Flood Resilience in Arlington, Virginia

COG January 13, 2023

Agenda

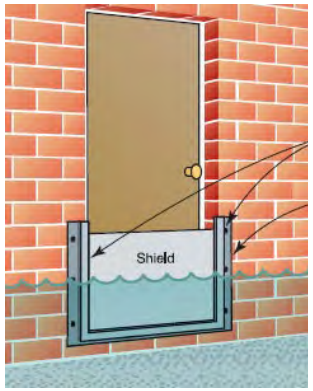
- Introduction
- Brief Background and History
- Cardinal School Stormwater Detention Vault System
- RAMP
- Voluntary Property Acquisition Program

Introductions

Arlington's Stormwater Team

- Demetra McBride, OSEM Bureau Chief, dmcbride@arlingtonva.us
- Aileen Winquist, Communications Manager, awinquist@arlingtonva.us
- Jason Papacosma, Watershed Programs Manager, Jpapacosma@arlingtonva.us
- Elizabeth Thurber, Stormwater Infrastructure Program Manager, Ethurber@arlingtonva.us

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

Balancing Stormwater Priorities and Issues

Floodplain, Zoning and Building Code Regulations

Overland Relief Pathway Easement, Acquisition

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

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

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

Underground Detention Vault System at the Cardinal Elementary School

Watershed Scale Anchor Project

County-APS Partnership

Strategic use of public land for multi-purpose goals to overcome space constraints and expand the capacity of the stormwater management system

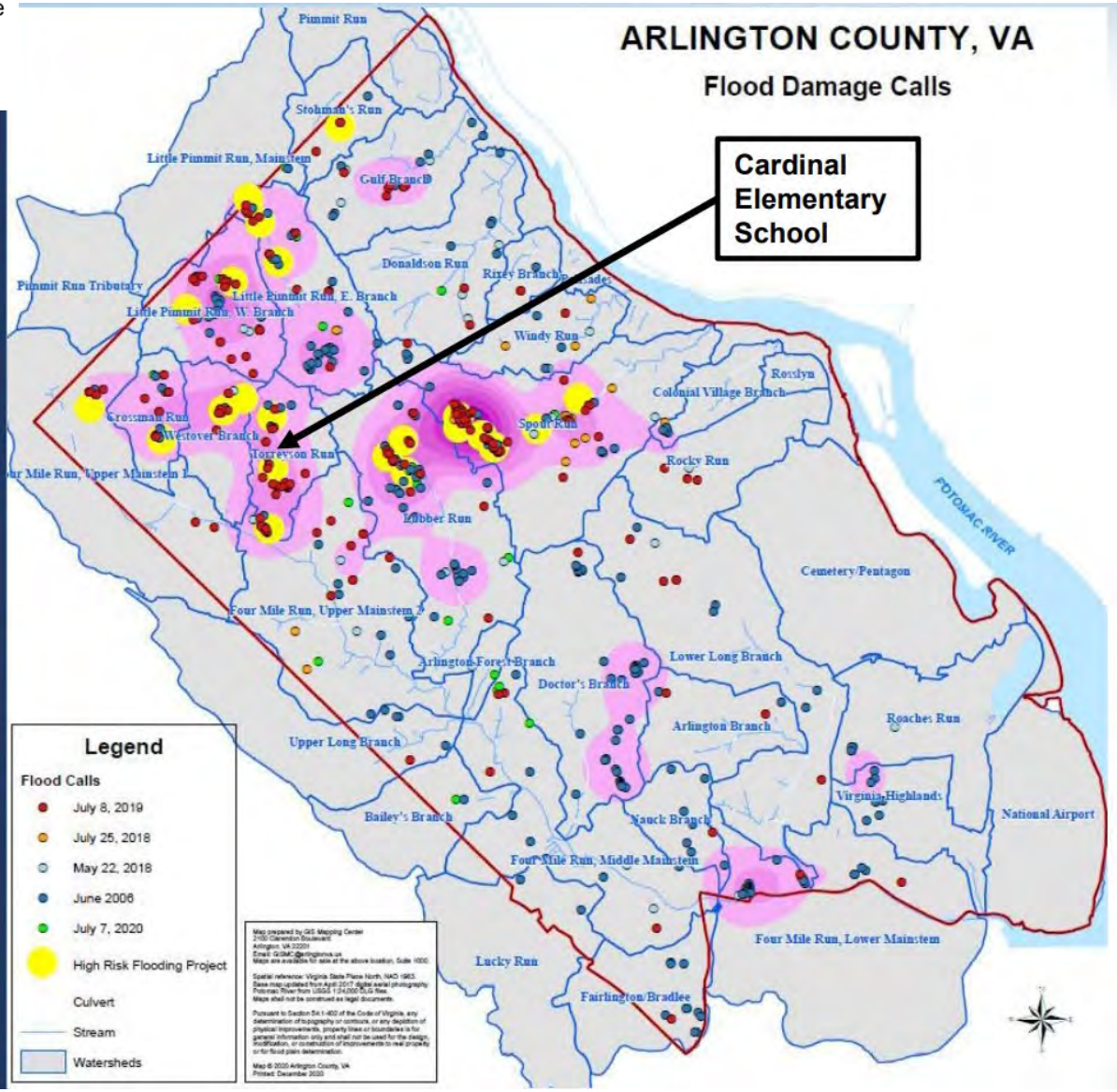
Severe flooding in Westover Commercial District on July 8, 2019

Residents and Civic Associations have identified this area as a **significant cultural and economic resource**. They have requested that the area be a high priority for flooding mitigation strategies in order to preserve and protect this valuable community resource.

A Call for Action

Map demonstrates flood calls from the following storms in relation to high risk flooding projects identified in Stormwater Master Plan:

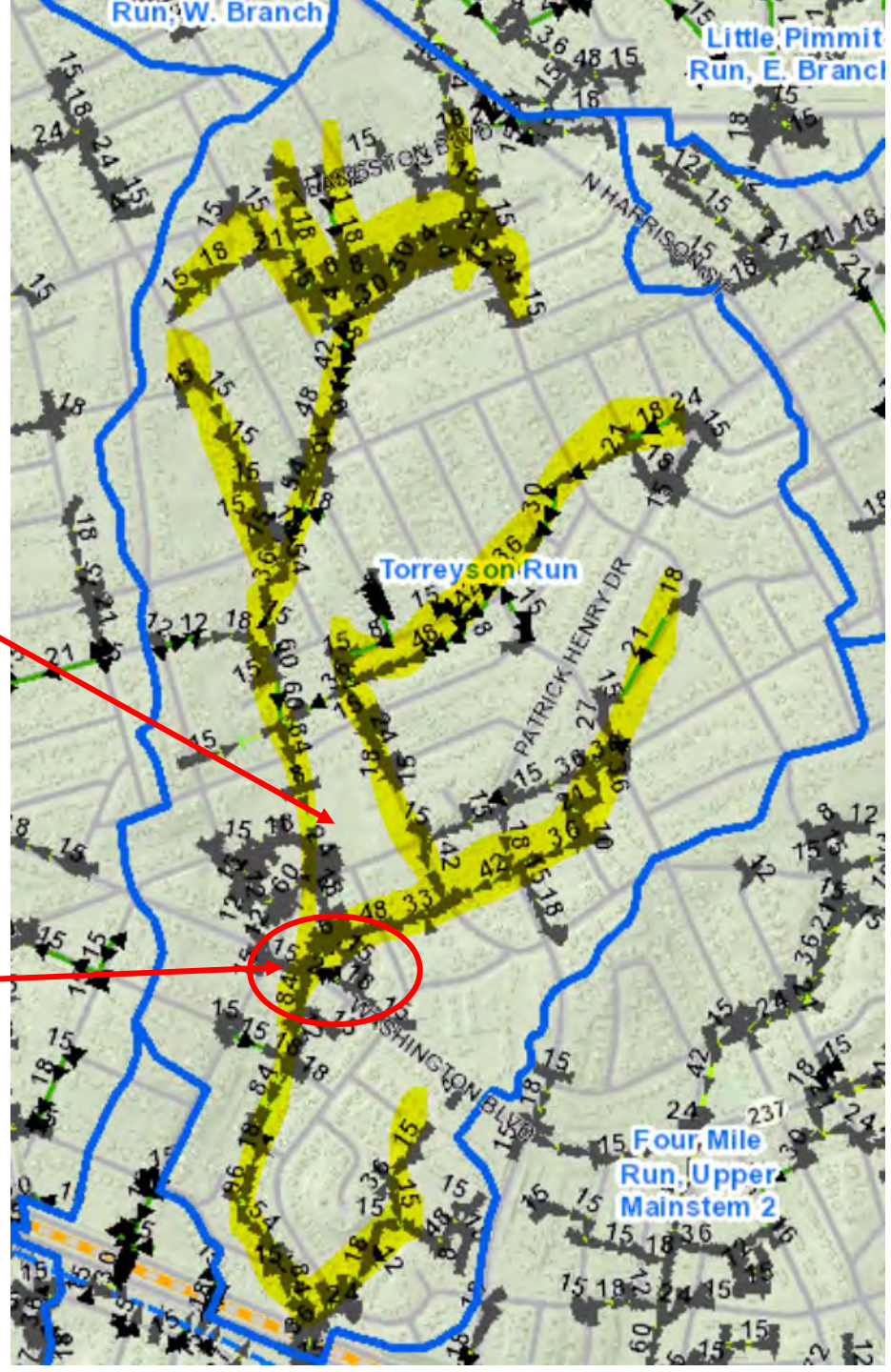
-July 7, 2020
-July 8, 2019
-July 25, 2018
-May 22, 2018
-June 2006

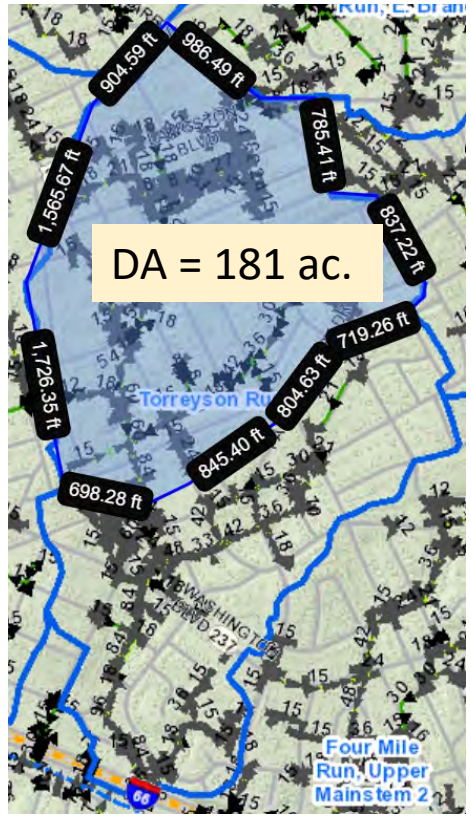


Project entails provision of stormwater detention just upstream of the Westover Commercial District

