

# Path to a Flood Resilient Lubber Run

Flood Resilient Arlington

September 21, 2022



**ARLINGTON**  
VIRGINIA



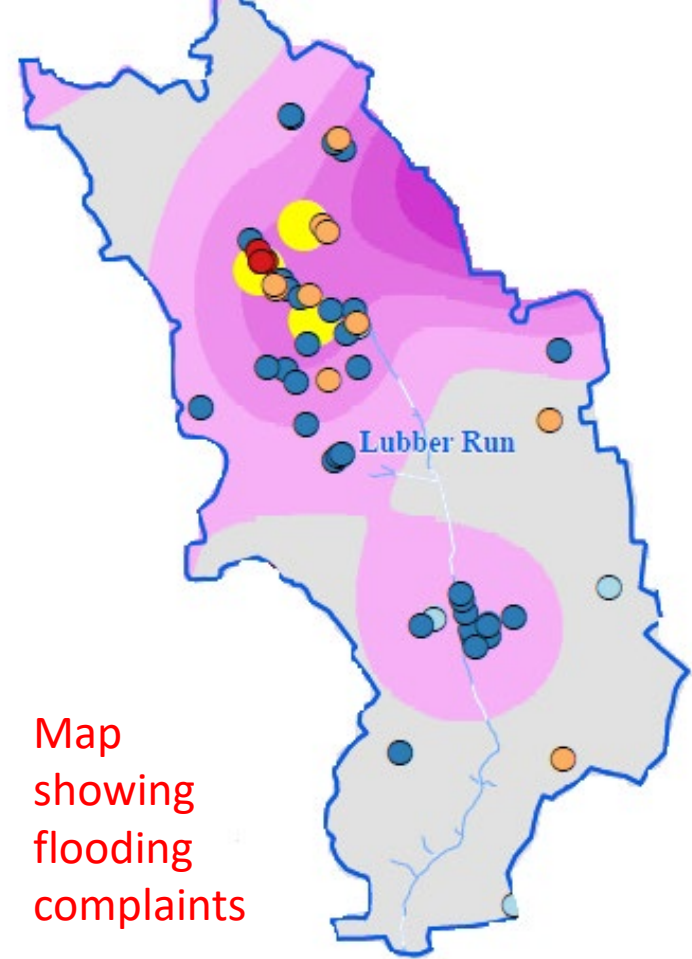
# Agenda

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- Why are we having this discussion?
- Causes of Flooding and Overland Relief
- Discussion of Design Options
- Resilience
- Options Explored, Watershed Strategy & Cost
- FAQ's
- CIP Funding
- Brief Updates on other Initiatives
- Questions



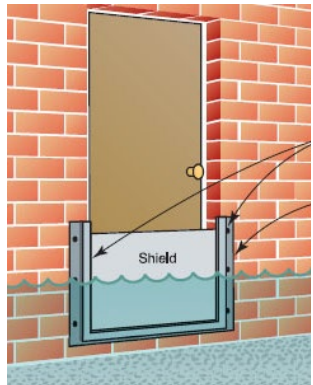
A reminder, why we are having this discussion:



Map showing flooding complaints



# Key Elements of Flood Resilient Arlington



Analytics and Data Assessment

New Types and Locations for Capacity Projects

Increased Stormwater Requirements

Increased Funding


Voluntary Property Acquisition

Floodproofing Outreach



# Mapping Program Investments


## Legend


 Watersheds


## Storm Water Management Projects


### Program / Status


 Capacity Complete / Under Construction

 Capacity / Planned


 Maintenance Capital / Complete


 Maintenance Capital / Planned

 Water Quality / Complete


 Water Quality / Planned


## Past Storm Water Management Initiatives

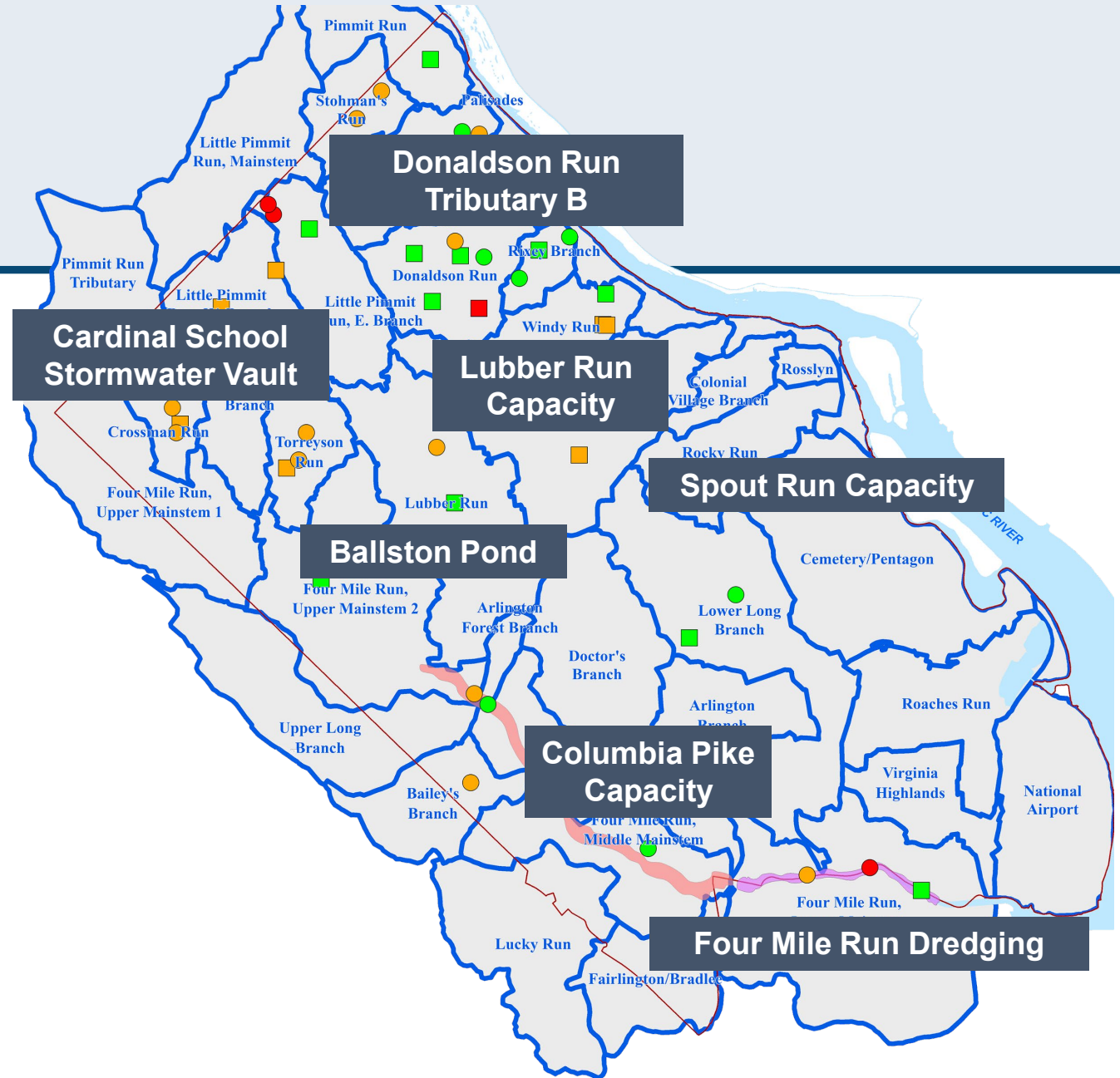
 Flood Control 1984

 Flood Plain Aquisition 60's-70's

## Other Map Elements

 County Line

 Potomac River



# County Watersheds

## ARLINGTON COUNTY, VIRGINIA Watersheds

**Legend**

- Watershed Boundary
- Stream and Open Channels
- Landmark Buildings
- Major Roads
- Potomac River
- County Line

★ Target program areas for Capacity Improvements program





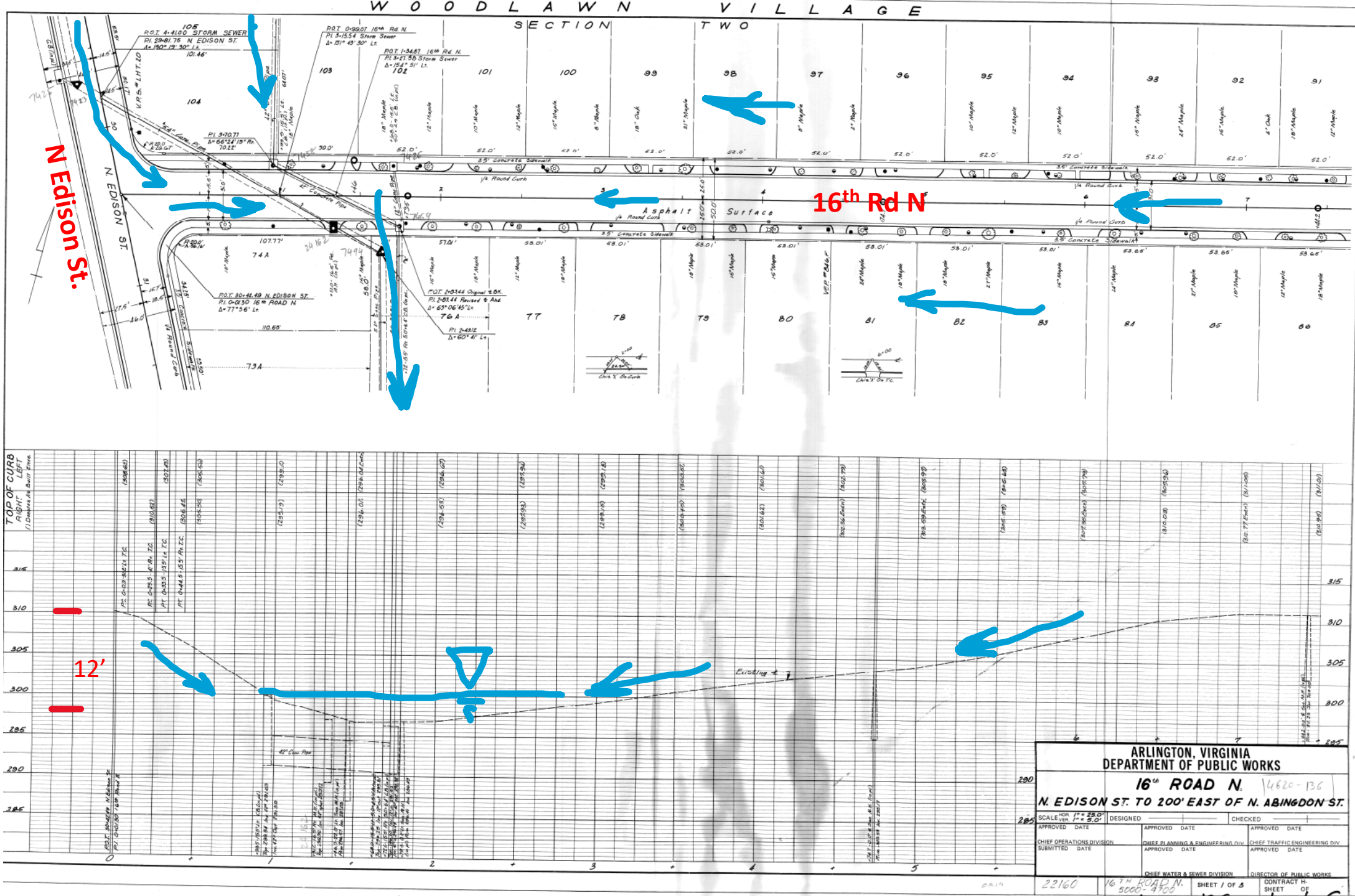
# Causes of Flooding

***Some properties are at a higher risk of flooding due to their location in former stream valleys.***

- During Arlington's early development, there were no stormwater management regulations, and standards for storm systems were less rigorous than today.
- Streams were buried in stormwater pipes and homes and businesses were built within the former floodplains.
- Given the low topography in these former stream valleys, these areas remain at higher risk of flooding despite the presence of the underground stormwater pipes.



