2710 - CID515519_Alexandria_CFPF-1

Application Details

Funding Opportunity:	2336-Virginia Community Flood Preparedness Fund - Project Grants - CY24 Round 5
Funding Opportunity Due Date:	Jan 24, 2025 11:59 PM
Program Area:	Virginia Community Flood Preparedness Fund
Status:	Under Review
Stage:	Final Application
Initial Submit Date:	Jan 24, 2025 10:06 AM
Initially Submitted By:	Jessica Lassetter
Last Submit Date:	
Last Submitted By:	

Contact Information

Primary Contact Information

Active User*: Yes

Type: External User

Name*: Ms. Jessica Middle Name Lassetter
Salutation First Name Last Name

Title:

Email*: jessica.lassetter@alexandriava.gov

Address*: 2900 B Business Center Drive

Alexandria Virginia 22314
City State/Province Postal Code/Zip

Phone*: (703) 746-4127 Ext.
Phone
###-###-####

Fax: ###-###-####

Comments:

Organization Information

Status*: Approved

Name*: ALEXANDRIA, CITY OF

Organization Type*: Local Government

Tax ID*:

Unique Entity Identifier (UEI)*:

Organization Website: https://www.alexandriava.gov/

Address*: 301 King Street, City Hall

Alexandria Virginia 22314
City State/Province Postal Code/Zip

Phone*: (703) 746-6499 Ext.
###-###-####

Fax: ###-###-####

Benefactor:

Vendor ID:

Comments:

VCFPF Applicant Information

Project Description

Name of Local Government*: City of Alexandria

Your locality's CID number can be found at the following link: Community Status Book Report

NFIP/DCR Community Identification Number (CID)*: 515519

If a state or federally recognized Indian tribe,

Name of Tribe:

Authorized Individual*: Jesse Maines
First Name Last Name

Mailing Address*: 2900-B Business Center Drive
Address Line 1

Address Line 2

Alexandria Virginia 22314
City State Zip Code

Telephone Number*: 703-746-4643

Cell Phone Number*: 571-414-8237

Email*: jesse.maines@alexandriava.gov

Is the contact person different than the authorized individual?

Contact Person*: Yes

Contact: Jessica Lassetter
First Name Last Name

2900-B Business Center Drive
Address Line 1

Address Line 2

Alexandria Virginia 22314
City State Zip Code

Telephone Number: 703-746-4127

Cell Phone Number: 703-915-5695

Email Address: jessica.lassetter@alexandriava.gov

Enter a description of the project for which you are applying to this funding opportunity

Project Description*:

The City of Alexandria (City) is applying for grant assistance under the Virginia Department of Conservation and Recreation (DCR) Community Flood Preparedness Fund (CFPF) Round 5 Project category to help mitigate flooding in the Valley Drive neighborhood in Alexandria, Virginia. The

Valley Drive Storm Drain Improvement Project aims to improve the local storm drainage system.

Low-income geographic area means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income, or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. A project of any size within a low-income geographic area will be considered.

Is the proposal in this application intended to benefit a low-income geographic area as defined above?

Benefit a low-income geographic area*: No

Information regarding your census block(s) can be found at census.gov

Census Block(s) Where Project will Occur*: 200900

Is Project Located in an NFIP Participating Community?*: Yes

Is Project Located in a Special Flood Hazard Area?*: No

Flood Zone(s) (if applicable):

Flood Insurance Rate Map Number(s) (if applicable): 5155190029F

Eligibility CFPF - Round 4 - Projects

Eligibility

Is the applicant a local government (including counties, cities, towns, municipal corporations, authorities, districts, commissions, or political subdivisions created by the General Assembly or pursuant to the Constitution or laws of the Commonwealth, or any combination of these)?

Local Government*: Yes

Yes - Eligible for consideration
No - Not eligible for consideration

Does the local government have an approved resilience plan and has provided a copy or link to the plan with this application?

Resilience Plan*: Yes

Yes - Eligible for consideration under all categories
No - Eligible for consideration for studies, capacity building, and planning only

If the applicant is not a town, city, or county, are letters of support from all affected local governments included in this application?

Letters of Support*: N/A

Yes - Eligible for consideration
No - Not eligible for consideration
N/A - Not applicable

Has this or any portion of this project been included in any application or program previously funded by the Department?

Previously Funded*: No

Yes - Not eligible for consideration
No - Eligible for consideration

Has the applicant provided evidence of an ability to provide the required matching funds?

Evidence of Match Funds*: Yes

Yes - Eligible for consideration
No - Not eligible for consideration
N/A - Match not required

Scoring Criteria for Flood Prevention and Protection Projects - Round 4

Scoring

Category Scoring:
Hold CTRL to select multiple options

Project Category*: All hybrid approaches whose end result is a nature-based solution

Is the project area socially vulnerable? (based on ADAPT Virginia?s Social Vulnerability Index Score)

Social Vulnerability Scoring:
Very High Social Vulnerability (More than 1.5)

High Social Vulnerability (1.0 to 1.5)
Moderate Social Vulnerability (0.0 to 1.0)
Low Social Vulnerability (-1.0 to 0.0)
Very Low Social Vulnerability (Less than -1.0)

Socially Vulnerable*: Very Low Social Vulnerability (Less than -1.0)

Is the proposed project part of an effort to join or remedy the community?s probation or suspension from the NFIP?

NFIP*: No

Is the proposed project in a low-income geographic area as defined below?
"Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income, or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. A project of any size within a low-income geographic area will be considered.

Low-Income Geographic Area*: No

Projects eligible for funding may also reduce nutrient and sediment pollution to local waters and the Chesapeake Bay and assist the Commonwealth in achieving local and/or Chesapeake Bay TMDLs. Does the proposed project include implementation of one or more best management practices with a nitrogen, phosphorus, or sediment reduction efficiency established by the Virginia Department of Environmental Quality or the Chesapeake Bay Program Partnership in support of the Chesapeake Bay TMDL Phase III Watershed Implementation Plan?

Reduction of Nutrient and Sediment Pollution*: Yes

Does this project provide ?community scale? benefits?

Community Scale Benefits*: Less than 25% of census block

Expected Lifespan of Project

Expected Lifespan of Project*: Over 20 Years

Comments:

The implementation of green infrastructure in concert with this project will likely result in the reduction of nitrogen, phosphorus, or sediment through publicly maintained stormwater BMPs.

Scope of Work - Projects - Round 4

Scope of Work

Upload your Scope of Work
Please refer to Part IV, Section B. of the grant manual for guidance on how to create your scope of work

Scope of Work*: CID515519_Alexandria_CFPF-1.pdf

Comments:

Valley Drive Scope of Work

Budget Narrative

Budget Narrative Attachment*: CID515519_Alexandria_CFPF-1_Budget Narrative.pdf

Comments:

The City is requesting $2,160,000.00 in CFPF funds for this Project.

Scope of Work Supporting Information - Projects

Supporting Information - Projects

Provide population data for the local government in which the project is taking place

Population*: 159467.00

Provide information on the flood risk of the project area, including whether the project is in a mapped floodplain, what flood zone it is in, and when it was last mapped. If the property or area around it has been flooded before, share information on the dates of past flood events and the amount of damage sustained

Historic Flooding data and Hydrologic Studies*: CID515519_Alexandria_CFPF-1_Hydrologic Studies Narrative.pdf

Include studies, data, reports that demonstrate the proposed project minimizes flood vulnerabilities and does not create flooding or increased flooding (adverse impact) to other properties

No Adverse Impact*: CID515519_Alexandria_CFPF-1_No Adverse Impact.pdf

Include supporting documents demonstrating the local government's ability to provide its share of the project costs. This must include an estimate of the total project cost, a description of the source of the funds being used, evidence of the local government's ability to pay for the project in full or quarterly prior to reimbursement, and a signed pledge agreement from each contributing organization

Ability to Provide Share of Cost*: CID515519_Alexandria_CFPF-1_Cost.pdf

A benefit-cost analysis must be submitted with the project application

Benefit-Cost Analysis*: CID515519_Alexandria_CFPF-1_BCA.pdf

Provide a list of repetitive loss and/or severe repetitive loss properties. Do not provide the addresses for the properties, but include an exact number of repetitive loss and/or severe repetitive loss structures within the project area

Repetitive Loss and/or Severe Repetitive Loss Properties*: CID515519_Alexandria_CFPF-1_Loss Narrative.pdf

Describe the residential and commercial structures impacted by this project, including how they contribute to the community such as historic, economic, or social value. Provide an exact number of residential structures and commercial structures in the project area

Residential and/or Commercial Structures*:

There are 91 residential properties in the project area, no commercial properties, and no critical facilities / infrastructure.

If there are critical facilities/infrastructure within the project area, describe each facility

Critical Facilities/Infrastructure*:

The project area is adjacent to Alexandria Fire Station 203 and George Mason Elementary School.

The 15,000 SF, two-story Alexandria Fire Station #203 is equipped with two and a half operational bays and houses an engine, a medic, administrative units, and required personnel. The steel and masonry structure has the capacity for special service units.

George Mason Elementary School is a public school with 320 students in grades PK, K-5 with a student-teacher ratio of 13 to 1.

Explain the local government's financial and staff resources. How many relevant staff members does the local government have? To what relevant software does the local government have access? What are the local government's capabilities?

Financial and Staff Resources*:

The City's Transportation and Environmental Services Stormwater Management Division will implement the project working with the Department of Project Implementation. The Division maintains several Project Managers, Professional Engineers, and PhD's on staff, two of which are Certified Floodplain Managers (CFMs). The Stormwater Management Division collaborates with the City's Department of Project Implementation (DPI) to execute all design/construction projects. DPI staff include Professional Engineers and Project Managers, which includes in-house ASFPM Certified Floodplain Managers (CFM). All Project Management staff are required to execute projects via AlexPM which is a Project Management Information System (PIMS) operating out of SmartSheet®. AlexPM tracks projects from inception through close-out. The City has full access to software such as ArcGIS and AutoCAD and all relevant MS Office Products.

Identify and describe the goals and objectives of the project. Include a description of the expected results of the completed project and explain the expected benefits of the project. This may include financial benefits, increased awareness, decreased risk, etc.

Goals and Objectives*:

The Valley Drive neighborhood has been experiencing localized flooding on frequent basis due to the increase in high intensity precipitation events. Valley Drive neighborhood is located between Kenwood Avenue and Dogwood Drive to the north and south, and Ridge Road and Oakcrest Drive to the east and west, respectively. During large scale storm events, runoff overtops the curb and flows predominantly between houses at Valley Drive and Crestwood Drive. The City of Alexandria received several calls, emails and Alex311 requests from property owners about flooding concerns in the area. Multiple residents reported in-home flooding due to water not captured by the existing inlets. This flow pattern results in flooding reaching depths between three to four feet during significant events. Additionally, the surcharge of water in the system frequently leads to the blowing of manhole lids.

The goals and objectives of this project are:

+ Mitigate the local flooding impacts of the City's standard 10-year, 24-hour storm within Valley Drive, Crestwood Drive, Summit Avenue, and Dogwood Drive;

+ Mitigate the impact of larger events as much as possible; and

+ Avoid worsening flooding elsewhere in the drainage system.

Outline a plan of action laying out the scope and detail of how the proposed work will be accomplished with a timeline identifying expected completion dates. Determine milestones for the project that will be used to track progress. Explain what deliverables can be expected at each milestone, and what the final project deliverables will be. Identify other project partners

Approach, Milestones, and Deliverables*: CID515519_Alexandria_CFPF-1_Approach Milestone Deliverable.pdf

Where applicable, briefly describe the relationship between this project and other past, current, or future resilience projects. If the applicant has received or applied for any other grants or loans, please identify those projects, and, if applicable, describe any problems that arose with meeting the obligations of the grant and how the obligations of this project will be met

Relationship to Other Projects*:

To date, the City has received several CFPF grants which focus on flood mitigation specifically in the Four Mile Run watershed. Other than the Inlet

Capacity and New Inlet Program (Inlet Program) which received funding through CFPF in Round 3 and focuses on upgrading and replacing inlets in Hooff's Run (and Four Mile Run), this will be the first neighborhood-specific project in the Hooff's Run watershed funded, in part, by CFPF. The project proposed in this application fulfills the requirements and support the goals of each of these resilience planning efforts and accelerate the City's efforts to deliver flood mitigation measures for this watershed.

For ongoing projects or projects that will require future maintenance, such as infrastructure, flood warning and response systems, signs, websites, or flood risk applications, a maintenance, management, and monitoring plan for the projects must be provided

Maintenance Plan*: CID515519_Alexandria_CFPF-1_Maintenance.pdf

Describe how the project meets each of the applicable scoring criteria contained in Appendix B. Documentation can be incorporated into the Scope of Work Narrative

Criteria*:

Based on the scoring criterion for the Project Category, this project scores a 30. This project will utilize a hybrid approach resulting in nature-based solution (15) using a Bay approved BMP (5) and will have an expected lifespan of over 20-years (10). As described in the narrative, this project location has very low social vulnerability, not part of a low-income geographic area and the area represents a portion of the census block.

Budget

Budget Summary

Grant Matching Requirement*:	Projects that will result in hybrid solutions - Fund 60%/Match 40%
Is a match waiver being requested?	
Match Waiver Request Note: only low-income communities are eligible for a match waiver. *:	No
Total Project Amount (Request + Match)*:	$3,600,000.00 **This amount should equal the sum of your request and match figures
REQUIRED Match Percentage Amount:	$1,440,000.00

BUDGET TOTALS

Before submitting your application be sure that you meet the match requirements for your project type.

Match Percentage:	40.00% Verify that your match percentage matches your required match percentage amount above.
Total Requested Fund Amount:	$2,160,000.00
Total Match Amount:	$1,440,000.00
TOTAL:	$3,600,000.00

Personnel

Description	Requested Fund Amount	Match Amount	Match Source

No Data for Table

Fringe Benefits

Description	Requested Fund Amount	Match Amount	Match Source

No Data for Table

Travel

Description	Requested Fund Amount	Match Amount	Match Source

No Data for Table

Equipment

Description	Requested Fund Amount	Match Amount	Match Source

No Data for Table

Supplies

Description	Requested Fund Amount	Match Amount	Match Source

No Data for Table

Construction

Description	Requested Fund Amount	Match Amount	Match Source

No Data for Table

Contracts

Description	Requested Fund Amount	Match Amount	Match Source
Professional Services Contract	$1,836,000.00	$1,224,000.00	Cash
	$1,836,000.00	**$1,224,000.00**	

Maintenance Costs

Description	Requested Fund Amount	Match Amount	Match Source

No Data for Table

PreAward and Startup Costs

Description	Requested Fund Amount	Match Amount	Match Source
Pre-Award Costs of 15% may be required depending on timeline of award	$324,000.00	$216,000.00	Cash
		$216,000.00	

Other Direct Costs

Description	Requested Fund Amount	Match Amount	Match Source

No Data for Table

Long and Short Term Loan Budget - Projects - VCFPF

Budget Summary

Are you applying for a short term, long term, or no loan as part of your application?

If you are not applying for a loan, select "not applying for loan" and leave all other fields on this screen blank

Long or Short Term*: Not Applying for Loan

Total Project Amount: $0.00

Total Requested Fund Amount: $0.00

TOTAL: $0.00

Salaries

Description	Requested Fund Amount

No Data for Table

Fringe Benefits

Description	Requested Fund Amount

No Data for Table

Travel

Description	Requested Fund Amount

No Data for Table

Equipment

Description	Requested Fund Amount

No Data for Table

Supplies

Description	Requested Fund Amount

No Data for Table

Construction

Description	Requested Fund Amount

No Data for Table

Contracts

Description	Requested Fund Amount

No Data for Table

Other Direct Costs

Description	Requested Fund Amount

No Data for Table

Supporting Documentation

Supporting Documentation

Named Attachment	Required	Description	File Name	Type	Size	Upload Date
Detailed map of the project area(s) (Projects/Studies)		Project map	ValleyDriveProjectArea 002.jpg	jpg	1 MB	01/22/2025 01:24 PM
FIRMette of the project area(s) (Projects/Studies)		The project is not in a FEMA mapped floodplain as indicated by this map which includes the project area.	5155190029f.pdf	pdf	682 KB	01/22/2025 01:25 PM

Historic flood damage data and/or images (Projects/Studies)	Hydrologic Studies Narrative and Image of Flooding in Project Area	CID515519_Alexandria_CFPF-1_Hydrologic Studies Narrative.pdf	pdf	177 KB	01/22/2025 01:42 PM
A link to or a copy of the current floodplain ordinance	The City's Floodplain Ordinance is available via Municode at https://library.municode.com/va/alexandria/codes/zoning?nodeId=ARTVISPOVZO_S6-300FLDI. It also is attached.	Sec._6_300___Floodplain_district..pdf	pdf	283 KB	01/22/2025 01:29 PM
Maintenance and management plan for project					
A link to or a copy of the current hazard mitigation plan	City of Alexandria Annex to the 2022 NOVA HMP	02 City of Alexandria Annex - 2022 NOVA HMP FINAL-compressed.pdf	pdf	1016 KB	01/22/2025 01:31 PM
A link to or a copy of the current comprehensive plan	The Master Plan is a series of Small Area Plans covering neighborhoods throughout the city, as well as topical chapters of citywide relevancy, such as Historic Preservation, Urban Design, Transportation, and Open Space. The Alexandria Master Plan was adopted by the City Council on June 13, 1992, and chapters are added or updated on an ongoing basis as needed through Master Plan Amendments. Visit https://tinyurl.com/alxcompplan to learn more. The plan for the Project Area is attached.	NorthRidgeRosemontSAPCurrent.pdf	pdf	2 MB	01/22/2025 01:37 PM
Social vulnerability index score(s) for the project area	Valley Drive SVI	CID515519_Alexandria_CFPF-1_SVI.pdf	pdf	72 KB	01/22/2025 01:41 PM
Authorization to request funding from the Fund from governing body or chief executive of the local government	City Council signed resolution attached	25-2513_Signed Resolution.pdf	pdf	27 KB	01/22/2025 01:37 PM
Signed pledge agreement from each contributing organization					
Maintenance Plan	Maintenance Plan	CID515519_Alexandria_CFPF-1_Maintenance.pdf	pdf	101 KB	01/23/2025 11:31 AM

Benefit-cost analysis must be submitted with project applications over $2,000,000. in lieu of using the FEMA benefit-cost analysis tool, applicants may submit a narrative to describe in detail the cost benefits and value. The narrative must explicitly indicate the risk reduction benefits of a flood mitigation project and compares those benefits to its cost-effectiveness.

Benefit Cost Analysis	BCA calculated for the project is 1.01.	CID515519_Alexandria_CFPF-1_BCA.pdf	pdf	362 KB	01/22/2025 01:43 PM
Other Relevant Attachments	Presentation to community	Presented to Valley Drive Neighborhood - Further Investigation of Neighborhood Flooding.pdf	pdf	704 KB	01/22/2025 01:38 PM

Letters of Support

Description	File Name	Type	Size	Upload Date
	No files attached.			

Resilience Plan

Resilience Plan

Description	File Name	Type	Size	Upload Date
The City's Resilience Plan is approved through 9/13/2026. The City is currently working on a new Resilience Plan funded by DCR's CFPF.	5_CityofAlexandriaResilincePlanV2.pdf	pdf	745 KB	01/22/2025 01:18 PM

Valley Drive Storm Drain Improvement Project Grant Application

Community Flood Preparedness Fund
Round 5

City of Alexandria, VA
January 24, 2025

Valley Drive Storm Drain Improvement Project

The City of Alexandria (City) is applying for grant assistance under the Virginia Department of Conservation and Recreation (DCR) Community Flood Preparedness Fund (CFPF) Round 5 'Project' category to help mitigate flooding in the Valley Drive neighborhood in Alexandria, Virginia. The *Valley Drive Storm Drain Improvement Project* aims to improve the local storm drainage system, specifically targeting areas prone to flooding during the City's standard 10-year, 24-hour storm event along Valley Drive, Crestwood Drive, Summit Avenue, and Dogwood Drive. The project seeks to mitigate the impact of larger storm events while ensuring that improvements do not worsen flooding in other parts of the drainage system. The work includes relocating the current storm pipe, which stretches from Crestwood Drive and passes under the backyards of homes on the west side of Valley Drive to Summit Avenue. The new route will align with the existing Valley Drive rights-of-way. Additionally, new manholes and curb inlets will be installed along Crestwood Drive. The design will improve the storm system along Valley Drive, which includes a new upsized sewer, boosting the capacity of current inlets, and installing new curb inlets. The design will also consider realigning storm drains. The project will add in Green Infrastructure where feasible, further increasing the resilience to flooding in the Hooff's Run watershed.

Virginia DCR approved the *City of Alexandria's Resilience Plan* September 10, 2021. The City has integrated flood mitigation and resilience goals across areas of the local government, with flood resilience a priority addressed holistically through master planning, environmental planning, small area planning, waterfront planning, and capital project planning and implementation, and this project will advance the priorities identified in these various plans. The City has established requirements for development controls in the floodplain through zoning and the local floodplain ordinance,
Alexandria, VA, Zoning, Article VI. Special and Overlay Zones, Section 6-300 Floodplain District.

The City's Transportation and Environmental Services Department (T&ES) is implementing resilient stormwater system upgrades informed by the *City of Alexandria Storm Sewer Capacity Analysis* (CASSCA), neighborhood investigations, resident service requests, anecdotal information, and making spot improvements to high priority flood risk areas (i.e., neighborhoods), along with accelerated operations and maintenance under the Flood Action Alexandria program. Additionally, the City understands the importance of engaging with communities in high-risk areas impacted by frequent urban flooding events. The City performed neighborhood investigations and met with residents following a series of intense storm events driven by climate change that caused urban flooding in 2019, 2020, and 2021. The City launched a Flood Mitigation Grant Program in August 2021 to assist property owners in making improvements to protect their private property through flood barrier implementation and structural adaptations. In 2019, the City released an update to the *Environmental Action Plan* with a roadmap for climate mitigation and resilience activities, followed by the updated *Energy and Climate Change Action Plan*. These initiatives are grounded by the City's Equity ordinance, which commits to addressing racial, social, and economic disparities in all areas of local government. The project proposed in this application fulfil the requirements and support the goals of each of these resilience planning efforts and accelerate the City's efforts to deliver flood mitigation measures for Alexandria.

1. Project Need

The Valley Drive neighborhood has been experiencing localized flooding on frequent basis due to the increase in high intensity precipitation events. In addition to flooding roadways, throughfares, and causing public and private property damage, these events also impact residential property by flooding garages, basements, and even the first floor of some residences with water reaching up to food-foot inside. Several major storms occurred in the Valley Drive area, with the storm in the early morning of August 15, 2021, causing the most damage.

Starting around midnight on August 15, Alexandria experienced flash flooding from an intense localized storm. Preliminary rainfall data from the recently installed City rain gauge network indicated that between three to five inches of rain fell in about an hour, with very heavy rainfall rates for 30 minutes. The storm caused widespread flooding, as well as power outages, sanitary backups, road closures, displaced manhole covers, traffic light outages, sink holes and other impacts on City infrastructure.

The maximum rain gauge reading was at George Mason Elementary, which recorded a massive 3.19 inches in 30 minutes, 4.43 inches in one hour, and 5.19 inches in two hours, finishing the event with a total of 5.47 inches at the six-hour mark. From a historical perspective, these rainfall intensities correspond to a 200 – 500-year storm event based on the City's Intensity, Duration, Frequency (IDF) curves, which are much more conservative than National Atmospheric and Oceanic Administration (NOAA) Atlas-14 that would rate these much higher than a 500-year storm.

Of note, George Mason Elementary School is adjacent to the Valley Drive neighborhood. The Valley Drive neighborhood is located between Kenwood Avenue and Dogwood Drive to the north and south, and Ridge Road and Oakcrest Drive to the east and west, respectively. During large scale storm events, runoff overtops the curb and flows predominantly between houses at Valley Drive and Crestwood Drive. The City received several calls, emails and Alex311 service requests from property owners about flooding concerns in the area. Multiple residents reported in-home flooding due to water not captured by the existing inlets. This flow pattern results in flooding reaching depths between three to four feet during significant events. Additionally, the surcharge of water in the system frequently leads to the blowing of manhole lids. Figure 1 is a still image from a video taken on August 15, 2021, from a resident on Valley Drive.

Figure 1. Street Flooding and Surcharged Manhole (far left) on Valley Drive around midnight on August 15, 2021

The *Valley Drive Storm Drain Improvement Project* will address the City's standard 10-year, 24-hour storm event which is greater than the NOAA Atlas-14. Further, the City will factor in climate change impacts of higher precipitation and greater intensity. Figure 2 highlights the project vicinity.

Figure 2. Project Vicinity Map

a. Population and Equity

Alexandria has a population of 159,467 (U.S. Census Bureau, 2020) and is the densest city in Virginia with a population density of about 9,460 people per square mile. The median household income in Alexandria in 2019 was $100,939. The *Valley Drive Storm Drain Improvement Project* is located within Census Block Tract 200900 with 1,850 total households, a per capita income of $106,669, total population of 4,974[1]. Within the smaller "project area", there are 91 residential properties; no commercial properties are within the project area. The Census Tract has a Vulnerability Index Score of -1.1 (Table 1) (not socially vulnerable).

[1] Alexandria Demographics and Statistics, available at https://www.alexandriava.gov/Demographics

Table 1. Social Vulnerability for Census Tracts 2009

Census Tract ID	Index Classification	Vulnerability Index Score
2009	Very Low	-1.1

b. Historic Flooding Data and Hydrologic Studies Projecting Flood Frequency

The City is experiencing more frequent and severe flash flooding from extreme precipitation events which have occurred more often in the last few years. These flash flood events may damage residential and commercial properties, impact critical assets, and cause day-to-day disruptions and economic losses. The City has experienced several major flooding events since 2019, including July 8, 2019, July 23, 2020, September 10, 2020, August 15, 2021, and September 16, 2021. These events are characterized between 50 to 500-year level rainstorm events. The City's Intensity-Duration-Frequency (IDF) curves developed in the 1980's were compared to other localities in the region and available climate predictions during the CASSCA study, completed in 2016, and were found to be more conservative than many surrounding localities' design storms, more conservative than NOAA Atlas-14, and were found to compare favorable to climate predictions available in 2016. The City is currently planning to further analyze these local IDF curves in comparison to regional efforts and more recent climate predictions.

The August and September 2021 storms were recorded by recently installed rain gauges that expand the City's gauge network to gather more localized storm information. Actual accumulation of over 5-inches in two hours, to be between 100 and 500-year level rain when compared to the statistical expectations derived for the City's curves developed in the 1980's for the City, which are more conservative than NOAA's predictions for the region. Meaning, what NOAA would call a 12-hour 25-year rainfall, Alexandria would call it closer to a 15-year rainfall.