Cardinal School Project

Westover Commercial District

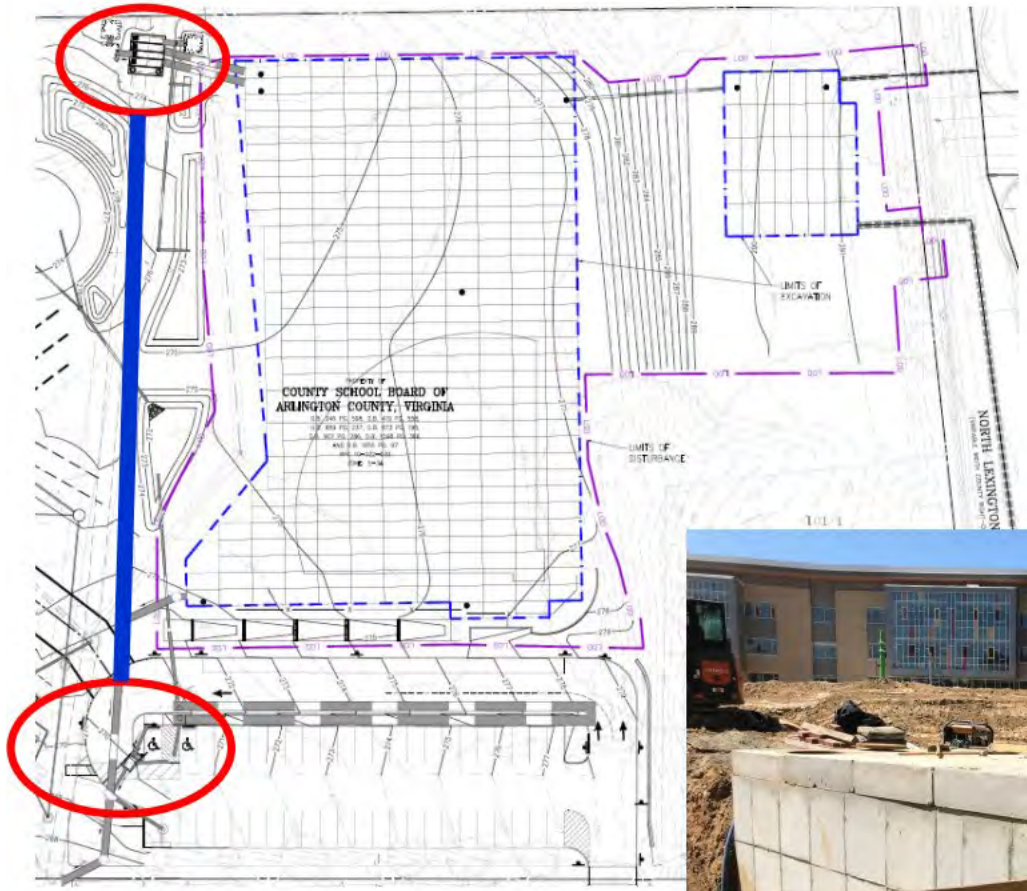





Parkhurst Park
Storm-water Vault
School Playground and Courts
Old Westover Library Site
School Building
Cardinal Elementary

Engagement Process

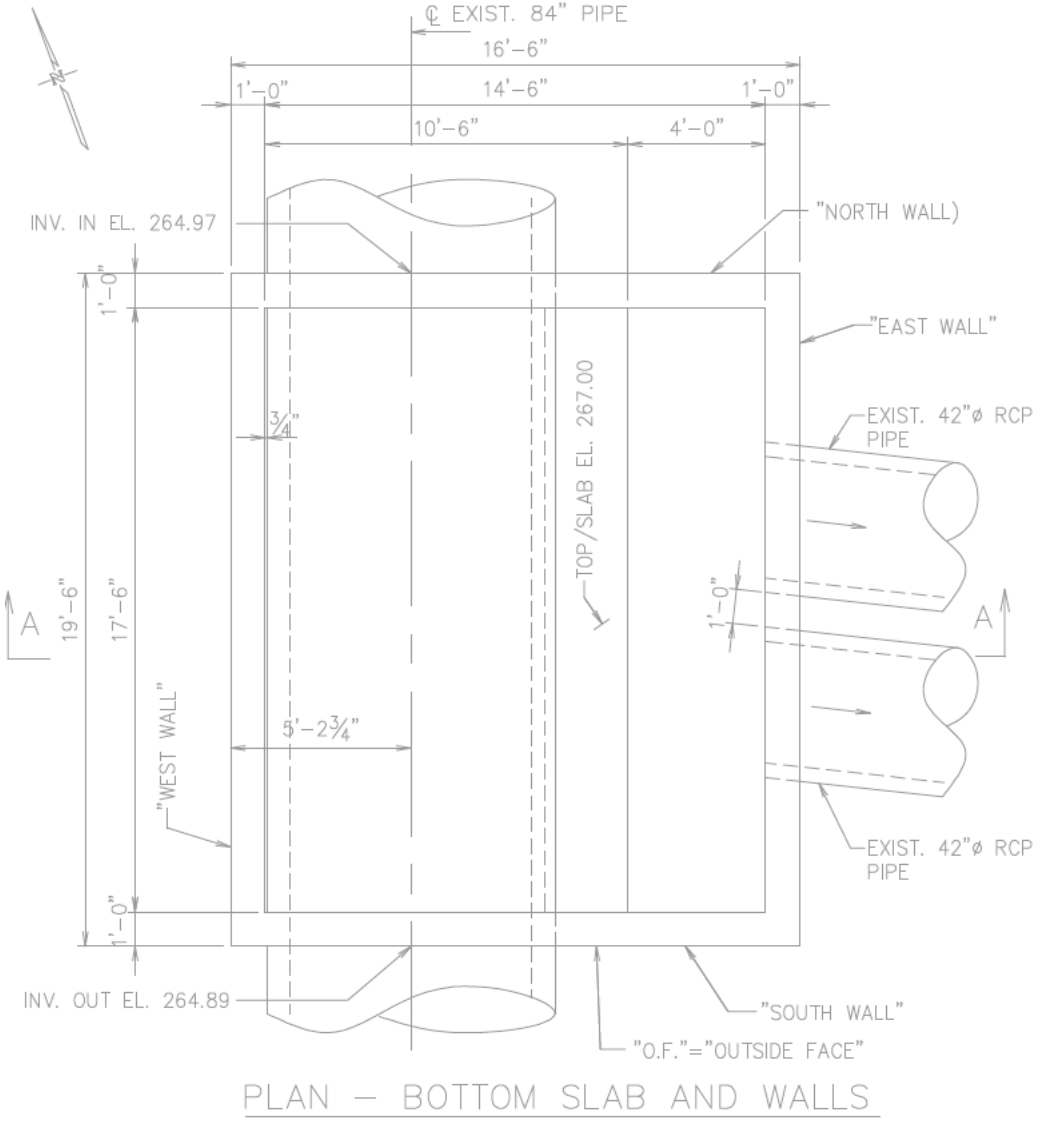
Date	Event	Materials
June 8, 2022, 7 PM	Construction Update Community Meeting	Meeting presentation
February 23, 2022, 7 PM	Construction Update meeting	Meeting Presentation Q&A Summary
November 10, 2021	Cardinal School PTA meeting - transportation update	Meeting presentation
September 22, 7-8 PM	Pre-Construction Meeting	Meeting presentation
July 28, 2021, 7 - 8 PM	90% Design Public Meeting	Meeting presentation
May 26, 2021, 6:30 PM	65% Design Public Meeting	Meeting presentation
March 2, 2021	Use Permit Public Meeting	
February 25, 2021	Sports Commission	Meeting video
February 4, 2021	Leeway Overlee Civic Association	Presentation
January 12, 2021	McKinley Elementary PTA Meeting	Presentation
January 6, 2021	Highland Park Overlee Knolls Civic Association	Presentation
January 5, 2021	Tara Leeway Civic Association	Presentation
December 16, 2020	Meeting with McKinley PTA Board	
December, 2020	School Board and County Board Meetings	APS Presentation County Presentation
November 20, 2020	Four Civic Association (4CA) Virtual Meeting/Call	
November 16, 2020	Civic Federation Stormwater Committee Virtual Meeting	
October 23, 2020	Civic Federation General Meeting	Meeting summary
July 6, 2020	Torreyson Run/Spout Run Civic Association Meeting	
June 24, 2020	Four Civic Association (4CA) Virtual Meeting/Call	
June 18, 2020	Torreyson Run/Four Civic Association (4CA) Meeting	



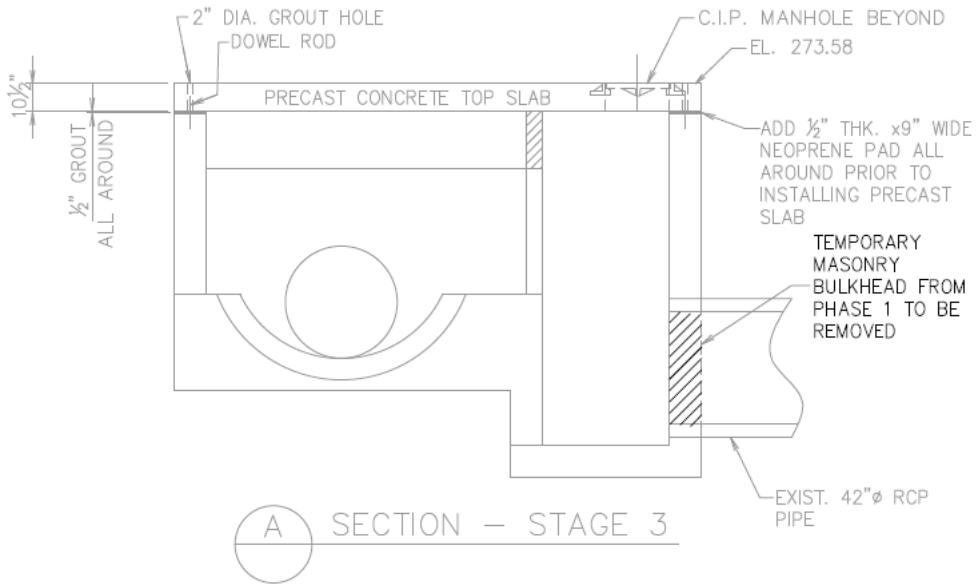
Diversion Structure from existing 84” Storm drain into Vault 1 and Connection from Vault 1 back into the 84” storm drain