Surface Water continues to flow to the low point (where the old stream valley used to be). Properties located at the low point are always at risk of flooding.







Reminder to understand flood risk using available all available sources

Note Trend is to increase awareness of true flood risk

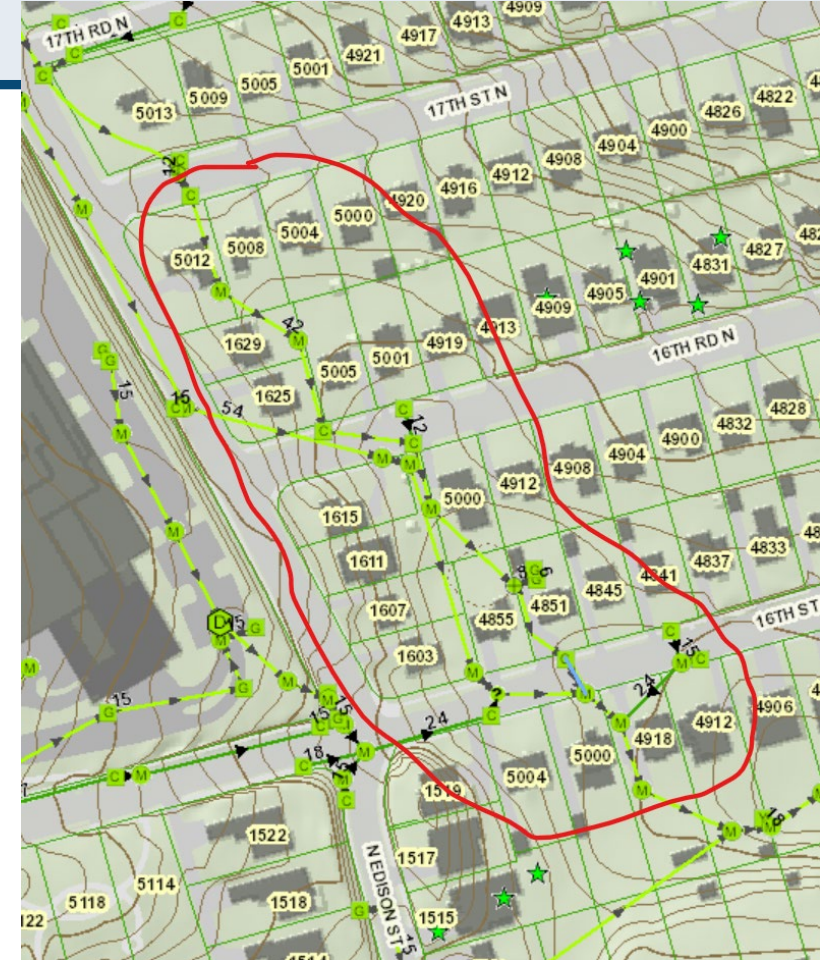


# Riskfactor.com

Riskfactor.com provides risk assessment information to the public and is being promoted by major real estate listing websites such as Redfin, Zillow, etc.

# Stormwater System Design Standards and Overland Relief

- Over time, the US government has collected rainfall data. This database of storm events is used to define the likelihood of a storm occurring.
- The 10-year storm is defined as having a 10% chance of happening each year, 100-year storm a 1% chance.
- Currently, stormwater systems are designed for a 10-year storm, with the assumption that there is overland relief present for larger storms.
- Overland relief is a safe pathway for stormwater to flow for storms greater than the 10-year storm.





# Balancing Stormwater Priorities and Issues



Floodplain, Zoning and Building Code Regulations

Prevent

Overland Relief Pathway Easement, Acquisition

Rebuild

Resilience

Restore

Floodproof/Elevate structures, Remove fences blocking flow path, remove driveways sloping towards home

Protect

Infrastructure for safe conveyance – underground structures, flood walls, swales

The Stormwater Team is working on all of these priorities and has multiple initiatives underway



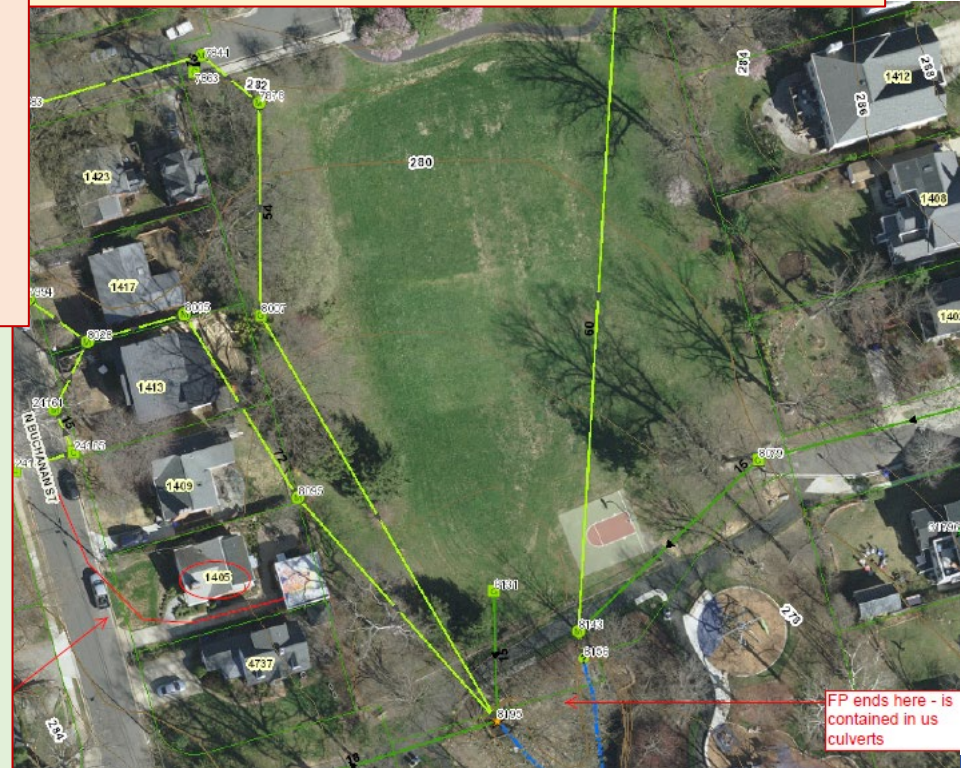
# Multiple Options Evaluated for Lubber Run

- Detention vaults – various scenarios
- Overland relief pathway
- Piped system – 10 year storm – multiple alignments



The only project found to help mitigate flooding in a meaningful way was the detention vault at Woodlawn Park

Limited impacts to trees and lack of above ground infrastructure are two major advantages of using Woodlawn Park for Stormwater detention





# Draft Proposed Watershed Strategy

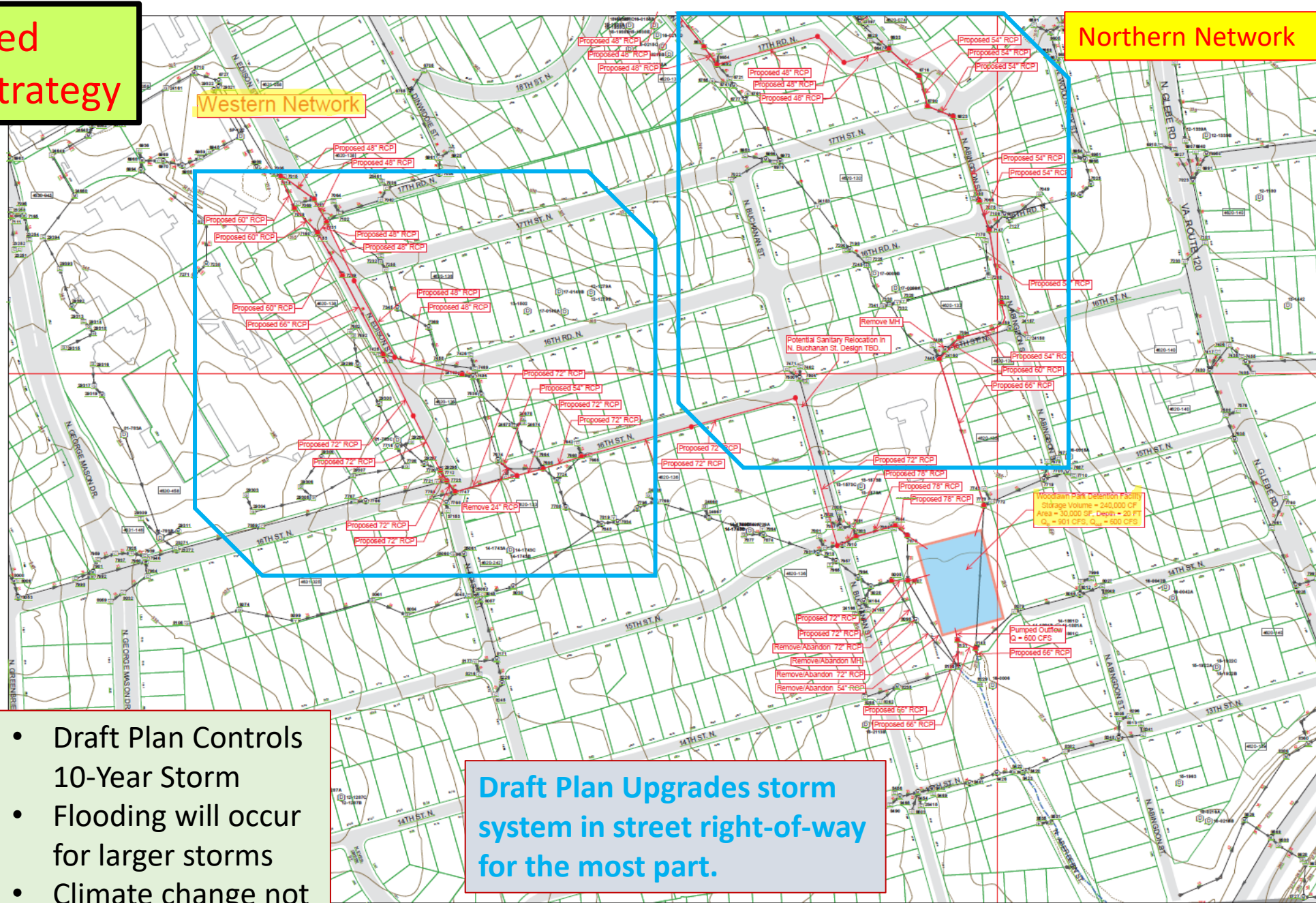
Three Areas of work:

1. Western Network
2. Vault at Woodlawn
3. Northern Network

Detention at Woodlawn Park requires Pump & vault is deep.