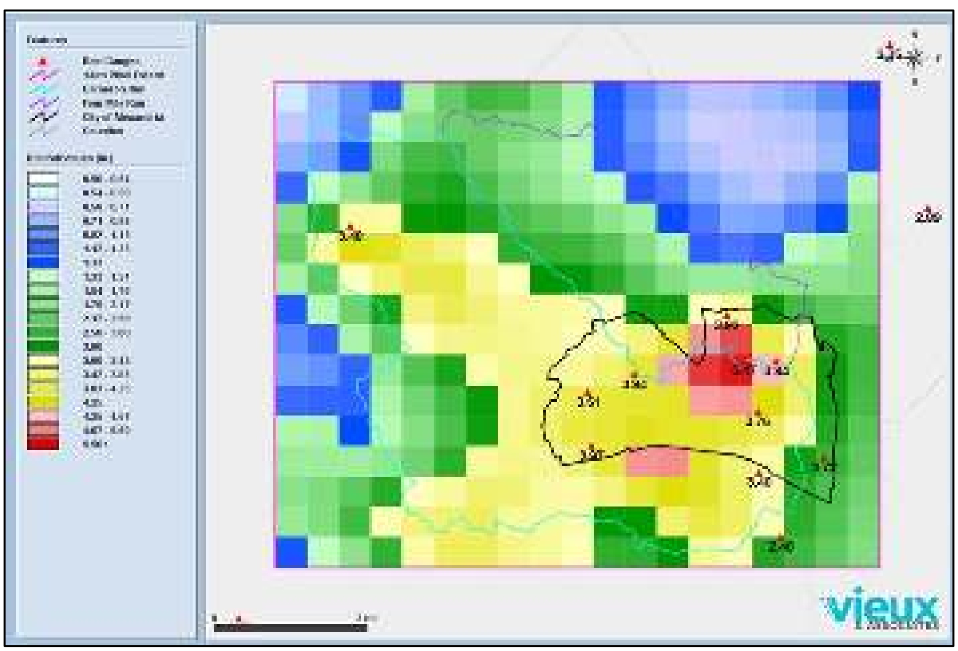


Figure 3. GARR Storm Total for August 15, 2021 (Vieux, 2021)

The project area is not in a mapped floodplain; however, residents indicated their property has flooded five times within a six-year period with the August 15, 2021, storm causing the most damage. Figure 3 shows the Gauge-Adjusted Radar Rainfall (GARR) for the August 15th storm event which highlights the storm total of 5.47 inches in the Valley Drive area[2]. Other dates that would have

[2] *Radar Rainfall Analysis Report, Alexandria, VA*, Vieux & Associates, October 29, 2021. Available at https://www.alexandriava.gov/sites/default/files/2022-03/AlexandriaVA_2019-2021_4events_GARR_Report.pdf.

impacted this neighborhood are July 2019, July 2020, and September 2020, as described above. Damage occurred to residential properties and includes impacts to basements, garages, and first floors. Further, based on videos and testimonials from residents, it appears that vehicles also may have been damaged during these severe flooding events.

c. Ability of Alexandria to Provide its Share of the Project Cost

In response to these recurring flooding events, in May 2021 the City Council unanimously adopted an ordinance to double the Stormwater Utility Fee with a 50% increase in the rate for the May 2021 billing and an additional 50% increase in the rate for the October billing to significantly increase local resources available for investments in our storm sewer infrastructure. Annual increases of 5% to the previous year's rate have been implemented since those large increases. The development of the FY 2022 – FY 2031 Stormwater Management Utility Ten Year Plan for funding of operating and capital improvement program (CIP) costs, included the identification and funding schedule for 11 top priority large capacity flood mitigation projects that include a mix of storage, conveyance, and green infrastructure. The 10-Year Plan also includes annually increasing funding for spot improvement projects and increased maintenance activities citywide. The Stormwater Utility Fee enables an acceleration of major capacity projects and spot improvement projects, an increase in channel maintenance, new state-of-good repair investments, property owner grants, and staffing in support of these projects. The City confirms that it can cover the cost share of the *Valley Drive Storm Drain Improvement Project* under the Storm Sewer System Spot Improvements program.

d. Alexandria is an Active Participant in the National Flood Insurance Program

The City began participating in the regular phase of Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) on May 8, 1970, and is recognized for exceeding the goals of the NFIP Community Rating System (CRS) program. Alexandria is one of two Virginia localities to achieve a Class 6 rating. As a result, residents and businesses purchasing flood insurance for properties in Alexandria are eligible to receive up to a 20% discount on flood insurance premiums. The City also has established a Floodplain Ordinance to regulate development and redevelopment in the floodplain. This neighborhood is located on map 5155190029F but is not located within a special flood zone.

e. No Adverse Impact

The intent of the *Valley Drive Storm Drain Improvement Project* is to design the system to capture flood waters in the project area in a way that mitigates property flooding while not contributing to adverse downstream impacts. The City's consultant investigated this neighborhood and provided a technical report dated December 1, 2023[3], which outlines the following objectives for the proposed *Project*:

- Provide increased capacity and flow sharing between the storm drain system.
- Provide relief to the downstream backyard storm drain system to reduce system surcharge and flood inundation.
- Proposed curb inlets in conjunction with the proposed storm drain system to significantly reduce the amount of flooding near the intersection of Crestwood Drive and Valley Drive, as well as, within the adjacent properties.

[3] *Task Order 52: Further Investigation of Neighborhood Flooding: Valley Drive*, December 1, 2023, prepared by AECOM.

[3] Economic Guidance Memorandum 04-01, Generic Depth-Damage Relationships for Residential Structures with Basements (USACE, 2003).

The new system provides significant reduction in flood inundations and system surcharging while upsized inlets and pipes conveys stormwater more efficiently enabling a substantial amount of stormwater to move through the system thereby decreasing the amount of bypass flow.

f. Benefit-Cost Analysis

The *Valley Drive Storm Drain Improvement Project* is located in the northern most subwatershed of Hooff's Run watershed. A benefit-cost analysis was performed using generic depth-damage curves from the U.S. Army Corps of Engineers flood damage reduction studies[3]. Each of the three properties subject to flood damage associated with this project were assessed based on depth, mean of damage, and standard deviation of damage associated with each structure by type. Table 2 provides a summary of the expected flood depth by property type.

Table 2. Flood Depth by Structure Type (adapted from Economic Guidance Memorandum 04-01, Generic Depth-Damage Relationships for Residential Structures with Basements)

Structure No.	Description	Depth	Mean of Damage (%)	Standard Deviation of Damage (%)
1	2 or more stories – no basement	2	20.9	2.8
2	2 or more stories – with basement	3	17.7%	1.43
3	1 story – with basement	1	32.0	0.96

Preliminary Calculations

Table 3 provides the inputs (costs / benefits) and results (BCA of 1.01) from the FEMA Benefit Cost Analysis Tool. Of note, to estimate benefits, quantified avoided damages was calculated using the 2024 tax assessed values for the three properties; actual market values may be higher.

Table 3. Valley Drive BCA

Valley Drive BCA CFPF 2025							
Project Costs							
	Total Project Costs (Planning, Design, Construction)					$	2,346,000
	Annual Maintenance Cost (50 year life)					$	10,000
	Discounted Maintenance Costs (3% per year)					$	257,298
	Present Value Total Project Costs					$	**2,603,298**
Project Benefits							
Avoided Property Damage (Per Flood Event)							
Property Damage Reduction							
	Pre-Project Damages						
	Property	Tax assessed value	Type	Flood Depth	Damage %		Damages
	Home 1	$ 1,003,946	SFR 1-story w/basement	1	0.32	$	321,263
	Home 2	$ 896,423	SFR 2-story no basement	2	0.209	$	187,352
	Home 3	$ 1,285,043	SFR 2-story w/basement	3	0.177	$	227,453
	Total Pre-Project Damages					$	**736,068**
	Post-Project Damages						
	Property	Tax assessed value	Type	Flood Depth	Damage %		Damages
	Home 1	$ 1,003,946	SFR 1-story w/basement	0.5	0.05	$	50,197
	Home 2	$ 896,423	SFR 2-story no basement	0.5	0.05	$	44,821
	Home 3	$ 1,285,043	SFR 2-story w/basement	0.5	0.05	$	64,252
	Total Post-Project Damages					$	**159,271**
	Avoided Damages (Per Flood Event)					$	**576,797**
Benefit Over Project Lifespan (50-years)							
	Assume a **10-year design storm** has a 10% chance of occuring annually.						
	Over 50 years: Expected number of 10-year storms ? 50×0.10=550 \times 0.10						5
	Total Avoided Damages (Undiscounted)					$	2,883,986
	Present Value of Benefits					$	**2,641,561**
Benefit-Cost Ratio							**1.01**

$$BCR = \frac{\text{Present Value of Benefits}}{\text{Present Value of Costs}}$$

g. Other Necessary Information to Establish Project Priority

The *Northern Virginia Hazard Mitigation Plan* identified flooding as one of Alexandria's predominant hazards due to riverine, precipitation, tidal, and storm surge flooding. The *Hazard Mitigation Plan* ranked natural hazards for Alexandria using historical weather-related events based on the Storm Event Database by the NOAA National Centers for Environmental Information, formerly the National Climatic Data Center (NCDC). Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods (see Figure 4). Flooding and Severe Storms both rank as High Hazard for the City. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrences;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

Hazard	Hazard Ranking
Winter Weather	High
Flood	High
High Wind/Severe Storm	High
Earthquake	High-Medium
Tornado	Medium
Drought	Medium
Dam Failure	Medium
Extreme Temperatures	Medium
Wildfire	Low
Karst/Sinkhole/Land Subsidence	Low
Landslide	Low

Figure 4. Ranking of Natural Hazards by Risk, Northern Virginia Hazard Mitigation Plan, Nov. 2022[4]

Critical Facilities & Structures

There are 91 residential properties within the project area and no commercial properties are within the project area. The project area is adjacent to Alexandria Fire Station 203 and George Mason Elementary School. The 15,000 SF, two-story Alexandria Fire Station #203 is equipped with two and a half operational bays and houses an engine, a medic, administrative units, and required personnel. The steel and masonry structure has the capacity for special service units. George Mason Elementary School is a public school with 320 students in grades PK, K-5 with a student-teacher ratio of 13 to 1.

Repetitive Loss

Within the project area, there are no repetitive loss and/or severe repetitive loss properties as indicated by FEMA.

2. Need for Assistance

The City has the staff and resources (SWM/SWU CIP), BSEGS 5 rating, CRS Class 6, to implement this project as soon as funding becomes available. DCR's financial support will help create a more resilient Alexandria while enhancing and improving the City's built infrastructure in the Valley Drive neighborhood.

The City's Transportation and Environmental Services Stormwater Management Division will implement the project working with the Department of Project Implementation (DPI). The Stormwater Management

[4] *Northern Virginia (NOVA) Hazard Mitigation Plan*. November 2022. *Annex 2: City of Alexandria*. Available at: https://www.alexandriava.gov/sites/default/files/2023-10/02%20City%20of%20Alexandria%20Annex%20-%202022%20NOVA%20HMP%20FINAL.pdf

Division collaborates with DPI to execute all design/construction projects. The Project Team maintains several Project Managers, Professional Engineers, and PhD's on staff, two of which are Certified Floodplain Managers (CFMs). All Project Management staff are required to execute projects via "AlexPM" which is a Project Management Information System (PIMS) operating out of SmartSheet®. AlexPM tracks projects from inception through close-out. The City has full access to software such as ArcGIS and AutoCAD and all relevant MS Office Products.

a. Goals and Objectives

The Valley Drive neighborhood has been experiencing localized flooding on frequent basis due to the increase in high intensity precipitation events. Valley Drive neighborhood is located between Kenwood Avenue and Dogwood Drive to the north and south, and Ridge Road and Oakcrest Drive to the east and west, respectively. During large scale storm events, runoff overtops the curb and flows predominantly between houses at Valley Drive and Crestwood Drive. The City of Alexandria received several calls, emails and Alex311 requests from property owners about flooding concerns in the area. Multiple residents reported in-home flooding due to water not captured by the existing inlets. This flow pattern results in flooding reaching depths between three to four feet during significant events. Additionally, the surcharge of water in the system frequently leads to the blowing of manhole lids.

The goals and objectives of this project are:

- Mitigate the local flooding impacts of the City's standard 10-year, 24-hour storm within Valley Drive, Crestwood Drive, Summit Avenue, and Dogwood Drive;
- Mitigate the impact of larger events as much as possible; and
- Avoid worsening flooding elsewhere in the drainage system.

b. Project Alternatives

The *Valley Drive Storm Drain Improvement Project* will utilize a hybrid solution to mitigate flooding. The selected project will reduce risk to populations currently expiring flooding as follows:

- Flooding on Crestwood Drive is substantial enough to go over the roadway curb and contribute to the flooding in the Backyards. The depth of flooding ranges from 4-inches to 1-foot.
- The Backyard flooding is the most substantial, with over 3-feet of water depth in some places.
- Flooding on Valley Drive ranges from 0.5 feet to 1.3 feet. The most probable cause of the increase in flooding in this area are the dual pipes converging at Node 02544SMH

Ultimately, this project will provide substantially more stormwater conveyance, thus decreasing the amount of bypass flow and stormwater spread throughout the intersection.

Green Infrastructure Implementation

Several green infrastructure technologies are considered feasible within the *Valley Drive Storm Drain Improvement Project* area City of Alexandria including: Bioretention/ Planters; Porous Pavement in ROW; Surface Storage (i.e., retrofit of inlets and catch basins to include flow regulators on streets with standard curb and gutter system so that stormwater can be stored within the roadway and slowly released back into the storm sewer system); and "Blue Streets" which provide short term surface storage on streets with relatively flat slopes and standard curb and gutter systems.

Because this project will employ a hybrid solution, no alternatives are presented in this Narrative.

c. Approach, Milestones, and Deliverables

The proposed project will implement three strategies in the neighborhood to help mitigate flooding: (1) add a new storm drain pipe system and new curb inlets along Crestwood Drive; (2) perform a storm drain pipe realignment at Dogwood Drive; and (3) increase storm drain inlet capacity along Valley Drive.
A new storm drain pipe system is proposed along Crestwood Drive that will share the conveyance capacity with the existing pipes on Crestwood Drive, and ultimately drain into the system along Valley Drive. This new storm drain system will provide an alternative path for water to be conveyed, thus freeing up capacity along the backyard pipe system. In addition, there will be new and upsized inlets along Crestwood Drive to provide more conveyance for stormwater, thus reducing flood inundation and bypass flows to the Crestwood Drive/Valley Drive intersection. Multiple curb inlets along Valley Drive are proposed to provide increase stormwater conveyance at multiple locations where there was significant bypass flows and gutter spread. These locations have seen substantial reduction in bypass flows and the associated storm drain pipes have been upsized to provide more capacity for the increased flows conveyed by each inlet. The last spot project involves pipe realignment and a curb inlet upsize at the Dogwood Drive intersection. This separates the two storm drain pipe systems along Valley Drive and realigns the systems to run parallel.

The project also will implement Green Infrastructure within strategically targeted areas within the City's Right-of-Way, to help further mitigate flooding.

It is anticipated that these strategies will take three years to complete as presented in Table 4, Project Timeline. Table 5 provides an overview of the project milestones and associated deliverables.

Table 4. Project Timeline

	FY2026		FY2027				FY2028				FY2029	
Phase	Q3	Q4	Q1	Q3	Q2	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Planning	X											
Design Procurement		X										
Design			X	X	X	X						
Construction Procurement							X					
Construction								X	X	X	X	
Project Closeout												X

Table 5. Milestones

Milestone	Deliverable
Project Planning	• Project Charter • Project Management Plan • Project Work Breakdown Structure • Project Schedule
Design Services Task Order	• Task Order Request based on existing contract • Task Order approval • Purchase Order and Notice to Proceed
Design Phase	• Recommendations for incorporating green infrastructure, where feasible Design Plans Sketch and/or 30% and Final Design • Construction Specifications at Final Design • Basis of Design including Hydraulic Calculations at 30% and Final Design • Cost Estimate at 30% and Final Design
Construction Procurement	• Invitation to Bid at contract award • Contractor Proposal at contract award • Purchase Order at contract award
Construction/Post Construction	• Sign & Sealed As-builts following project close out • Site photographs following project close out
Final Deliverables	• Report finalized based on project work and Team feedback • Lessons learned

The *Valley Drive Storm Drain Improvement Project* is comprised of the following specific tasks:

New Storm Drain Pipe System and New Curb Inlets along Crestwood Drive. The existing storm drain system that runs down Crestwood Drive and under the backyards of the homes on the west side of Valley Drive is surcharging along Crestwood Drive manholes and has caused flood damage to multiple homes. In addition, the only curb inlet on the south side of Crestwood Drive, near the intersection with Valley Drive is a small 4-foot-wide inlet. This inlet is over capacity, as over 21-cfs drains to this inlet, which flows over the crest of the curb and spreads downstream/south. To provide increased capacity and flow sharing between the storm drain system, a new storm drain system is being proposed as well as adding two inlets further uphill along Crestwood Drive and replacing an existing curb inlet with a larger inlet.

Storm Drain Pipe Realignment at Dogwood Drive. The proposed storm drain realignment is intended to separate the west and east storm drain system along Valley Drive, at the intersection with Dogwood Drive. The west storm drain system just south of Dogwood Drive has capacity to accept the flow from the storm drain system north of Dogwood Drive, thus relieving the eastern system which is over capacity in the existing conditions modeling near this intersection. The proposed pipe realignment includes abandoning pipe and adding a new 36-inch RCP. Since improvements are going to impact the existing curb inlet, it is recommended to replace and upsize the current curb inlet as well, to be a 4-inch x 20-foot wide opening with a 2-inch inlet local depressions, to maximize the inlet's conveyance capability.

Storm Drain Inlet Increased Capacity along Valley Drive. The current storm drain inlet placement within this neighborhood is generally located on Valley Drive or close by within an adjacent intersection. The neighborhood drainage areas drain from the west and east side of Valley Drive, towards Valley Drive, causing a significant amount of drainage to overwhelm the existing undersized curb inlets. Due to the drainage area of the existing inlets, spread calculations were completed to determine the peak flows draining to this inlet, inlet depths and gutter spread, see calculations for the existing and proposed spread analysis can be found in Appendix D. Most of the inlets evaluated are significantly overcapacity, resulting in significant amount of bypass flows and spread, that overwhelms downstream structures.

It is recommended to upsize many of the existing curb inlets and add additional new inlets that have storm drain pipes nearby, with larger 4-inch-tall x 20-foot-wide and 4-inch-tall x an additional 8-foot-wide curb opening, all that also have a 2-inch inlet depression. One set of inlets is not in great shape on the west side of Valley Drive along Summit Avenue and should be replaced with the same size inlets with the 2-inch local depression. The combined larger inlet openings, and steeper inlet local depression provides significantly greater conveyance by each inlet compared to the existing inlet openings. Due to the increased conveyance capacity of these proposed inlets the associated storm drain pipes were also upsized, if needed, to ensure drainage could be conveyed by both the inlet and the downstream pipe. These upsized inlets and pipes provide substantially more stormwater conveyance to convey efficiently, thus decreasing the amount of bypassing flow and stormwater spread throughout the intersection.

3. Evaluation

The *Valley Drive Storm Drain Improvement Project* will be considered successful after the construction of the following project components:

- New Storm Drain Pipe System and New Curb Inlets along Crestwood Drive.
- Storm Drain Pipe Realignment at Dogwood Drive.
- Storm Drain Inlet Increased Capacity along Valley Drive.

These project components will be accompanied by several types of outreach including in-person meetings with impacted stakeholders (residents), webpage development explaining the Project and its timeline and components, updates to the general Flood Action Alexandria webpage, and updates to the Stormwater Utility and Flood Mitigation Advisory Committee on the status of the project. Further, the Alexandria City Council will be briefed quarterly on the status of the project through the City's Project Management reporting system.

After the development of the Project Charter, Project Management Plan, Work Breakdown Structure (WBS), and Project Schedule, City staff will meet at defined intervals both internally and externally with the project team (consultants) to discuss the status of the project. The work undertaken by the Project Team will be continuously monitored and reported using the City's PMIS system. Issues unforeseen at the launch of the project will be handled using an adaptive, iterative approach, and will be brought forth to DCR for full consideration should there be an instance of scope change or a similar issue.

Finally, in the event the City experiences a similar event to the one in August 2021 which caused major flooding to this area, the controls put in place through the execution of the grant-funded Project will be assessed to determine if they provided sufficient flood control. To perform this assessment, the City will rely on rainfall gauges and Alex311 data in addition to speaking with impacted residents about their first-hand experiences.

4. Relationship to Other Projects

To date, the City has received several CFPF grants which focus on flood mitigation specifically in the Four Mile Run watershed. Other than the *Inlet Capacity and New Inlet Program ("Inlet Program")* – which received funding through CFPF in Round 3 – and focuses on upgrading and replacing inlets in Hooff's Run (and Four Mile Run), this will be the first neighborhood-specific project in the Hooff's Run watershed funded, in part, by CFPF. The project proposed in this application fulfills the requirements and support the goals of each of these resilience planning efforts and accelerate the City's efforts to deliver flood mitigation measures for this watershed.

5. Maintenance Plan

City sewer infrastructure 'state of good repair' program maintenance objectives includes inspection and maintenance on a rotating 3-5 year service schedule. The City also performs inspection and maintenance in response to Alex311 service requests an in advance of forecasted storm events. The initial work will be inspected regularly early on to ensure proper functioning prior to the routine, rotating schedule being implemented. More information is available on the City's Sewer Maintenance webpage.

,

Valley Drive Storm Drain Improvement Project Grant Application
January 24, 2025

Budget Narrative

Applicant Name: City of Alexandria, VA

Community Flood Preparedness
Fund & Resilient Virginia Revolving
Loan Fund

Detailed Budget Narrative

Period of Performance: June 1, 2025 through June 1, 2028

Submission Date: January 24, 2025

Grand Total State Funding Request	$2,160,000
Grand Total Local Share of Project	$1,440,000
Federal Funding (if applicable)	$0
Project Grand Total	$3,600,000
Locality Cost Match	40%

Breakout By Cost Type	Personnel	Fringe	Travel	Equipment	Supplies	Contracts	Indirect Costs	Other Costs	Total
Federal Share (if applicable)									
Local Share						$1,440,000			$1,440,000
State Share						$2,160,000			$2,160,000
Pre-Award/Startup						*$324,000*			*$324,000*
Maintenance									
Total	$	$	$	$	$	$3,600,000	$	$	$3,600,000

Personnel – The City will not charge Personnel costs under this grant agreement.

Fringe – The City will not charge Fringe costs under this grant agreement.

Travel – The City will not charge Travel costs under this grant agreement.

Supplies – The City will not charge Supply costs under this grant agreement.

Contracts – The design will be procured through the existing engineering services master on-call contract. Construction will be procured through an Invitation to Bid (ITB). Construction management and inspection will be secured through the construction services master on-call contract. The project will have input and oversight from City staff.

The City is requesting 60% of the funds through CFPF ($2,160,000) and commits to match the remaining 40% with City funds ($1,440,000) for a total project amount of $3,600,000.

Indirect Costs – The City will not charge indirect costs under this grant agreement.

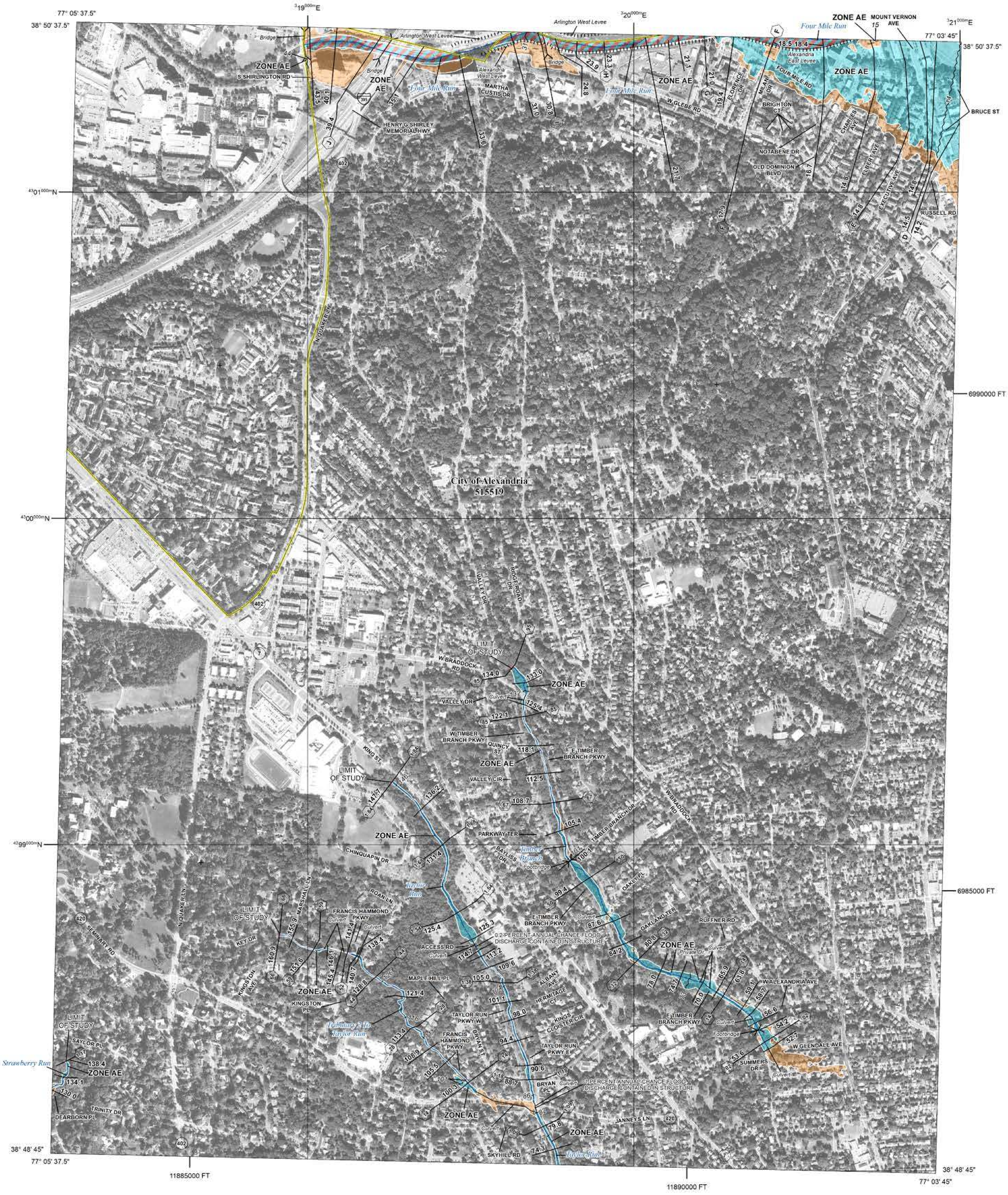
Pre-Award Costs – The City respectfully requests approval from DCR for pre-award costs in the amount of $324,000, or 15% of the total grant award amount of $2,160,000.