Phase 1

Inlet Diversion Structure Details



PLAN – BOTTOM SLAB AND WALLS



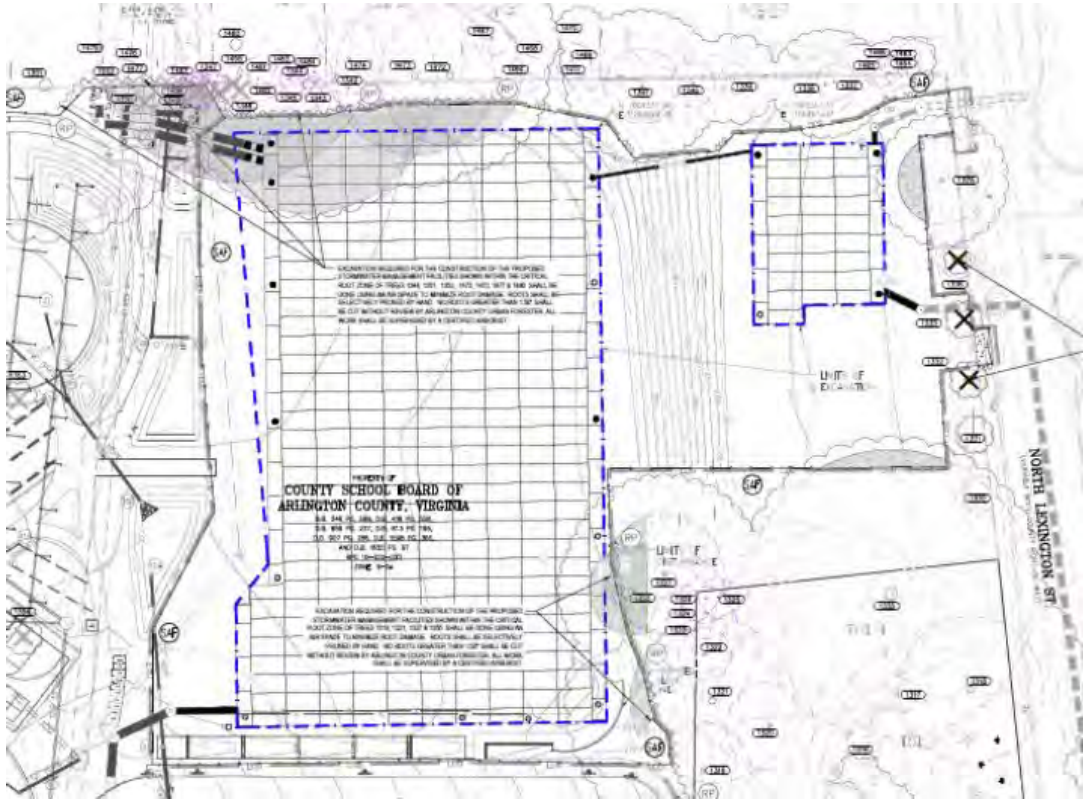
PLAN – PRECAST CONCRETE TOP SLAB – STAGE 3

Cardinal School Stormwater Detention Vault in Torreyson Run Watershed

Phase II

Project consists of two underground stormwater storage vaults

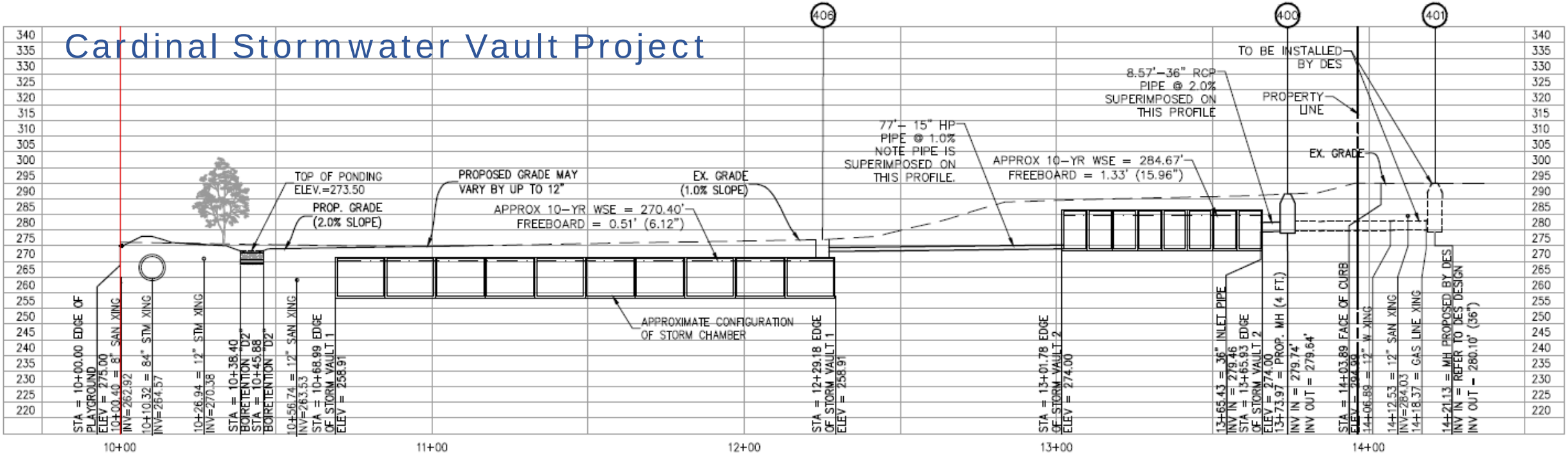
These Photos show construction of first, larger vault



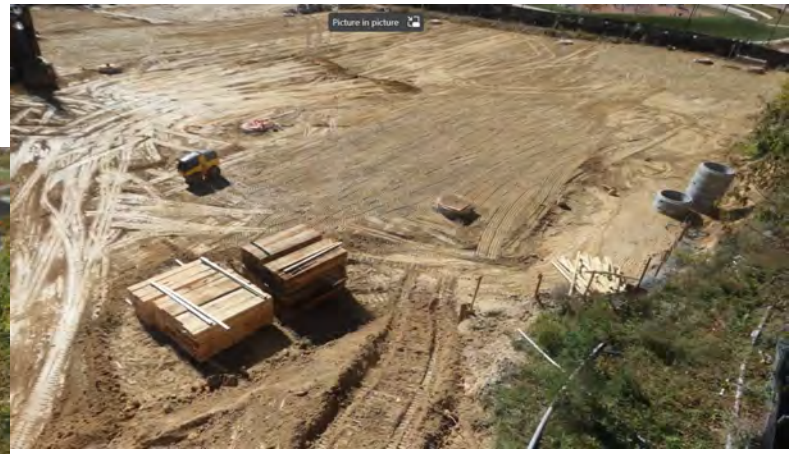
[Cardinal Elementary School Stormwater Vault – Official Website of Arlington County Virginia Government (arlingtonva.us)]

[Cardinal Elementary Stormwater Vault Timelapse, Nov. 9, 2022 - YouTube]

Cardinal Stormwater Vault Project



SECTION B-B PROFILE VIEW
HORIZONTAL SCALE: 1"=25'
VERTICAL SCALE: 1"=25'



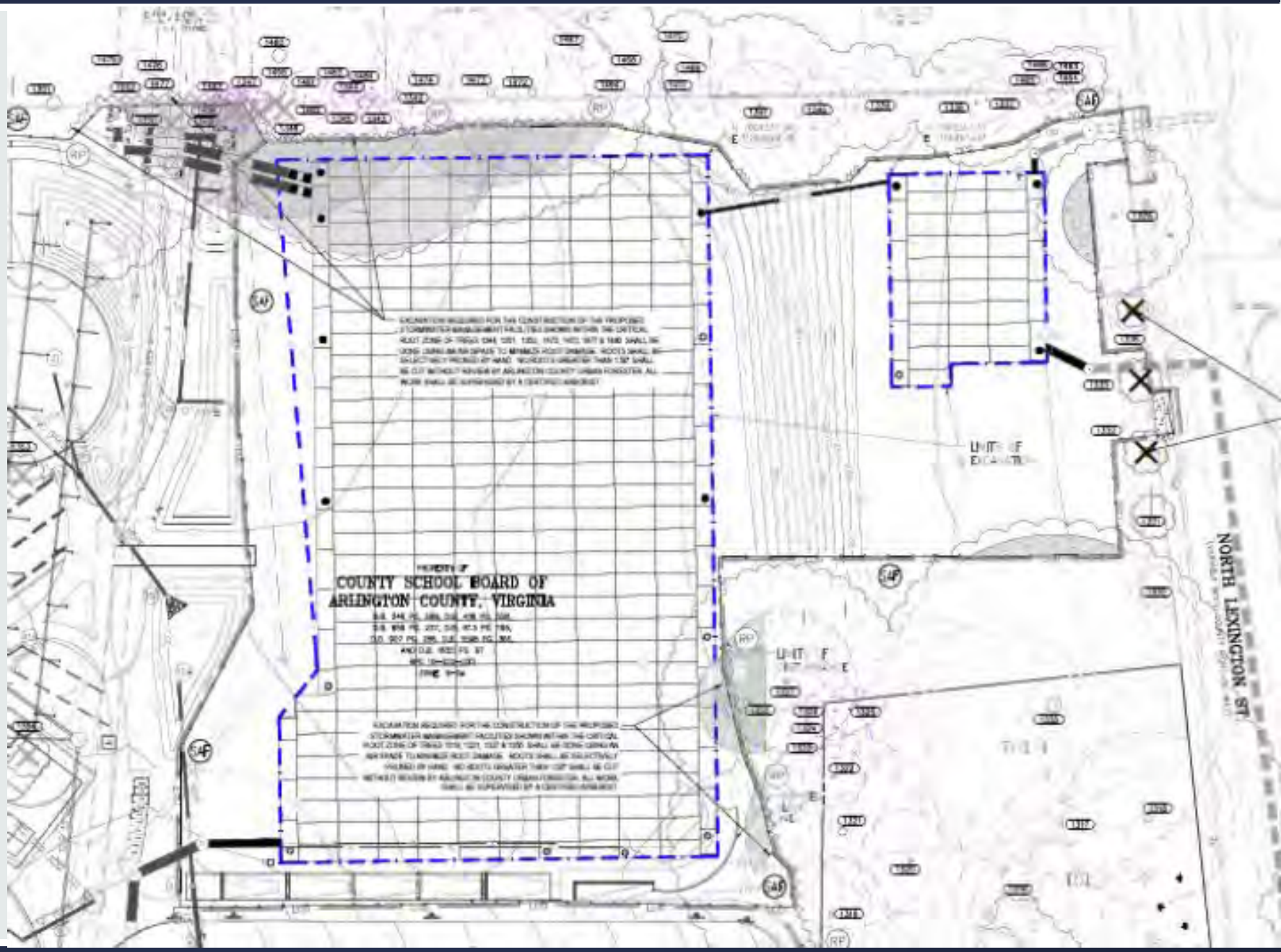
System Statistics

Two Underground Precast Concrete Vaults
One of largest systems of its kind on east coast.