Concerns regarding utility conflicts along N Edison St.

- Draft Plan Controls 10-Year Storm
- Flooding will occur for larger storms
- Climate change not accounted for.



**Draft Plan Upgrades storm system in street right-of-way for the most part.**

**Northern Network**

**Western Network**

**Legend**

**Storm Water Junctions**

- Best Management Practices / Detention Facility
- Catch Basin
- End Wall
- Gate Inlet
- Junction
- Manhole
- Yard Inlet
- Discharge Point
- Under Drain
- Other/Unidentified

**Storm Water Mains**

- All Pipe
- Arch Culvert
- Box Culvert
- Open Channel/Ditch
- Open Drainage
- Stream Channel
- Other/Unidentified
- Unknown
- Under Drain
- Direction of Flow
- Diameter of Pipe

**Other Map Elements**

- Properties
- 5 Ft Contours
- County Line
- As-Built Drawing Number
- Structure ID Number

**NOTE:** All attributes on this map are provided by AECOM. All other data is provided by the City of Arlington. Data is intended for reference purposes ONLY. NOT A legal document.

Print Date: 04/2019

ARLINGTON COUNTY, VIRGINIA  
STORM WATER SYSTEM



**Storm Water MAP**

**DRAFT**

# Notes on System Enhancements Considered



No options considered could manage the 10-year storm + Climate Change. Flooding would still occur during larger storms; hence some land acquisition will be required.

Costs included system in ROW and limited property acquisition.

### Cost Estimate:

Western Branch:	\$ 10 M
Vault and outfall:	\$ 27 M
Northern Branch:	\$ 4 M
Total:	\$ 41 M (not escalated)
CIP Funding	\$ 49.5 M (over 10 years)

### Comparison of Conceptual Woodlawn Park Detention Vault with Cardinal School Vault

Woodlawn Park	Cardinal School
240,000 cf Storage	535,000 cf of storage
20 ft. depth	12.5 ft. to 13.5 ft. tall units
30,000 sf area	60,600 sf. in easement area
Pump*	Gravity

### Previous Community Meetings:

- March 22, 2022
- January 13, 2022
- October 28, 2020
- August 12, 2019

\* May require zoning action



## Progress since October 28, 2020 meeting:

- ▶ What work is underway?
  - ▶ Conceptual Engineering Analysis of Watershed
  - ▶ Easement/ROW searches
    - ▶ Gaps in easement/row appears to be problematic
    - ▶ Identification of possible distributed detention options
      - ▶ Currently appears to be limited
  - ▶ Evaluation of pipe upgrade options
  
- ▶ Next Steps:
  - ▶ Reach out to residents regarding easement gaps
  - ▶ Continue Engineering Analysis and surveys
  - ▶ Secure Funding and staff resources

Beginning Soon

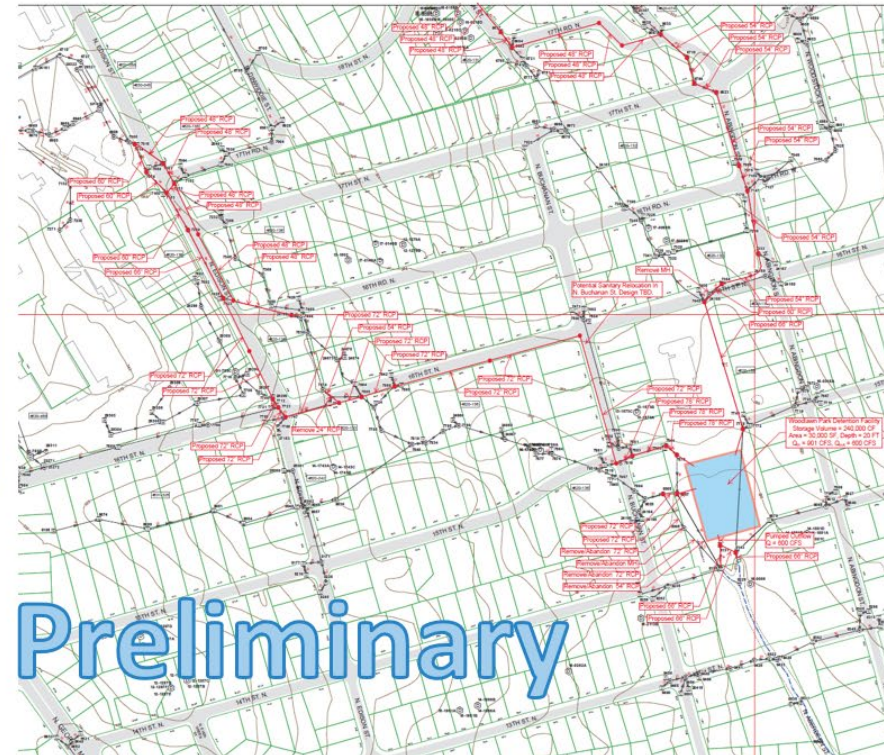
# N. Buchanan St. Flooding Solutions

Currently working on analysis of entire watershed to determine solutions to flooding



- Detention sites evaluated
- Pipe upgrades evaluated
- Will address updated Capacity Study – Also RAMP
- 10-year design storm for piped system/**100-year overland relief path being evaluated**

Progress since last meeting:  
Some Policy issues regarding overland relief are still in process





## Proposed Supplemental Watershed Strategy for Lubber Run Voluntary Property Acquisition for Overland Relief and System Expansion

- None of the solutions evaluated can manage the updated 10-year storm.
- Designing for a 10-year storm event is only appropriate where overland relief is available for larger storm events.
- There may not be sufficient available space within existing rights-of-way to maintain the infrastructure, make resilient system upgrades, or to provide overland relief. (Concern for utility conflicts in N Edison St. & Concern for stormwater pumping facilities.)
- **Upon completion of more detailed Engineering Studies, the long-term solution to reduce flood risk in Lubber Run may require overland relief. (Note that initially, voluntary property acquisition will focus on properties located in Spout Run Watershed.)\***  
\* There are a few properties located in Lubber Run that have expressed interest in voluntary property acquisition.
- Phased Property Acquisition is a necessary component of a resilient stormwater improvement program to provide overland relief or expand the system capacity and reduce flood risk to the community.



# Proposed Supplemental Watershed Strategy for Lubber Run

## Voluntary Property Acquisition for Overland Relief and System Expansion

- Land acquisition of properties in 100-year inundation zone proposed to be phased in prioritized/tiered approach
- Property would become open space to maintain the infrastructure, enhance the system, or to provide overland relief. Properties would be protected from development encroachments by regulation
- Problematic flooding areas and stormwater overflow paths have been identified by numerous studies and empirical evidence:
  - Capacity Study, Stormwater Masterplan and Engineering Studies
  - Riskfactor.com
  - RAMP
  - Flood events (2006, 2018, 2019, 2020)
- Voluntary land acquisitions



## Why Does Overland Relief reduce overall community flood risk?

Watershed "A" has 100 lots  
with an undergrounded stream



10 of the 100 lots are in an inundation zone & flood



10 flood  
90 do not flood

# Why Does Overland Relief reduce overall community flood risk?

Year 1

5 lots are acquired thru voluntary acquisition



5 still flood  
90 do not flood

Year 5

8 lots are acquired thru voluntary acquisition



2 still flood  
90 do not flood

Year 10

10 lots are acquired thru voluntary acquisition



0 flood  
90 do not flood

After 10 years, risk was reduced from 10 flooded lots out of 100, to 0 flooded lots out of 90.



Property losses are reduced, public safety is improved, there is more room for system upgrades and maintenance access.



Flood Resilience is increased since storms up to the 100 year storm are contained within the vacant inundation zone.



Those who do not choose to participate in the voluntary program, remain at risk of flooding for a longer time frame.



**Letters from the County Real Estate Bureau will be sent to property owners** indicating opportunity to participate in a Voluntary Property Acquisition Program for the purpose of improving overland flow relief within the Spout Run Watershed – specifically beginning with Waverly Hills neighborhood. **There are also some properties in Lubber Run that have already reached out to the County.**

There are advantages in participating in the program:

1. Lower closing costs
2. No commissions to be paid
3. Stable negotiating environment
4. Peace of Mind

# FAQs Available Online

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**How do I know if the County is interested in purchasing my property?** *The County's real estate team will begin contacting homeowners this fall -about potential property acquisitions by letter. Properties will be considered based on the degree that they can be used by the County for the purposes noted above and the flood risk present in specific areas of the watershed based on historic development patterns, topography, etc.*

**What will the purchased properties be used for?** *Properties acquired through voluntary acquisitions will be used to:*

- *re-establish overland relief flow paths for water during large storm events for flood mitigation,*
- *provide access to existing stormwater infrastructure to conduct necessary maintenance or upgrades,*
- *locate future stormwater infrastructure stormwater detention facilities and/or water quality facilities*

[Property Acquisition FAQs](#)



# Break for Questions

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# CIP Funding for Lubber Run

Adopted FY 23 – FY 32 CIP

## 10 YEAR CATEGORY SUMMARY (in \$1,000s)

	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	10 Year Total
10. Lubber Run Watershed Capacity Improvements	1,500	1,500	1,905	155	4,920	4,855	4,570	11,930	10,640	7,480	49,455

Land Acquisition	Lubber Run Watershed Capacity Improvements	1,500	1,500	1,545	-	-	-	-	-	-	-	<b>4,545</b>
Design	Lubber Run Watershed Capacity Improvements	-	-	360	155	4,705	2,610	655	-	-	-	<b>8,485</b>
Construction	Lubber Run Watershed Capacity Improvements	-	-	-	-	215	2,245	3,915	11,930	10,640	7,480	<b>36,425</b>
											<b>49,455</b>	

**NOTE: Proposed funding is NOT for improvements in the Langston Blvd. Planning corridor, but is for downstream flooding mitigation.**

\* Property Acquisition will be phased and prioritized over multiple CIP cycles.  
There is some flexibility in project design, acquisition and construction categories.

