100 yr – Potential SWM - T1/NC3/H7



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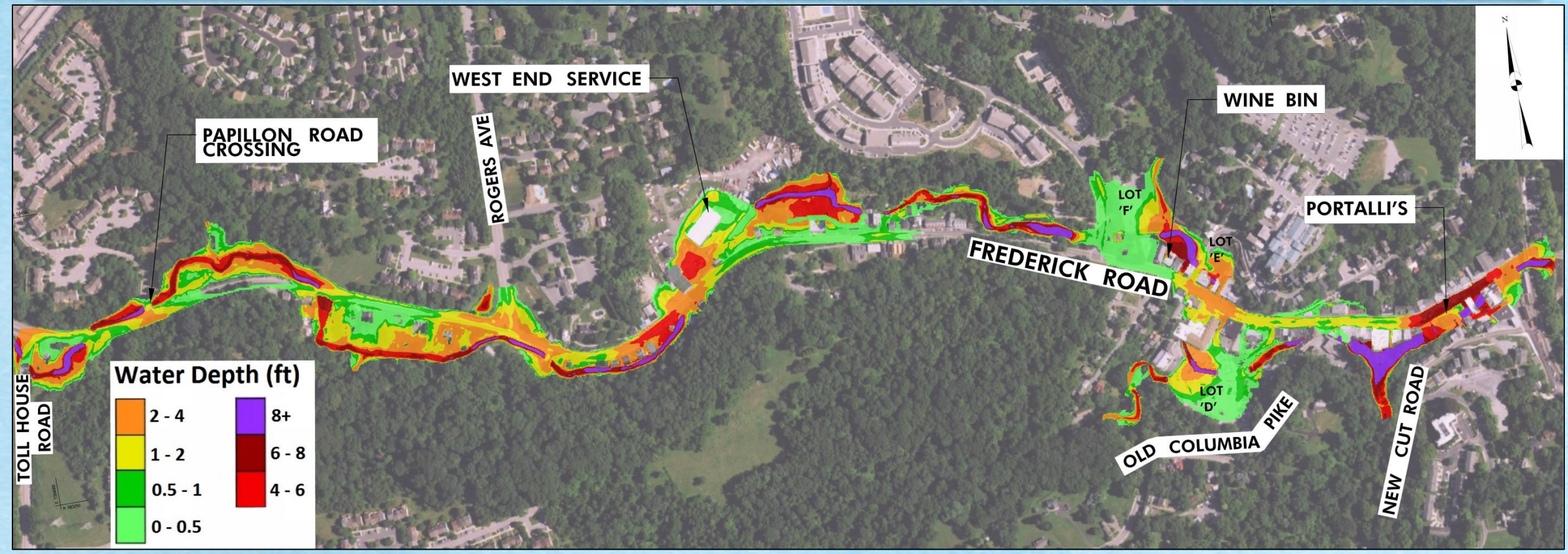
Modeling Results

100 yr – Potential SWM - T1/NC3/H7+ SD



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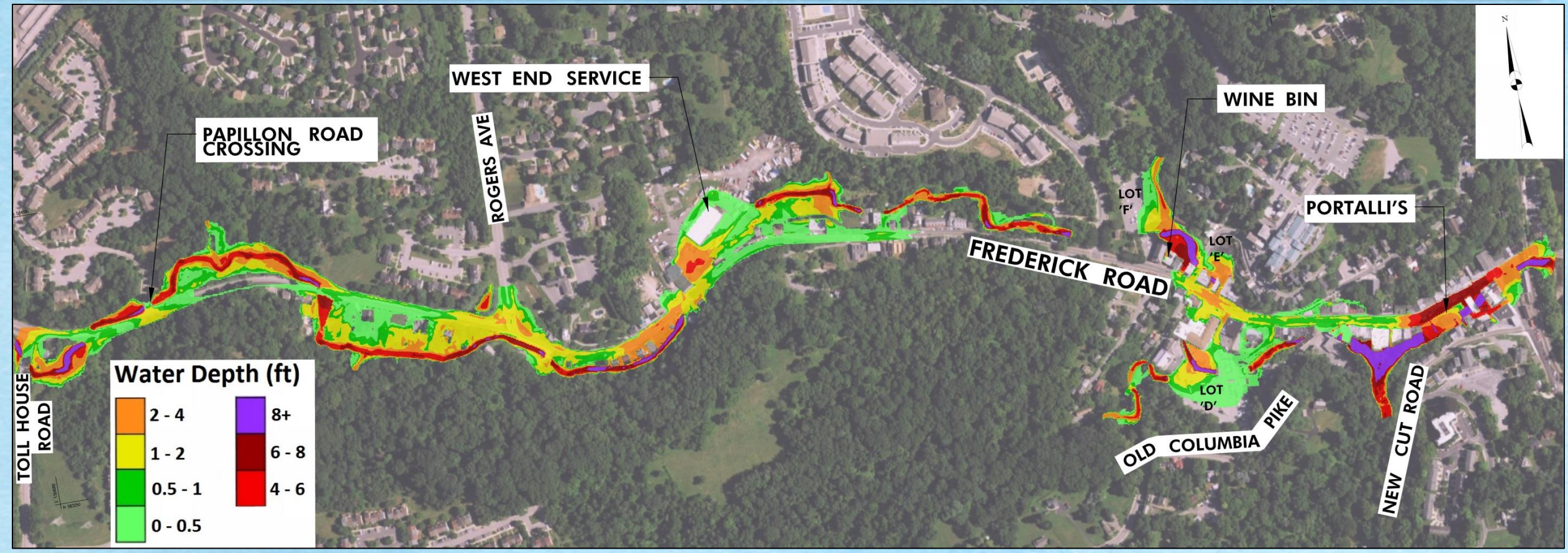
Modeling Results