Historic Flooding Data and Hydrologic Studies Projecting Flood Frequency

The City is experiencing more frequent and severe flash flooding from extreme precipitation events which have occurred more frequently in the last few years. These flash flood events may damage residential and commercial properties, impact critical assets, and cause day-to-day disruptions and economic losses. The City has experienced several major flooding events since 2019, including July 8, 2019, July 23, 2020, September 10, 2020, August 15, 2021, and September 16, 2021. These events are characterized between 50 to 500-year level rainstorm events. The City's Intensity-Duration-Frequency (IDF) curves developed in the 1980's were compared to other localities in the region and available climate predictions during the CASSCA study, completed in 2016, and were found to be more conservative than many surrounding localities' design storms, more conservative than NOAA Atlas-14, and were found to compare favorable to climate predictions available in 2016. The City is currently planning to further analyze these local IDF curves in comparison to regional efforts and more recent climate predictions.

The August and September 2021 storms were recorded by recently installed rain gauges that expand the City's gauge network to gather more localized storm information. Actual accumulation of over 5-inches in two hours, to be between 100 and 500-year level rain when compared to the statistical expectations derived for the City's curves developed in the 1980's for the City, which are more conservative than NOAA's predictions for the region. Meaning, what NOAA would call a 12-hour 25-year rainfall, Alexandria would call it closer to a 15-year rainfall.

The project area is not in a mapped floodplain; however, residents indicated their property has flooded five times within a six-year period with the August 15, 2021, storm causing the most damage. Other dates that would have impacted this neighborhood are July 2019, July 2020, and September 2020, as described above. Damage occurred to residential properties and includes impacts to basements, garages, and first floors. Further, based on videos and testimonials from residents, it appears that vehicles also may have been damaged during these severe flooding events.



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	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 X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Areas of Minimal Flood Hazard *Zone X*
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
	E 18.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
OTHER FEATURES	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Mapping and Insurance eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the United States Department of Agriculture - Aerial Photography Field Office (USDA - APFO), National Agriculture Imagery Program (NAIP). This information was derived from digital orthophotography at a 2-foot resolution from photography dated 2019.

NON-ACCREDITED LEVEE SYSTEM: This panel contains a levee system that has not been accredited and is therefore not recognized as reducing the 1-percent-annual-chance flood hazard.

SCALE

Map Projection:
NAD 1983 UTM Zone 18N;
Western Hemisphere; Vertical Datum: NAVD 88

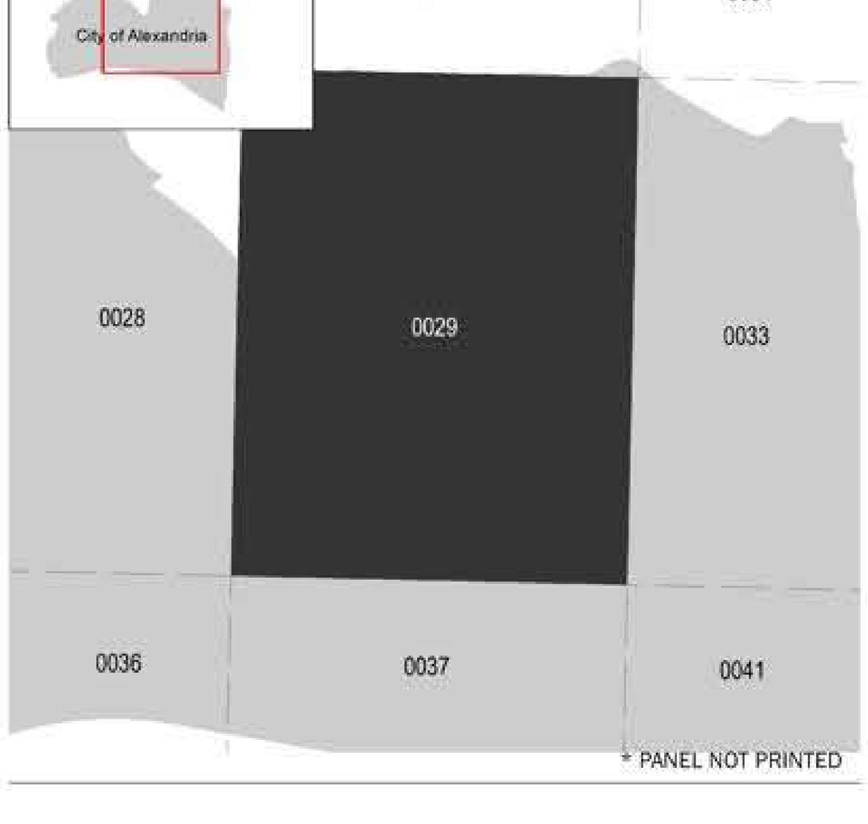
N

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



* PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

ALEXANDRIA, VIRGINIA
Independent City

PANEL **29** OF **45**

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALEXANDRIA, CITY OF	515519	0029	F

VERSION NUMBER
2.6.4.6

MAP NUMBER
5155190029F

MAP REVISED
JANUARY 11, 2024

No Adverse Impact

The intent of the Valley Drive Storm Drain Improvement Project is to engineer the system in a way that diverts and distributes flood waters in the project area in a way that mitigates property flooding while not contributing to adverse downstream impacts. The City's consultant, AECOM, provided an investigation of this neighborhood in a technical report dated December 1, 2023[1], which outlines the following objectives for the proposed Project:

- Provide increased capacity and flow sharing between the storm drain system;
- Provide relief to the downstream backyard storm drain system which will reduce system surcharge and flood inundation
- Proposed curb inlets in conjunction with the proposed storm drain system will significantly reduce the amount of flooding near the intersection of Crestwood Drive and Valley Drive, as well as within the adjacent properties.
- The new system provides significant reduction in flood inundations and system surcharging.
- These upsized inlets and pipes provide substantially more stormwater conveyance to convey efficiently, thus decreasing the amount of bypassing flow and stormwater spread throughout the intersection.

[1] *Task Order 52: Further Investigation of Neighborhood Flooding: Valley Drive*, December 1, 2023, prepared by AECOM.

Task Order 52: Further Investigation of Neighborhood Flooding

Valley Drive

December 1, 2023

Prepared for:

The City of Alexandria
2900 Business Center Drive
Alexandria, VA 22314

Prepared by:

AECOM

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Germantown, MD 20876

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Appendices

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Acronyms and Definition

CASSCA……………………………….City of Alexandria Storm Sewer Capacity
CCTV………………………………….Closed-Circuit Television
City…………………………………….City of Alexandria
Check Valve………………………….. A device that inhibits flow upstream but allows flow to continue downstream.
DPI…………………………………….. Department of Project Implementation
GIS……………………………………..Geographic Information Systems
HRC…………………………………….Hooff's Run Culvert
IDF…………………………………….. Intensity-Duration-Frequency
Larger System Capacity Projects….. Capital Improvement Projects to improve the hydraulics in the City of Alexandria's storm sewer system.
NASSCO – PACP…………………….National Association of Sewer Service Companies – Pipeline Assessment and Certification Program.
PWS…………………………………….T&ES Public Works Division
RCP……………………………………. Reinforced Concrete Pipe
Small Scall Projects…………………. Proposed projects that have been identified with minimal design and costs.
Sump Pump…………………………...Private discharge pipe from a private homeowner's residence to their lawn and/or roadway that discharges water from elevations below ground level.
Storm Event Frequency……………...The 10-year storm event has an annual rainfall frequency of 10% of occurring ; the City of Alexandria rainfall for the 10-year storm event is 5.04-inches per 24-hours.
Synthetic Storm Event……………….Storm event (3-inch 3-hour) created by the City of Alexandria, to represent a more frequent and high intensity storm event; peak intensity is 4.37 inch/hour.
T&ES………………………………….. City of Alexandria Transportation and Environmental Services
TO……………………………………... Task Order, eg: TO 33
VDOT…………………………………..Virginia Department of Transportation
XP-SWMM…………………………….Computer program that simulates rainfall-runoff through pipes and channels in urban watersheds (AECOM used version 2020.1).

1. Introduction

1.1 Background

Between 1972 and 2020, four extreme storm events adversely affected the City of Alexandria (City): Hurricane Agnes in June 1972, Hurricane Isabel in September 2003, a large storm event in June 2006 and Tropical Storm Lee in September 2011.

Recently, over a 14-month period between 2019 and 2020, there have been four major storm events that have had similar impacts: July 8, 2019; July 23, 2020; August 29, 2020 (remnants of Hurricane Laura); and September 10, 2020. Compared with the City's IDF curves based on regional rain gauges, the four major storm events were all larger than the 10-year, 24-hour storm event. In addition to the increase in frequency of large storm events, smaller storm events have increased in intensity and frequency, with 2018 documented as the wettest year on record. With these increases in intensity and frequency of rain events, 19 neighborhoods located throughout the City has been particularly impacted during these recent rain events.

Within the City, there are 9 watersheds where stormwater runoff is collected and conveyed to a waterbody, as seen in Figure 1. The Backlick Run, Cameron Run, Holmes Run, Hooffs Run, Strawberry Run and Taylor Run watersheds all discharge into Cameron Run, the Combined Sewer watershed discharges into the Potomac River, and the Four Mile Run watershed discharges into Four Mile Run. This report addresses the "Valley Drive" neighborhood, which is located within the Hooffs Run watershed.

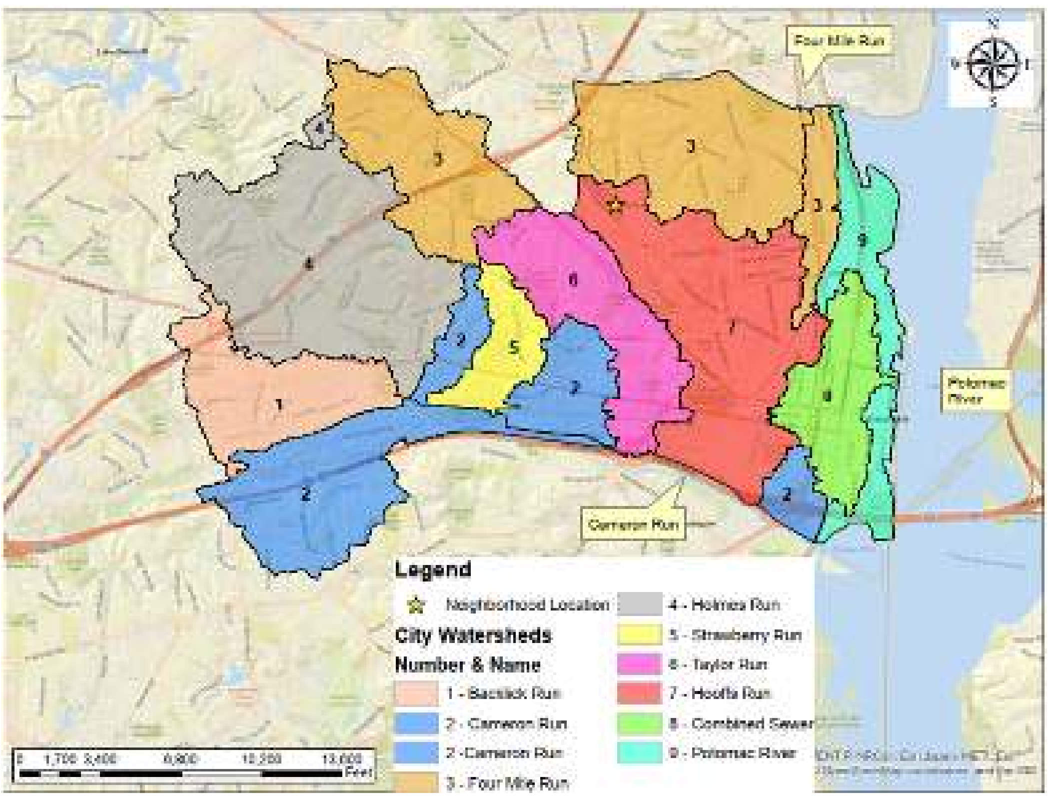


Figure 1: Watershed map

The City is currently implementing larger capital improvement projects that are intended to improve both stormwater conveyance and flood mitigation within the watersheds. These larger projects were initially identified as part of the CASSCA that was performed in 2016 to analyze the City-wide storm sewer system capacity. The CASSCA project analyzed storm drain capacity issues, identified problem areas, developed and prioritized solutions, and provided support for public outreach and education activities.

In 2020, the City began neighborhood engagement activities that involved collecting information during on-site and virtual community meetings, in response to flash flooding events that occurred since 2018. The City has formed a Task Force that includes staff from various departments—T&ES, Stormwater Management Division, PWS, and DPI—to address these flooding issues.

AECOM is working with the City to further investigate the existing conditions and the storm drain network that traverses the 21 neighborhoods that have experienced, and still are experiencing, localized flooding. AECOM is identifying, prioritizing, and tracking actionable items to mitigate property and infrastructure impacts caused by localized flooding. These investigations include completing CCTV surveys of the storm drain network, field investigations of the neighborhoods, and hydraulic modeling of the storm drain system. The collected information and field observations will aid in the identification and the development of solutions to mitigate flash flooding impacts.

Based on the findings of the investigations, AECOM and the City will develop a suite of potential solutions for each neighborhood ranging from individual property floodproofing recommendations to larger capital improvement projects.

1.2 Project Goals

AECOM is tasked with performing investigations of the storm drain networks, flooding issues and drainage patterns of the Valley Drive neighborhood that has been experiencing localized flooding on a frequent basis. The investigation will support the development of very high-level potential solutions to minimize future flooding occurrences. The potential solutions were then grouped into the following two categories listed in Table 1.

Table 1. Solution Development Categories

Solution Category	Description
Floodproofing (private property)	Floodproofing can help to mitigate the flooding impacts. Residents who are experiencing issues related to flooding may be eligible to receive reimbursement for their installed floodproofing measures or receive funds to implement floodproofing measures.
Spot Projects	These potential projects may involve major construction work and would require land and/or permit acquisitions, utility impacts, roadway closures, or other community impacts.

The City's goals include mitigating future flooding issues within Valley Drive neighborhood and other neighborhoods through a combination of the two project solution categories.

1.3 Neighborhood: Valley Drive

The "Valley Drive" neighborhood can be found adjacent to the Valley Drive and Summit Avenue intersection within the City. This neighborhood is located within the Hooffs Run watershed; refer to Figure 1. As seen in Figure 2, the segments of the storm drain network that are associated with this neighborhood are located between Kenwood Avenue and Dogwood Drive (north and south boundaries, respectively) and between Ridge Road and Oakcrest Drive (east and west boundaries, respectively). As seen in the Figure 2 surface runoff is collected and conveyed by a series of inlets and storm drain pipes. The storm drain network conveys collected runoff from north to south via the neighborhood storm drain pipes along Crestwood Drive and Valley Drive. Overall, the runoff from this neighborhood drains into the upper reaches of the Hooffs Run Culvert (HRC). The neighborhood location within the City can be seen in Figure 3.

Figure 2: Valley Drive neighborhood

Figure 3: Neighborhood location

1.3.1 Flooding Issues in Valley Drive Neighborhood

As part of TO 52, there was a kickoff meeting on June 20, 2023 between AECOM, City staff and residents of the Valley Drive neighborhood. During the meetings, members of the community shared their experiences with the flooding from large-scale storm events and more frequent high intensity storms. Specific flooding issues and concerns include:

- Residents identified water is predominantly flowing from Crestwood Drive, over the curb and flowing between 2812 Valley Drive and 1400 Crestwood Drive. The water then flows south through the backyards of 2812, 2810 and 2808 Valley Drive. There is a low spot in the backyard of 2808 Valley Drive that flooding ponds up to a depth between 3 and 4 feet during large rainfall events.
- Manhole lids have been blown off due to water surcharging the system often causing flooding to the adjacent and downstream properties.
- Multiple residents reported in home flood damage, and some have installed floodproofing devices on the back side of their homes
- Properties at the southwest corner of Crestwood Drive and Valley Drive have experienced flooding likely from system under capacity and water not captured by the existing inlets, thus overflowing the curb into the adjacent properties.

2. Site Evaluation

2.1 Field Investigation

Prior to starting the field investigation, a desktop study of the neighborhood was performed, which included reviewing the City GIS Sewer Viewer in areas of concern identified by the residents during the community meetings.

Photo 1: Dual inlets on the west side of Valley Drive

On September 1, 2023, AECOM performed the field investigation of the Valley Drive neighborhood. A custom field checklist was used to document observations about the storm drain system, roadways, homes, and drainage patterns seen around the neighborhood. Photographs and notes from the field investigation can be found in the field checklist within Appendix A. Some of the significant findings include:

Photo 2: Storm drain pipe that flows south contrary to GIS direction

- There are multiple undersized storm drain inlets within the neighborhood, including multiple on opposite side of each other along Valley Drive.
- Based on field observations and GIS mapping it was unclear how the storm drain pipes connect at the intersection of Valley Drive and Dogwood Drive. This was confirmed in the field as multiple manhole lids were removed to confirm the pipe directions/orientation. Photo 2 shows the manhole in the street and photo 3 shows the view from within that structure looking east/downstream.
- Multiple storm drain structures are located within residential properties/front yards.
- Many of the curb inlets look to be under sized and in need of replacement

Photo 4: Storm drain manholes within residential yard

Photo 3: Curb inlet along Dogwood Drive

Photo 5: Curb inlet along Crestwood Drive, just west of Valley Drive

2.2 CCTV Inspection

CCTV inspection of the storm drain pipes was completed by a subcontractor, Quality Pipe Cleaning Company, Inc. Video recordings and pipe conditions were provided for each storm drain captured by CCTV. The CCTV data was reviewed to verify pipe information documented in the City's GIS information and within the XP-SWMM hydraulic model. Pipe information includes the pipe's condition, size, length, and lateral connection locations; the inside of the storm drain structures can be observed in the video recordings but scoring conditions of them were not performed as part of this TO. Understanding the conditions of the storm drain pipes helped with developing and identifying areas in need of maintenance, replacement or resizing.

Figure 4 identifies specific storm drain pipes traversing the Valley Drive neighborhood where CCTV survey was completed. A summary of the CCTV recordings can be found in Appendix B. The data was used to make corresponding updates to the CASSCA XP-SWMM and the Existing Conditions Model (refer to section 3.2) as documented in Appendix C.

Figure 4: Valley Drive CCTV Investigation

The CCTV footage was successful in surveying most of the storm drain pipes in the Valley Drive neighborhood that were requested. The storm drain system that runs behind the homes on the west side of Valley Drive had multiple defects and damage locations. There are multiple holes and pipe cracks through the segment (pipe 007464STMP). The CCTV footage of pipe 009388STMP also showed significant defects and damages including multiple tree root protrusion locations, a pipe fracture, pipe joint offset and a hole in the pipe segment. Storm drain pipes 009182STMP and 009390STMP could not be accessed for CCTV survey as vehicles were parked over the manhole structures. Pipe 009064STMP had a large piece of rebar that was laying on the bottom of the pipe. Storm drain pipe 009391STMP had a large circumferential crack that was a little wet likely from water infiltration.

Photo 7: Broken pipe section in 07464STMP

Photo 6: Hole visible in pipe 009388STMP

The pipes in this storm drain system appear to be in operable condition and there are various points in which there are defects that are currently not affecting the operating condition of the system such as:

- Infiltration stains, indicating that groundwater is entering the pipe.
- Exposure of reinforcement bars, showing erosion is occurring within the pipe.

Photo 8: Circumferential crack 009391STMP

Photo 9: Surface damage visible in pipe 009180STMP

- Circumferential and longitudinal cracks, indicating that the pipe is damaged.
- Small broken sections of pipe and joint offsets and locations where there is standing water, indicating low spots in the pipes
- The CCTV Summary in Appendix B identifies all the structural and operation maintenance observations that were made during the CCTV survey done by the CCTV subcontractor.

While none of the defects and damages found during the CCTV investigation seem to be impacting system performance, it would be beneficial for City maintenance staff to perform repairs and maintenance to resolve many of these issues.

2.3 Summary of Site Evaluation Findings

After completing the field investigation on September 1, 2021, and reviewing the CCTV recordings and condition sheets, residents' concerns were evaluated with respect to the findings. The following is a list of pertinent findings that aided in the development of the potential solutions:

- The storm drain system has minor damages and defects throughout the system, however the system appears in sufficient condition to effectively convey stormwater.
- Storm drain pipe 007464STMP and 009388STMP have the most significant damages and defects, including cracks, holes, pipe joint offsets, pipe fracture and root protrusions.
- During the field investigation it was determined that storm drain pipe 009390STMP drains to the south connecting at structure 002610SMH, contrary to the GIS data. The GIS data shows that the pipe flows to the southeast connecting to the downstream system at structure 002544SMH, however this alignment seemed too close to the adjacent pipe, which is what spurred the field investigation at this location. Confirmation of the correct pipe alignment and direction allowed the existing conditions model to be updated correctly.
- The CCTV investigation in pipe 014918STMP and 014917STMP revealed that the pipes are both 36-inch x 51-inch oval pipes. GIS data showed these pipes were 36-inch circular, so the CCTV confirmed the correct dimensions and pipe shape. These pipes were updated in the existing conditions model as well.
- The field investigation provided further insight into the existing curb inlets and how some of the inlets in the neighborhood could be replaced and likely upsized to handle more stormwater conveyance. The inlets seem to have a small throat opening height and width, likely limiting the amount of stormwater that can be conveyed.

3. Hydraulic Model Verification

3.1 CASSCA Model

As part of the CASSCA project, XP-SWMM models were developed to evaluate storm sewer capacity issues, identify problem areas, and develop and prioritize solutions. The CASSCA study, conducted in 2016, included the development of the hydraulic model and analysis of the storm sewer network's capacity. Eight models were created based on the City's watersheds. The Valley Avenue neighborhood is located within the northern portion of the Hooffs Run watershed model; the XP-SWMM model incorporates survey and updated precipitation results.

3.1.1 Storm Events

The XP-SWMM model used the standard 10-year 24-hour storm event which is being utilized to evaluate flooding impact within this neighborhood.

3.2 Description of Changes

The CASSCA model was updated based on field investigation, observations from the CCTV survey, and imagery to create the existing conditions model. Changes to the model include renaming features to be consistent with the CCTV findings: updating pipe diameters, lengths, and sizes; removing unverified nodes; updating node invert elevations; adjusting location of nodes to be consistent with imagery; and updating the direction of flow. Changes to the Hooffs Run CASSCA model, with respect to the Valley Drive neighborhood, consisted of:

- Updating pipe diameters of the storm drain pipes on Crestwood Drive, Valley Drive, Summit Avenue and Dogwood Drive.
- Relocating storm drain pipe 009390STMP to flow south and connect to structure 002610SMH.

A detailed list of changes to the Hooffs Run XP-SWMM model can be found in Appendix C.

Proposed solutions were modeled in XP-SWMM by updating the existing conditions model described above with the new system. Scenarios that included inlet capacity and the addition/replacement of inlets were not modeled due to limitations in the original XPSWMM model. Based on the Technical Memorandum Inlet Capacity Analysis for City of Alexandria Storm Sewer Capacity Analysis, it was determined that the evaluation of inlet capacity was a significant level of effort that caused instabilities in the model and would lengthen runtimes; curb inlet spread analysis was completed using Hydraflow Express Extension for Autodesk AutoCAD Civil 3D 2018 (Hydraflow). Proposed modeling updates and results are discussed in Section 4.3.2.

3.3 Existing Conditions Model

For the evaluation of the results, the storm drain system is shown in Figure 5.

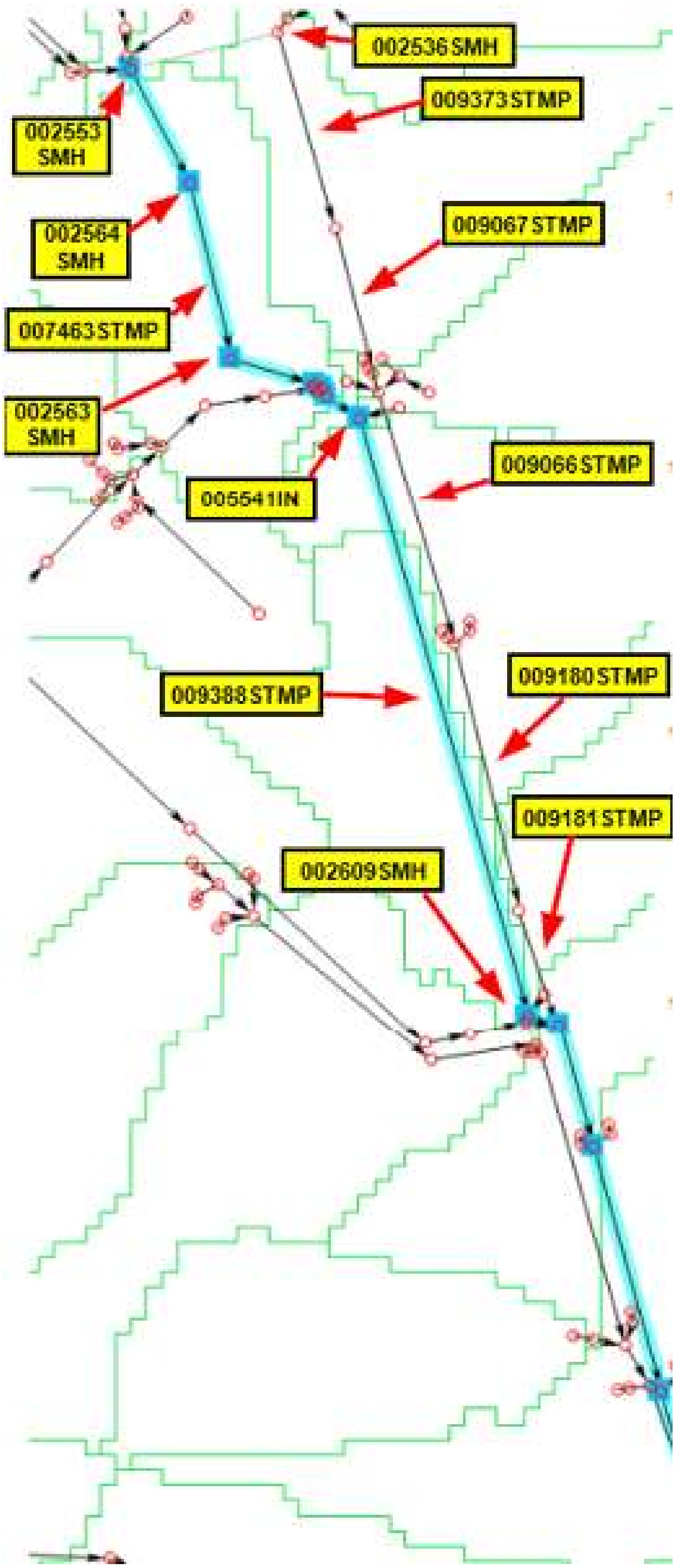


Figure 5: XP-SWMM Model Schematic

The results from the existing conditions model shows that most of the flooding is occurring on Crestwood Drive, the Backyards between Crestwood Drive and Summit Avenue, and Valley Drive (south of Dogwood Drive).