StormTrap®
MODULAR CONCRETE STORMWATER MANAGEMENT

	Vault 1	Vault 2	Total
Volume (CF)	480,354	54,744	535,098
Number of units	670	78	748
Height (FT)	12.5	13.5	N/A
Area	8,800	4,820	13,620
Project Cost			$18,376,466

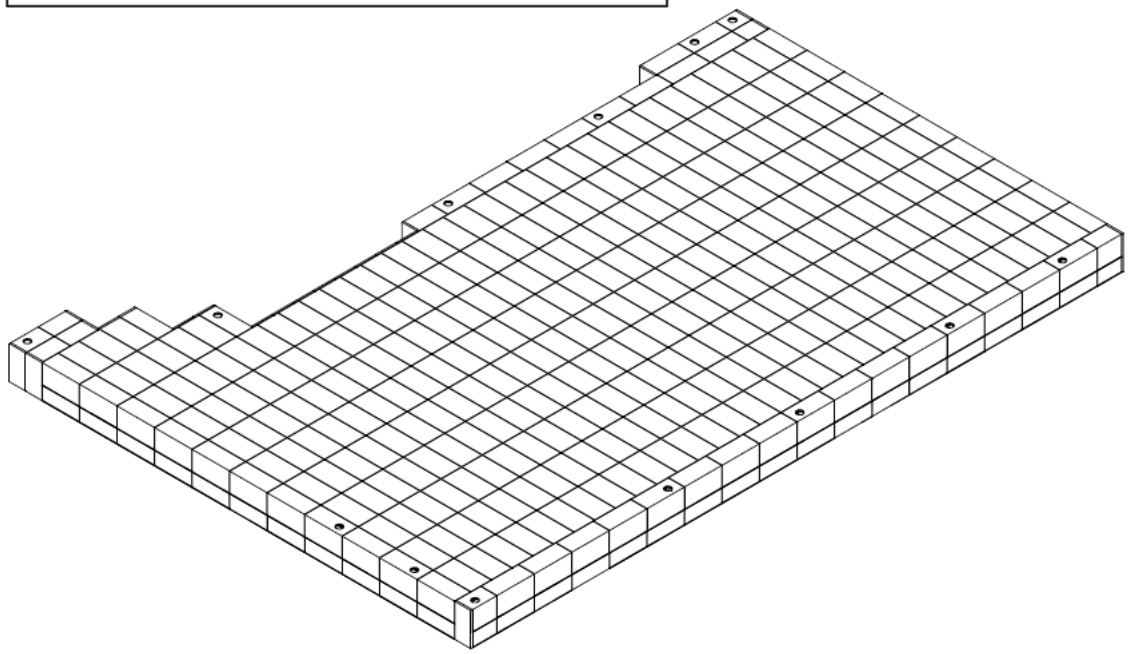
Milestone		Date
Phase 1 complete		Jul-21
Vault 1 Construction started		21-Dec
Vault 2 Construction started		22-Nov
Vault assembly completed		23-Jan
Site Restoration Completed		Spring 23
Athletic Fields open for use		Fall 23

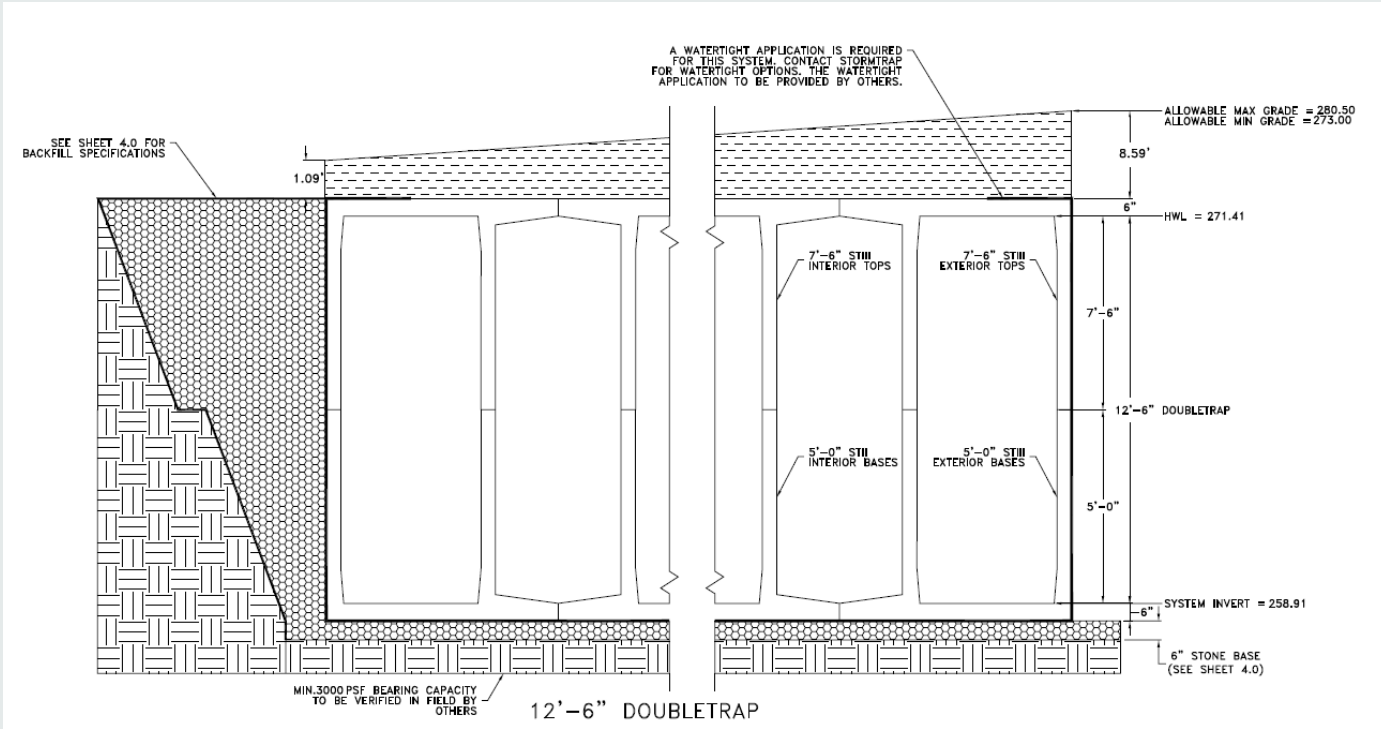


System Statistics

Vault 1

STORMTRAP SYSTEM INFORMATION	
WATER STORAGE PROV:	480,354.51 CUBIC FEET
UNIT HEADROOM:	12'–6" DOUBLETRAP
UNIT QUANTITY:	670 TOTAL PIECES