100 yr – Potential SWM - T1/NC3/H7 + SD + H8 UG



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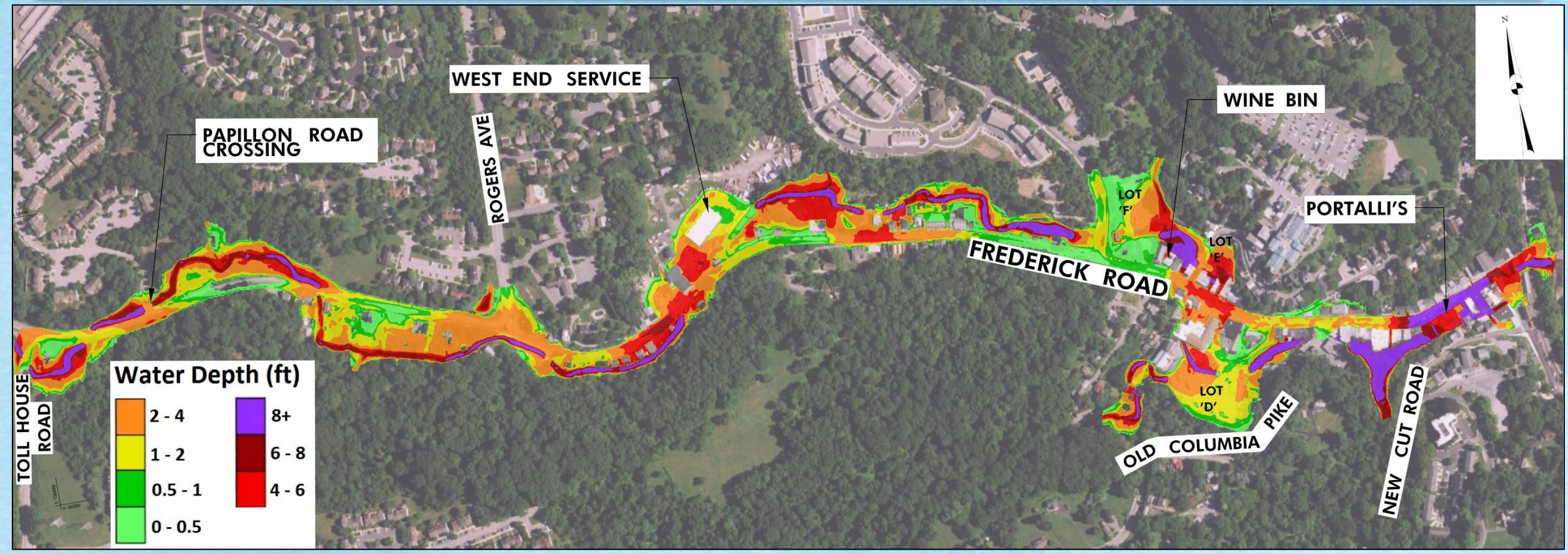
Modeling Results

7/30/16 – Existing



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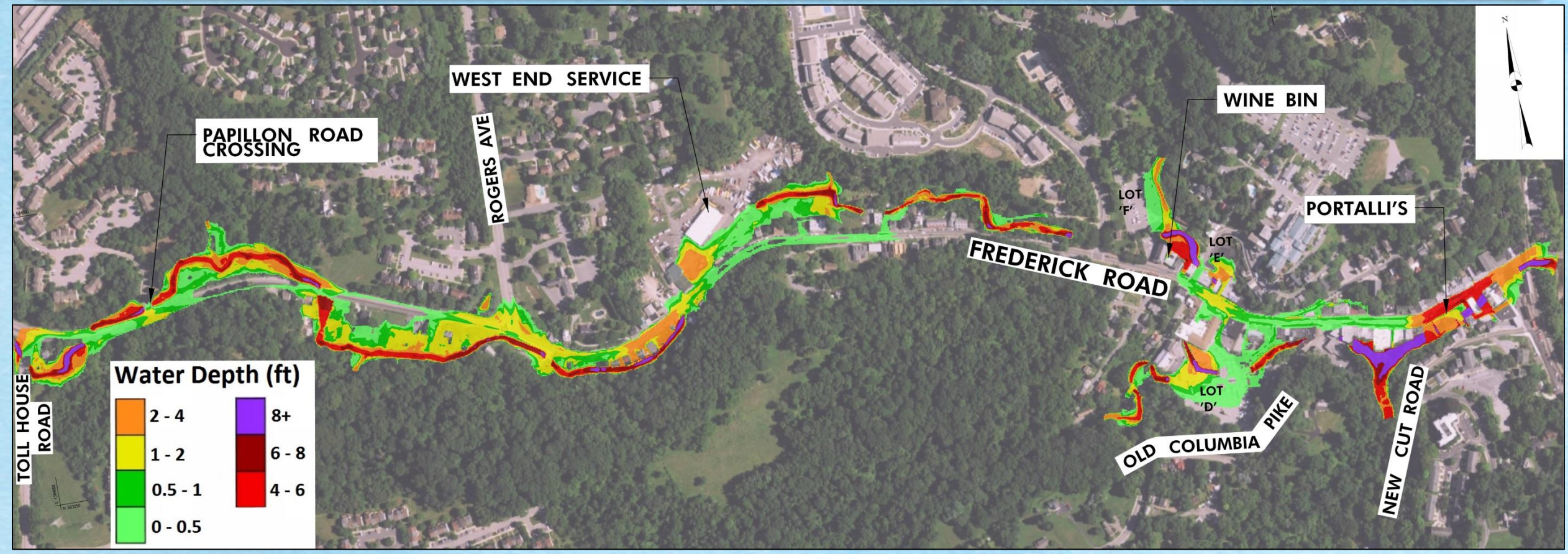
Modeling Results