- Flooding on Crestwood Drive is substantial enough to go over the roadway curb and contribute to the flooding in the Backyards. The depth of flooding ranges from 4-inches to 1-foot.
- The Backyard flooding is the most substantial, with over 3-feet of water depth in some places. The HGL of the existing pipe through the Backyards is shown in Figure 5.
- Flooding on Valley Drive ranges from 0.5 feet to 1.3 feet. The most probable cause of the increase in flooding in this area are the dual pipes converging at Node 02544SMH.

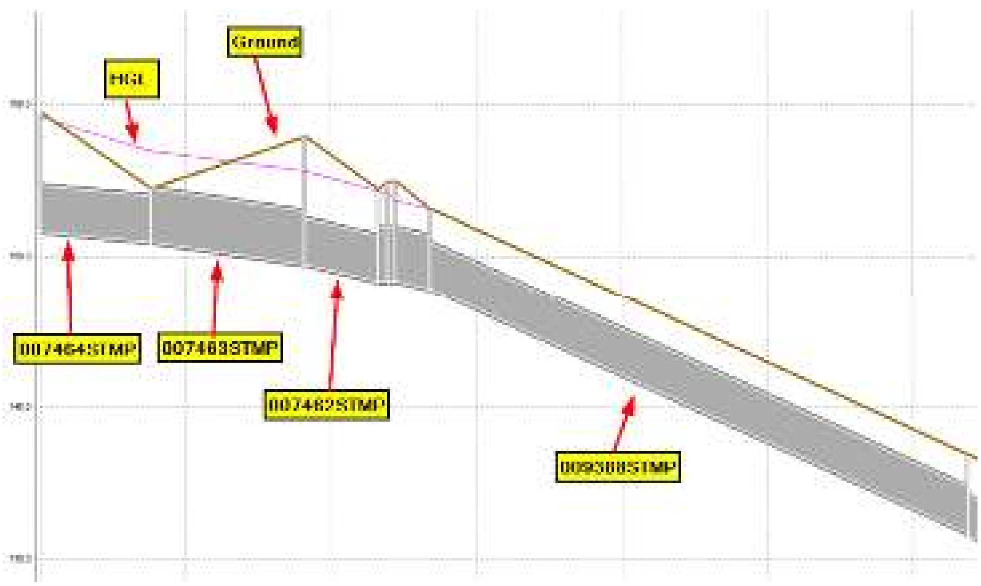


Figure 6: Existing Conditions Backyard System Profile

XP-SWMM model results in this neighborhood are dependent on changes made to the existing conditions at the time of this report. Updates, based on newly available data may affect the results discussed in this report.

4. Solution Development

All proposed projects that will make use of or be within the City's right-of-way will require permits from T&ES. Depending on the type of project, the required permits include, but are not limited to Maintenance of Traffic, Construction General Permit, Excavation Permit, Hauling Permit and Demolition Permit. Permits can be applied for and tracked using the City's APEX online portal.

4.1 Floodproofing

Recent and historic flooding events have caused damage to several residents' properties. Floodproofing can serve as a temporary mitigation measure that the property owners can take while the City evaluates additional solutions. Residents who are experiencing issues related to flooding may be eligible to receive grant funds for approved flood proofing measures under the City's Flood Mitigation Pilot Grant Program. Residents experiencing sanitary sewer backups could work through and apply for the City's grant program to install individual back flow prevents to avoid future issues. At least one home in this neighborhood has already installed floodproofing measures.

4.2 Small Scale projects

4.2.1 New Storm Drain Pipe System and New Curb Inlets along Crestwood Drive

The existing storm drain system that runs down Crestwood Drive and under the backyards of the homes on the west side of Valley Drive is surcharging along Crestwood Drive manholes and has caused flood damage to multiple homes. In addition, the only curb inlet on the south side of Crestwood Drive, near the intersection with Valley Drive is a small 4-foot-wide inlet. This inlet is over capacity, as over 21-cfs drains to this inlet, which flows over the crest of the curb and spreads downstream/south. To provide increased capacity and flow sharing between the storm drain system, a new storm drain system is being proposed as well as adding inlets further uphill along Crestwood Drive and replacing the existing curb inlet 005458IN with a larger inlet.

The new system will start about 120 feet upstream from the downstream manholes that are in the front yard of 2812 Valley Drive. This system will consist of 36-inch RCPs that will connect to both parallel storm drain systems that run downstream along Crestwood Drive, as shown in Figure 7 and provide an additional system to share the flow with the existing system, ultimately connecting to the storm drain system along Valley Drive. Flow sharing is possible as the Valley Drive system has capacity to accept additional flow from this system. The proposed pipe system will also connect to and convey flow from both storm drain pipes that currently connect to curb inlet 005458IN. This new pipe system will provide relief to the downstream backyard storm drain system which will reduce system surcharge and flood inundation.

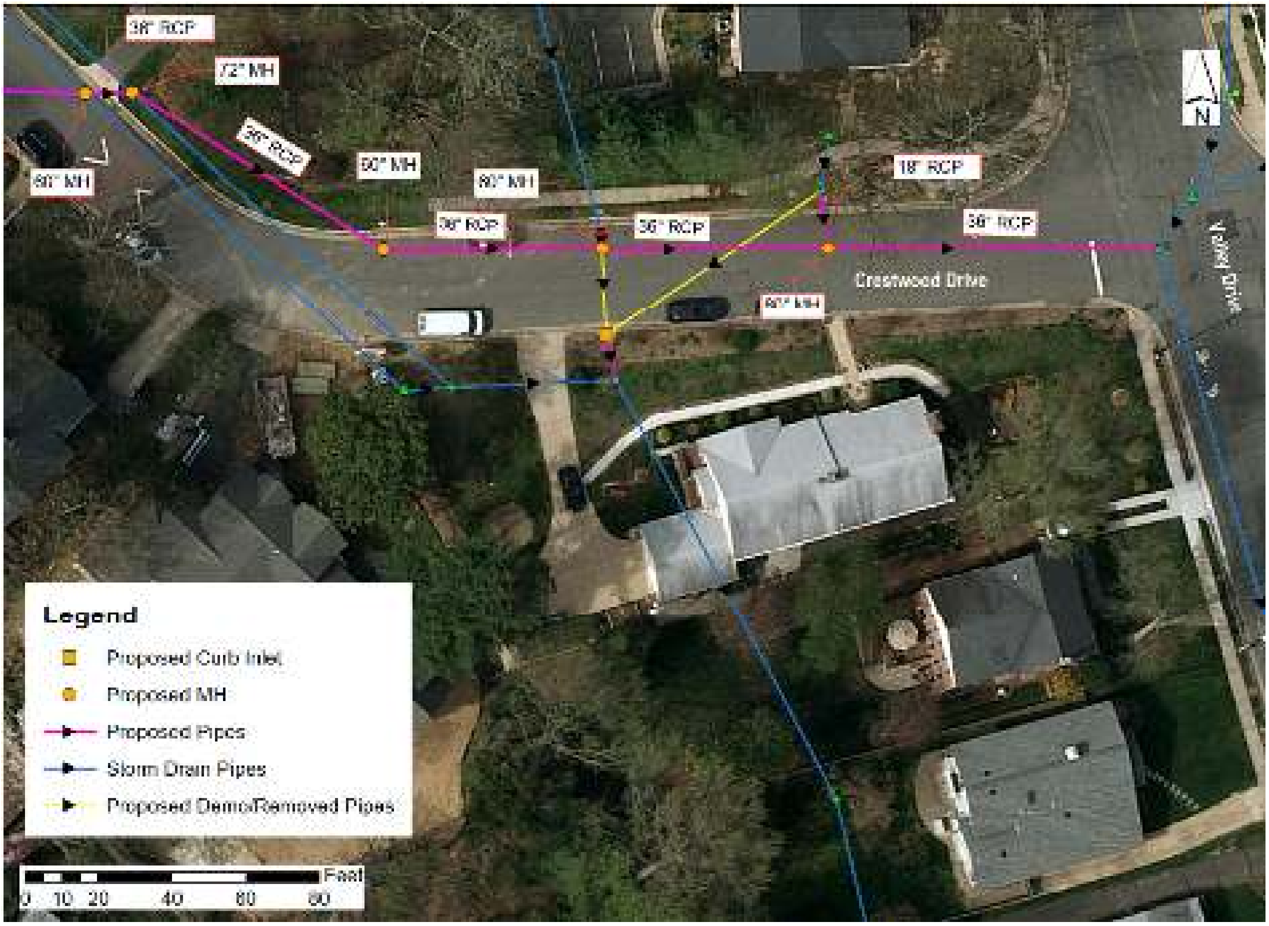


Figure 7: Proposed Storm Drain System along Crestwood Drive

Due to the drainage area of the existing inlet, spread calculations were completed to determine the peak flows draining to this inlet, inlet depths and gutter spread, see calculations for the existing and proposed spread analysis in Appendix D. The existing curb inlet 005458IN has about 21 cfs that drains to it which causes this inlet to be overcapacity with gutter spread that extends into adjacent properties. However, with the additional inlets upstream, the proposed flow that drains to the upsized 005458IN curb inlet is significantly reduced to about 3 cfs, with a gutter spread of about 10 feet. Two 4-inch x 20-feet curb inlets with a 2-inch inlet local depression are proposed to be added and connected to the existing storm drain pipes further upstream along Crestwood Drive. In addition, curb inlet 005458IN will be replaced with a larger 4-inch x 10-foot curb inlet along the southside of Crestwood Drive as shown in Figure 8. The three proposed inlets will be connected by 18-inch RCPs. The proposed curb inlets have capacity to convey the 10yr flows while ensuring the inlet depths are below the 6-inch curb. These proposed curb inlets in conjunction with the proposed storm drain system will significantly reduce the amount of flooding near the intersection of Crestwood Drive and Valley Drive, as well as within the adjacent properties.

Figure 8: Proposed Curb Inlets along Crestwood Drive

The proposed project was modeled in XP-SWMM by adding in the additional storm drain system and associated proposed pipe connections, while also correcting the negative pipe slope that conveys flow from 005458IN. Results from the proposed pipe system modeling indicates that the proposed model reduces the water stage by at least 3-feet at the upstream pipe segments of the backyard system, just south of Crestwood Drive. Included in Figure 9 is a profile of the proposed pipe network that runs behind the homes along Valley Drive. Adding capacity to the storm drain system by way of the 36-inch RCP storm drain system reduces the amount of flow that gets conveyed by the backyard system. This new system provides significant reduction in flood inundation and system surcharging. A detailed list of proposed changes and results can be found in Appendix D.

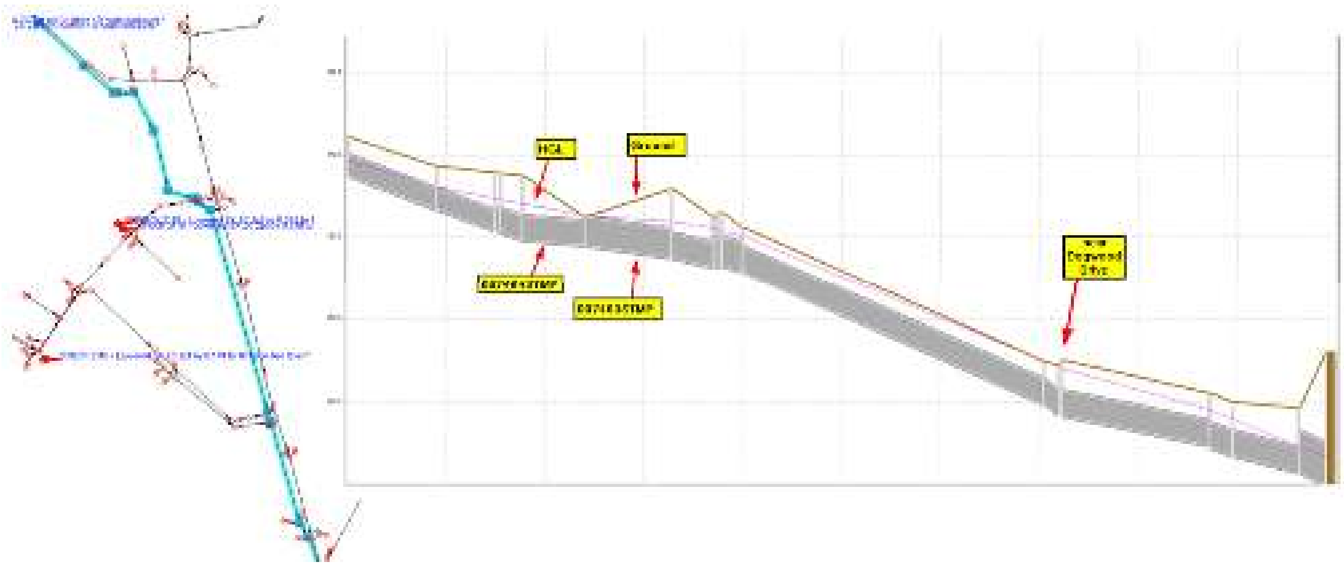


Figure 9: Proposed Conditions Backyard System Profile

4.2.2 Storm Drain Pipe Realignment at Dogwood Drive

The proposed storm drain realignment is intended to separate the west and east storm drain system along Valley Drive, at the intersection with Dogwood Drive. The west storm drain system just south of Dogwood Drive has capacity to accept the flow from the storm drain system north of Dogwood Drive, thus relieving the eastern system which is over capacity in the existing conditions modeling near this intersection. The proposed pipe realignment includes abandoning pipe 009387STMP, adding a new 36-inch RCP to connect 007610IN to 002609MH. Since improvements are going to impact the existing curb inlet, it is recommended to replace and upsize the current curb inlet as well, to be a 4-inch x 20-foot wide opening with a 2-inch inlet local depressions, to maximize the inlet's conveyance capability. These proposed improvements can be seen in Figure 10. The proposed project was modeled in XP-SWMM by removing the connection to the eastern system and adding a new connection for the western system. The storm drain pipes along Valley Drive will run in parallel which provides surcharge relief to the

Figure 10: Dogwood Drive Storm Drain Pipe Realignment

eastern storm drain system. Results from the adjusted pipe alignment near Dogwood Drive in the model can be seen above in Figure 9.

4.2.3 Storm Drain Inlet Increased Capacity along Valley Drive

The current storm drain inlet placement within this neighborhood is generally located on Valley Drive or close by within an adjacent intersection. The neighborhood drainage areas drain from the west and east side of Valley Drive, towards Valley Drive, causing a significant amount of drainage to overwhelm the existing undersized curb inlets. Due to the drainage area of the existing inlets, spread calculations were completed to determine the peak flows draining to this inlet, inlet depths and gutter spread, see calculations for the existing and proposed spread analysis can be found in Appendix D. Most of the inlets evaluated are significantly overcapacity, resulting in significant amount of bypass flows and spread, that overwhelms downstream structures.

It is recommended to upsize many of the existing curb inlets and add additional new inlets that have storm drain pipes nearby, with larger 4-inch-tall x 20-foot-wide and 4-inch-tall x an additional 8-foot-wide curb opening, all that also have a 2-inch inlet depression. One set of inlets is not in great shape on the west side of Valley Drive along Summit Avenue and should be replaced with the same size inlets with the 2-inch local depression. The combined larger inlet openings, and steeper inlet local depression provides significantly greater conveyance by each inlet compared to the existing inlet openings. Due to the increased conveyance capacity of these proposed inlets the associated storm drain pipes were also upsized, if needed, to ensure drainage could be conveyed by both the inlet and the downstream pipe. The proposed inlets and associated storm drain pipes along Valley Drive can be seen in Figure 12. These upsized inlets and pipes provide substantially more stormwater conveyance to convey efficiently, thus decreasing the amount of bypassing flow and stormwater spread throughout the intersection. The proposed inlets are sized to ensure that the 10-year flow depth is maintained within the curb height. The proposed inlets were evaluated and sized using Hydraflow which analyzes curb inlets based on the below measurements shown in Figure 11.

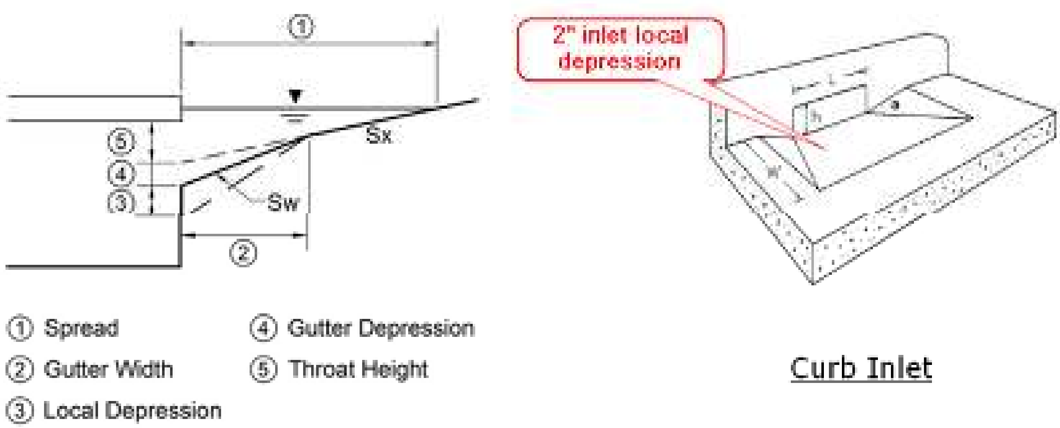


Figure 11: Curb Inlet Measurements

Figure 12: Valley Drive Inlet Upsizing and Storm Drain Pipe Locations

5. Summary of Recommendations and Cost Estimates

5.1 Basis of Estimate

The City contracted with AECOM for this TO 52 to support the development of small scale and spot projects with the intent to minimize the impacts of future localized flooding occurrences. To assist in the screening of projects and evaluating their feasibility cost estimates were completed. The format of the cost estimate is a Microsoft Excel spreadsheet (transposed into a Microsoft Word table). The XPSWMM model and City provided GIS were used to support the estimate accuracy of the quantities for the construction items. This report and its corresponding appendices serve as reference for the projects listed in cost estimate.

The estimates are based on pricing and methodologies from a recent City project TO 49 Edison Dale Reed, which was prepared by a professional cost estimator and that project included storm drain capacity improvement designs. The details for how the estimate was prepared are included below, with three changes from TO 49 pricing which includes revising the multiplier rates with 50% contingency, adding an overall 20% contingency to cover utility relocation costs and 25% to the subtotal for engineering.

The following assumptions and exclusions were made throughout the cost estimate:

- We have assumed that all 3rd party inspections, materials and soil testing will be conducted by the owner's consultants and paid for by the owner. Line item for on-site material testing is not included in this cost estimate.
- We have assumed contractors will comply with procurement, design, and construction requirements as well as all local and federal codes and ordinances.

The cost estimates completed have been prepared by a Virginia Licensed Engineer.

5.2 Floodproofing Grant Application

Until any small scale or spot projects are constructed, it is highly recommended that residents of the Valley Drive neighborhood implement private floodproofing measures wherever possible, primarily to prevent runoff from the alley and adjacent backyards from getting into homes.

5.3 Spot Projects

A new storm drain pipe system is proposed along Crestwood Drive that will share the conveyance capacity with the existing pipes on Crestwood Drive, and ultimately drain into the system along Valley Drive. This new storm drain system will provide an alternative path for water to be conveyed, thus freeing up capacity along the backyard pipe system. In addition, there will be new and upsized inlets along Crestwood Drive to provide more conveyance for stormwater, thus reducing flood inundation and bypass flows to the Crestwood Drive/Valley Drive intersection. Multiple curb inlets along Valley Drive are proposed to provide increase stormwater conveyance at multiple locations where there was significant bypass flows and gutter spread. These locations have seen substantial reduction in bypass flows and the associated storm drain pipes have been upsized to provide more capacity for the increased flows conveyed by each inlet. The last spot project involves pipe realignment and a curb inlet upsize at the Dogwood Drive intersection. This separates the two storm drain pipe systems along Valley Drive and realigns the systems to run parallel. The costs for these four sets of spot projects can be found below.

Table 2: Cost Estimate for Storm Drain Pipe along Crestwood Drive

Item #	Item Description	Quantity	Unit	Unit Price	Total	Reference
1.0	**General Conditions**					
1.1	Traffic Control	20	DAY	$ 1,814.00	$ 36,280.00	TO 49
2.0	**Demolition**					
2.1	Asphalt	800	SY	$ 10.00	$ 8,000.00	TO 49
2.2	Sidewalk	100	SF	$ 14.00	$ 1,400.00	TO 49
2.3	Curb and Gutter	60	LF	$ 16.00	$ 960.00	TO 49
2.4	12" RCP	25	LF	$ 91.00	$ 2,275.00	TO 49
2.5	18" RCP	71	LF	$ 130.00	$ 9,230.00	TO 49
3.0	**Roadway**					
3.1	Asphalt Paving	800	SY	$ 160.00	$ 128,000.00	TO 49
3.2	Sidewalks 4'	100	SF	$ 26.00	$ 2,600.00	TO 49
3.3	Curb and Gutter	60	LF	$ 127.00	$ 7,620.00	TO 49
4.0	**Earthwork**					
4.1	Grass	760	SF	$ 1.06	$ 805.60	TO 49
5.0	**Drainage**					
5.1	18" RCP	20	LF	$ 462.00	$ 9,240.00	TO 49
5.2	36" RCP	305	LF	$ 784.00	$ 239,120.00	TO 49
5.3	Structure Connections	12	EA	$ 1,985.00	$ 23,820.00	TO 49
5.4	72" Manhole	1	EA	$ 18,000.00	$ 18,000.00	TO 49
5.5	60" Manhole	4	EA	$ 17,149.00	$ 68,596.00	TO 49
				Subtotal	$ 555,946.60	
6	**Utility Relocation/Conflict Resolution Contingency - 20%**				$ 111,189.32	
				Subtotal	$ 667,135.92	
7	**Engineering – 25%**				$ 166,783.98	
				Total	**$ 833,919.90**	

Table 3: Cost Estimate for Curb Inlets along Crestwood Drive

Item #	Item Description	Quantity	Unit	Unit Price	Total	Reference
1.0	**General Conditions**					
1.1	Traffic Control	10	DAY	$ 1,814.00	$ 18,140.00	TO 49
2.0	**Demolition**					
2.1	Asphalt	53	SY	$ 10.00	$ 533.33	TO 49
2.2	Sidewalk	250	SF	$ 14.00	$ 3,500.00	TO 49

2.3	Curb and Gutter	80	LF	$ 16.00	$ 1,280.00	TO 49
2.4	36" RCP	13	LF	$ 223.00	$ 2,899.00	TO 49
2.5	Storm Drain Structures/Inlets	1	EA	$ 3,062.00	$ 3,062.00	TO 49
3.0	**Roadway**					
3.1	Asphalt Paving	53	SY	$ 160.00	$ 8,480.00	TO 49
3.2	Sidewalks 4'	200	SF	$ 26.00	$ 5,200.00	TO 49
3.3	Curb and Gutter	80	LF	$ 127.00	$ 10,160.00	TO 49
4.0	**Earthwork**					
4.1	Grass	200	SF	$ 1.06	$ 212.00	TO 49
5.0	**Drainage**					
5.1	18" RCP	70	LF	$ 462.00	$ 32,340.00	TO 49
5.2	10' Curb Inlet	1	EA	$ 17,041.00	$ 17,041.00	TO 49
5.3	20' Curb Inlet	2	EA	$ 21,000.00	$ 42,000.00	TO 49
5.4	Structure Connections	6	EA	$ 1,985.00	$ 11,910.00	TO 49
5.5	60" Manhole	1	EA	$ 17,149.00	$ 17,149.00	TO 49
				Subtotal	$ 173,906.33	
6				**Utility Relocation/Conflict Resolution Contingency - 20%**	$ 34,781.27	
				Subtotal	$ 208,687.60	
7				**Engineering - 25%**	$ 52,171.90	
				Total	**$ 260,859.50**	

Table 4: Cost Estimate for Pipe Realignment at Dogwood Drive

Item #	Item Description	Quantity	Unit	Unit Price	Total	Reference
1.0	**General Conditions**					
1.1	Traffic Control	2	DAY	$ 1,814.00	$ 3,628.00	TO 49
2.0	**Demolition**					
2.1	Asphalt	20	SY	$ 10.00	$ 1,500.00	TO 49
2.2	Curb and Gutter	50	LF	$ 16.00	$ 800.00	TO 49
2.3	Storm Drain Structures	1	EA	$ 3,062.00	$ 3,062.00	TO 49
3.0	**Roadway**					
3.1	Asphalt Paving	20	SY	$ 160.00	$ 3,200.00	TO 49
3.2	Sidewalks 4'	100	SF	$ 26.00	$ 2,600.00	TO 49
3.3	Curb and Gutter	60	LF	$ 127.00	$ 7,620.00	TO 49
4.0	**Earthwork**					
4.1	Grass	20	SF	$ 1.06	$ 21.20	TO 49
5.0	**Drainage**					

5.1	30" RCP	6	LF	$ 750.00	$ 4,500.00	TO 49
5.2	20' Curb Inlet	1	EA	$ 21,000.00	$ 21,000.00	TO 49
5.3	Structure Connections	2	EA	$ 1,985.00	$ 3,970.00	TO 49
				Subtotal	$ 50,601.20	
6				**Utility Relocation/Conflict Resolution Contingency - 20%**	$ 10,120.24	
				Subtotal	$ 60,721.44	
7				**Engineering – 25%**	$ 15,180.36	
				Total	**$ 75,901.80**	

Table 5: Cost Estimate for Valley Drive Curb Inlet Upsizing

Item #	Item Description	Quantity	Unit	Unit Price	Total	Reference
1.0	**General Conditions**					
1.1	Traffic Control	25	DAY	$ 1,814.00	$ 45,350.00	TO 49
2.0	**Demolition**					
2.1	Asphalt	500	SY	$ 10.00	$ 5,000.00	TO 49
2.2	Sidewalk	500	SF	$ 14.00	$ 7,000.00	TO 49
2.3	Curb and Gutter	250	LF	$ 16.00	$ 4,000.00	TO 49
2.4	12" RCP	35	LF	$ 105.00	$ 3,675.00	TO 49
2.5	15" RCP	110	LF	$ 130.00	$ 14,300.00	TO 49
2.6	Storm Drain Structures/Inlet	5	EA	$ 3,062.00	$ 15,310.00	TO 49
3.0	**Roadway**					
3.1	Asphalt Paving	1000	SY	$ 160.00	$ 160,000.00	TO 49
3.2	Sidewalks 4'	500	SF	$ 26.00	$ 13,000.00	TO 49
3.3	Curb and Gutter	250	LF	$ 127.00	$ 31,750.00	TO 49
4.0	**Earthwork**					
4.1	Grass	200	SF	$ 1.06	$ 212.00	TO 49
5.0	**Drainage**					
5.1	18" RCP	140	LF	$ 430.00	$ 60,200.00	TO 49
5.2	21" RCP	65	LF	$ 538.00	$ 34,970.00	TO 49
5.3	24" RCP	80	LF	$ 543.00	$ 43,440.00	TO 49
5.4	20' Curb Inlet	5	EA	$ 21,000.00	$ 105,000.00	TO 49
5.5	9' Curb Inlet	1	EA	$ 15,631.00	$ 15,631.00	TO 49
5.6	8’ Curb Inlet	1	EA	$ 14,217.00	$ 14,217.00	TO 49
5.7	Structure Connections	15	EA	$ 1,985.00	$ 29,775.00	TO 49
5.8	72" Manhole	2	EA	$ 17,149.00	$ 34,298.00	TO 49
				Subtotal	$ 637,128.00	
6	**Utility Relocation/Conflict Resolution Contingency - 20%**				$ 127,425.60	
				Subtotal	$ 764,553.60	
7				**Engineering – 25%**	$ 191,138.46	
				Total	**$ 955,692.00**	

Cost Estimate Methodology

1. This is a Class 5 Estimate.
2. Pricing based on unit costs/rates as of June 2023.
3. Mobilization /Demobilization costs are included at the rate of 5%
4. Local Sales and Use Tax is included at the rate of 6% on material and equipment.
5. Small Tools and Consumables are included at the rate of 1.5% on craft labor only.
6. Safety Supplies and Equipment are included at the rate of .5% on craft labor and equipment.
7. Consumable are included at the rate of 1.5% on craft labor and equipment.
8. Inspection and Material Testing is included at the rate of 1.25% on total direct cost.
9. Pricing is in today's US dollars and escalation is included at the rate of 5% to a midpoint of construction.
10. General Conditions is included at the rate of 12%.
11. Contingency is included at the rate of 50%
12. GC Overhead and Profit are included at the rate of 15%.
13. Permits are included at a rate of .75%.
14. All Risk Insurance is included at the rate of .18%.
15. Performance and Payment Bond is included at the rate of 1%.
16. Wage Rates are based on prevailing wage rate. Total wage rate includes hourly wage rate plus craft fringes (plus burden).
17. Typical Work Week – (1) eight hour shift per day / (5) days per week.
18. Liquidated damages are not included.
19. Our estimate includes current budget pricing from the following local suppliers and vendors:
    - CP&P- RCP pipe
    - Rinker- RCP pipe
    - Berry Paving & Concrete Construction- asphalt paving, curb & gutter, and sidewalks
20. Our estimate is based on the AECOM design team generated quantities.
21. Site security guard services are excluded.
22. Engineering, PM and Administration fees are not included.
23. Engineering Services During Construction are not included.
24. 3rd party inspections are not included.
25. Agency design contingencies, project management fees or other client costs excluded.
26. Any land acquisition costs are not included.
27. Engineering costs have been included as 25% of the subtotal including utility contingency
28. It is assumed that many of the locations of the proposed spot projects are within the public right of way or within a drainage easement. No costs were developed associated with gaining property access.