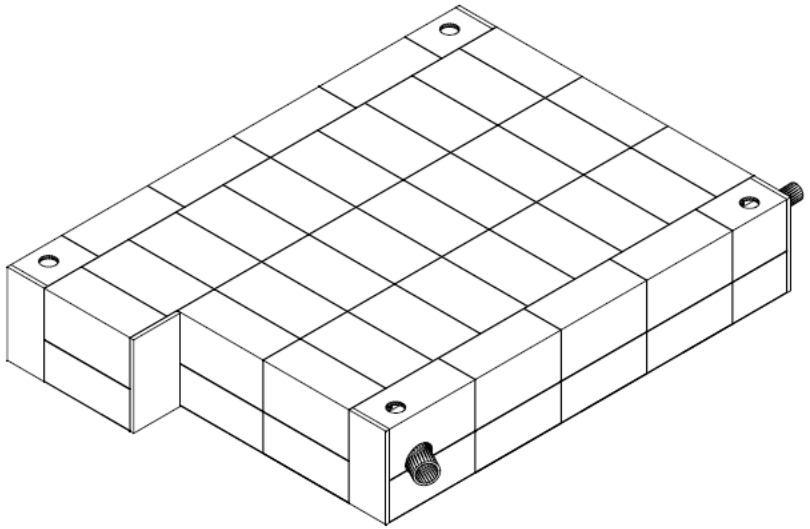


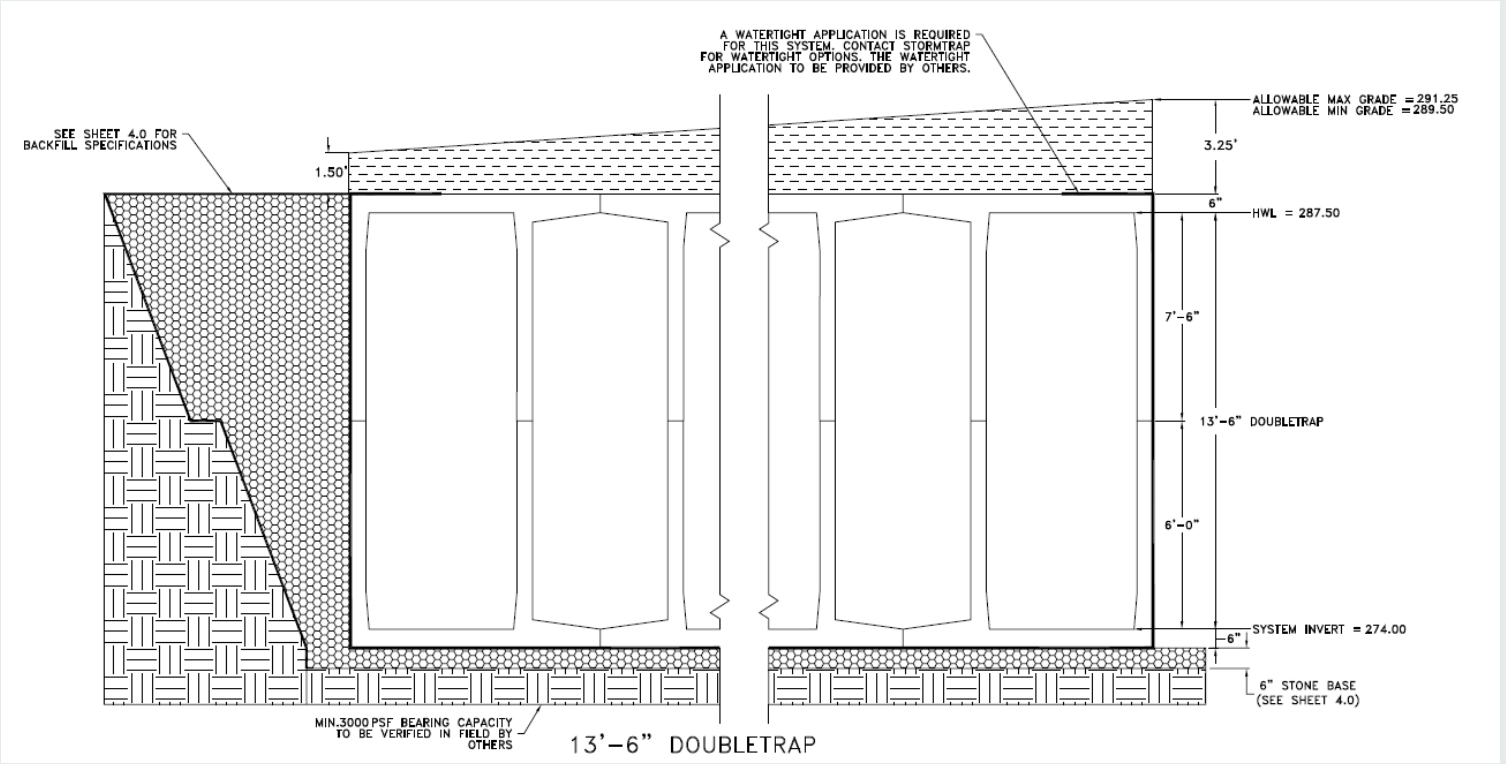


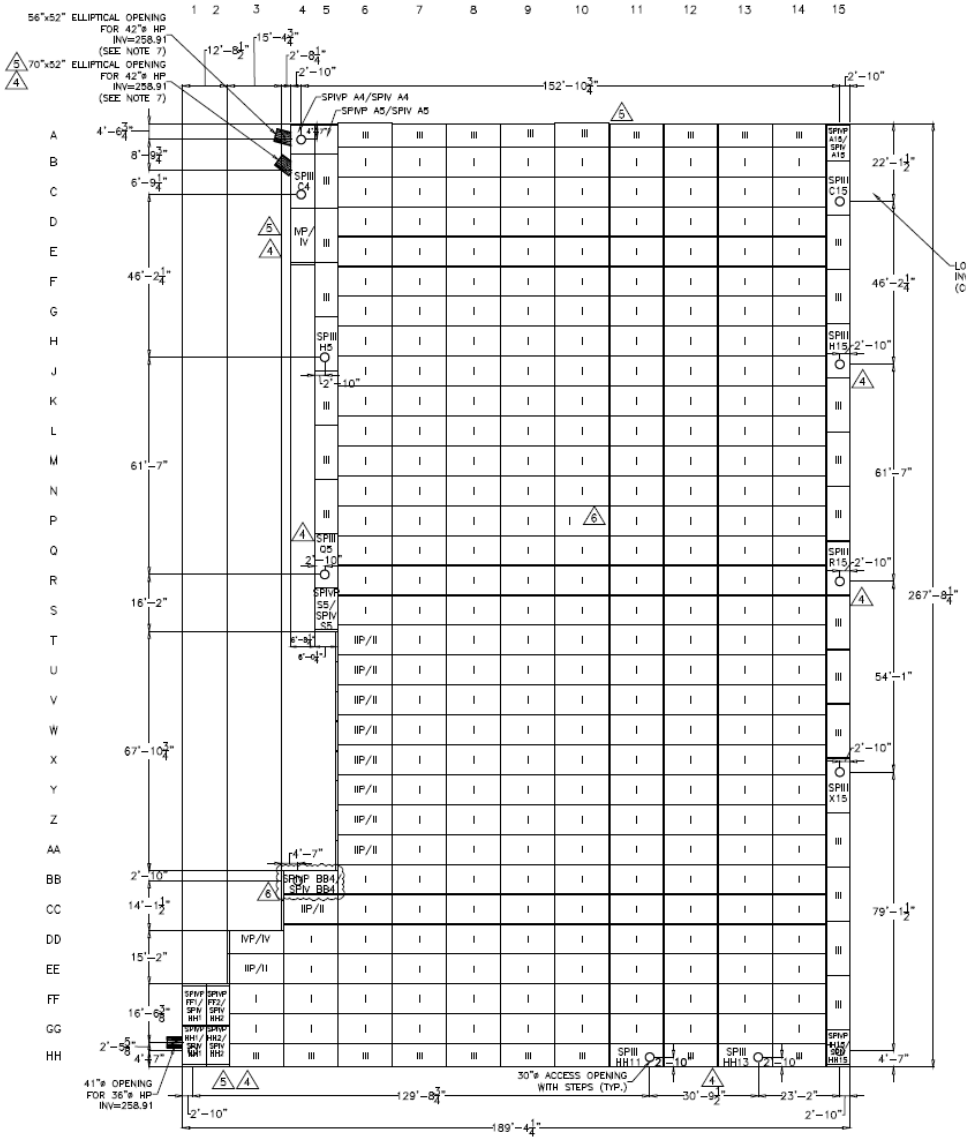
System Statistics

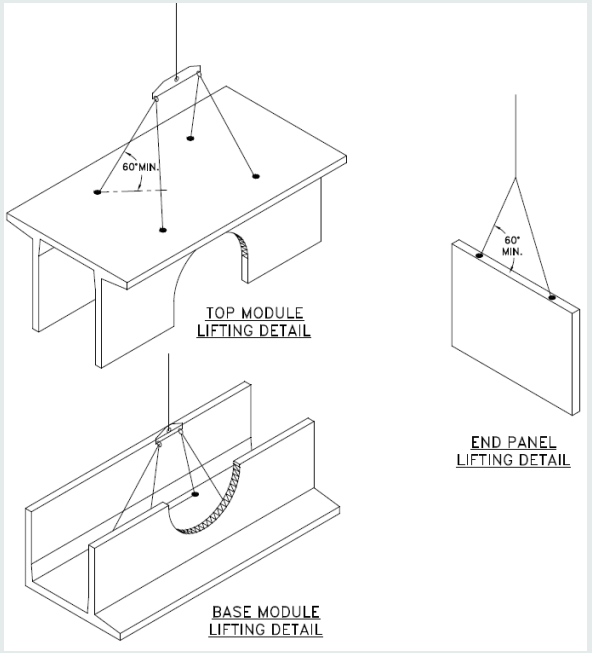
Vault 2

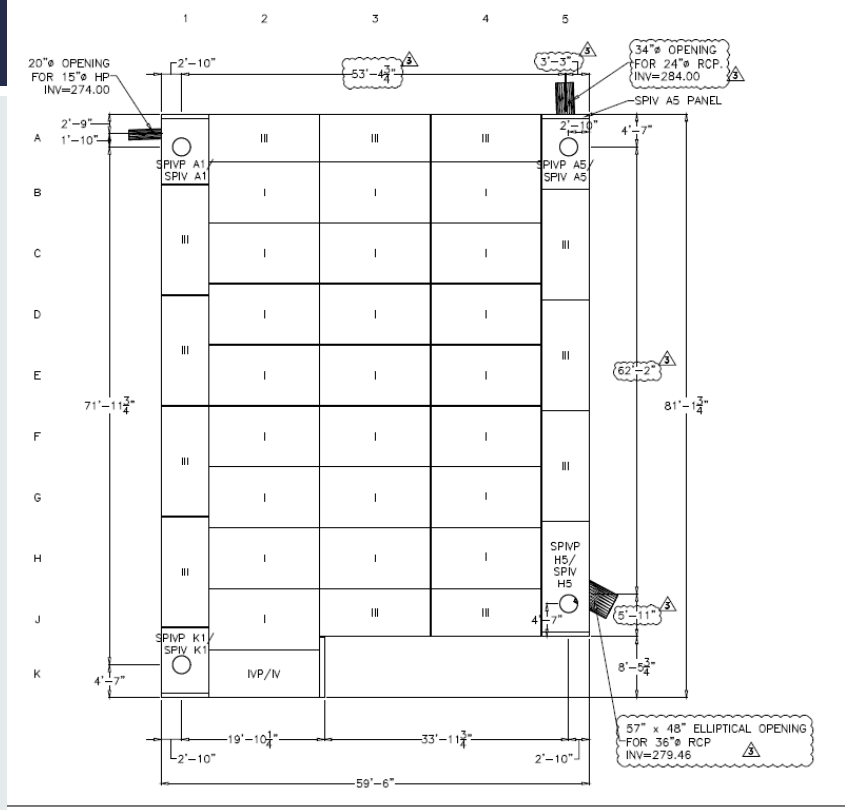
STORMTRAP SYSTEM INFORMATION		
WATER STORAGE PROV:	54,744.23	CUBIC FEET
UNIT HEADROOM:	13'–6" DOUBLETRAP	
UNIT QUANTITY:	78 TOTAL PIECES	