Note: The proposed level of funding for this projects begins to approach the funding levels for stormwater that sister jurisdictions already provide.



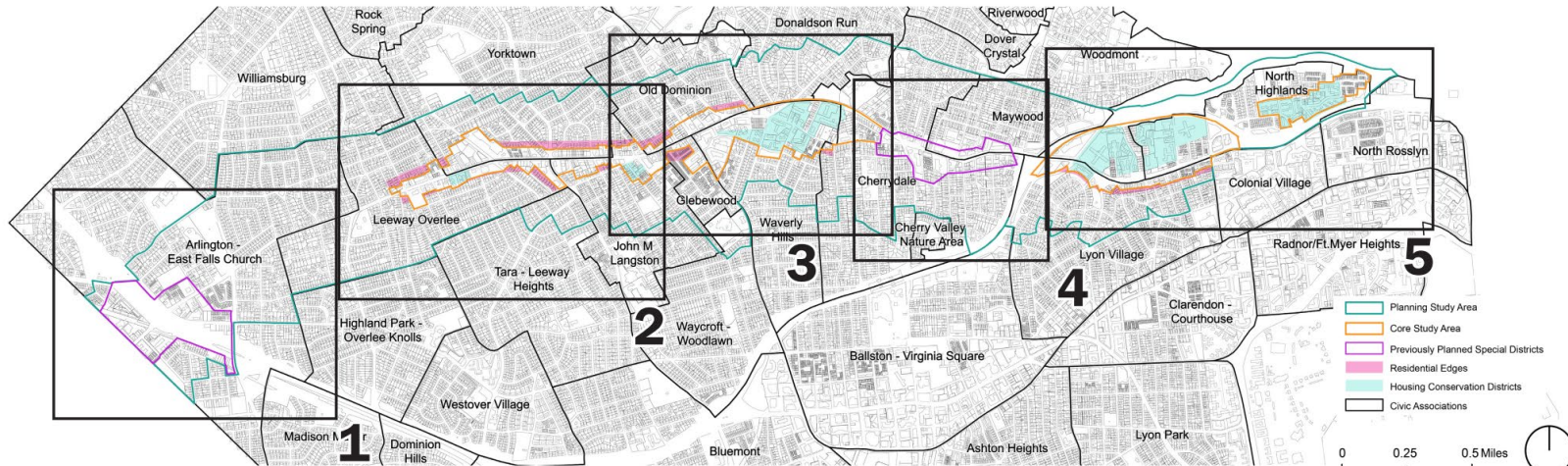
## Updates on Other Stormwater Initiatives

- Plan Langston Boulevard (PLB)
- FEMA FIRM update
- Arlington County Floodplain Ordinance update
- Stormwater Utility Update
- RAMP update
- High Water Detection Sensors
- Ballston Pond Update
- LDA 2.0
- Zoning Study
- Flood Resilient Design and Construction Manual



# Plan Langston Boulevard Engagement Preliminary Concept Plan

- Preliminary Concept Plan Report is available online
- Series of public meetings scheduled:
  - Wednesday, Sept. 14
  - Wednesday, Sept. 21
  - Thursday, Sept. 22
  - Tuesday, Oct. 11
- Multiple opportunities for providing feedback on the PCP



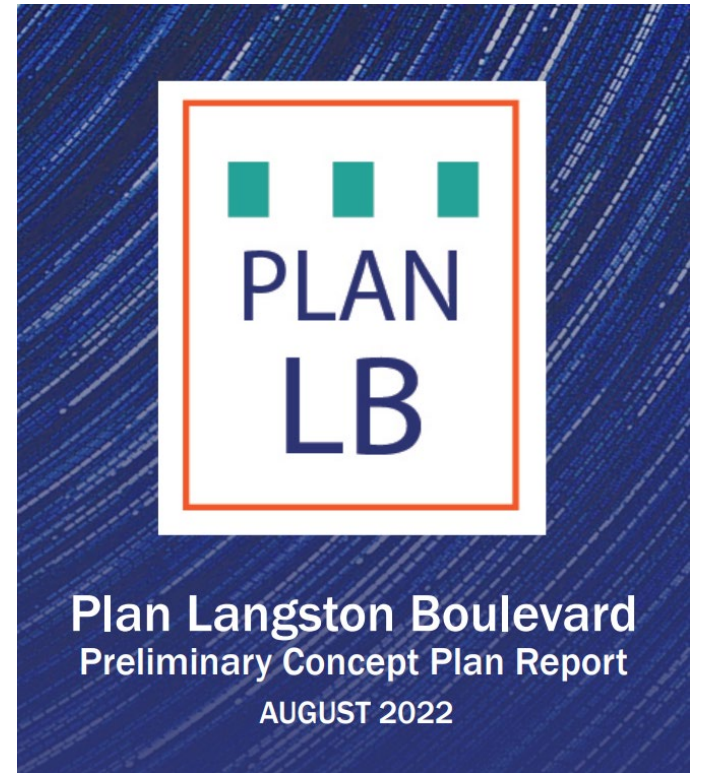
**AREA 1**  
Arlington - East Falls Church

**AREA 2**  
John M. Langston  
Yorktown  
Tara Leeway Heights  
Leeway Overlee

**AREA 3**  
Waverly Hills  
Donaldson Run  
Old Dominion  
Glebewood  
Waycroft Woodlawn

**AREA 4**  
Cherrydale  
Maywood

**AREA 5**  
North Highlands  
Lyon Village



Plan Langston Boulevard  
Preliminary Concept Plan Report  
AUGUST 2022

## CONTACT US

[planlangstonblvd@arlingtonva.us](mailto:planlangstonblvd@arlingtonva.us)

**Coordinator**  
Natasha Alfonso-Ahmed  
703-228-3691

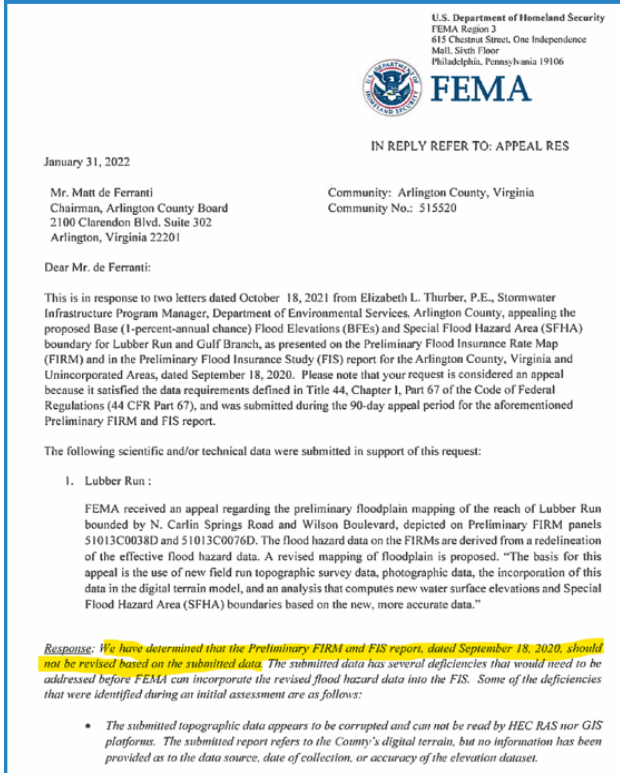
**Communications & Engagement**  
Rachel LaPiana  
703-228-0059





# Floodplain Progress Since January 12, 2022 and March 23, 2022 Meetings

## Status of FEMA Appeals



## Lubber Run Appeal was not accepted by FEMA

See letter dated Jan. 31, 2022

Result is not unexpected (very difficult to win Appeals)

Next step: **LOMR**

May be two: 1. Using Existing Q

2. Updated Q from Ballston Pond

Why Two? Obtain approval of existing conditions model, which is easier approval. Reducing Q from pond will be more complex and will entail pond routings and as-builts from pond

Currently working with Consultant on Scope of Work

Note that one of the Appeals was accepted (Four Mile Run near border with Falls Church)

FEMA will issue revised FIRM and FIS and a new review period starts. No schedule yet. No dates for Letter of Final Determination.



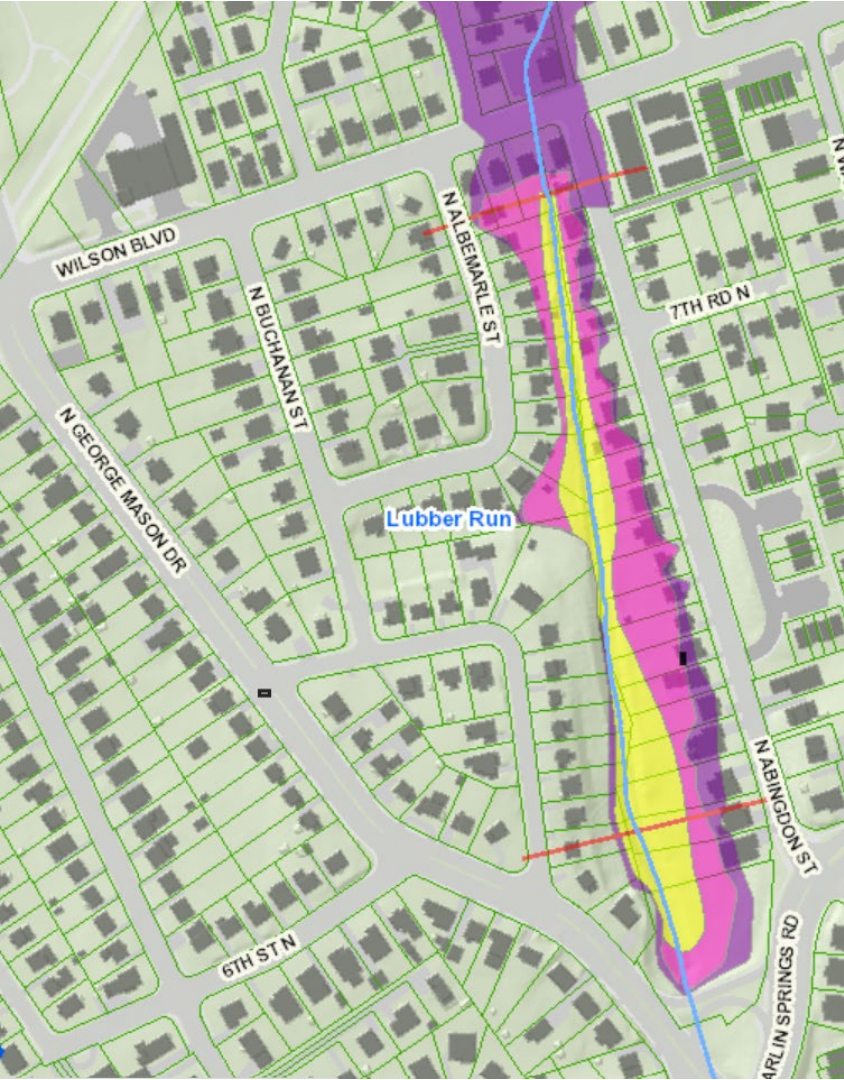
## Procurement Is Underway

This will be a major undertaking in this fiscal year.