The enclosed class 5 estimate is an estimate of possible construction costs for budgeting purposes. This estimate is limited to the conditions existing at issuance and is not a guaranty of actual price or cost. Uncertain market conditions such as, but not limited to; local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events and developing bidding conditions, etc. may affect the accuracy of this estimate. AECOM is not responsible for any variance from this Opinion of Probable Cost or actual prices and conditions obtained.

Appendix A:
Field Investigation Report and Photo Log

Task Order 52 – Further Investigation of Neighborhood Flooding

Meeting Date
June & Aug 2023

Meeting Time
0930 - 1130

Subject
Field Reconnasaince

Neighborhood
Valley Drive

Attendees
Sarim Assadulah, AECOM
Greg Toohey, AECOM

Neighborhood Map

See below

Site Photos: Valley Drive

AECOM

Picture 1: Storm drain curb inlet 005458IN at the sump near the intersection of Crestwood Drive and Valley Drive, facing south. Approximate inlet dimensions 4”x3.5’.

Picture 2: Storm drain curb inlets located at the northeast corner of the intersection at Summit Avenue and Valley Drive. Facing northeast.

Picture 3: Storm drain manhole 002552SMH located in the yard of 2812 Valley Drive, facing south.

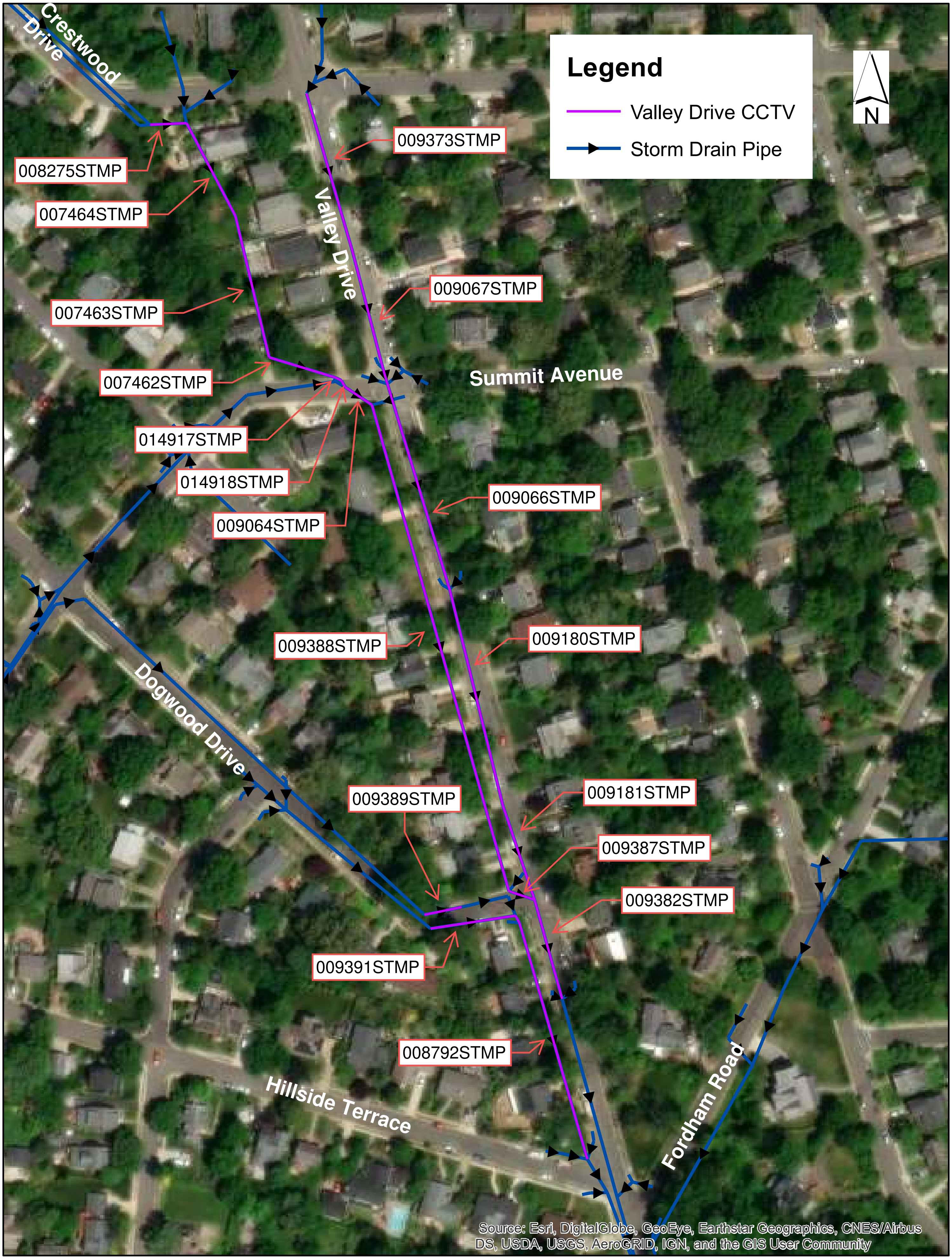
Picture 4: Storm drain curb inlet (007610IN), which conveys flow from Dogwood Drive and ultimately drains to the eastern storm drain system along Valley Drive, facing north. Also shown, storm drain manhole 002609SMH, which flows south.

Picture 5: Curb inlets (005542IN) along the west side of Valley Drive, approximately 2-6”x4’. Facing west.

Picture 6: Dual curb inlets on both sides of Valley Drive between Summit Avenue and Dogwood Drive. Facing north.

<ins>Picture 7:</ins> Curb inlet (007613IN) along the west side of Valley Drive just north of the intersection with Dogwood Drive. Approximately 5”x4’, facing west.

Appendix B: CCTV Summary



Legend
Valley Drive CCTV
Storm Drain Pipe
N
Crestwood Drive
Valley Drive
Summit Avenue
Dogwood Drive
Hillside Terrace
Fordham Road
008275STMP
007464STMP
007463STMP
007462STMP
014917STMP
014918STMP
009064STMP
009373STMP
009067STMP
009066STMP
009388STMP
009180STMP
009389STMP
009181STMP
009387STMP
009382STMP
009391STMP
008792STMP
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Pipe Name	Size and Material	Recorded Direction (DS/US)	Starting Node	Ending Node	Pipe Length (ft)	Recorded Distance from Starting Node (ft.)	Recorded Video Description	File Source (from The City)
009250STMP	12" RCP	South (D/S)	005814IN	005813IN	39.0	0.0	Access Point Catch Basin.	•009250STM.mp4
						1.2	Deposits Attached Other (Concrete).	
						28.1	Broken.	
						39.0	Access Point Catch Basin.	
009249STMP	18" RCP	Southeast (D/S)	005813IN	003063SMH	5.2	0.0	Access Point Catch Basin.	•009249STM.mp4
						1.2	Hole.	
						5.2	Manhole.	
008943STMP	18" RCP	Southwest (U/S)	002919SMH	003063SMH	78.0	3.0	Miscellaneous General Observation (Starting @ 3.0FT Into Pipe).	•008943STMP.mp4
						8.0	Miscellaneous General Observation (Mastic (Black Tar)).	
						12.2	Hole. Crack Longitudinal. Continuous Defect Start.	
						20.3	Hole.	
						26.6	Crack Longitudinal. Continuous Defect Finish.	
						32.3	Miscellaneous General Observation (Mastic (Black Tar)).	
						34.0	Crack Longitudinal.	
						36.9	Miscellaneous General Observation (Not A Crack, Wet Spot After Cleaning).	
						44.7	Hole.	
						53.5	Crack Longitudinal.	
						61.1	Hole.	
						64.9	Crack Longitudinal.	
						69.6	Hole. Continuous Defect Finish.	
						76.4	Deposits Attached Other (Concrete).	
						78.0	Manhole.	
008942STMP	15" RCP	Northwest (U/S)	002919SMH	005811IN	30.0	0.0	Manhole.	•008942STM.mp4
						0.5	Fracture Longitudinal. Fracture Multiple.	
						7.9	Fracture Longitudinal.	
						9.1	Miscellaneous General Observation (Not A Crack, Wet Spot After Cleaning).	
						12.1	Fracture Longitudinal.	
						16.4	Deposits Attached Other (Concrete).	
						18.7	Crack Longitudinal.	
						19.4	Joint Offset Medium.	
						24.3	Joint Offset Medium.	
						24.8	Fracture Longitudinal.	
						30.0	Access Point Catch Basin.	

Pipe Name	Size and Material	Recorded Direction (DS/US)	Starting Node	Ending Node	Pipe Length (ft)	Recorded Distance from Starting Node (ft.)	Recorded Video Description	File Source (from The City)
008939STMP	15" RCP	Southwest (U/S)	003072SMH	005809IN	-	0.0	Manhole.	•008939STM.mp4
						25.1	Miscellaneous General Observation (Segment Has Been Capped).	
008938STMP	18" RCP	East (D/S)	003072SMH	003086SMH	166.0	0.0	Manhole.	•008938STM.mp4 •2.17.21 Pipe Run Graph with Scoring Jordan St. (3) 8.pdf •2.17.21 Pipe Run Graph with Scoring Jordan St. (3) 9.pdf
						3.2	Fracture Longitudinal.	
						22.1	Fracture Longitudinal. Continuous Defect Start.	
						32.7	Fracture Longitudinal. Continuous Defect Finish.	
						54.5	Fracture Longitudinal. Continuous Defect Start.	
						64.9	Fracture Longitudinal. Continuous Defect Finish.	
						70.1	Fracture Longitudinal. Continuous Defect Start.	
						99.6	Fracture Longitudinal. Continuous Defect Finish.	
						102.4	Fracture Longitudinal. Continuous Defect Finish.	
						107.5	Fracture Longitudinal. Continuous Defect Start.	
						147.3	Fracture Longitudinal.	
						153.0	Fracture Longitudinal. Continuous Defect Finish.	
						163.3	Deposits Attached Other (Concrete).	
						166.0	Manhole.	
009080STMP	12" RCP	North (U/S)	003086SMH	000760ND	40.5	3.0	Miscellaneous General Observation (Starting @ 3.0FT Into Pipe).	•009080STM.mp4
						10.2	Deposits Attached Other (Concrete).	
						10.9	Fracture Circumferential.	
						18.6	Deposits Attached Other (Concrete).	
						40.5	Tap Break-in/Hammer.	
			000760ND	005808IN	38.5	42.9	Deposits Attached Other (Concrete).	
						79.0	Access Point Catch Basin.	

Pipe Name	Size and Material	Recorded Direction (DS/US)	Starting Node	Ending Node	Pipe Length (ft)	Recorded Distance from Starting Node (ft.)	Recorded Video Description	File Source (from The City)
009290STMP	18" RCP	East (D/S)	003086SMH	000767ND	50.7	0.0	Manhole.	•009290STM.mp4 •2.17.21 Pipe Run Graph with Scoring Jordan St. (3) 10.pdf
						6.1	Fracture Longitudinal. Continuous Defect Start.	
						45.5	Fracture Longitudinal. Continuous Defect Finish.	
						49.8	Deposits Attached Other (Concrete).	
						50.7	Tap Break-in/Hammer.	
			00767ND	003085SMH	34.3	63.1	Fracture Longitudinal. Continuous Defect Finish.	
						85.0	Manhole.	
009286STMP	24" RCP	Northeast (D/S)	003083SMH	003082SMH	22.4	0.0	Manhole.	•009286STM.mp4
						1.1	Deposits Attached Other (Concrete).	
						5.8	Fracture Spiral. Miscellaneous General Observation (Chipped Joint).	
						8.7	Miscellaneous Water Level Sag. Continuous Defect Start.	
						19.8	Miscellaneous Water Level Sag. Continuous Defect Finish.	
						22.4	Manhole.	
009287STMP	24" RCP	Northeast (D/S)	003082SMH	005833IN	48.0	0.0	Manhole.	•009287STM.mp4
						3.1	Crack Longitudinal.	
						6.7	Infiltration Stain.	
						14.7	Crack Longitudinal.	
						48.0	Miscellaneous General Observation (Buried Structure). Access Point Catch Basin.	
009282STMP	15" RCP	Southwest (D/S)	005829IN	000764ND	11.0	0.0	Manhole.	•009282STM.mp4
						2.4	Fracture Circumferential.	
						6.7	Crack Multiple.	
						11.0	Manhole.	
007464STMP	36" RCP	Southeast (DS)	002553SSMH	002564SSMH	128.9	0.0	Manhole.	2_007464STMP.mp4
						7.5	Crack Circumferential from 6-8:00	
						20.3	Lift Point	
						45.3	Crack Longitudinal at 12:00	
						71.8	Hole void at 11:00	
						106.7	Pipe Connection	
						121.7	Hole at 11:00	
						128.9	Manhole.	
007463STMP	42" RCP	South (DS)	002564SSMH	002563SSMH	174.0	0.0	Manhole.	3_007463STMP.mp4
						174.0	Manhole.	
007462STMP	36" RCP	Southeast (DS)	002563SSMH	002537SSMH	74.2	0.0	Manhole.	
						53.4	Pipe Connection	

Pipe Name	Size and Material	Recorded Direction (DS/US)	Starting Node	Ending Node	Pipe Length (ft)	Recorded Distance from Starting Node (ft.)	Recorded Video Description	File Source (from The City)
						74.2	Manhole.	4_007462STMP.mp4
014918STMP	36" X 51" Oval RCP	Northwest (US)	002538SSMH	002537SSMH	11.1	0.0	Manhole.	5_014918STMP.mp4
						11.1	Manhole.	
009064STMP	36" X 51" Oval RCP	Southeast (DS)	002538SSMH	7	31.2	0.0	Manhole.	6_009064STMP.mp4
						25.3	Settled deposits; 5% of cross-sectional area at 6:00/REBAR	
						31.2	Manhole.	
009181STMP	42" RCP	South (DS)	002543SSMH	002544SSMH	268.4	0.0	Manhole.	14_009181STMP.mp4
						268.4	Manhole.	
009382STMP	36" RCP	South (DS)	002544SSMH	002608SSMH	122.3	0.0	Manhole.	16_009382STMP.mp4
						122.3	Manhole.	
009389STMP	36" RCP	East (DS)	002527SSMH	002612SSMH	40.8	0.0	Manhole.	8_009389STMP.mp4
						40.8	Manhole.	
008275STMP	36" RCP	East (DS)	1	002553SSMH	41.7	0.0	Manhole.	1_008275STMP.mp4
						41.7	Manhole.	
009373STMP	36" RCP	Southeast (DS)	002536SSMH	002540SSMH	197.7	0.0	Manhole.	11_009373STMP.mp4
						197.7	Manhole.	
009067STMP	36" RCP	Southeast (DS)	002540SSMH	002539SSMH	168.7	0.0	Manhole.	12_009067STMP.mp4
						144.8	Pipe Connection	
						168.7	Manhole.	
009388STMP	36" RCP	North (US)	002609SSMH	J	624.1	0.0	Manhole.	7_009388STMP.mp4
						22.7	Pipe Connection	
						113.2	Roots Fine Joint at 5:00	
						121.6	Roots Fine Joint at 5:00	
						173.7	Pipe Connection	
						178.5	Roots Fine Joint at 6:00	
						210.7	Pipe Connection	
						265.9	Pipe Connection	
						274.2	Pipe Connection	
						310.3	Pipe Connection	
						322.7	Pipe Connection	
						341.4	Pipe Connection	
						348.3	Hole - Soil visible from 10-2:00	
						359.2	Pipe Connection	
						409.0	Pipe Connection	
						417.9	Pipe Connection	
						426.5	Joint Offset Medium.	
						512.6	Multiple fractures from 6-7:00	
						605.4	Roots Fine Joint at 5:00	
						624.1	Manhole.	
009390STMP	36" RCP	Southeast (DS)	002609SSMH	002544SSMH	25.4	0.0	Manhole.	15_009390STMP.mp4
						25.4	Manhole.	

Pipe Name	Size and Material	Recorded Direction (DS/US)	Starting Node	Ending Node	Pipe Length (ft)	Recorded Distance from Starting Node (ft.)	Recorded Video Description	File Source (from The City)
008792STMP	36" RCP	South (DS)	002610SSMH	002611SSMH	305.5	0.0	Manhole.	10_008792STMP.mp4
						80.9	Pipe Connection	
						171.3	Pipe Connection	
						238.6	Pipe Connection	
						305.5	Manhole.	
009391STMP	15" RCP	West (US)	002610SSMH	002526SSMH	101.4	0.0	Manhole.	9_009391STMP.mp4
						20.3	Circumferential Crack from 12:00-12:00	
						101.4	Manhole.	
009066STMP	36" RCP	North (US)	002542SSMH	002539SSMH	258.3	0.0	Manhole.	13_009066STMP.mp4
						250.7	Abandoned factory-made tap at 2:00, 15" diam.	
						258.3	Manhole.	
009180STMP	36" RCP	South (DS)	002542SSMH	002543SSMH	268.3	0.0	Manhole.	31_009180STMP.mp4
						162.0	Surface Damage Reinforcement at 3:00	
						259.7	Lift Point	
						268.3	Manhole.	

Project

Project	2023_06_21 CRESTWOOD DR & VALLEY DR 6/21/2023

WinCan

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Project Summary

Project	Project Number	Project Date
2023_06_21 CRESTWOOD DR & VALLEY DR		6/21/2023

Pipe Summary

No.	Type	Pipe Name	Upstream Node	Downstream Node	Road	Town	Use	Mat.	Profile	Length
1	SEC	007464STMP	002553SSMH	002564SSMH	Crestwood Dr	Alexandria Va	SW	RCP	Circular 36inch	128.91
2	SEC	007463STMP	002564SSMH	002563SSMH	Crestwood Dr	Alexandria Va	SW	RCP	Circular 42inch	173.97
3	SEC	007462STMP	002563SSMH	002537SSMH	Crestwood Dr	Alexandria Va	SW	RCP	Circular 36inch	74.16
4	SEC	014918STMP	002537SSMH	002538SSMH	Summit Ave	Alexandria Va	SW	RCP	Oval 36/51inch	11.11
5	SEC	009064STMP	002538SSMH	7	Summit Ave	Alexandria Va	SW	RCP	Oval 36/51inch	31.22
6	SEC	009181STMP	002543SSMH	002544SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 42inch	268.44
7	SEC	009382STMP	002544SSMH	002608SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 36inch	122.27
8	SEC	009389STMP	002527SSMH	002612SSMH	Dogwood Dr	Alexandria Va	SW	RCP	Circular 36inch	40.81
9	SEC	008275STMP	1	002553SSMH	Crestwood Dr	Alexandria Va	SW	RCP	Circular 36inch	41.65
10	SEC	009373STMP	002536SSMH	002540SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 36inch	197.71
11	SEC	009067STMP	002540SSMH	002539SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 36inch	168.69
12	SEC	009388STMP	J	002609SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 36inch	624.14
13	SEC	009390STMP	002609SSMH	002544SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 36inch	25.42
14	SEC	008792STMP	002610SSMH	002611SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 36inch	305.45
15	SEC	009391STMP	002526SSMH	002610SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 15inch	101.35
16	SEC	009066STMP	002539SSMH	002542SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 36inch	258.27
17	SEC	009180STMP	002542SSMH	002543SSMH	Valley Dr	Alexandria Va	SW	RCP	Circular 36inch	268.33
									Total:	**2841.91**

Pipe Levels

No.	Pipe Name	Upstream Node	Upstream C.L.	Upstream I.L.	Upstream I.D.	Downstream Node	Downstream C.L.	Downstream I.L.	Downstream I.D.
1	007464STMP	002553SSMH			0.000	002564SSMH			0.000
2	007463STMP	002564SSMH			0.000	002563SSMH			0.000
3	007462STMP	002563SSMH			0.000	002537SSMH			0.000
4	014918STMP	002537SSMH			0.000	002538SSMH			0.000
5	009064STMP	002538SSMH			0.000	7			0.000
6	009181STMP	002543SSMH			0.000	002544SSMH			0.000

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Project Summary

Project	Project Number	Project Date
2023_06_21 CRESTWOOD DR & VALLEY DR		6/21/2023

No.	Pipe Name	Upstream Node	Upstream C.L.	Upstream I.L.	Upstream I.D.	Downstream Node	Downstream C.L.	Downstream I.L.	Downstream I.D.
7	009382STMP	002544SSMH			0.000	002608SSMH			0.000
8	009389STMP	002527SSMH			0.000	002612SSMH			0.000
9	008275STMP	1			0.000	002553SSMH			0.000
10	009373STMP	002536SSMH			0.000	002540SSMH			0.000
11	009067STMP	002540SSMH			0.000	002539SSMH			0.000
12	009388STMP	J			0.000	002609SSMH			0.000
13	009390STMP	002609SSMH			0.000	002544SSMH			0.000
14	008792STMP	002610SSMH			0.000	002611SSMH			0.000
15	009391STMP	002526SSMH			0.000	002610SSMH			0.000
16	009066STMP	002539SSMH			0.000	002542SSMH			0.000
17	009180STMP	002542SSMH			0.000	002543SSMH			0.000

Pipe Summary by Profile

Profile	Total Length	No. Pipes
Circular 15inch	101.35	
Circular 15inch =	101.35	1
Circular 36inch	128.91	
Circular 36inch	74.16	
Circular 36inch	122.27	
Circular 36inch	40.81	
Circular 36inch	41.65	
Circular 36inch	197.71	
Circular 36inch	168.69	
Circular 36inch	624.14	
Circular 36inch	25.42	
Circular 36inch	305.45	
Circular 36inch	258.27	
Circular 36inch	268.33	
Circular 36inch =	2255.82	12
Circular 42inch	173.97	
Circular 42inch	268.44	
Circular 42inch =	442.41	2
Oval 36/51inch	11.11	
Oval 36/51inch	31.22	

Project Summary

Project	Project Number	Project Date
2023_06_21 CRESTWOOD DR & VALLEY DR		6/21/2023

Profile		Total Length	No. Pipes
Oval 36/51inch	=	42.33	2
Total	**=**	**2841.91**	**17**

Inspection Summary

Pipe No.	Insp. No.	Upstream Node	Downstream Node	Dir.	Operator	Insp. Date	Insp. Time	Str	Ser	Final Observation	Length
1	1	002553SSMH	002564SSMH	DS	Kirby Alford	06/21/2023	9:16	3	3	AMH, 002564SSMH	128.91
2	1	002564SSMH	002563SSMH	DS	Kirby Alford	06/21/2023	9:25			AMH, 002563SSMH	173.97
3	1	002563SSMH	002537SSMH	DS	Kirby Alford	06/21/2023	9:31			AMH, 002537SSMH	74.16
4	1	002537SSMH	002538SSMH	US	Kirby Alford	06/21/2023	9:51			AMH, 002537SSMH	11.11
5	1	002538SSMH	7	DS	Kirby Alford	06/21/2023	9:57	2	2	AMH, 7	31.22
6	1	002543SSMH	002544SSMH	DS	Kirby Alford	06/21/2023	10:32			AMH, 002544SSMH	268.44
7	1	002544SSMH	002608SSMH	DS	Kirby Alford	06/21/2023	10:39			AMH, 002608SSMH	122.27
8	1	002527SSMH	002612SSMH	DS	Kirby Alford	06/21/2023	10:56			AMH, 002612SSMH	40.81
9	1	1	002553SSMH	DS	Kirby Alford	06/22/2023	9:40			AMH, 002553SSMH	41.65
10	1	002536SSMH	002540SSMH	DS	Kirby Alford	06/22/2023	9:56			AMH, 002540SSMH	197.71
11	1	002540SSMH	002539SSMH	DS	Kirby Alford	06/22/2023	10:01			AMH, 002539SSMH	168.69
12	1	J	002609SSMH	US	Kirby Alford	06/22/2023	10:23	2	2	AMH, J	624.14
13	1	002609SSMH	002544SSMH	DS	Kirby Alford	06/22/2023	10:49			AMH, 002544SSMH	25.42
14	1	002610SSMH	002611SSMH	DS	Kirby Alford	06/22/2023	11:06			AMH, 002611SSMH	305.45
15	1	002526SSMH	002610SSMH	US	Kirby Alford	06/22/2023	11:23	1	1	AMH, 002526SSMH	101.35
16	1	002539SSMH	002542SSMH	US	Kirby Alford	07/10/2023	14:00			AMH, 002539SSMH	258.27
17	1	002542SSMH	002543SSMH	DS	Kirby Alford	07/10/2023	14:13	4	4	AMH, 002543SSMH	268.33
										Total:	**2841.91**