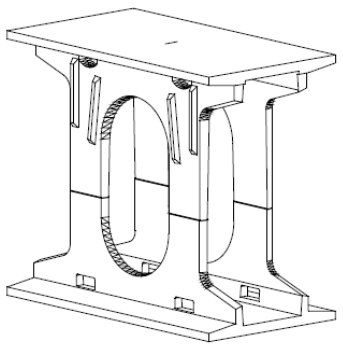


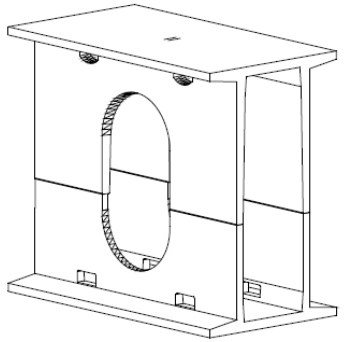









TYPE I

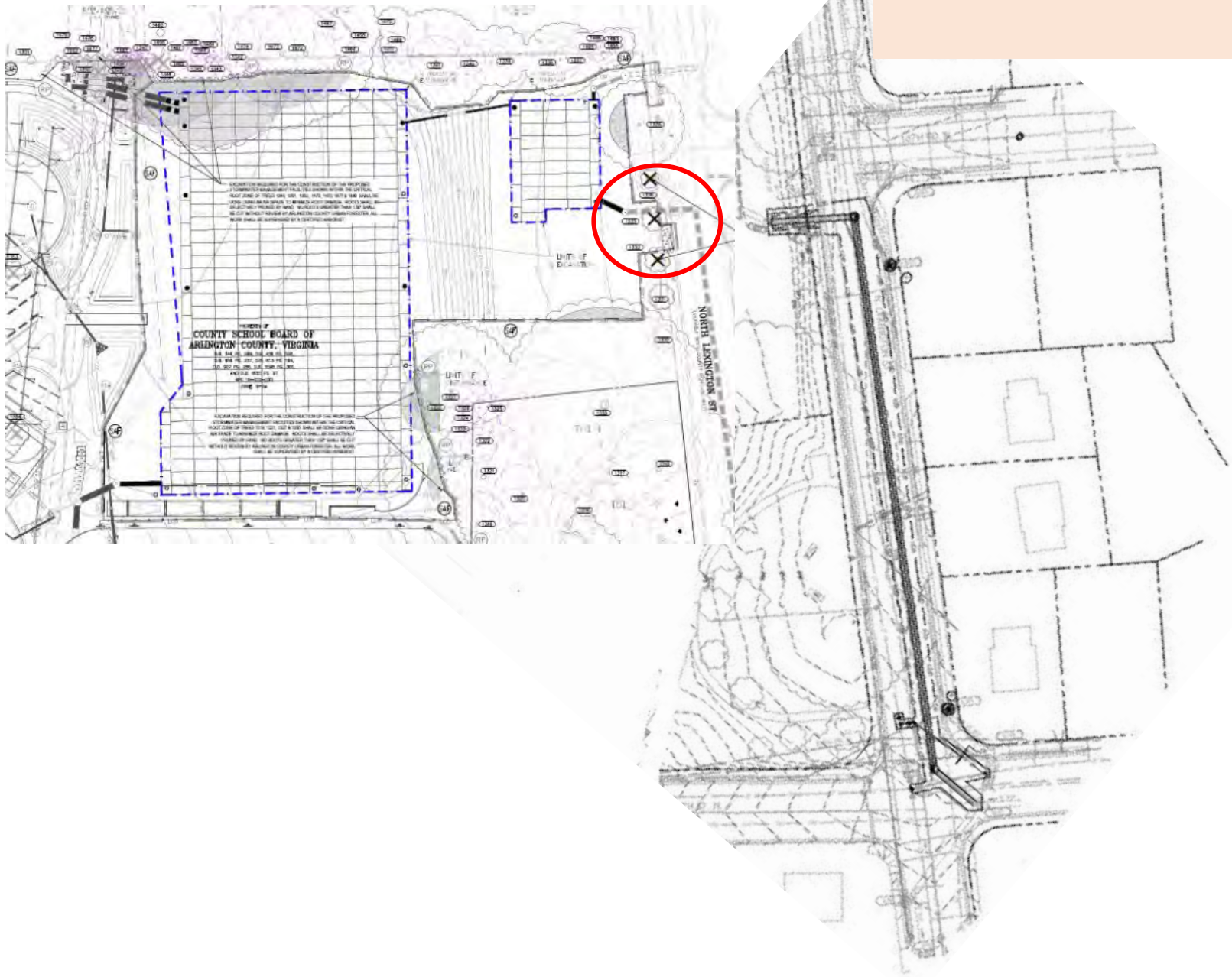

TYPE II

System Statistics

This is what it looks like today

- Some Interior Photos

N Lexington St. Storm Drainage Improvement About to Begin

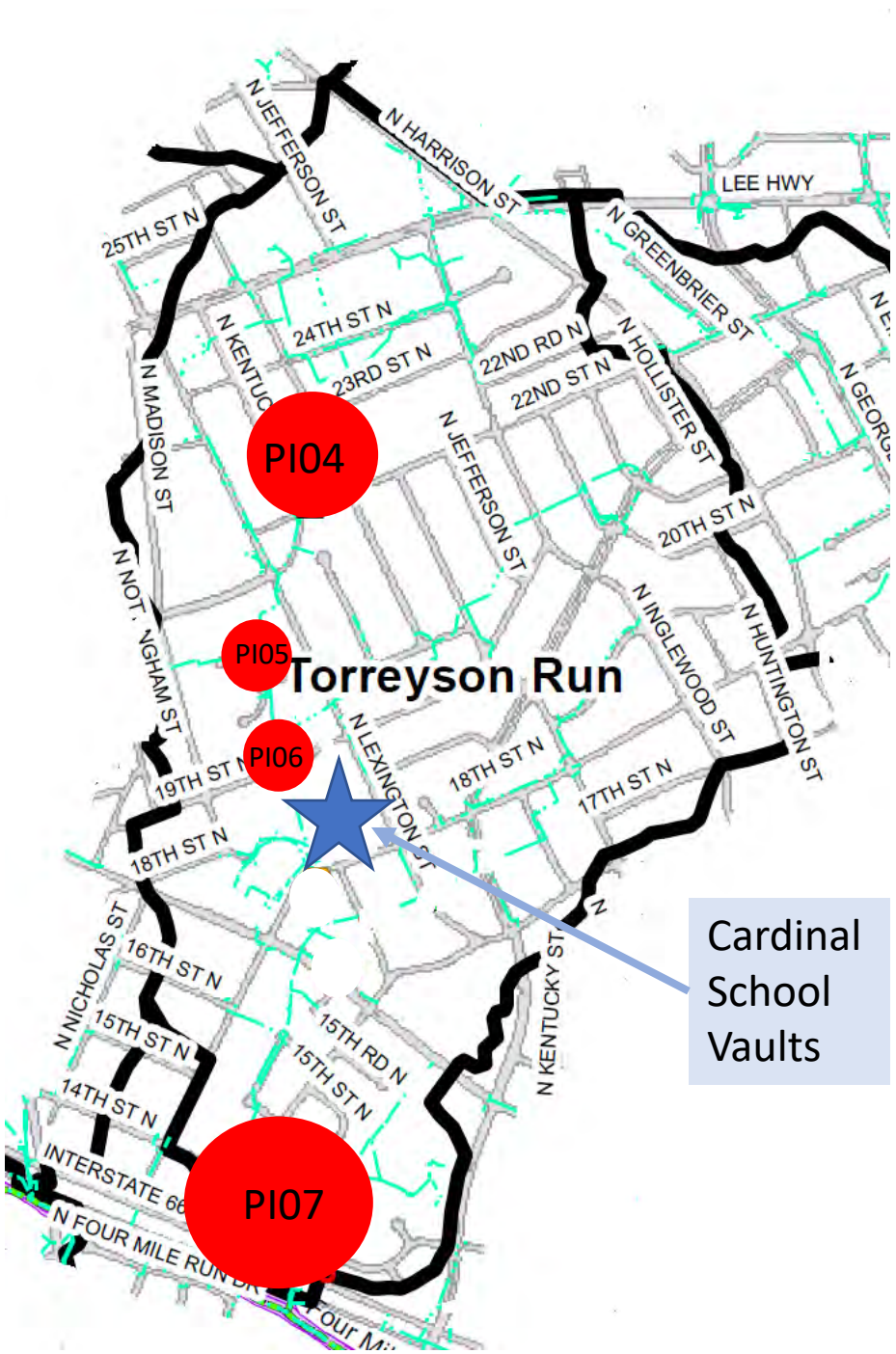


N Lexington St. work to require about 4 months.

Project collects additional runoff volume and diverts it into Vault 2, which drains to Vault 1

Washington Gas will relocate some gas lines first – expected in February 2023. They will prepare their own MOT.

4 Additional Storm Drainage Projects



Design of four additional Storm Drainage Projects for additional reaches of the Watershed have been initiated:

1. PI04 N Kensington @ 23rd St.
2. PI05 N Lexington @ 20th St. N
3. PI06 19th St. @ N Lexington St.
4. PI07 Expansion of Culvert at I-66 and N Longfellow

Projects in **Design** phase

No Schedule determined yet

Continuation of Watershed Improvements to facilitate storm water to enter Vaults at Cardinal School

Also working on Flow monitoring of Vault flows and performance

Risk Assessment and Mitigation Project (RAMP)

Risk Assessment and Management Plan (RAMP)

- Maps the County's "urban" floodplains (outside FEMA floodplains)
- Provides updated 2040, 2070 and 2100 climate projections, for both inland flooding and sea-level rise/storm surge
- Delivers updated rainfall curves and 10-year design standard
- Developed vulnerability assessments, including public infrastructure and critical public facilities
- Calculates and defines economic, environmental and social risk, or "the cost of inaction"
- Informs flood resilient design and construction standards
- Demonstrates value of current investments against cost of inaction

SAMPLE MAPS from **RAMP**

Lower Four Mile Run

Baseline 100 - year

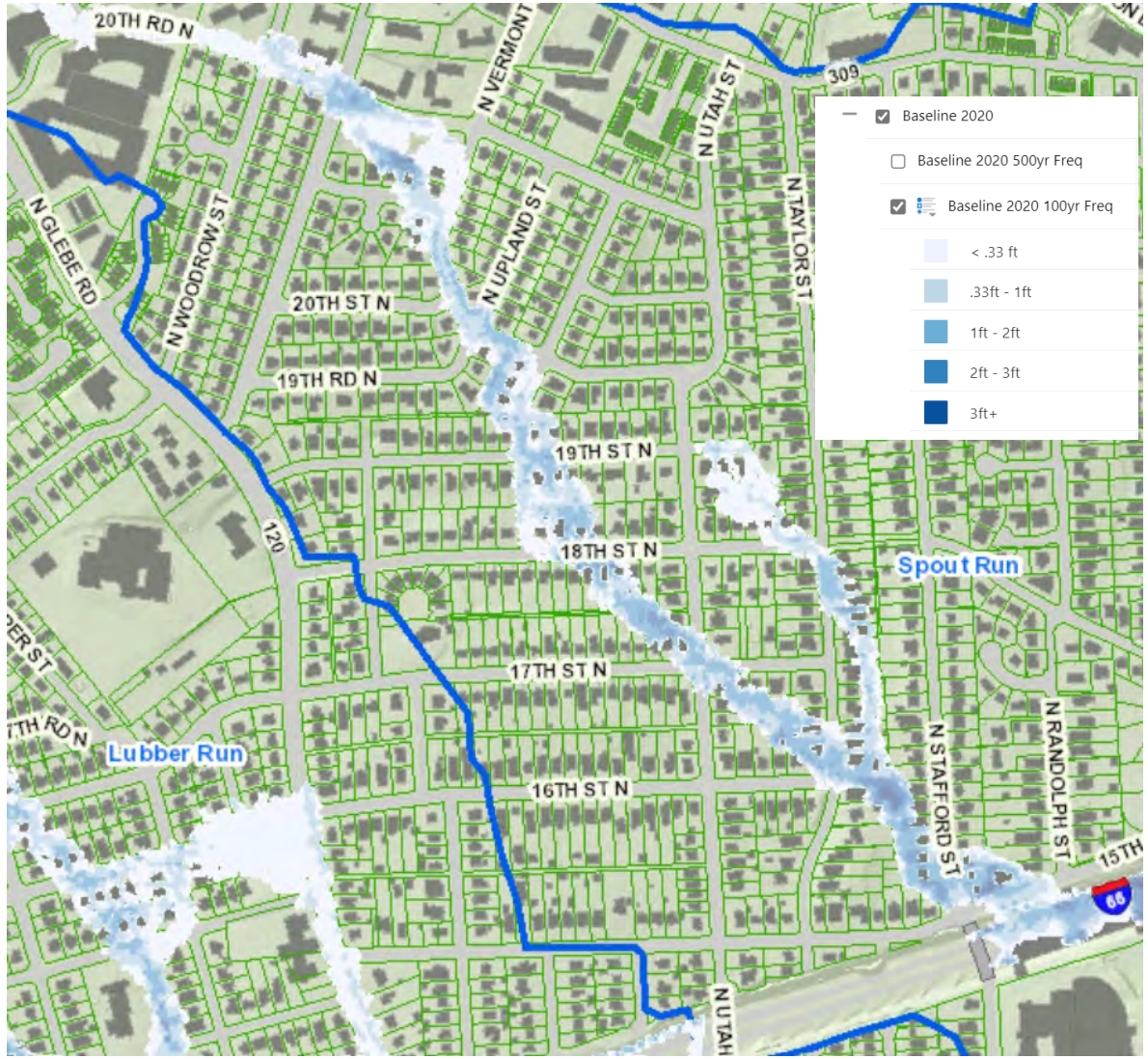
- Baseline 2020
  - Baseline 2020 500yr Freq
  - Baseline 2020 100yr Freq
    - < .33 ft
    - .33ft - 1ft
    - 1ft - 2ft
    - 2ft - 3ft
    - 3ft+