# FEMA Floodplain Map Update

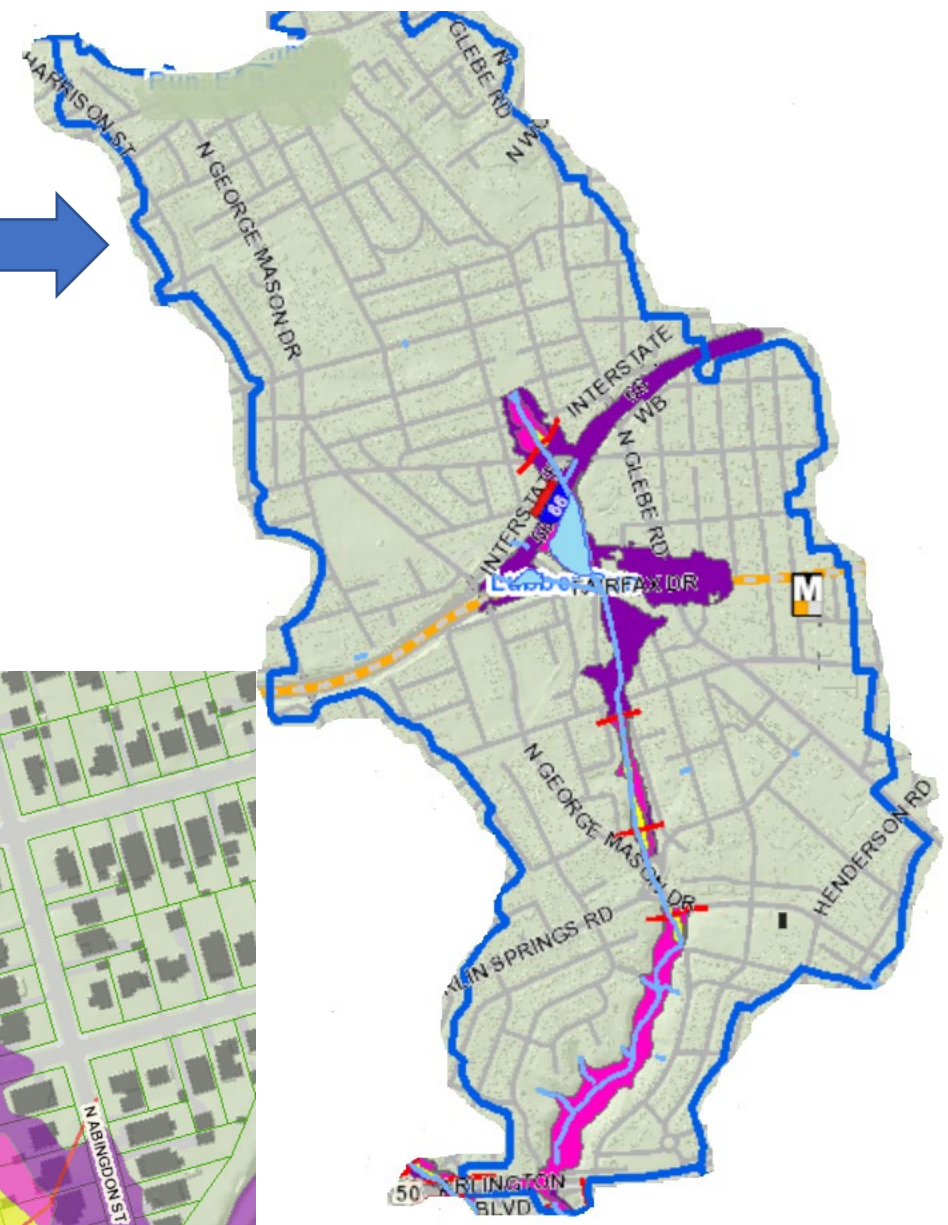
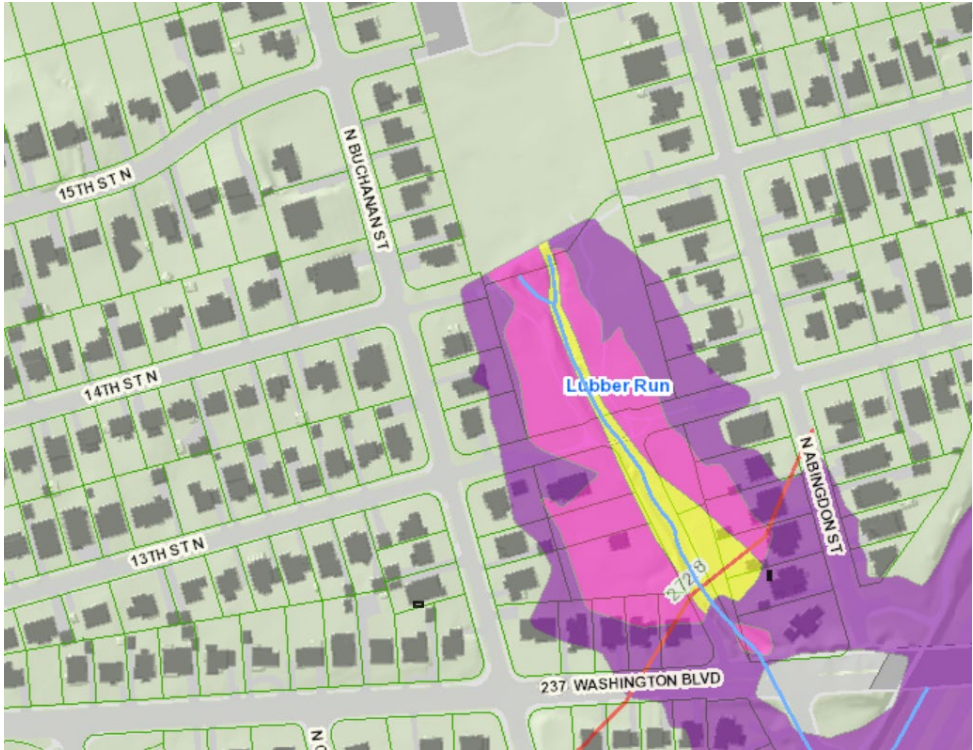
Detail of Preliminary floodplains



Overall view of Lubber Run watershed with Preliminary floodplains



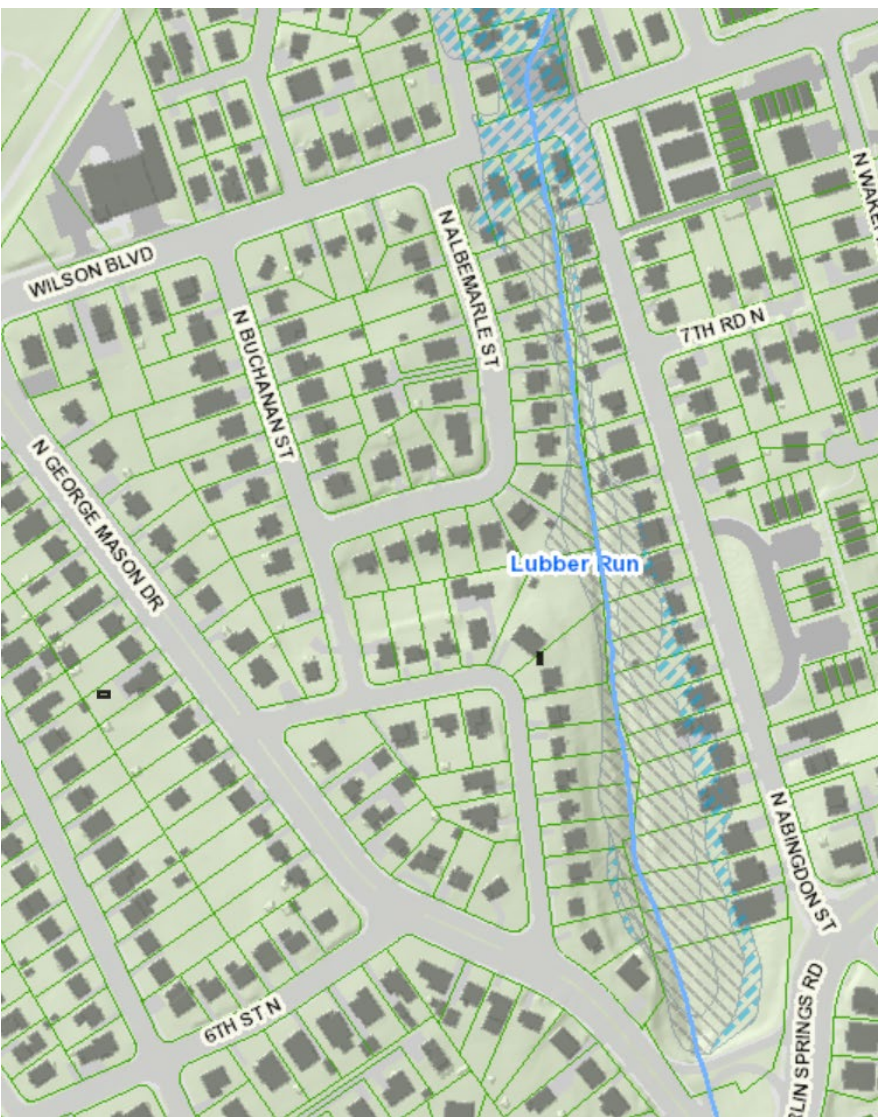
- A,
- AE,
- AE, FLOODWAY
- X, 0.2 PCT ANNUAL CHANCE