Inspection Summary by Profile

Profile		Total Length	No. Inspections
Circular 15inch		101.35	
Circular 15inch	=	101.35	1
Circular 36inch		128.91	

Project Summary

Project	Project Number	Project Date
2023_06_21 CRESTWOOD DR & VALLEY DR		6/21/2023

Profile		Total Length	No. Inspections
Circular 36inch		74.16	
Circular 36inch		122.27	
Circular 36inch		40.81	
Circular 36inch		41.65	
Circular 36inch		197.71	
Circular 36inch		168.69	
Circular 36inch		624.14	
Circular 36inch		25.42	
Circular 36inch		305.45	
Circular 36inch		258.27	
Circular 36inch		268.33	
Circular 36inch	=	2255.82	12
Circular 42inch		173.97	
Circular 42inch		268.44	
Circular 42inch	=	442.41	2
Oval 36/51inch		11.11	
Oval 36/51inch		31.22	
Oval 36/51inch	=	42.33	2
Total	=	**2841.91**	**17**

Defect Summary

				CCTV Drainage Survey Observation Count																				
				General				Structural Condition									Service Condition						Misc	
Sect. No.	Insp. No.	Upstream Node	Downstream Node	Insp. Length	No. Grade 4/5 Obs.	Survey Abandoned	Camera Under Water	Cracks	Fractures	Broken	Deformed	Collapsed	Holes	Surface Damage	Displaced Joints	Open Joints	Roots	Infiltration	Encrustation	Silt	Grease	Obstruction	Water Level	Line Deviates
1	1	002553SSMH	002564SSMH	128.9	1			2					1											
2	1	002564SSMH	002563SSMH	174.0																				
3	1	002563SSMH	002537SSMH	74.2																				
4	1	002537SSMH	002538SSMH	11.1																				
5	1	002538SSMH	7	31.2																				
6	1	002543SSMH	002544SSMH	268.4																				
7	1	002544SSMH	002608SSMH	122.3																				

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Project Summary

Project	Project Number	Project Date
2023_06_21 CRESTWOOD DR & VALLEY DR		6/21/2023

Sect. No.	Insp. No.	Upstream Node	Downstream Node	Insp. Length	No. Grade 4/5 Obs.	Survey Abandoned	Camera Under Water	Cracks	Fractures	Broken	Deformed	Collapsed	Holes	Surface Damage	Displaced Joints	Open Joints	Roots	Infiltration	Encrustation	Silt	Grease	Obstruction	Water Level	Line Deviates
8	1	002527SSMH	002612SSMH	40.8																				
9	1	1	002553SSMH	41.6																				
10	1	002536SSMH	002540SSMH	197.7																				
11	1	002540SSMH	002539SSMH	168.7																				
12	1	J	002609SSMH	624.1	1				1								4							
13	1	002609SSMH	002544SSMH	25.4																				
14	1	002610SSMH	002611SSMH	305.5																				
15	1	002526SSMH	002610SSMH	101.4				1																
16	1	002539SSMH	002542SSMH	258.3																				
17	1	002542SSMH	002543SSMH	268.3																				
			Total:	**2,841.9**	**2**			**3**	**1**				**1**				**4**							

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Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/21/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**007464STMP**
Year laid:	Pre-cleaning:	Direction:	Pipe Joint Length:	Total Length:	Length Surveyed:
	No Pre-Cleaning	**Downstream**		**128.9 '**	**128.9 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002553SSMH**
Street:	**CRESTWOOD DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002564SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:973

002553SSMH

Distance	Code	Observation	Counter	Photo	Grade
0.0	AMH	Manhole / 002553SSMH	00:00:00	007464STMP_0701203c-0c41-	
0.0	MWL	Water Level, 5% of the vertical dimension	00:00:15	007464STMP_69e783d0-adf1-4	
7.5	CC	Crack Circumferential from 6 o'clock to 8 o'clock	00:00:44	007464STMP_aa3425a4-f565-4	S1
20.3	MGO	Miscellaneous General Observation / LIFT POINT	00:01:08	007464STMP_4e6de127-f280-4	
45.3	CL	Crack Longitudinal at 12 o'clock	00:01:51	007464STMP_bb3d9554-8eb0-	S2
71.8	HVV	Hole Void Visible at 11 o'clock	00:02:39	007464STMP_fefbbdb5-ffff-40e	S5
106.7	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:03:38	007464STMP_c753e772-de65-	
121.7	H	Hole at 11 o'clock	00:04:13	007464STMP_ee039985-5dcc-	S4
128.9	AMH	Manhole / 002564SSMH	00:04:37		

002564SSMH

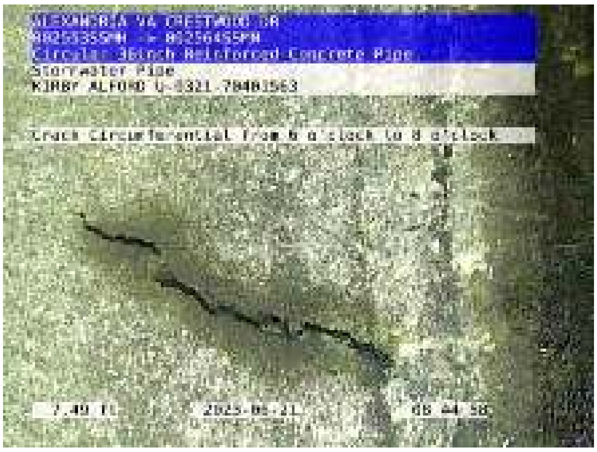
QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
5141	0000	5141	12.0	0.0	12.0	3.0	0.0	3.0

Section Pictures - 6/21/2023 - 007464STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**CRESTWOOD DR**	**6/21/2023**	**007464STMP**	**1**

007464STMP_0701203c-0c41-4283-9004-fc5f72b1e70f_20230621_091655_737.jpg, 00:00:00, 0.00ft
Manhole / 002553SSMH

007464STMP_69e783d0-adf1-48ce-bda1-ad6928900325_20230621_091713_871.jpg, 00:00:15, 0.00ft
Water Level, 5% of the vertical dimension



007464STMP_aa3425a4-f565-40ad-b4a5-371804118181_20230621_091745_961.jpg, 00:00:44, 7.49ft
Crack Circumferential from 6 o'clock to 8 o'clock

007464STMP_4e6de127-f280-4387-bf53-1f96ddb88169_20230621_091815_311.jpg, 00:01:08, 20.28ft
Miscellaneous General Observation / LIFT POINT

WinCan

Section Pictures - 6/21/2023 - 007464STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**CRESTWOOD DR**	**6/21/2023**	**007464STMP**	**1**

007464STMP_bb3d9554-8eb0-4290-a689-0782eaa1fdfc_20230621_091904_422.jpg, 00:01:51, 45.29ft
Crack Longitudinal at 12 o'clock

007464STMP_fefbbdb5-ffff-40e0-aba7-c4333ea9ea5a_20230621_092006_345.jpg, 00:02:39, 71.84ft
Hole Void Visible at 11 o'clock

007464STMP_c753e772-de65-4a65-921c-7a0e3515459e_20230621_092113_847.jpg, 00:03:38, 106.66ft
Miscellaneous General Observation / PIPE CONNECTION

007464STMP_ee039985-5dcc-48ab-855a-c3b2a5833599_20230621_092155_768.jpg, 00:04:13, 121.68ft
Hole at 11 o'clock

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/21/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**007463STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Downstream**	Pipe Joint Length:	Total Length: **174.0 '**	Length Surveyed: **174.0 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002564SSMH**
Street:	**CRESTWOOD DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002563SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**42 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:1313	Distance	Code	Observation	Counter	Photo	Grade
002564SSMH						
	0.0	AMH	Manhole / 002564SSMH	00:00:00	007463STMP_0135009d-0337-	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:13		
	174.0	AMH	Manhole / 002563SSMH	00:03:45		
002563SSMH						

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

![WinCan]

Section Pictures - 6/21/2023 - 007463STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**CRESTWOOD DR**	**6/21/2023**	**007463STMP**	**2**

007463STMP_0135009d-0337-48b0-9c90-27513c67389b_20230621_092541_947.jpg, 00:00:00, 0.00ft
Manhole / 002564SSMH

WinCan

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/21/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**007462STMP**
Year laid:	Pre-cleaning:	Direction:	Pipe Joint Length:	Total Length:	Length Surveyed:
	No Pre-Cleaning	**Downstream**		**74.2 '**	**74.2 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002563SSMH**
Street:	**CRESTWOOD DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002537SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

002563SSMH

1:560 Distance	Code	Observation	Counter	Photo	Grade
0.0	AMH	Manhole / 002563SSMH	00:00:00	007462STMP_c3fa7375-67e8-	
0.0	MWL	Water Level, 5% of the vertical dimension	00:00:11	007462STMP_4bbcf432-3dd3-	
53.4	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:01:24	007462STMP_5cb1a6a0-3209-	
74.2	AMH	Manhole / 002537SSMH	00:02:37		

002537SSMH

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

Section Pictures - 6/21/2023 - 007462STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**CRESTWOOD DR**	**6/21/2023**	**007462STMP**	**3**

007462STMP_c3fa7375-67e8-48da-9ca1-8f9d26eca7a9_20230621_093137_224.jpg, 00:00:00, 0.00ft
Manhole / 002563SSMH

007462STMP_4bbcf432-3dd3-451c-8bca-b83bef6ffb76_20230621_093150_094.jpg, 00:00:11, 0.00ft
Water Level, 5% of the vertical dimension

007462STMP_5cb1a6a0-3209-4565-89d0-37f327fbeadd_20230621_093309_534.jpg, 00:01:24, 53.42ft
Miscellaneous General Observation / PIPE CONNECTION

WinCan

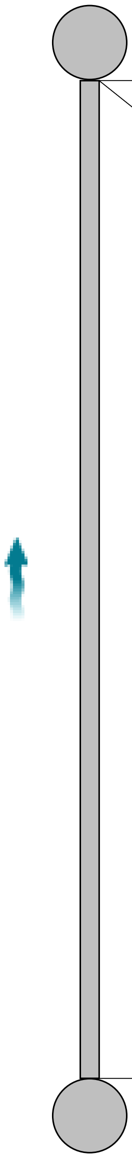
Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/21/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**014918STMP**
Year laid:	Pre-cleaning:	Direction:	Pipe Joint Length:	Total Length:	Length Surveyed:
	No Pre-Cleaning	**Upstream**		**11.1 '**	**11.1 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002537SSMH**
Street:	**SUMMIT AVE**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002538SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Oval**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 x 51 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

002538SSMH



1:84	Distance	Code	Observation	Counter	Photo	Grade
	0.0	AMH	Manhole / 002538SSMH	00:00:00	014918STMP_16507180-60fe-4	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:15	014918STMP_9991b795-db95-	
	11.1	AMH	Manhole / 002537SSMH	00:00:37		

002537SSMH

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

Section Pictures - 6/21/2023 - 014918STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**SUMMIT AVE**	**6/21/2023**	**014918STMP**	**4**

014918STMP_16507180-60fe-420d-8f5a-d67034a7c50a_20230621_095153_105.jpg, 00:00:00, 0.00ft
Manhole / 002538SSMH

014918STMP_9991b795-db95-4c3f-95b3-88fb73af8ae3_20230621_095243_967.jpg, 00:00:15, 0.00ft
Water Level, 5% of the vertical dimension

WinCan

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/21/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009064STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Downstream**	Pipe Joint Length:	Total Length: **31.2 '**	Length Surveyed: **31.2 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002538SSMH**
Street:	**SUMMIT AVE**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**7**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Oval**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 x 51 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:236	Distance	Code	Observation	Counter	Photo	Grade
002538SSMH						
	0.0	AMH	Manhole / 002538SSMH	00:00:00	009064STMP_253ce69d-b760-	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:20	009064STMP_7b409d1b-2695-	
	25.3	DSZ	Deposits Settled Other, 5% of cross sectional area at 6 o'clock / REBAR	00:00:56	009064STMP_5e88708d-a199-	M2
	31.2	AMH	Manhole / 7	00:01:12		
7						

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	2100	2100	0.0	2.0	2.0	0.0	2.0	2.0

Section Pictures - 6/21/2023 - 009064STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**SUMMIT AVE**	**6/21/2023**	**009064STMP**	**5**

009064STMP_253ce69d-b760-44d7-87dd-26e18f25112d_20230621_095731_453.jpg, 00:00:00, 0.00ft
Manhole / 002538SSMH

009064STMP_7b409d1b-2695-4919-be22-303da10fa1d5_20230621_095759_485.jpg, 00:00:20, 0.00ft
Water Level, 5% of the vertical dimension

009064STMP_5e88708d-a199-4822-84c4-6fce5eae4744_20230621_095852_438.jpg, 00:00:56, 25.28ft
Deposits Settled Other, 5% of cross sectional area at 6 o'clock / REBAR

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/21/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009181STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Downstream**	Pipe Joint Length:	Total Length: **268.4 '**	Length Surveyed: **268.4 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002543SSMH**
Street:	**VALLEY DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002544SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**42 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:2026	Distance	Code	Observation	Counter	Photo	Grade
002543SSMH						
	0.0	AMH	Manhole / 002543SSMH	00:00:00	009181STMP_6c69d399-18d7-	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:14	009181STMP_66f65b7b-6bf8-4	
	268.4	AMH	Manhole / 002544SSMH	00:05:39		
002544SSMH						

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

Section Pictures - 6/21/2023 - 009181STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/21/2023**	**009181STMP**	**7**

009181STMP_6c69d399-18d7-4fb8-8f52-79f3b7675253_20230621_103212_133.jpg, 00:00:00, 0.00ft
Manhole / 002543SSMH

009181STMP_66f65b7b-6bf8-4116-bd99-0724494522f1_20230621_103227_957.jpg, 00:00:14, 0.00ft
Water Level, 5% of the vertical dimension

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/21/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009382STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Downstream**	Pipe Joint Length:	Total Length: **122.3 '**	Length Surveyed: **122.3 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002544SSMH**
Street:	**VALLEY DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002608SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:923	Distance	Code	Observation	Counter	Photo	Grade
002544SSMH						
	0.0	AMH	Manhole / 002544SSMH	00:00:00	009382STMP_9d00e13b-95c5-	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:13	009382STMP_38744c1a-a7e9-	
	122.3	AMH	Manhole / 002608SSMH	00:02:44		
002608SSMH						

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

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Section Pictures - 6/21/2023 - 009382STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/21/2023**	**009382STMP**	**8**

009382STMP_9d00e13b-95c5-4242-a939-e54a9e51559f_20230621_103923_945.jpg, 00:00:00, 0.00ft
Manhole / 002544SSMH

009382STMP_38744c1a-a7e9-4672-8bc0-e3f9a30b1683_20230621_103939_324.jpg, 00:00:13, 0.00ft
Water Level, 5% of the vertical dimension

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/21/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009389STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Downstream**	Pipe Joint Length:	Total Length: **40.8 '**	Length Surveyed: **40.8 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002527SSMH**
Street:	**DOGWOOD DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002612SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:308	Distance	Code	Observation	Counter	Photo	Grade
002527SSMH						
	0.0	AMH	Manhole / 002527SSMH	00:00:00	009389STMP_ece1cef7-738b-4	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:20	009389STMP_2e58b232-1a3b-	
	40.8	AMH	Manhole / 002612SSMH	00:01:19		
002612SSMH						

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

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Section Pictures - 6/21/2023 - 009389STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**DOGWOOD DR**	**6/21/2023**	**009389STMP**	**9**

009389STMP_ece1cef7-738b-4e99-aaef-8660fadb2451_20230621_105635_970.jpg, 00:00:00, 0.00ft
Manhole / 002527SSMH

009389STMP_2e58b232-1a3b-4a74-a9b1-cc7a30f72607_20230621_105656_835.jpg, 00:00:20, 0.00ft
Water Level, 5% of the vertical dimension

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Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/22/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**008275STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Downstream**	Pipe Joint Length:	Total Length: **41.6 '**	Length Surveyed: **41.6 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**1**
Street:	**CRESTWOOD DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002553SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:315	Distance	Code	Observation	Counter	Photo	Grade
1	0.0	AMH	Manhole / 1	00:00:00	008275STMP_6c49d1a6-4cd3-	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:20	008275STMP_55c136fb-9713-4	
002553SSMH	41.6	AMH	Manhole / 002553SSMH	00:01:15		

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

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Section Pictures - 6/22/2023 - 008275STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**CRESTWOOD DR**	**6/22/2023**	**008275STMP**	**10**

008275STMP_6c49d1a6-4cd3-466f-91a2-6b2be2b9b9ba_20230622_094038_348.jpg, 00:00:00, 0.00ft
Manhole / 1

008275STMP_55c136fb-9713-446c-8527-d261547c1ac5_20230622_094100_097.jpg, 00:00:20, 0.00ft
Water Level, 5% of the vertical dimension

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/22/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009373STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Downstream**	Pipe Joint Length:	Total Length: **197.7 '**	Length Surveyed: **197.7 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002536SSMH**
Street:	**VALLEY DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002540SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:1493	Distance	Code	Observation	Counter	Photo	Grade
002536SSMH						
	0.0	AMH	Manhole / 002536SSMH	00:00:00	009373STMP_4d21cc25-6990-	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:19	009373STMP_f35a2587-8398-	
	197.7	AMH	Manhole / 002540SSMH	00:03:52		
002540SSMH						

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

Section Pictures - 6/22/2023 - 009373STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**009373STMP**	**11**

009373STMP_4d21cc25-6990-4502-ba68-53209f5fbf86_20230622_095626_171.jpg, 00:00:00, 0.00ft
Manhole / 002536SSMH

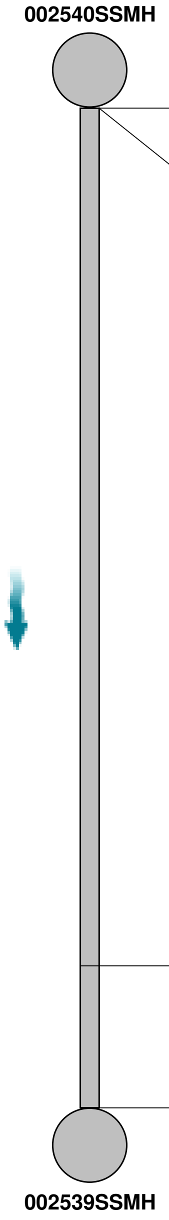
009373STMP_f35a2587-8398-4325-89f9-b599ba0e4177_20230622_095649_122.jpg, 00:00:19, 0.00ft
Water Level, 5% of the vertical dimension

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/22/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009067STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Downstream**	Pipe Joint Length:	Total Length: **168.7 '**	Length Surveyed: **168.7 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002540SSMH**
Street:	**VALLEY DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002539SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:



Distance	Code	Observation	Counter	Photo	Grade
0.0	AMH	Manhole / 002540SSMH	00:00:00	009067STMP_18122cf2-a853-4	
0.0	MWL	Water Level, 5% of the vertical dimension	00:00:17	009067STMP_2dd28f99-fc84-4	
144.8	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:02:58	009067STMP_e39816e4-7749-	
168.7	AMH	Manhole / 002539SSMH	00:03:34	009067STMP_84177e0d-4f74-4	

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

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Section Pictures - 6/22/2023 - 009067STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**009067STMP**	**12**

009067STMP_18122cf2-a853-43e2-977e-0a078c730dec_20230622_100139_460.jpg, 00:00:00, 0.00ft
Manhole / 002540SSMH

009067STMP_2dd28f99-fc84-4d0a-a61d-edfe09dacc3e_20230622_100157_809.jpg, 00:00:17, 0.00ft
Water Level, 5% of the vertical dimension

009067STMP_e39816e4-7749-4060-bac7-6f39f8314072_20230622_100452_667.jpg, 00:02:58, 144.83ft
Miscellaneous General Observation / PIPE CONNECTION

009067STMP_84177e0d-4f74-4694-9cca-08aa6088da47_20230622_100528_417.jpg, 00:03:34, 168.69ft
Manhole / 002539SSMH

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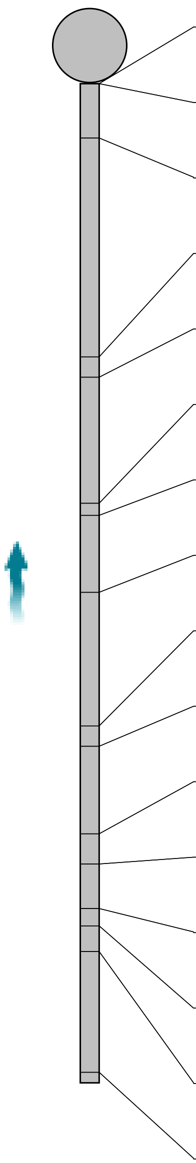
Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/22/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009388STMP**
Year laid:	Pre-cleaning:	Direction:	Pipe Joint Length:	Total Length:	Length Surveyed:
	No Pre-Cleaning	**Upstream**		**624.1 '**	**624.1 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**J**
Street:	**VALLEY DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002609SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

002609SSMH



1:3121 Distance	Code	Observation	Counter	Photo	Grade
0.0	AMH	Manhole / 002609SSMH	00:00:00		
0.0	MWL	Water Level, 5% of the vertical dimension	00:00:13	009388STMP_6a9681d7-057b-	
22.7	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:00:56	009388STMP_b794ec58-abe6-	
113.2	RFJ	Roots Fine Joint at 5 o'clock, within 8 inch	00:02:30	009388STMP_cd7635b1-5508-	M1
121.6	RFJ	Roots Fine Joint at 5 o'clock, within 8 inch	00:02:44	009388STMP_8cd6cad0-2ddc-	M1
173.7	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:03:32	009388STMP_4efef903-8e99-4	
178.5	RFJ	Roots Fine Joint at 6 o'clock, within 8 inch	00:03:44	009388STMP_2c17cce2-d41c-	M1
210.7	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:04:20	009388STMP_0ab3cd11-735a-	
265.9	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:05:28	009388STMP_ca042ab8-bd12-	
274.2	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:05:45	009388STMP_0977b09a-5761-	
310.3	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:06:27	009388STMP_9edef05f-133f-4	
322.7	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:06:51	009388STMP_5ebd683e-711c-	
341.4	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:07:17	009388STMP_0990ec29-455a-	
348.3	HSV	Hole Soil Visible from 10 o'clock to 2 o'clock	00:07:31	009388STMP_dc43dbdf-9e14-4	S5
359.2	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:07:52	009388STMP_c7e1524c-cc60-4	
409.0	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:08:46	009388STMP_e114218d-37ca-	

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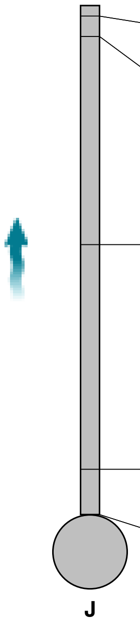
Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/22/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009388STMP**
Year laid:	Pre-cleaning:	Direction:	Pipe Joint Length:	Total Length:	Length Surveyed:
	No Pre-Cleaning	**Upstream**		**624.1 '**	**624.1 '**



1:3121 Distance	Code	Observation	Counter	Photo	Grade
417.9	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:09:04	009388STMP_86105d55-416f-4	
426.5	JOM	Joint Offset Medium	00:09:23	009388STMP_b6e59068-e64c-	S3
512.6	FM	Fracture Multiple from 6 o'clock to 7 o'clock	00:11:14	009388STMP_1c332d5d-e69f-4	S4
605.4	RFJ	Roots Fine Joint at 5 o'clock, within 8 inch	00:14:20	009388STMP_04a58910-8051-	M1
624.1	AMH	Manhole / J	00:15:16	009388STMP_ddb6e932-6b05-	

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
5141	1400	5141	12.0	4.0	16.0	4.0	1.0	2.3

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Section Pictures - 6/22/2023 - 009388STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**009388STMP**	**13**

009388STMP_6a9681d7-057b-47a5-a3b2-a73337b61d8d_20230622_102352_432.jpg, 00:00:13, 0.00ft
Water Level, 5% of the vertical dimension

009388STMP_b794ec58-abe6-4011-9022-35b8449e26a7_20230622_102442_561.jpg, 00:00:56, 22.68ft
Miscellaneous General Observation / PIPE CONNECTION

009388STMP_cd7635b1-5508-4e35-aadd-6589be399be7_20230622_102623_078.jpg, 00:02:30, 113.21ft
Roots Fine Joint at 5 o'clock, within 8 inch

009388STMP_8cd6cad0-2ddc-4407-a58f-d2d4eb3e4051_20230622_102640_793.jpg, 00:02:44, 121.58ft
Roots Fine Joint at 5 o'clock, within 8 inch

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Section Pictures - 6/22/2023 - 009388STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**009388STMP**	**13**

009388STMP_4efef903-8e99-4cda-a62b-1278e7569f0c_20230622_102735_752.jpg, 00:03:32, 173.69ft
Miscellaneous General Observation / PIPE CONNECTION

009388STMP_2c17cce2-d41c-471f-b23f-71b011b400c5_20230622_102753_488.jpg, 00:03:44, 178.53ft
Roots Fine Joint at 6 o'clock, within 8 inch

009388STMP_0ab3cd11-735a-406a-935f-63c88756cb4f_20230622_102834_872.jpg, 00:04:20, 210.65ft
Miscellaneous General Observation / PIPE CONNECTION

009388STMP_ca042ab8-bd12-4237-a815-a79c8a08b941_20230622_102947_852.jpg, 00:05:28, 265.86ft
Miscellaneous General Observation / PIPE CONNECTION

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Section Pictures - 6/22/2023 - 009388STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**009388STMP**	**13**

009388STMP_0977b09a-5761-4be2-a487-c69218e67a77_20230622_103012_136.jpg, 00:05:45, 274.23ft
Miscellaneous General Observation / PIPE CONNECTION

009388STMP_9edef05f-133f-49de-bf4a-1a0d692d42e2_20230622_103100_160.jpg, 00:06:27, 310.33ft
Miscellaneous General Observation / PIPE CONNECTION

009388STMP_5ebd683e-711c-49d0-a262-69ebe03f0d01_20230622_103130_145.jpg, 00:06:51, 322.74ft
Miscellaneous General Observation / PIPE CONNECTION

009388STMP_0990ec29-455a-487b-80a9-df60dab39b20_20230622_103202_841.jpg, 00:07:17, 341.43ft
Miscellaneous General Observation / PIPE CONNECTION

Section Pictures - 6/22/2023 - 009388STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**009388STMP**	**13**