- Year 2040
  - Year 2040 500yr Freq
  - Year 2040 100yr Freq
    - < .33 ft
    - .33ft - 1ft
    - 1ft - 2ft
    - 2ft - 3ft
    - 3ft+

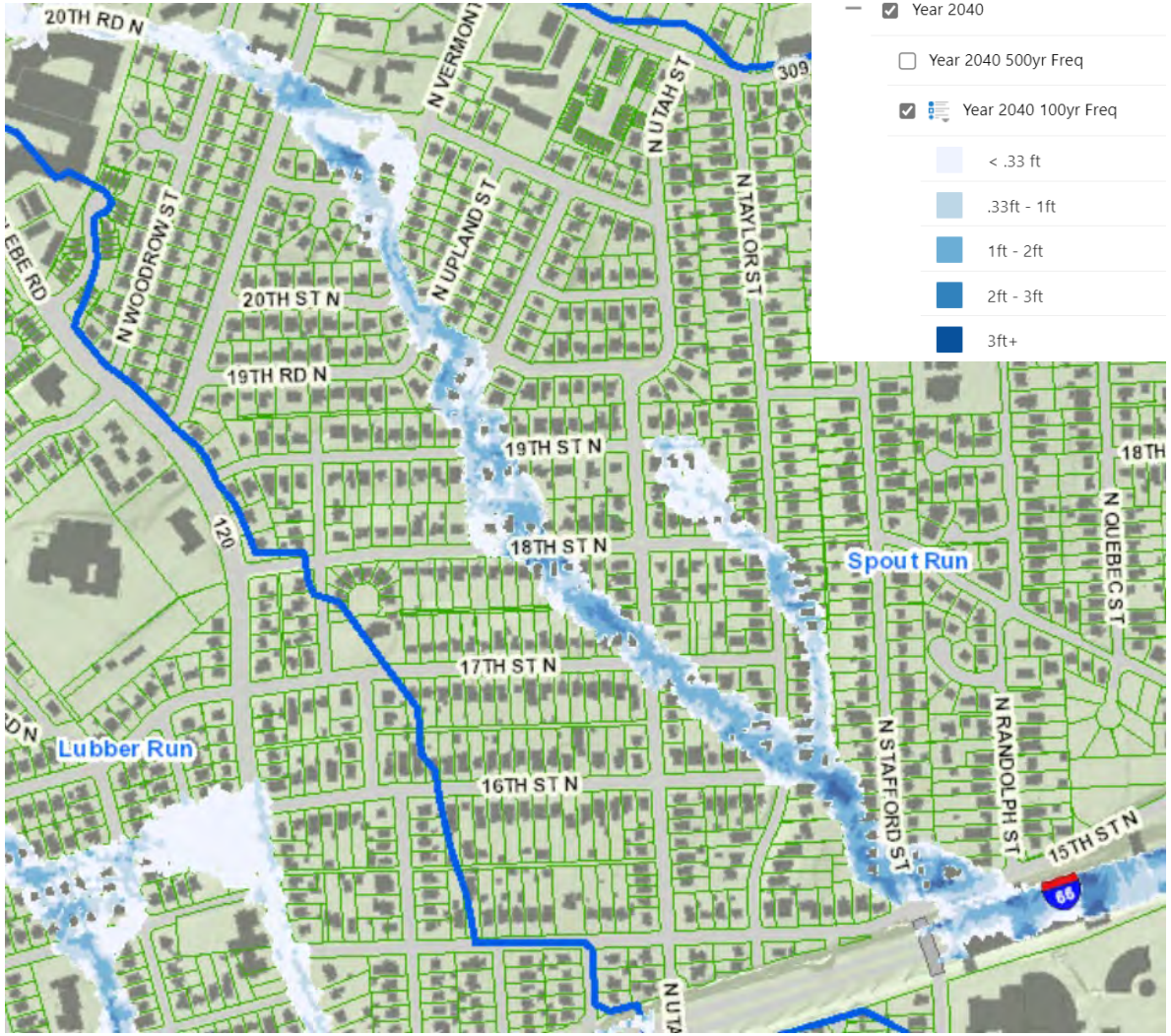
2040 100 - year

Spout Run – Waverly Hills/Cherrydale

Baseline 100 - year



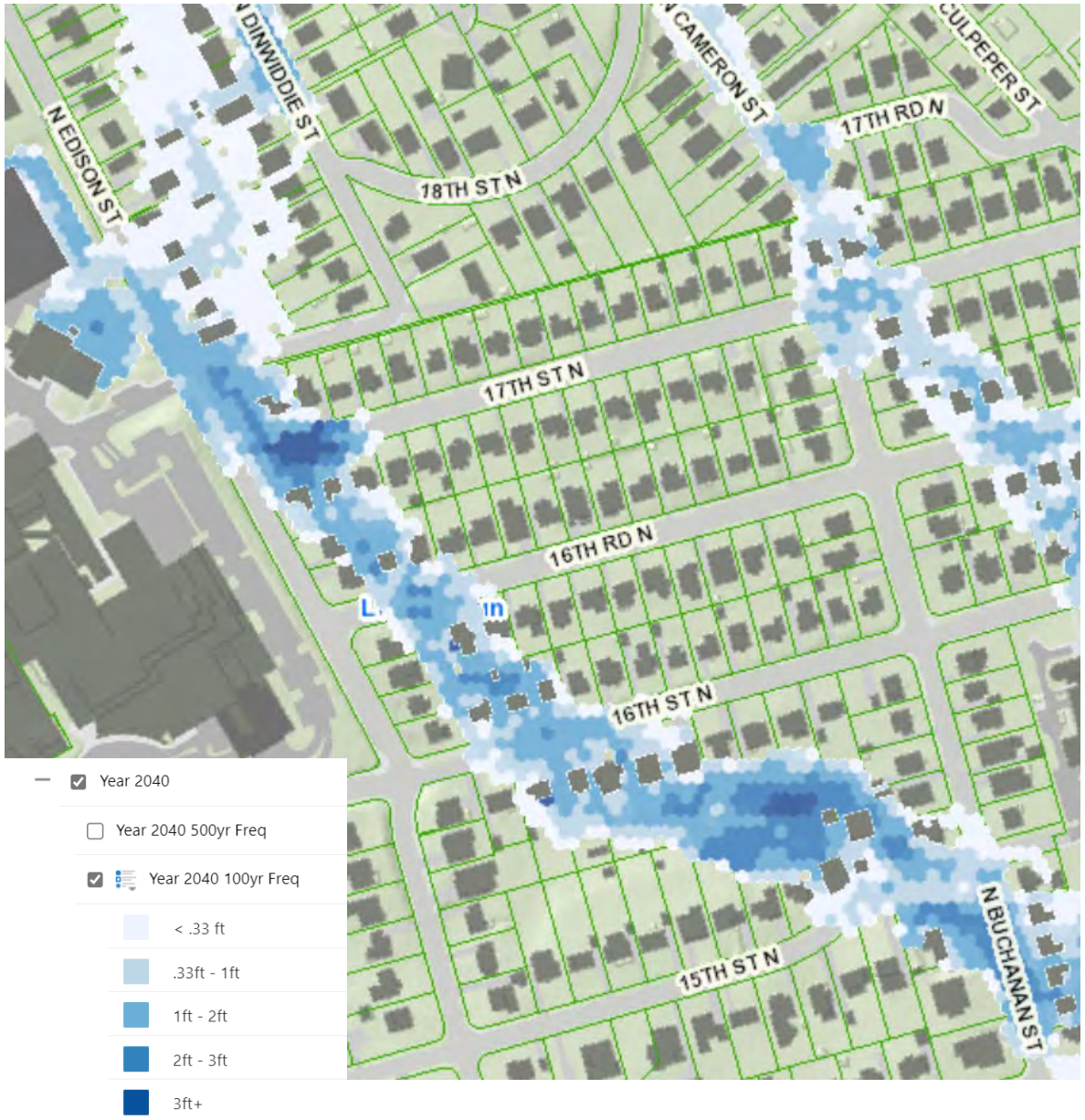
2040 100 - year



Lubber Run

Baseline 100 - year

2040 100 - year



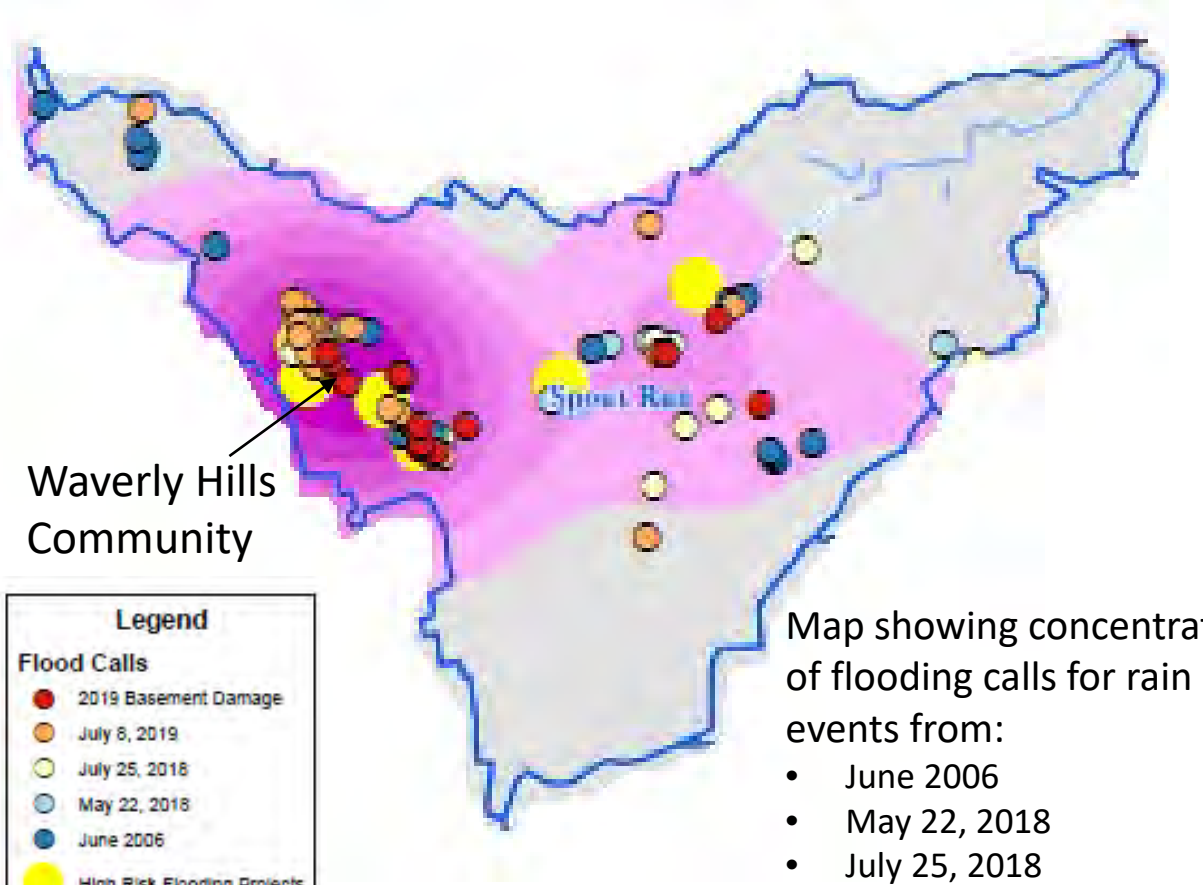
Voluntary Property Acquisition Program

Why are we here talking about flood resilience?

Example of flooding in 2019
(one of many that is all too familiar to most people here)

History of Flooding – Spout Run Watershed

One of the Five Critical Watersheds

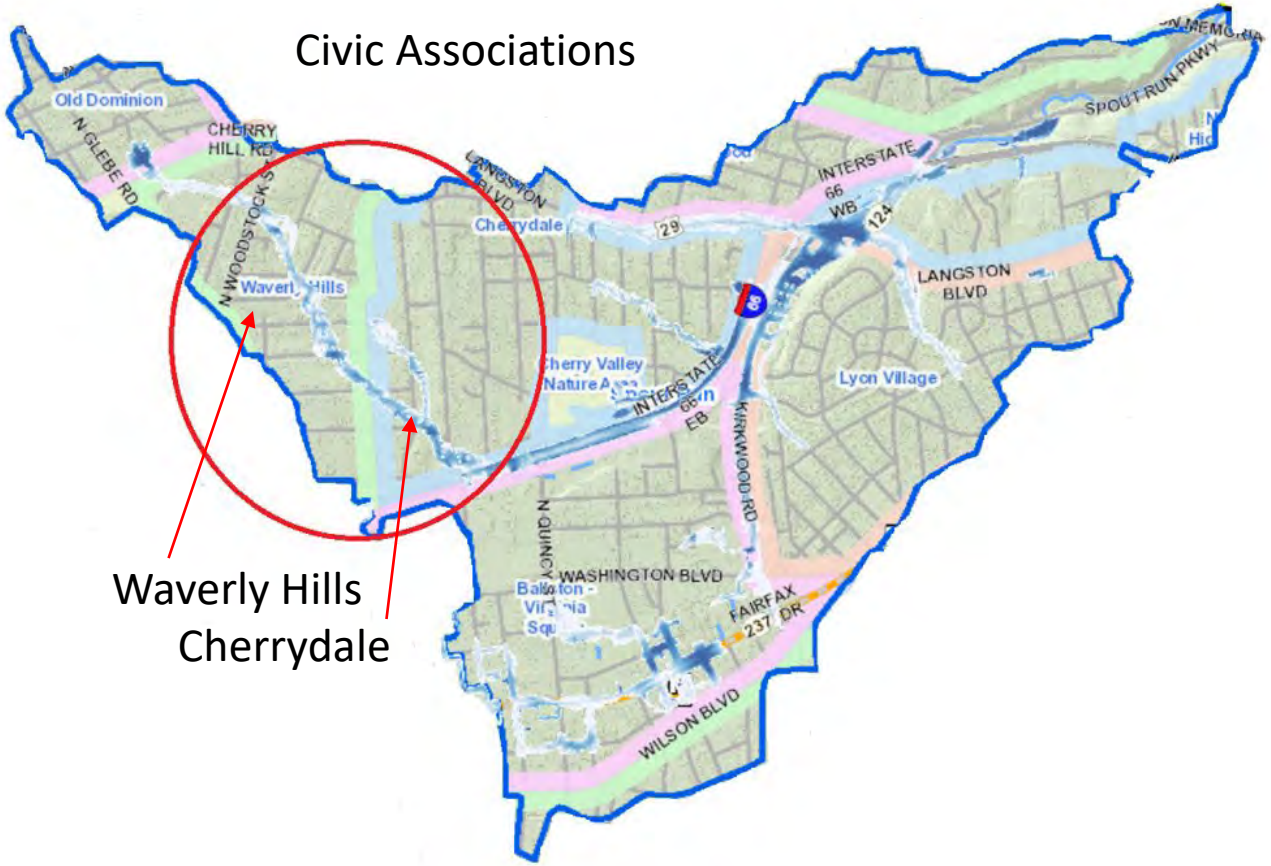


Waverly Hills Community

Map showing concentration of flooding calls for rain events from:

- June 2006
- May 22, 2018
- July 25, 2018
- July 8, 2019

Civic Associations



Waverly Hills
Cherrydale

Summary of Water Depth in basements from July 8, 2019 County-wide

4 Ft. of depth – 18 locations

5 Ft. of depth – 18 locations

6 Ft. of depth – 16 locations

7 Ft. of depth – 3 locations

8 Ft. of depth – 4 locations

9 Ft. of depth – 1 location

10 Ft. of depth – 5 locations

11 Ft. of depth – 2 locations

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.

Since many areas in Arlington developed before the adoption of stormwater design standards which included overland relief, there is limited, or no, overland relief in many watersheds.

Goal = 10-Year storm + Overland Relief

Overland relief does not exist for this area!
This area will always have some flood risk.

ARLINGTON VIRGINIA

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.

Proposed Watershed Strategy
Voluntary Property Acquisition for Overland Relief

Restore

- 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 is not sufficient available space within existing rights-of-way to maintain the infrastructure, make resilient system upgrades, or to provide overland relief.
- **There is no long-term solution to reduce flood risk in Spout Run without adding overland relief.**
- Phased Property Acquisition is a necessary component of a resilient stormwater improvement program to provide overland relief and reduce flood risk to the community.

Proposed Watershed Strategy
Voluntary Property Acquisition for Overland Relief

Restore

- 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

Acquisition of Overland Flow Path Tiered Approach

Restore

- Land Acquisition of properties in the 100-year inundation zone is proposed, to be **phased** in a prioritized/tiered approach
- Properties in inundation zones that have sustained repeated losses with significant depths of water (based on actual documented flooding) are to be acquired first (Tier 1)