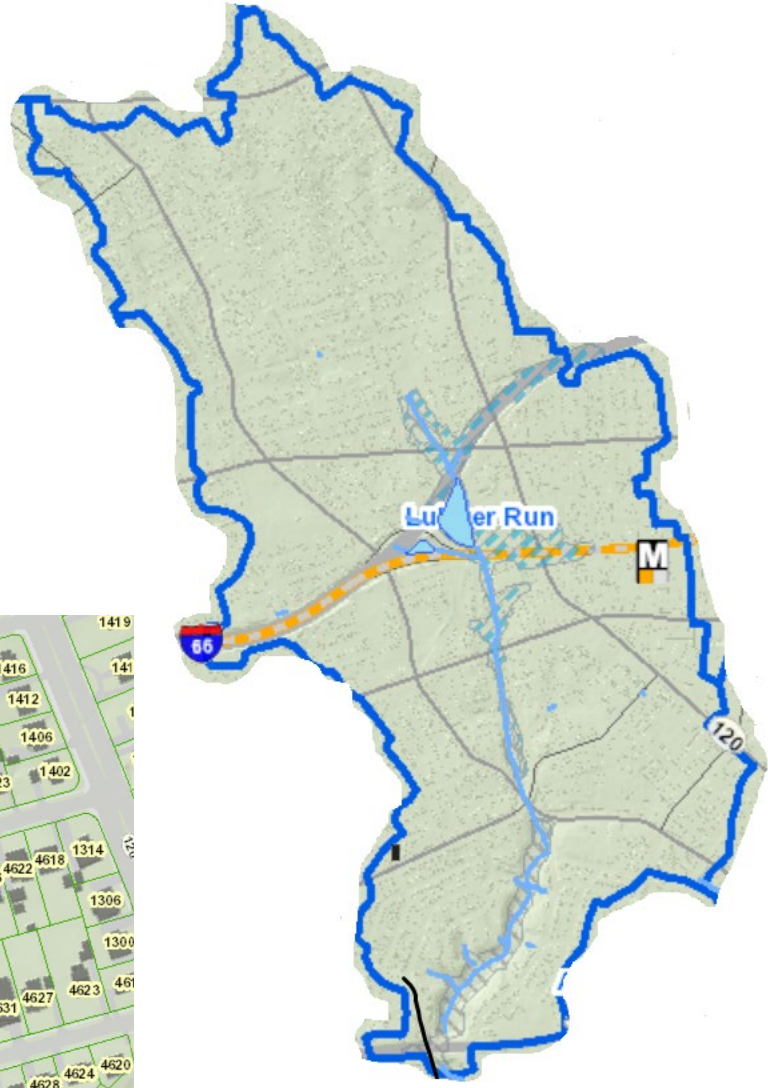


# FEMA Floodplain Map Update

Detail of Effective floodplains



Overall view of Lubber Run watershed with Effective floodplains

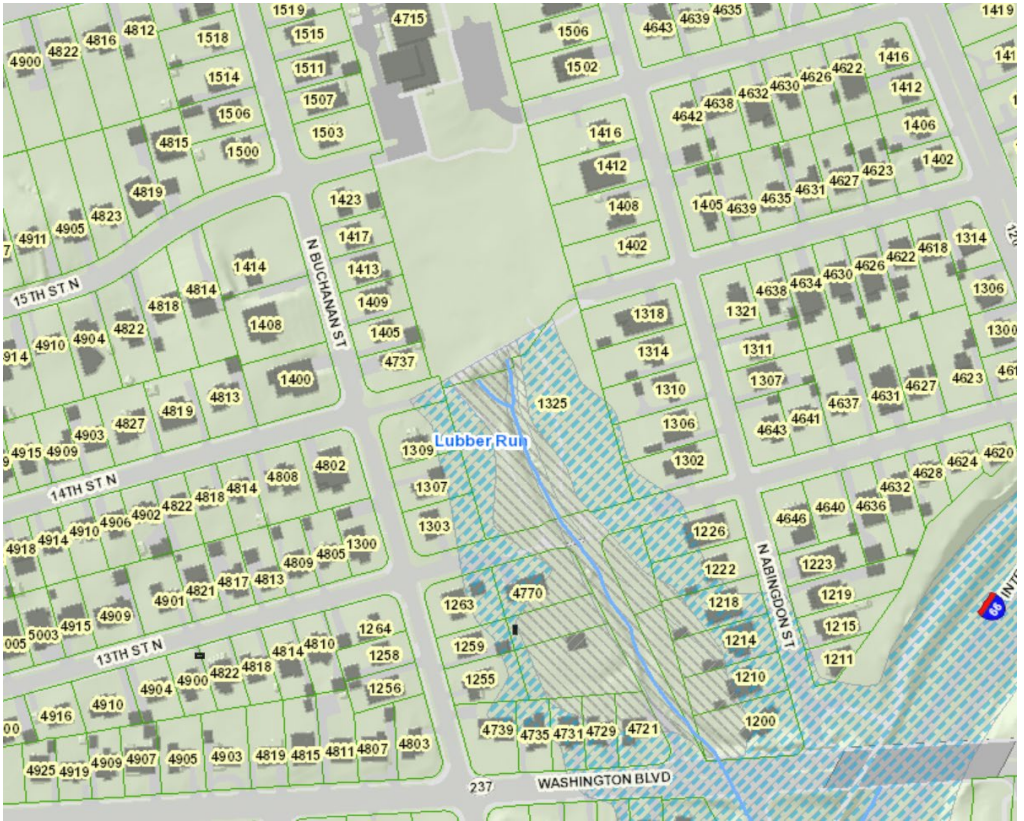


Effective Flood Zones

Effective Base Flood Plain

0.2 % Annual Chance Flood

Hazard





# Panel 38D



# Preliminary FIRM

### FLOOD HAZARD INFORMATION

FOR THE PURPOSES OF SPECIAL APPLICABLE HAZARD MAPS FOR FLOOD HAZARD ZONING, THE INFORMATION SHOWN ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT [HTTPS://MG.C/FEMA.GOV](https://mgc.fema.gov)

	Without Base Flood Elevation (BFE) Zone A
	With BFE or Depth Zone AE, A1, A2, A3, A99
	Regulatory Floodway
	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile (Zone C)
	Future Conditions 1% Annual Chance Flood Hazard (Zone D)
	Area with Reduced Flood Risk due to Levee Sea Walls (Zone D)
	Area with Flood Risk due to Levee (Zone D)
	Wetlands
	Area of Undetermined Flood Hazard (Zone D)
	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall

### OTHER AREAS OF FLOOD HAZARD

	Cross Sections with 1% Annual Chance Water Surface Elevation
	Culvert Transit
	Culvert Transit Baseline
	Profile Baseline
	Hydrographic Feature
	Base Flood Elevation Line (BFE)

### OTHER FEATURES

	Limit of Study
	Jurisdiction Boundary

### NOTES TO USERS

The information on this map was prepared by the Flood Insurance Study Team for the purpose of determining flood insurance rates. It is not intended to be used for any other purpose. The information on this map is preliminary and is subject to change without notice. The information on this map is preliminary and is subject to change without notice. The information on this map is preliminary and is subject to change without notice.

### SCALE

1 inch = 500 feet

### PANEL LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM  
FLOOD INSURANCE RATE MAP  
ARLINGTON COUNTY, VIRGINIA  
Map 38 of 83

PRELIMINARY  
9/18/2020

VERSION NUMBER: 2.6.4.6  
MAP NUMBER: EA01300380  
MAP REVISION:

County is in the process of procuring consulting services to prepare two LOMR's (Letters of Map Revision) for the Area south of Wilson Blvd and also Ballston Pond. Cost for both will be in the \$125,000 range.

Areas downstream on Panel 76D are on public land with no impacts to private property

## Tentative Schedule for updated FIRM and Floodplain Ordinance:

Step / Milestone	Start Date	End Date	Notes
Revised Preliminary Issued	04/29/2022	n/a	County received / downloaded files
30-Day comment period	04/29/2022	05/29/2022	County provided comments to FEMA
Prep work for Appeal Start	June 2022	July 2022	FEMA's contractor will begin prep work for the Appeal Period*
FR notice prepared, submitted, and published	July 2022 (submitted)	08/02/2022 (published)	FEMA's contractor will prepare and submit the <i>Federal Register</i> notice for publication
Newspaper publications (2)	09/29/2022 (tentative)	10/06/2022 (tentative)	FEMA's contractor will contact local newspaper and arrange for 2 publications
Appeal Period (90 days)	10/06/2022 (tentative)	01/06/2023 (tentative)	FEMA's contractor will mail out the Appeal Start letter
Prep work to ready the study for LFD	Jan. 2023	Mar. 2023	FEMA's contractor will begin prep work for completing the study*
Study is independently reviewed by another contractor	May 2023	June 2023	Independent contractor has 60 days to review and approve the study
Letter of Final Determination	June 2023	Nov 2023	Independent contractor has 60 days to review and approve the study
New Study Effective Date	Dec. 2023	n/a	County will receive new products

## Floodplain Ordinance Update

- Required due to FIRM updates
- Must be approved by DCR and FEMA
- Must conform to model ordinance
- Must be adopted within 6 months after Letter of Final Determination (LOD) or approximately December, 2023

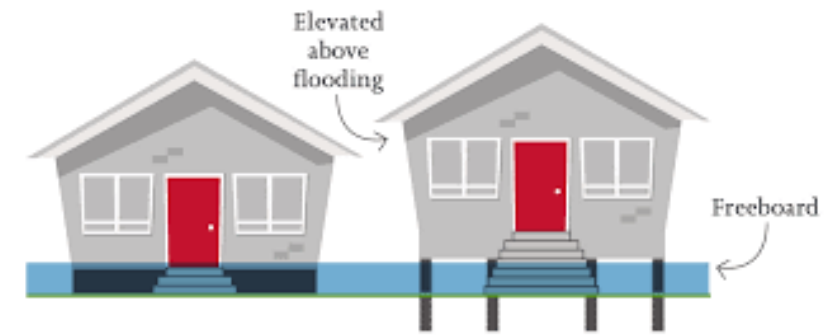
Overall, proposed changes are minor





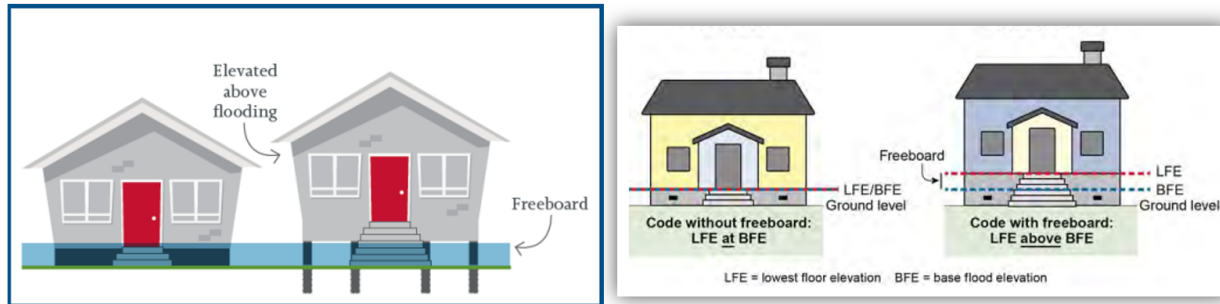
# Proposed changes to Floodplain Ordinance

- Increase in required freeboard (distance above base flood elevation) from 12 to 18 inches, or
- Buildings in 100-year floodplain must be watertight 2 feet above the base flood elevation (previous requirement 1 foot)
- Accessory structures can not be larger than 600 feet
- No emergency service records, medical records or government records can be stored in 500 year floodplain



# Summary of Proposed Changes to Floodplain Ordinance

## Freeboard Update



When the base flood elevation data is utilized, the lowest floor shall be elevated to or above the base flood level **plus eighteen (18) inches**. The additional elevation is called 'freeboard', which provides an added margin of safety to address the flood modeling and mapping uncertainties associated with FIRMs.