009388STMP_dc43dbdf-9e14-404f-a375-10f772fded3d_20230622_103229_549.jpg, 00:07:31, 348.31ft
Hole Soil Visible from 10 o'clock to 2 o'clock

009388STMP_c7e1524c-cc60-44b4-9a64-ea9e11e6e0b4_20230622_103254_056.jpg, 00:07:52, 359.18ft
Miscellaneous General Observation / PIPE CONNECTION

009388STMP_e114218d-37ca-43af-a568-5dc153d6c5ac_20230622_103354_520.jpg, 00:08:46, 409.03ft
Miscellaneous General Observation / PIPE CONNECTION

009388STMP_86105d55-416f-462b-9d92-d490a1984c71_20230622_103419_574.jpg, 00:09:04, 417.92ft
Miscellaneous General Observation / PIPE CONNECTION

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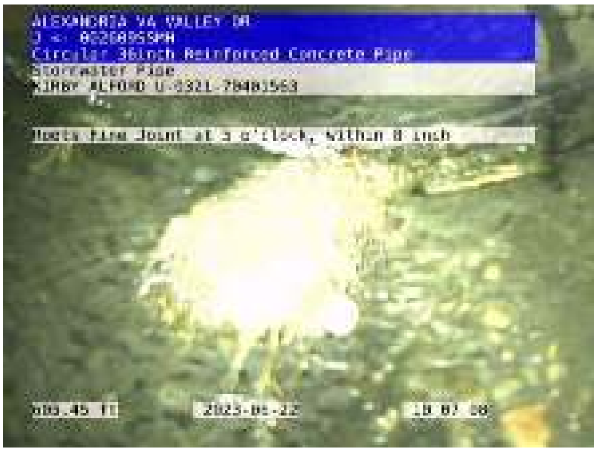
Section Pictures - 6/22/2023 - 009388STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**009388STMP**	**13**

009388STMP_b6e59068-e64c-4a70-9862-1077f19174e2_20230622_103447_650.jpg, 00:09:23, 426.54ft
Joint Offset Medium

009388STMP_1c332d5d-e69f-40f5-bf2e-952484668de6_20230622_103644_924.jpg, 00:11:14, 512.56ft
Fracture Multiple from 6 o'clock to 7 o'clock



009388STMP_04a58910-8051-417e-a0ed-9943959cdac0_20230622_103958_049.jpg, 00:14:20, 605.45ft
Roots Fine Joint at 5 o'clock, within 8 inch

009388STMP_ddb6e932-6b05-455a-be2b-dfc3ca6f6425_20230622_104056_211.jpg, 00:15:16, 624.14ft
Manhole / J

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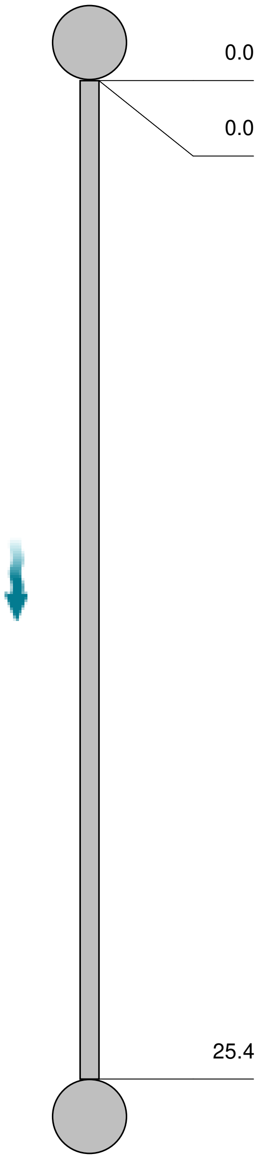
Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/22/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009390STMP**
Year laid:	Pre-cleaning:	Direction:	Pipe Joint Length:	Total Length:	Length Surveyed:
	No Pre-Cleaning	**Downstream**		**25.4 '**	**25.4 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002609SSMH**
Street:	**VALLEY DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002544SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:192	Distance	Code	Observation	Counter	Photo	Grade
002609SSMH						
	0.0	AMH	Manhole / 002609SSMH	00:00:00	009390STMP_f643a7f3-2f0f-45	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:17	009390STMP_858fdadb-103a-	
	25.4	AMH	Manhole / 002544SSMH	00:00:43		
002544SSMH						



QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

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Section Pictures - 6/22/2023 - 009390STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**009390STMP**	**14**

009390STMP_f643a7f3-2f0f-4551-96c3-14cc68e2dded_20230622_104954_298.jpg, 00:00:00, 0.00ft
Manhole / 002609SSMH

009390STMP_858fdadb-103a-4482-867f-2b2e4cd205f7_20230622_105011_423.jpg, 00:00:17, 0.00ft
Water Level, 5% of the vertical dimension

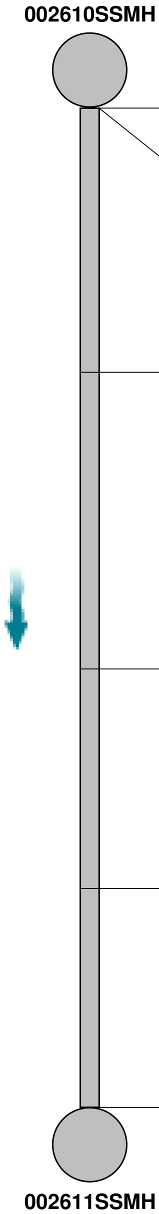
WinCan

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/22/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**008792STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Downstream**	Pipe Joint Length:	Total Length: **305.5 '**	Length Surveyed: **305.5 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002610SSMH**
Street:	**VALLEY DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002611SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:



1:2306 Distance	Code	Observation	Counter	Photo	Grade
0.0	AMH	Manhole / 002610SSMH	00:00:00		
0.0	MWL	Water Level, 5% of the vertical dimension	00:00:15	008792STMP_ad28dbee-ff13-4	
80.9	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:01:52	008792STMP_60e094fd-95a0-4	
171.3	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:03:51	008792STMP_56783154-0477-	
238.6	MGO	Miscellaneous General Observation / PIPE CONNECTION	00:05:14	008792STMP_c398f669-1acf-4	
305.5	AMH	Manhole / 002611SSMH	00:06:29		

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

Section Pictures - 6/22/2023 - 008792STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**008792STMP**	**15**

008792STMP_ad28dbee-ff13-4b32-9bac-40f9ffa4c84f_20230622_110654_415.jpg, 00:00:15, 0.00ft
Water Level, 5% of the vertical dimension

008792STMP_60e094fd-95a0-4cb6-bb58-23a85f3c91bb_20230622_110838_513.jpg, 00:01:52, 80.91ft
Miscellaneous General Observation / PIPE CONNECTION

008792STMP_56783154-0477-4d56-81a9-b8e961aefbbc_20230622_111044_358.jpg, 00:03:51, 171.34ft
Miscellaneous General Observation / PIPE CONNECTION

008792STMP_c398f669-1acf-4e39-aa92-5a73db30971f_20230622_111212_401.jpg, 00:05:14, 238.63ft
Miscellaneous General Observation / PIPE CONNECTION

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
6/22/2023		**Light Rain**	**KIRBY ALFORD**	**U-0321-70401563**	**009391STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Upstream**	Pipe Joint Length:	Total Length: **101.4 '**	Length Surveyed: **101.4 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002526SSMH**
Street:	**VALLEY DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002610SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**15 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:765	Distance	Code	Observation	Counter	Photo	Grade
002610SSMH						
	0.0	AMH	Manhole / 002610SSMH	00:00:00	009391STMP_528e7fc8-2b98-4	
	0.0	MWL	Water Level, 5% of the vertical dimension	00:00:13	009391STMP_24fbec89-7f00-4	
	20.3	CC	Crack Circumferential from 12 o'clock to 12 o'clock	00:00:48	009391STMP_1e1a5cb9-f3d9-4	S1
	101.4	AMH	Manhole / 002526SSMH	00:02:23	009391STMP_d9ebba60-ef8b-4	
002526SSMH						

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
1100	0000	1100	1.0	0.0	1.0	1.0	0.0	1.0

Section Pictures - 6/22/2023 - 009391STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**6/22/2023**	**009391STMP**	**16**

009391STMP_528e7fc8-2b98-4250-9023-dfd169812050_20230622_112314_627.jpg, 00:00:00, 0.00ft
Manhole / 002610SSMH

009391STMP_24fbec89-7f00-44bb-bda2-7cebfcae9c0c_20230622_112329_657.jpg, 00:00:13, 0.00ft
Water Level, 5% of the vertical dimension

009391STMP_1e1a5cb9-f3d9-45f1-bdd9-9c8380fa6f5c_20230622_112407_985.jpg, 00:00:48, 20.29ft
Crack Circumferential from 12 o'clock to 12 o'clock

009391STMP_d9ebba60-ef8b-4d65-bc8e-d1163607f845_20230622_112546_504.jpg, 00:02:23, 101.35ft
Manhole / 002526SSMH

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
7/10/2023		**Dry**	**KIRBY ALFORD**	**U-0321-70401563**	**009066STMP**
Year laid:	Pre-cleaning: **No Pre-Cleaning**	Direction: **Upstream**	Pipe Joint Length:	Total Length: **258.3 '**	Length Surveyed: **258.3 '**

City:	**ALEXANDRIA VA**	Drainage Area:		Upstream MH:	**002539SSMH**
Street:	**VALLEY DR**	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	**002542SSMH**
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	**Circular**	Sewer Use:	**Stormwater Pipe**	Total gallons used:	**0.0**
Pipe size:	**36 "**	Sewer Category:	**SEC**	Joints passed:	**0**
Pipe material:	**Reinforced Concrete Pipe**	Purpose:		Joints failed:	**0**
Lining Method:		Owner:			

Additional Info:

1:1950	Distance	Code	Observation	Counter	Photo	Grade
002542SSMH						
	0.0	AMH	Manhole / 002542SSMH	00:00:00	009066STMP_c4dbf796-d2e2-	
	0.0	MWL	Water Level, 0% of the vertical dimension	00:00:19	009066STMP_b347aec2-bdd4-	
	250.7	TFB	Tap Factory Made Abandoned at 2 o'clock, dia/height: 15inch / FOUND TAP CONCRETED	00:04:49	009066STMP_12888b6e-1916-	
	258.3	AMH	Manhole / 002539SSMH	00:05:08	009066STMP_3b0af0b3-f9b7-4	
002539SSMH						

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	0000	0000	0.0	0.0	0.0	0.0	0.0	0.0

WinCan

Section Pictures - 7/10/2023 - 009066STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**7/10/2023**	**009066STMP**	**17**

009066STMP_c4dbf796-d2e2-4771-b733-456f7623dd88_20230710_140033_301.jpg, 00:00:00, 0.00ft
Manhole / 002542SSMH

009066STMP_b347aec2-bdd4-4ef4-8183-8aa86fba86b6_20230710_140104_187.jpg, 00:00:19, 0.00ft
Water Level, 0% of the vertical dimension

009066STMP_12888b6e-1916-4f20-a171-5b480e25d747_20230710_140644_835.jpg, 00:04:49, 250.71ft
Tap Factory Made Abandoned at 2 o'clock, dia/height: 15inch / FOUND TAP CONCRETED

009066STMP_3b0af0b3-f9b7-4276-b462-81b09c5d994c_20230710_140706_010.jpg, 00:05:08, 258.27ft
Manhole / 002539SSMH

WinCan

Inspection report

Date:	Work Order:	Weather:	Surveyed By:	Certificate Number:	Pipe Segment Ref.:
7/10/2023		Dry	KIRBY ALFORD	U-0321-70401563	009180STMP
Year laid:	Pre-cleaning:	Direction:	Pipe Joint Length:	Total Length:	Length Surveyed:
	No Pre-Cleaning	Downstream		268.3 '	268.3 '

City:	ALEXANDRIA VA	Drainage Area:		Upstream MH:	002542SSMH
Street:	VALLEY DR	Media Label:		Up Rim to Invert:	
Location Code:		Flow Control:		Downstream MH:	002543SSMH
Location Details:		Sheet Number:		Down Rim to Invert:	
Pipe shape:	Circular	Sewer Use:	Stormwater Pipe	Total gallons used:	0.0
Pipe size:	36 "	Sewer Category:	SEC	Joints passed:	0
Pipe material:	Reinforced Concrete Pipe	Purpose:		Joints failed:	0
Lining Method:		Owner:			

Additional Info:

1:2026	Distance	Code	Observation	Counter	Photo	Grade
002542SSMH						
	0.0	AMH	Manhole / 002542SSMH	00:00:00	009180STMP_a32defba-bfec-4	
	0.0	MWL	Water Level, 0% of the vertical dimension	00:00:15	009180STMP_4332f316-e077-	
	162.0	SRV	Surface Damage Reinforcement Visible at 3 o'clock	00:03:38	009180STMP_6f5bfa64-b2f4-44	S4
	259.7	MGO	Miscellaneous General Observation / LIFT POINT	00:06:47	009180STMP_ed38141f-6705-4	
	268.3	AMH	Manhole / 002543SSMH	00:07:04	009180STMP_f44c1e78-58fc-4	
002543SSMH						

QSR	QMR	QOR	SPR	MPR	OPR	SPRI	MPRI	OPRI
4100	0000	4100	4.0	0.0	4.0	4.0	0.0	4.0

Section Pictures - 7/10/2023 - 009180STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**7/10/2023**	**009180STMP**	**18**

009180STMP_a32defba-bfec-48af-a515-bb31f5edad86_20230710_141310_579.jpg, 00:00:00, 0.00ft
Manhole / 002542SSMH

009180STMP_4332f316-e077-4772-b9de-d9fb39b37119_20230710_141330_505.jpg, 00:00:15, 0.00ft
Water Level, 0% of the vertical dimension

009180STMP_6f5bfa64-b2f4-4464-a473-43d7d9ee9cb2_20230710_141717_416.jpg, 00:03:38, 161.99ft
Surface Damage Reinforcement Visible at 3 o'clock

009180STMP_ed38141f-6705-44c0-b090-403b08637c30_20230710_142052_313.jpg, 00:06:47, 259.73ft
Miscellaneous General Observation / LIFT POINT

Section Pictures - 7/10/2023 - 009180STMP

City	Street	Date	Lateral Segment Reference	Section No.
ALEXANDRIA VA	**VALLEY DR**	**7/10/2023**	**009180STMP**	**18**

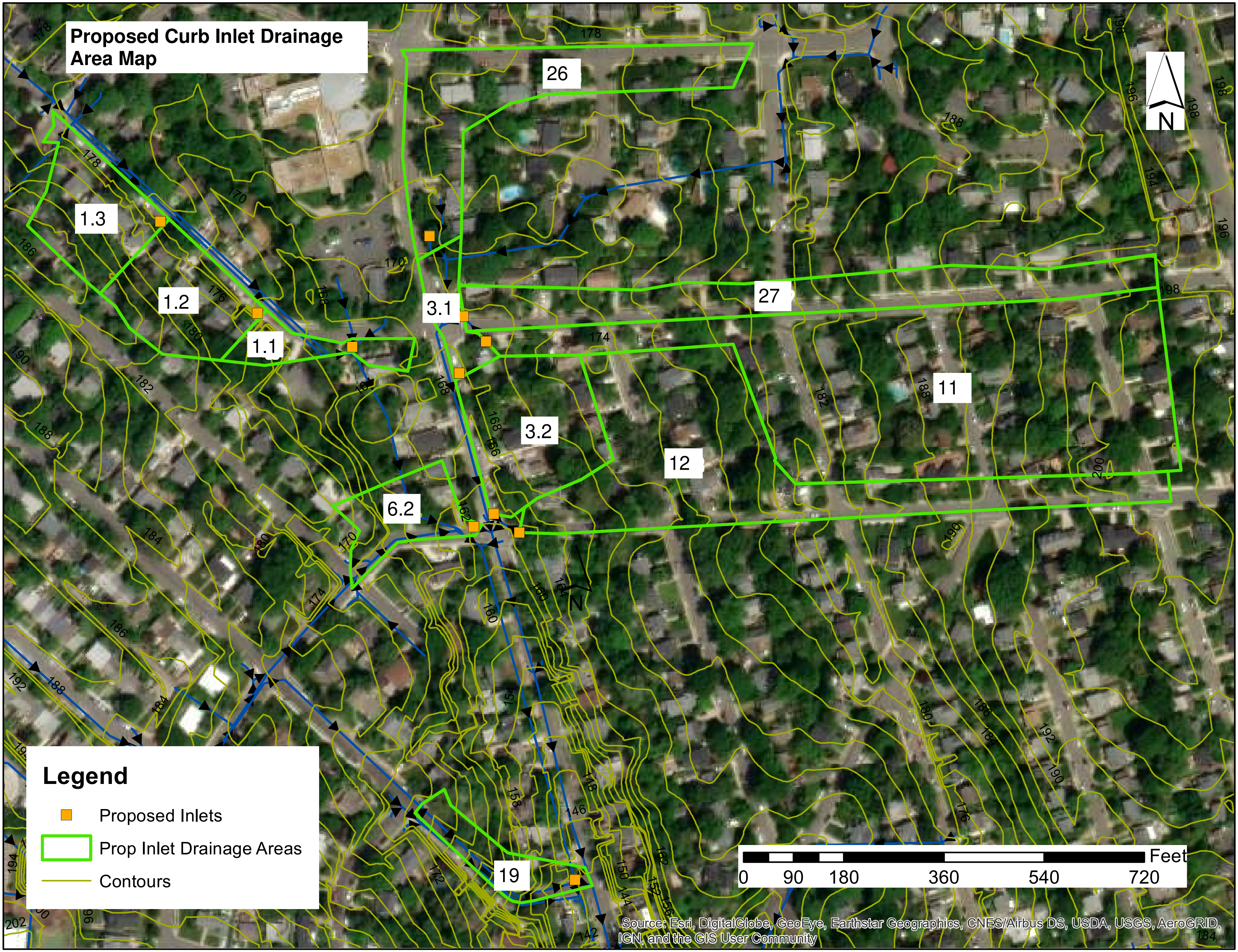
009180STMP_f44c1e78-58fc-491f-a8c6-60db5d039c9e_20230710_142116_673.jpg, 00:07:04, 268.33ft
Manhole / 002543SSMH

Appendix C:
XP-SWMM Update

Appendix C - XP-SWMM Update

Existing Conditions Model Updates/Changes			
Action	**Feature**	**Name**	**Description**
Edit	Link	014917STMP	Updated pipe diameter based on CCTV survey, from 36" to 42"
Edit	Link	014918STMP	Updated pipe diameter based on CCTV survey, from 36" to 42"
Edit	Link	009064STMP	Updated pipe diameter based on CCTV survey, from 30" to 42"
Edit	Link	009067B	Updated pipe diameter based on CCTV survey, from 30" to 36"
Edit	Link	009066STMP	Updated pipe diameter based on CCTV survey, from 30" to 36"
Edit	Link	009388STMP	Updated pipe diameter based on CCTV survey, from 30" to 36"
Edit	Link	009387STMP	Updated pipe diameter based on CCTV survey, from 30" to 36" - assumed an equivalent diameter for the elliptical pipe to be 42" circular pipe
Edit	Link	008791STMP	Updated pipe diameter based on field investigation, from 36" to 42"
Edit	Link	009382STMP	Updated pipe diameter based on field investigation, from 36" to 42"
Edit	Link	009390STMP	Updated pipe orientation to flow south instead of to the southeast
Edit	Link	009392STMP	Updated pipe diameter from 15" to 12"

Appendix D:
Solutions Evaluation



Proposed Curb Inlet Drainage Area Map
26
27
1.3
1.2
1.1
3.1
3.2
11
12
6.2
19
N
Legend
Proposed Inlets
Prop Inlet Drainage Areas
Contours
Feet
0
90
180
360
540
720
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FID DA	Area, A	Inlet	Direct, Q (cfs)	Inlet Size	Upstream Bypass Total, Q (cfs)	Total Flow, Q (cfs)
EC 1 (1.1)	2.64	005458IN	11.93	.33x4.5	9.19	21.12
PC 1.3	0.912		4.46	.33x20	9.19	13.65
PC 1.2	0.963		4.49	.33x20	3.11	7.60
PC 1.1	0.37	005458IN	1.92	.33x10	0.99	2.91
EC 3 (3.2)	1.662	005510IN	8.36	.5x3.5	21.1	29.46
PC 3.1	0.35		1.97	.33x20	21.1	23.07
PC 3.2	1.31	005510IN	6.26	.33x20	10.12	16.38
EC 6.2	no DA - just ds of FID 6 inlets			2 -.33x4.5	4.7	4.70
PC 6.2	just ds of FID 6 inlets			2 -.33x4.5	3.13	3.13
EC 11	5.88	005508IN	29.11	.33x8	0	29.11
PC 11	5.88	005508IN	29.11	.33x20		29.11
EC 12	3.4	005511IN	16.88	.5x3.5	0	16.88
PC 12	3.4	005511IN	16.88	.33x20		16.88
EC 19	0.481	007610IN	2.34	.5x4.5	8.23	10.57
PC 19	0.481	007610IN	2.34	.33x20		10.57
EC 26	1.86	005460IN	10.70	3-.5x4.5		10.70
PC 26	1.86	005460IN	10.70	3-.5x4.5 & .5x8		10.70
EC 27	1.84	005509IN	10.22	.33x9		10.22
PC 27	1.84	005509IN	10.22	.33x20		10.22

Inlet Report

Hydraflow Curb Inlet Spread Calculations

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. | Monday, Sep 25 2023

EC Inlet FID 1 (sump)

Existing curb inlet
005458IN

Curb Inlet

Location	=	Sag
Curb Length (ft)	=	4.50
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

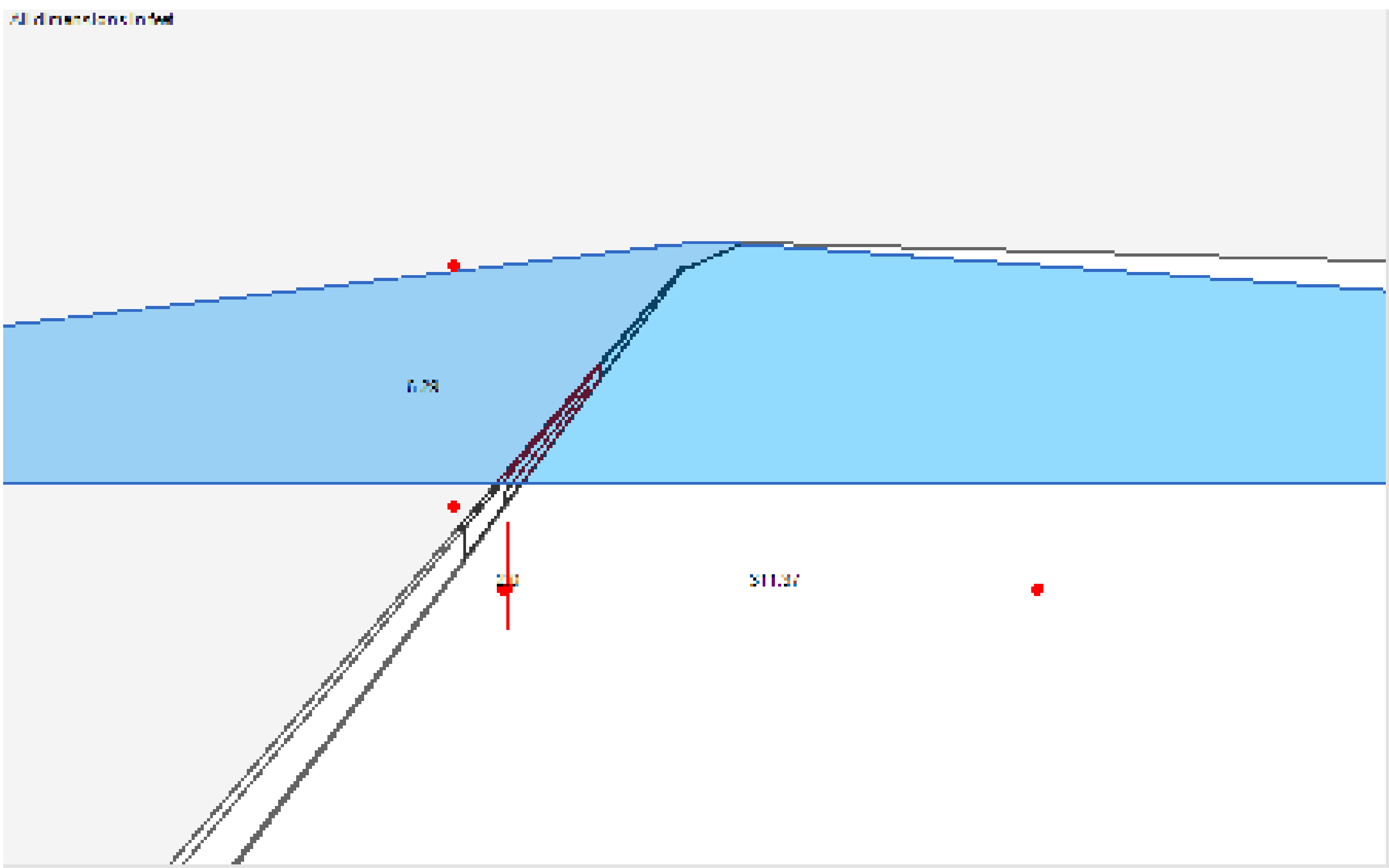
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	-0-
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	-0-
Gutter n-value	=	-0-

Calculations

Compute by:		Known Q
Q (cfs)	=	21.12

Highlighted

Q Total (cfs)	=	21.12
Q Capt (cfs)	=	21.12
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	75.45
Efficiency (%)	=	100
Gutter Spread (ft)	=	313.37
Gutter Vel (ft/s)	=	4.42
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. — Thursday, Sep 28 2023

PC FID 1.1 - 2inch local depression

Proposed Inlet at 005458IN

Curb Inlet

Location	=	Sag
Curb Length (ft)	=	10.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