7/30/16 – Potential Total SWM + Conveyance



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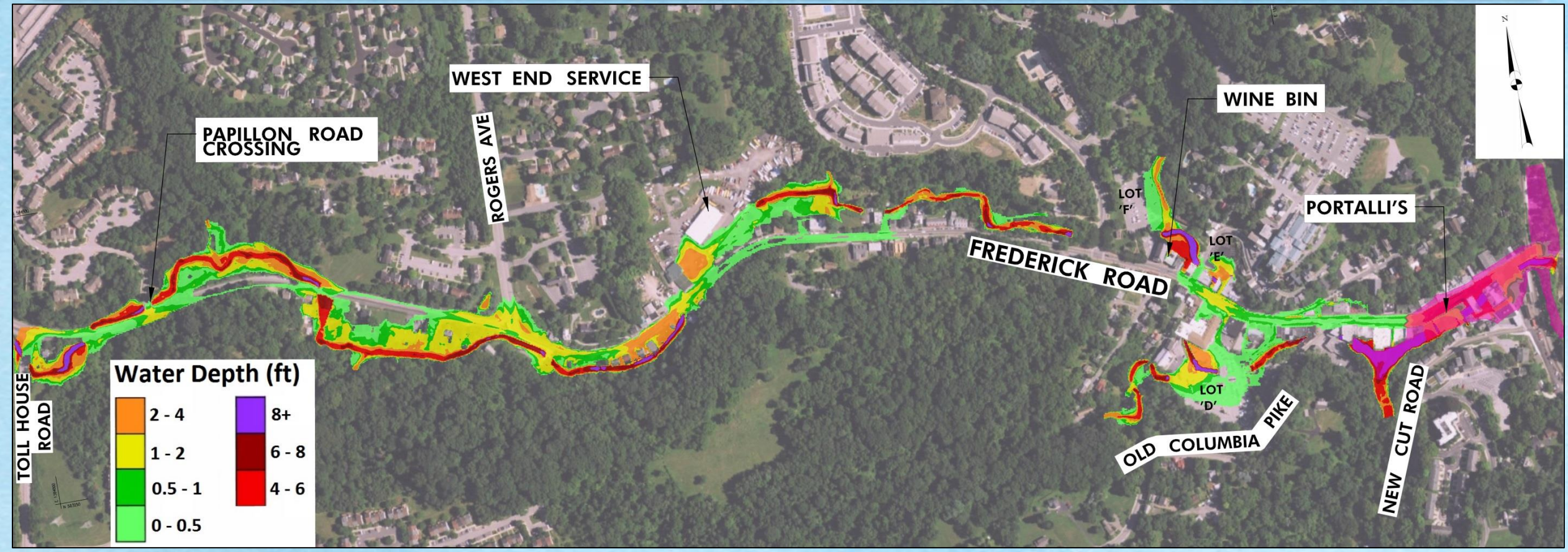
Modeling Results

7/30/16 – Potential Total SWM + Conveyance



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Next Steps

Potential Concept Improvements to be further examined

- Consider within Master Planning effort
- Additional Cost – Benefit analysis

Develop a long range plan based on cost and funding

- Initial Recommendation costs:
  - $13M for 3 SWM Ponds
  - $15M for H8 Underground Pipe Farms
  - $5M-$7M for conveyance improvements
- Total for all 18 SWM projects (Ponds + UG) ~$85M
- Tunnel Bores $60M - $??M

Concluding Thoughts

- The expanded model provides a further basis for prioritizing alternatives within Master Plan
  - Many effective options identified - Details, Impacts, Costs will evolve through the process
- It's a long range effort
  - Years to decades to fully implement
  - Start with most effective and efficient approaches
  - County will develop a timeframe for funding
- Always some threat of flooding
  - Does not help Patapsco backwater (Agnes-type) event

Questions?

What can we help explain better?