## Non-Residential Construction Freeboard Updates

New construction or substantial improvement of any commercial, industrial, or non-residential building shall have the lowest floor, including basement, elevated to or above the base flood elevation (BFE) **a minimum of eighteen (18) inches**. *The previous minimum floor elevation was one foot above the BFE.*

Buildings located in Zone AE may be flood-proofed in lieu of being elevated provided that all areas of the building components below the **BFE plus two (2) feet** are watertight with walls substantially impermeable to the passage of water and use structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy. *The previous requirement was the BFE plus one (1) foot.*

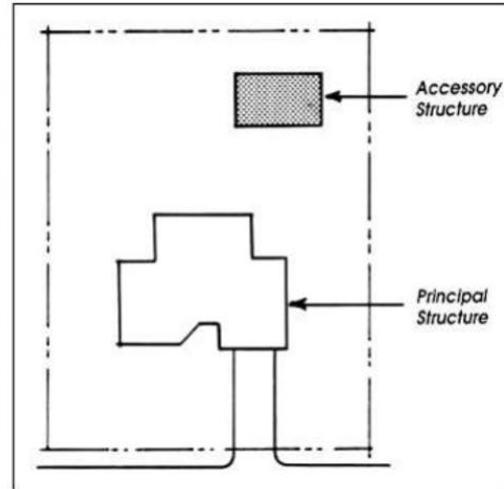
## Residential Construction Freeboard Update



New construction or substantial improvement of any residential structure in Zones AE and A with detailed base flood elevations shall have the lowest floor, including basement, elevated to a minimum of **eighteen (18) inches above the base flood level**. *The previous minimum elevation was one (1) foot.*

# Appurtenant or 'Accessory Structure'

## Summary of Proposed Changes to Floodplain Ordinance



## Appurtenant or 'Accessory Structure'

- **Structure Size** - the footprint of the structure can be no greater than **600 square feet in area**
- **Characteristics** –
  - Not be used for human habitation
  - Be useable only for parking of vehicles or limited storage
  - Be constructed with flood damage-resistant materials below the base flood elevation
  - Be constructed and placed to offer the minimum resistance to the flow of floodwaters
  - Be anchored to prevent flotation
  - Have electrical service and mechanical equipment elevated to or above the base flood elevation





# Summary of Proposed Changes to Floodplain Ordinance

## 0.2 Percent Annual Chance Flood Hazard Area

The mapped floodplain includes the districts designated as having a 0.2 percent annual chance of flooding as shown on the Flood Insurance Rate Map.

In this district no emergency service, medical service, or governmental records storage shall be allowed, except by special exception using the waiver process.

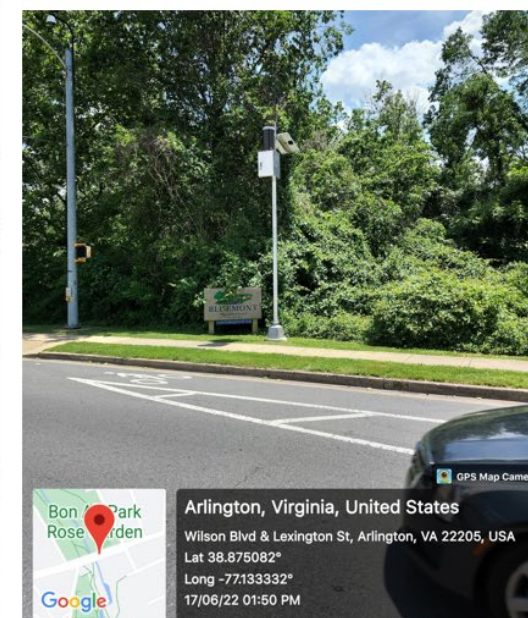
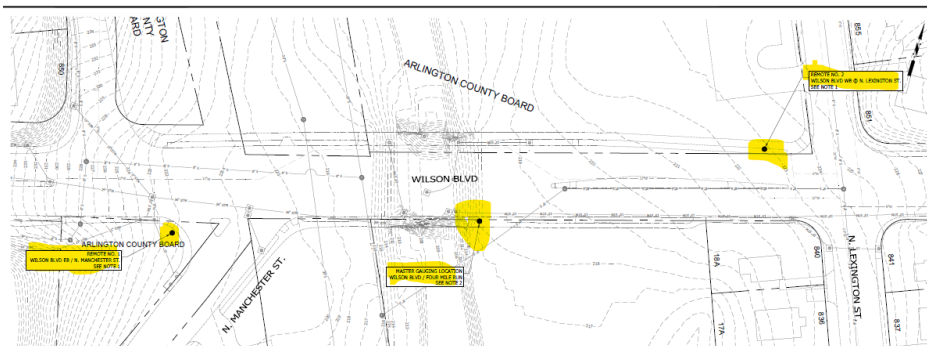
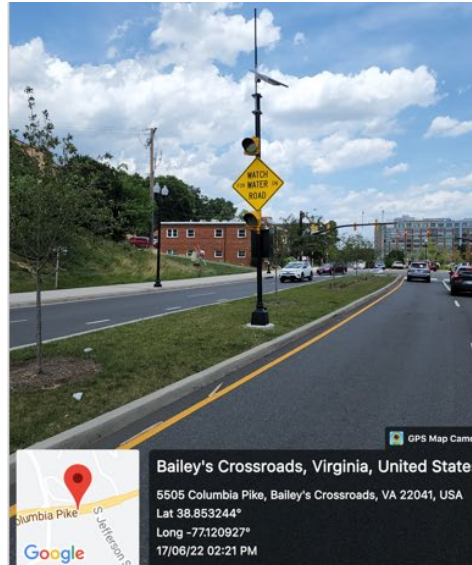
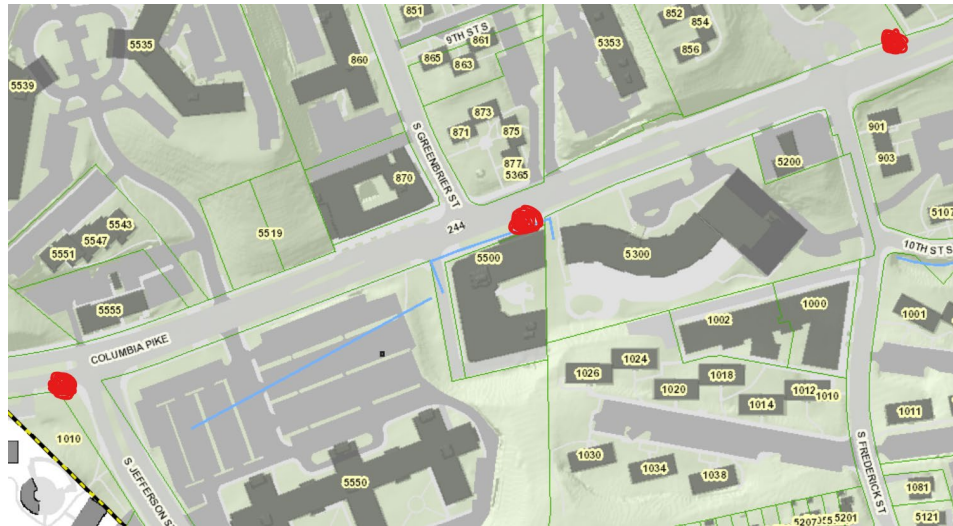




# High Water Detection Devices

Two high water detection devices installed

Location #1: Columbia Pike near Greenbrier



A third set of devices is slated for Kirkwood Rd. @ Langston Blvd.

Location #2 Wilson Blvd. near N Lexington St. and N Manchester St. <sup>37</sup>



# Ballston Pond Project



The original pond was designed to reduce peak flows by 30%, and the new design will maintain that flood mitigation.

The project will remove accumulated sediment from the pond and route water all throughout the pond area in new flow channels, as opposed to flowing directly along one side of the pond as it does now.

There will be regular maintenance after the project is done (2023)

The County has pollution reduction regulations in addition to flood mitigation. This project was designed to maintain the flood mitigation of the pond, and also to add water quality treatment.





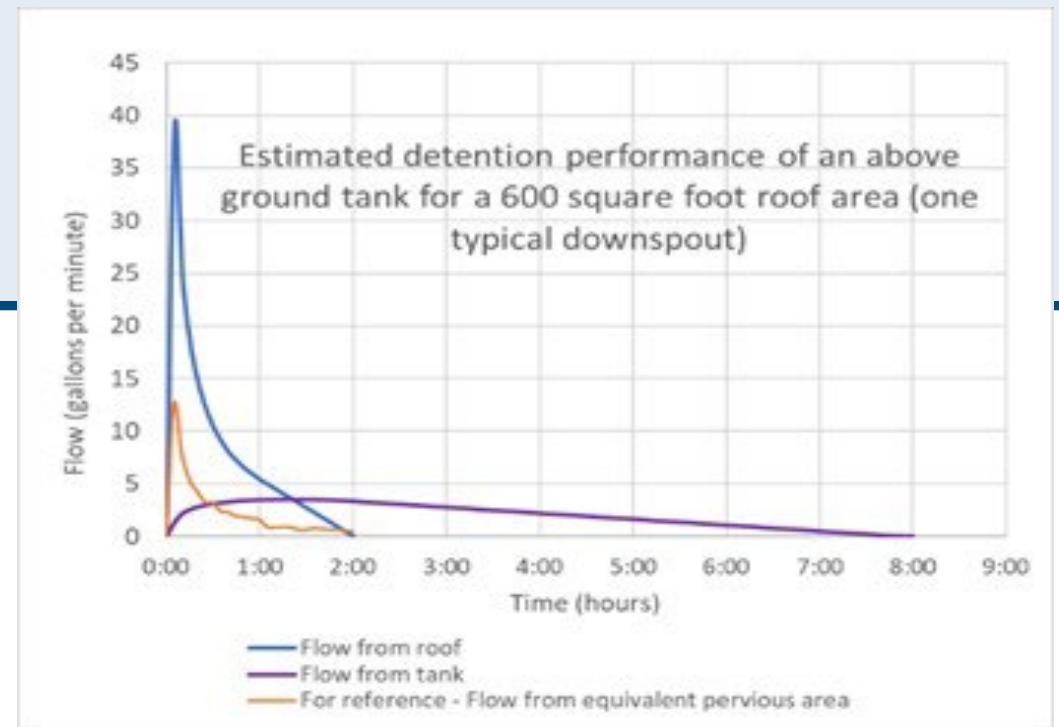
# LDA 2.0 - Increased Stormwater Management Requirements