- Property within inundation zones but with less significant flooding occurrences are in second tier. Longer time frames for acquisition may be involved.
- Property within inundations zones, but which may not experience significant flood levels or which may experience manageable flooding are in tier 3. With sufficient floodproofing and land use regulations, these properties may be acquired after long periods, or never at all. Some acquisitions could consist of flow/drainage easements rather than fee simple.
- Acquired property would become open space for drainage purposes and would be protected from development encroachments by regulation. Other uses for the space would be for wildlife/bio-diversity/biophilia corridors, and possible MS4 compliance (impervious area reduction).

Letters from the County Real Estate Bureau were 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 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

How do I know if the County is interested in purchasing my property? *The County's real estate team began contacting homeowners this past 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 below 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

Demolition

Of house at

6415 24th St. N

- Structure is demolished and gone.
- Permanent fencing installed
- Future maintenance is still being worked out – mowing, and snow removal for sidewalks

[Demolition and Microforest 6415 N. 24th St – Official Website of Arlington County Virginia Government (arlingtonva.us)]

6415 24th St. N

Microforest

Grass now specified as purple lovegrass

These species will be planted: white oak, willow oak, black oak, scarlet oak, red maple, black walnut, box elder

Demolition and Microforest 6415 N. 24th St – Official Website of Arlington County Virginia Government (arlingtonva.us)

Program Funding

Arlington County, Virginia

CIP 2023-2032

STORMWATER MANAGEMENT: PROGRAM FUNDING SUMMARY

10 YEAR PROGRAMMED 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
1. SM Maintenance Capital	7,545	7,255	6,730	3,725	3,830	4,545	4,035	4,120	4,220	4,220	50,225
2. Stormwater Infrastructure/ Capacity Improvements	13,935	27,235	21,080	38,890	38,565	20,010	13,935	20,680	19,300	15,355	228,985
3. Streams and Water Quality	7,315	5,260	4,510	5,770	2,460	5,650	3,085	6,085	5,995	5,995	52,125
Total Recommendation	**28,795**	**39,750**	**32,320**	**48,385**	**44,855**	**30,205**	**21,055**	**30,885**	**29,515**	**25,570**	**331,335**
*Implementation Adjustment	(5,760)	(7,950)	(6,460)	(9,680)	(8,970)	(6,040)	(4,210)	(6,180)	(5,900)	(5,110)	(66,260)
Adjusted CIP	23,035	31,800	25,860	38,705	35,885	24,165	16,845	24,705	23,615	20,460	265,075

* Reflects a budget adjustment to include risk of project execution to more accurately forecast annual expenditures