LDA = Land disturbing activity permit

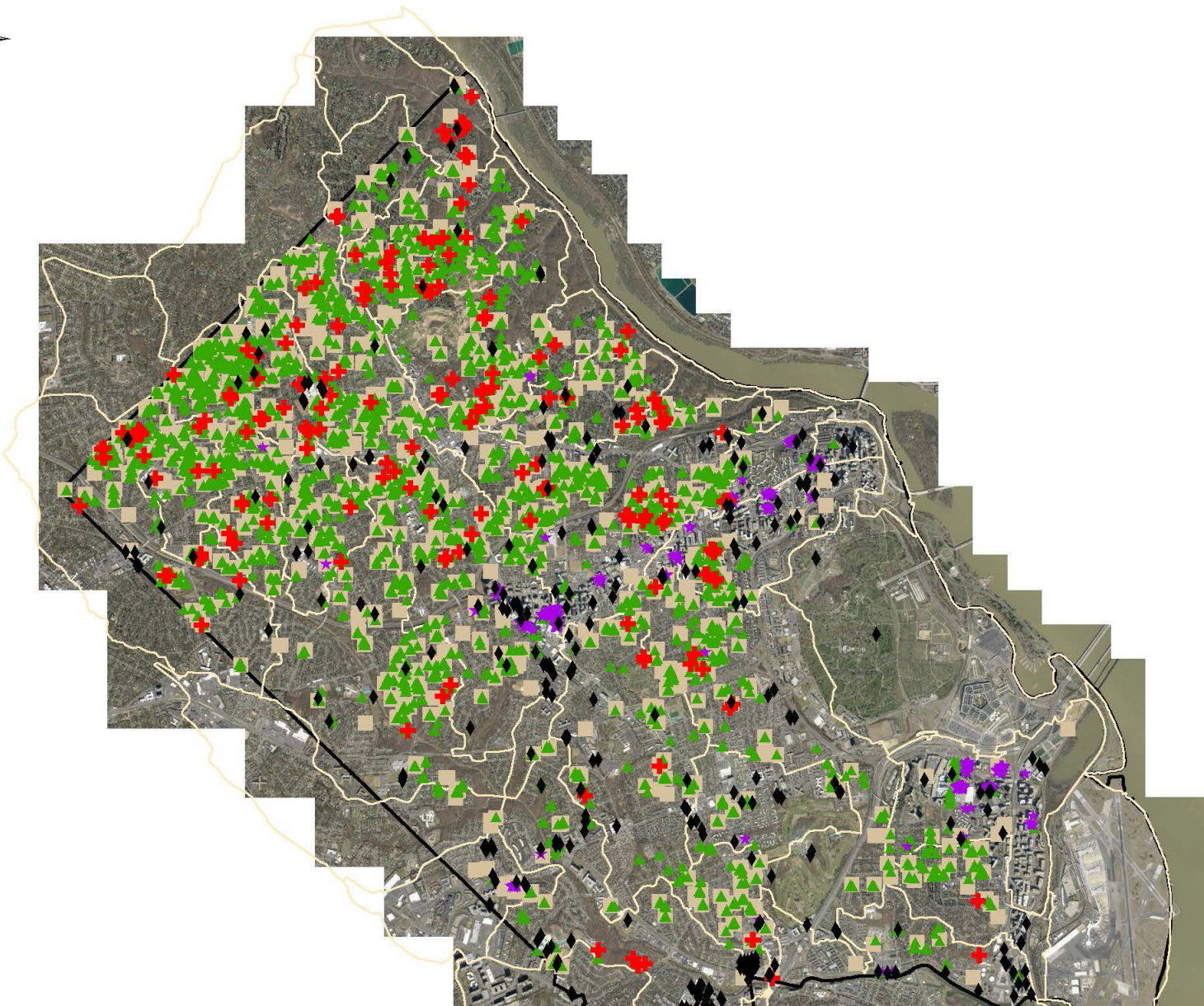
With LDA 2.0, the County has increased stormwater management requirements for single-family home projects to reduce impacts to neighboring properties.

Took effect September 2021

Requirement to detain up to 3 inches of runoff from new impervious area on site and restore soil permeability after construction



# Stormwater Management Facilities in Arlington County

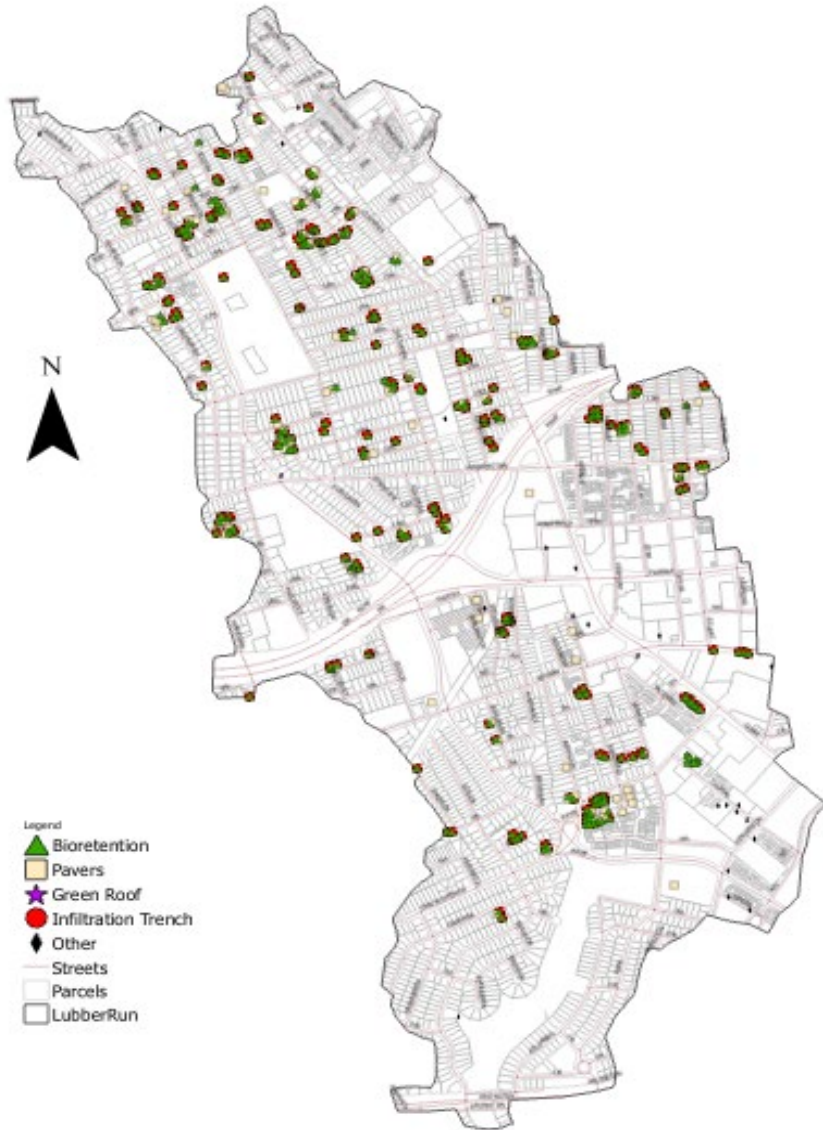


## Legend

- ▲ Bioretention
- Permeable Pavement
- ✚ Infiltration Trench
- ★ Green Roofs
- ◆ Other
- Watersheds
- Arlington County



# Stormwater Management Facilities In Lubber Run

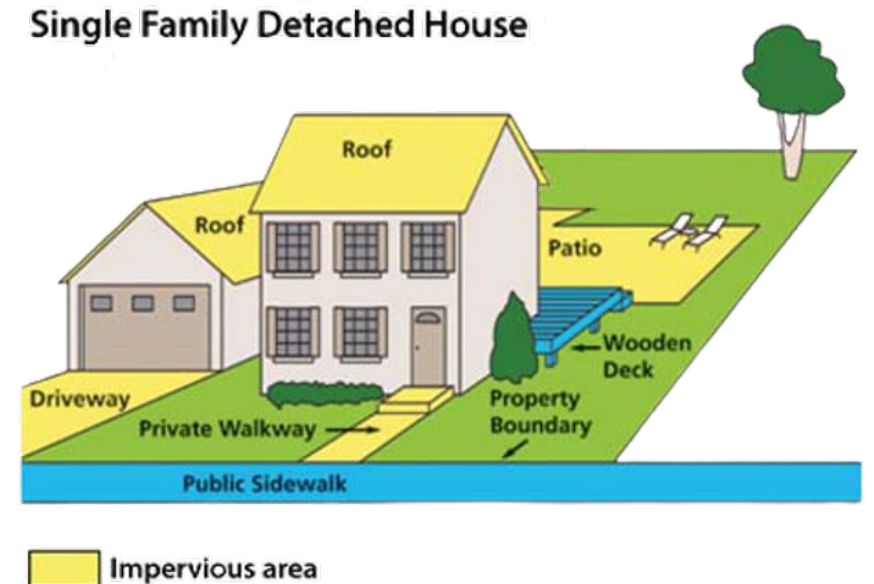


## Stormwater Management Facilities in Lubber Run



# Stormwater Utility

- County is considering changing to a stormwater utility for funding the stormwater program
- Currently, property owners pay a stormwater tax based on property assessment
- Stormwater utility fee would instead be based on impervious cover on the lot (yellow areas on the diagram)
- Credit would be offered for actions taken to reduce runoff
- More information and resources on the web page



<https://bit.ly/ArlingtonStormwaterUtility>

# Risk Assessment and Management Plan (RAMP)

- Will deliver updated rainfall curves, 10 year design standard and 2040 and 2070 climate projections
- The RAMP maps critical community facilities in all sectors, to support vulnerability and risk assessments, and allow mitigation planning.
- Map County's "urban" floodplains (outside FEMA floodplains)
- Measures both Flooding and Sea Level Rise/Storm Surge Risks
- Define and value risks from flooding
- Informs flood resilient design and construction standards





# Upcoming Zoning Study for Stormwater Facilities

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**Improve Consistency:** The Zoning Ordinance treats stormwater systems differently for public zoned sites (ex., parks, schools) and also differs from how other water utilities are treated

**Add Flexibility:** The current zoning regulations do not readily enable the use of certain stormwater stormwater system components

- **Zoning study will take place over the next 6 months.** Public meeting tentatively planned for late October/early November.
- Unrelated to this study, we are beginning work on a Flood Resilient Design Manual as well

# Path to a Flood Resilient Lubber Run

**Questions?**