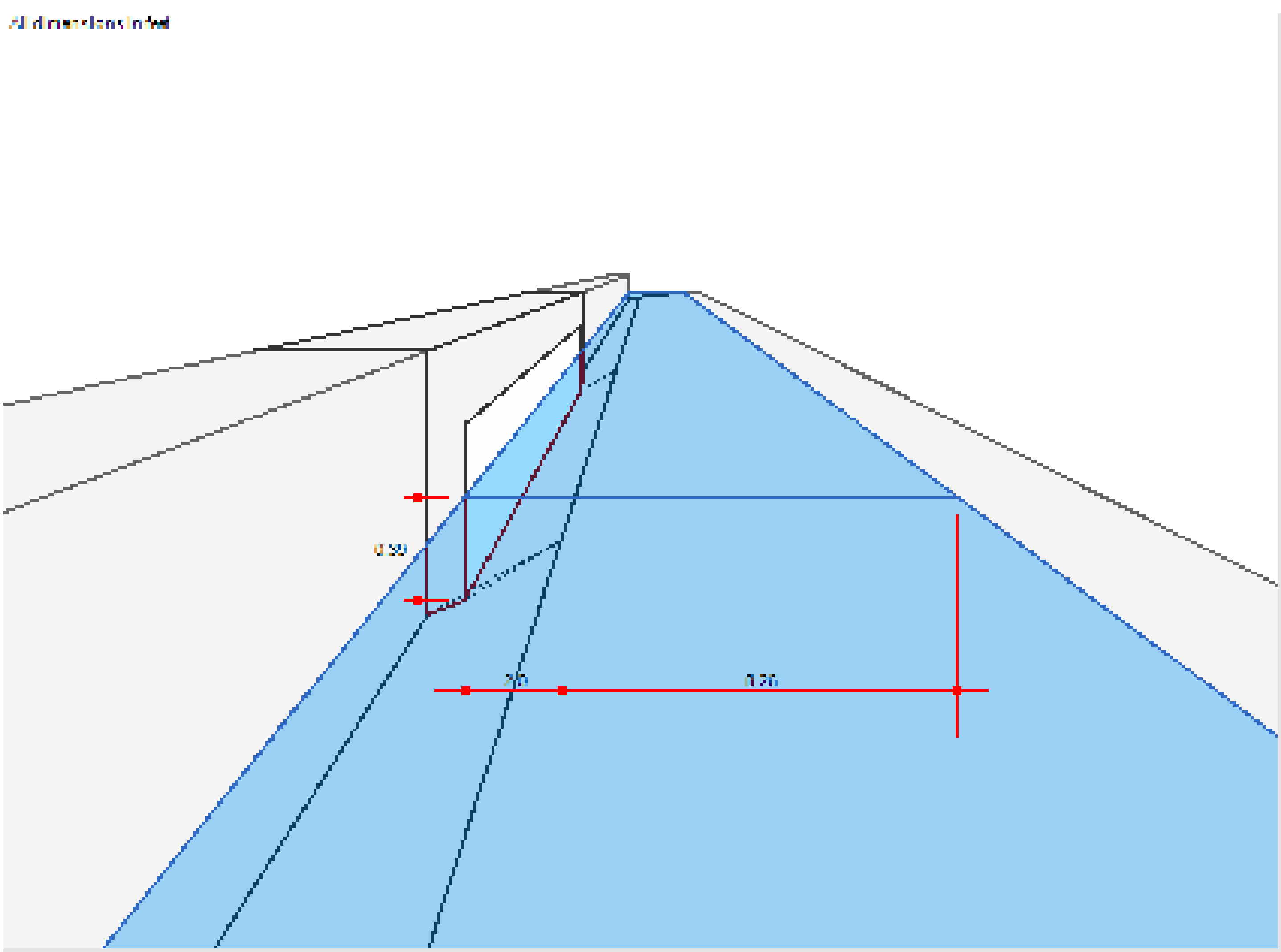
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	-0-
Gutter n-value	=	-0-

Calculations

Compute by:		Known Q
Q (cfs)	=	2.91

Highlighted

Q Total (cfs)	=	2.91
Q Capt (cfs)	=	2.91
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	4.70
Efficiency (%)	=	100
Gutter Spread (ft)	=	10.26
Gutter Vel (ft/s)	=	4.08
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 28 2023

PC FID 1.2 - 2inch local depression

Proposed Inlet just uphill of 005458IN along Crestwood Drive

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	20.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

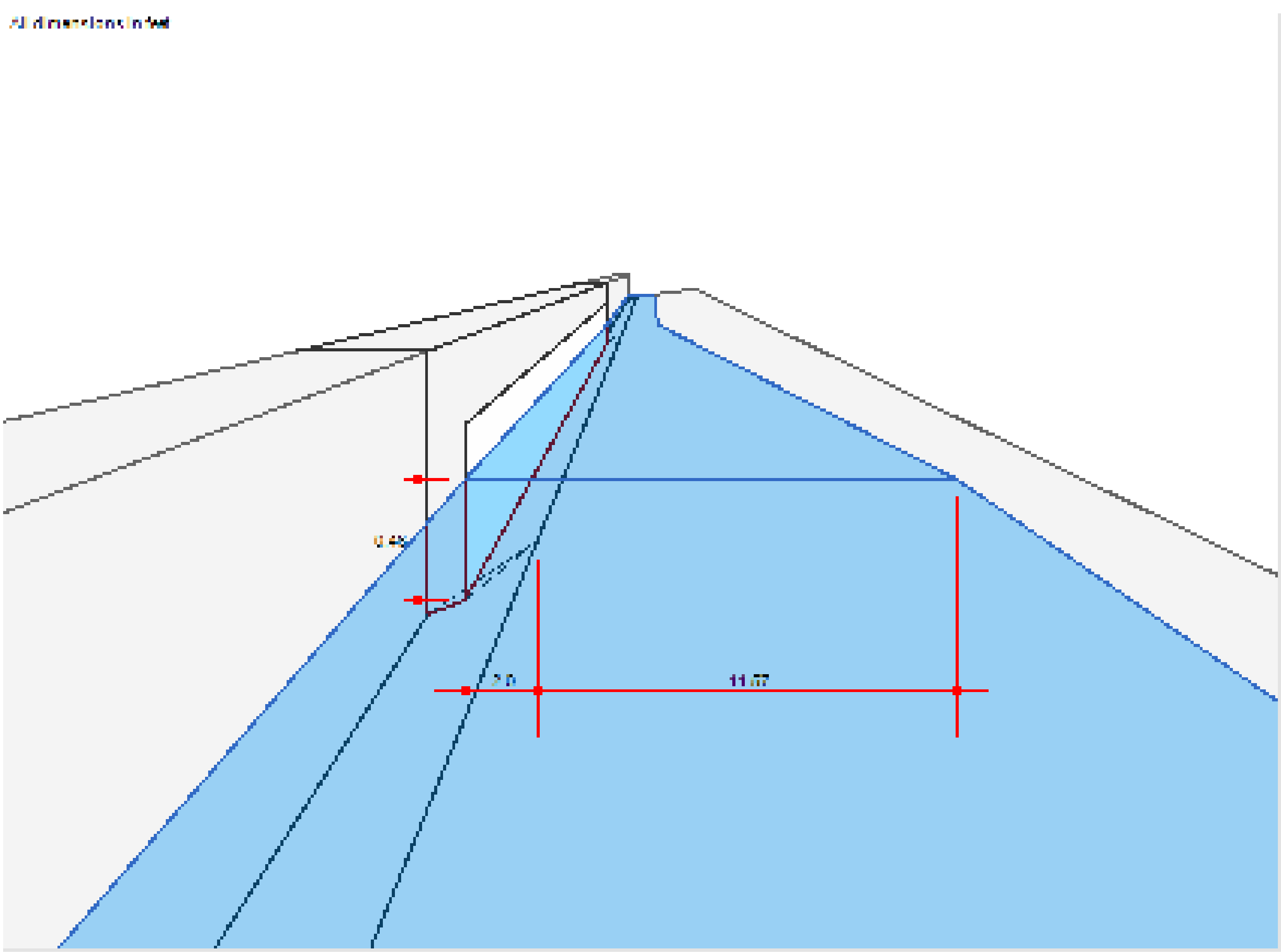
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	1.25
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	7.60

Highlighted

Q Total (cfs)	=	7.60
Q Capt (cfs)	=	6.61
Q Bypass (cfs)	=	0.99
Depth at Inlet (in)	=	5.50
Efficiency (%)	=	87
Gutter Spread (ft)	=	13.57
Gutter Vel (ft/s)	=	4.09
Bypass Spread (ft)	=	6.13
Bypass Depth (in)	=	1.71



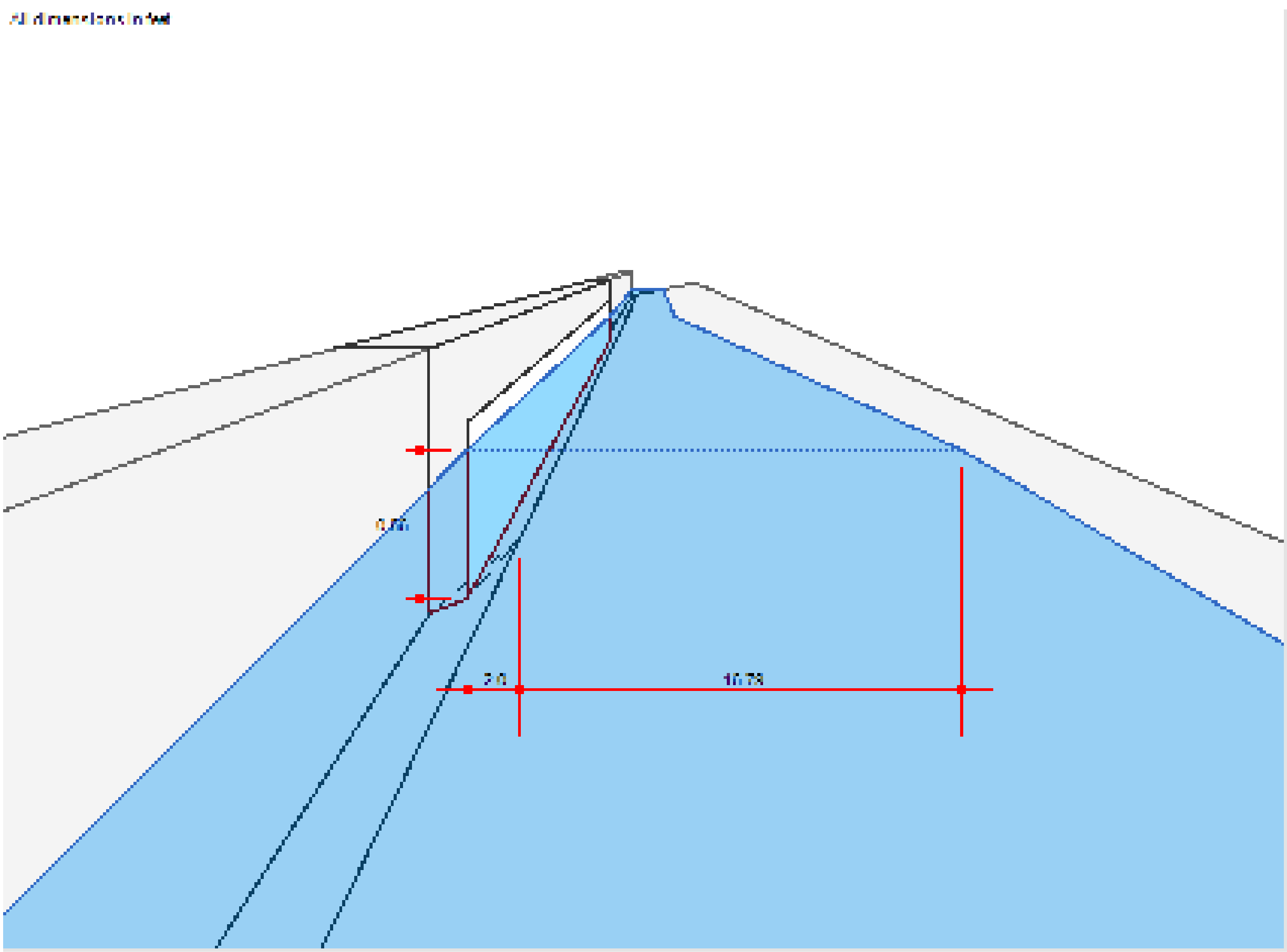
Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 28 2023

PC FID 1.3 - 2inch local depression

Proposed Inlet furthest uphill along Crestwood Dr.

Curb Inlet			**Calculations**	
Location	= On grade		Compute by:	Known Q
Curb Length (ft)	= 20.00		Q (cfs)	= 13.65
Throat Height (in)	= 4.00			
Grate Area (sqft)	= -0-		**Highlighted**	
Grate Width (ft)	= -0-		Q Total (cfs)	= 13.65
Grate Length (ft)	= -0-		Q Capt (cfs)	= 10.54
			Q Bypass (cfs)	= 3.11
Gutter			Depth at Inlet (in)	= 6.75
Slope, Sw (ft/ft)	= 0.030		Efficiency (%)	= 77
Slope, Sx (ft/ft)	= 0.020		Gutter Spread (ft)	= 18.79
Local Depr (in)	= 2.00		Gutter Vel (ft/s)	= 3.85
Gutter Width (ft)	= 2.00		Bypass Spread (ft)	= 10.69
Gutter Slope (%)	= 1.10		Bypass Depth (in)	= 2.80
Gutter n-value	= 0.016			



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Oct 5 2023

Inlet FID 3

Existing Conditions curb inlet 005510IN

Curb Inlet

Location	= On grade
Curb Length (ft)	= 3.50
Throat Height (in)	= 6.00
Grate Area (sqft)	= -0-
Grate Width (ft)	= -0-
Grate Length (ft)	= -0-

Gutter

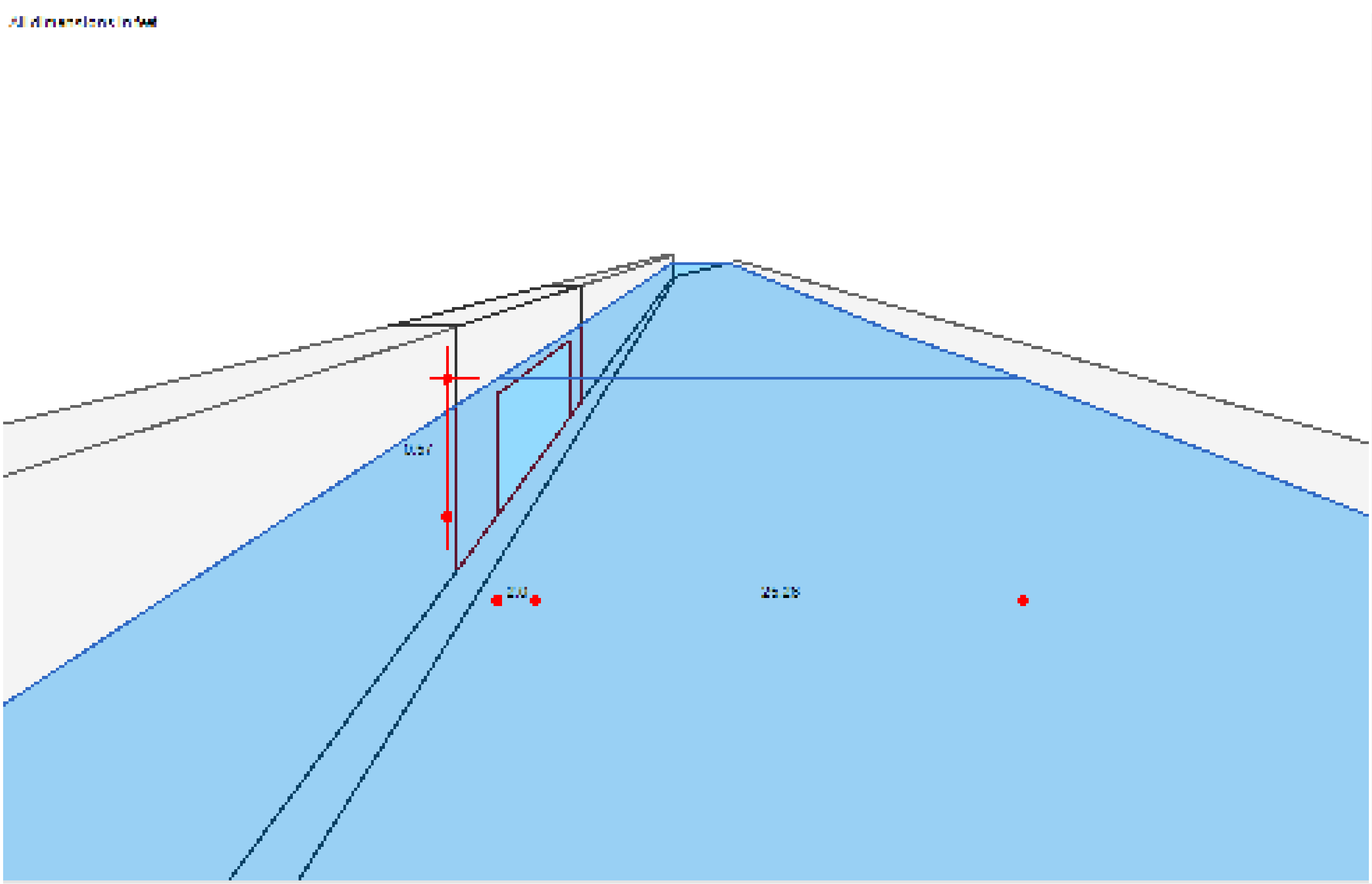
Slope, Sw (ft/ft)	= 0.030
Slope, Sx (ft/ft)	= 0.020
Local Depr (in)	= -0-
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= 1.30
Gutter n-value	= 0.013

Calculations

Compute by:	Known Q
Q (cfs)	= 49.00

Highlighted

Q Total (cfs)	= 49.00
Q Capt (cfs)	= 2.72
Q Bypass (cfs)	= 46.28
Depth at Inlet (in)	= 6.78
Efficiency (%)	= 6
Gutter Spread (ft)	= 27.26
Gutter Vel (ft/s)	= 6.58
Bypass Spread (ft)	= 26.68
Bypass Depth (in)	= 6.64



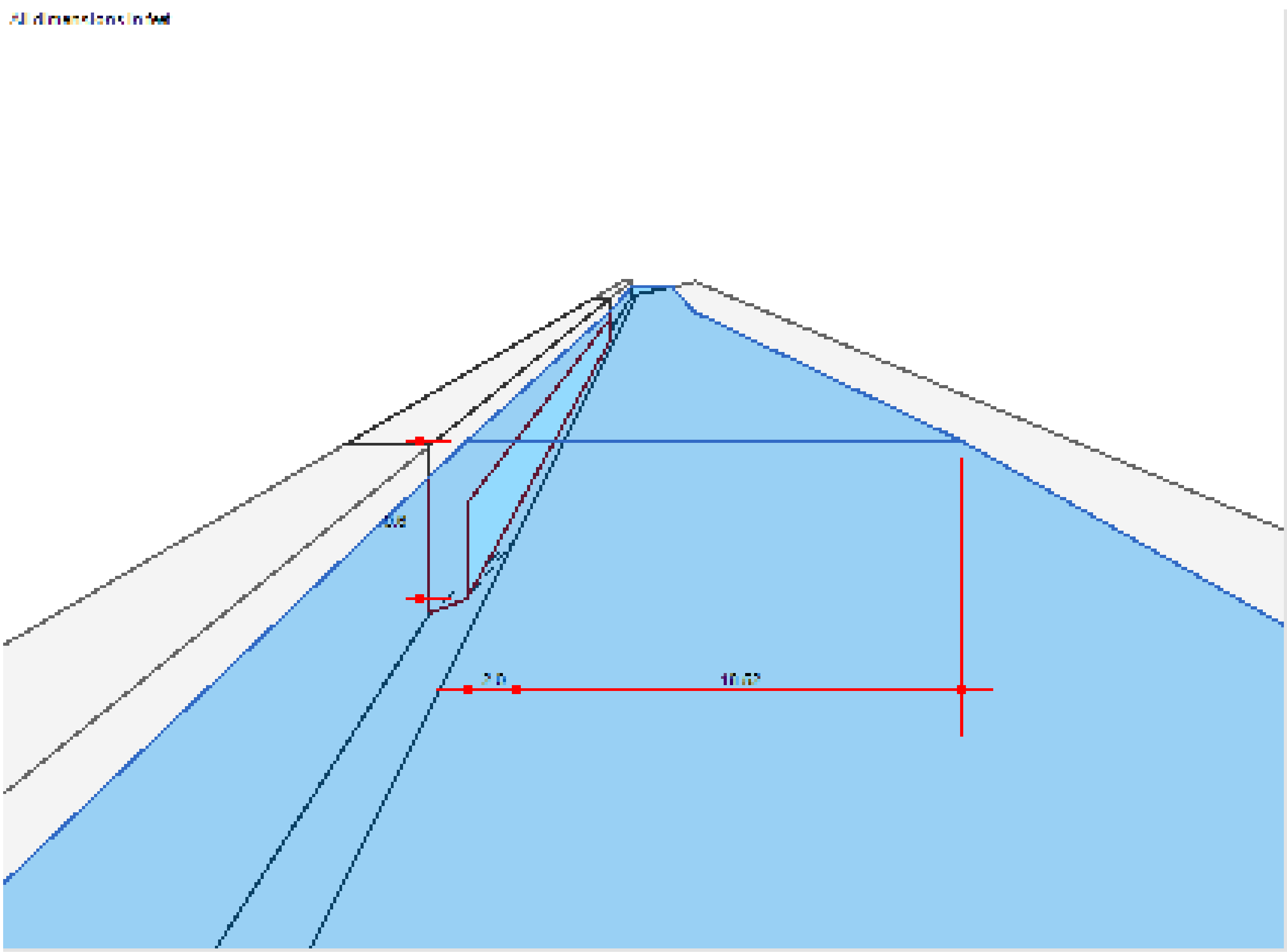
Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 28 2023

PC Inlet FID 3.1 - 2inch local depression

Proposed Curb Inlet Upstream of Existing Inlet 005510IN

Curb Inlet			**Calculations**		
Location	=	On grade	Compute by:		Known Q
Curb Length (ft)	=	20.00	Q (cfs)	=	23.07
Throat Height (in)	=	0.33			
Grate Area (sqft)	=	-0-	**Highlighted**		
Grate Width (ft)	=	-0-	Q Total (cfs)	=	23.07
Grate Length (ft)	=	-0-	Q Capt (cfs)	=	12.95
			Q Bypass (cfs)	=	10.12
Gutter			Depth at Inlet (in)	=	7.16
Slope, Sw (ft/ft)	=	0.030	Efficiency (%)	=	56
Slope, Sx (ft/ft)	=	0.020	Gutter Spread (ft)	=	20.52
Local Depr (in)	=	2.00	Gutter Vel (ft/s)	=	5.45
Gutter Width (ft)	=	2.00	Bypass Spread (ft)	=	15.02
Gutter Slope (%)	=	1.30	Bypass Depth (in)	=	3.84
Gutter n-value	=	0.013			



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. | Thursday, Sep 28 2023

PC Inlet FID 3.2 - 2 inch local depression

Proposed Curb Inlet 005510IN

Curb Inlet

Location = On grade
Curb Length (ft) = 20.00
Throat Height (in) = 0.33
Grate Area (sqft) = -0-
Grate Width (ft) = -0-
Grate Length (ft) = -0-

Gutter

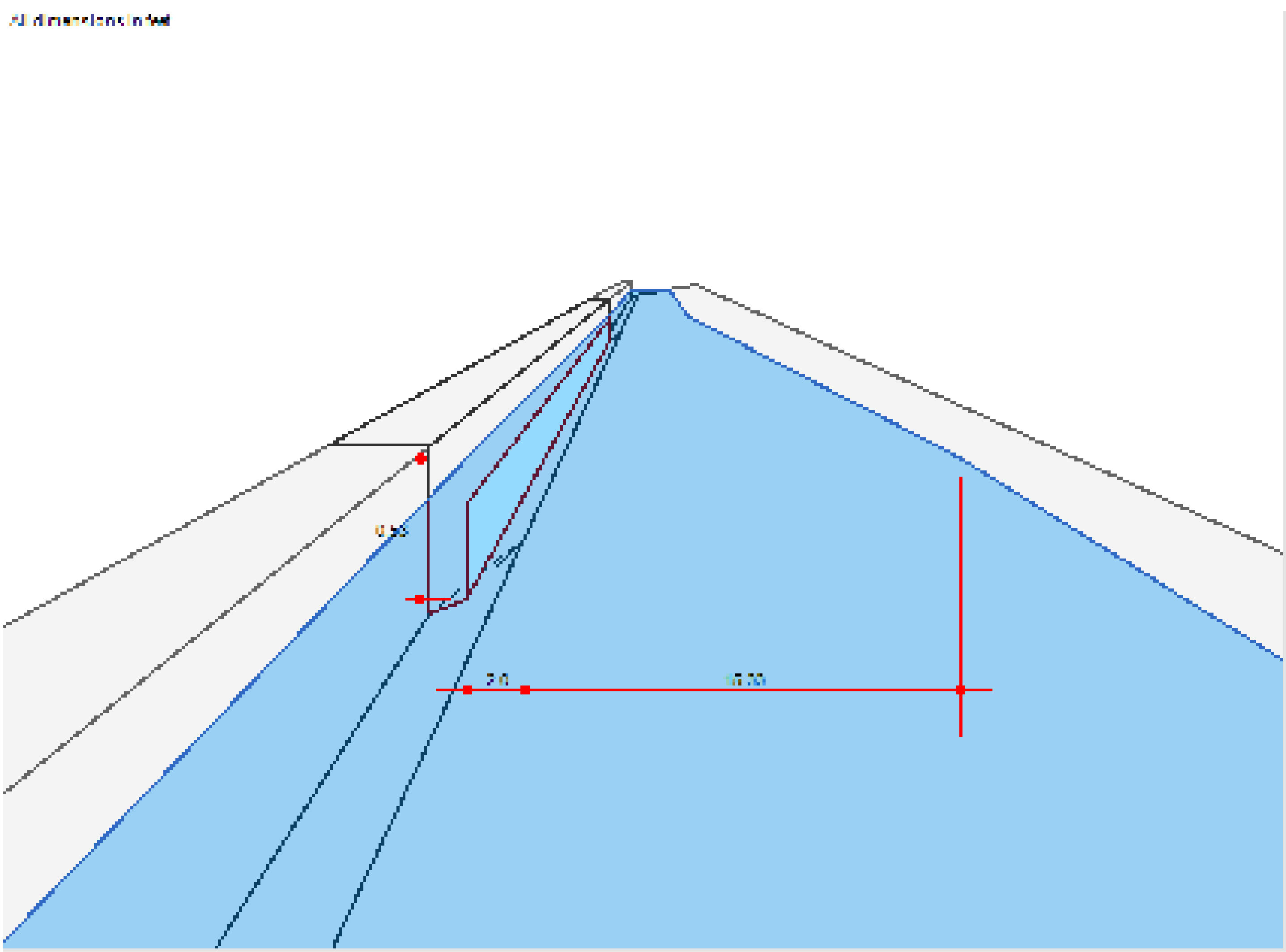
Slope, Sw (ft/ft) = 0.030
Slope, Sx (ft/ft) = 0.020
Local Depr (in) = 2.00
Gutter Width (ft) = 2.00
Gutter Slope (%) = 1.60
Gutter n-value = 0.013

Calculations

Compute by: Known Q
Q (cfs) = 16.38

Highlighted

Q Total (cfs) = 16.38
Q Capt (cfs) = 10.24
Q Bypass (cfs) = 6.14
Depth at Inlet (in) = 6.40
Efficiency (%) = 62
Gutter Spread (ft) = 17.33
Gutter Vel (ft/s) = 5.42
Bypass Spread (ft) = 11.93
Bypass Depth (in) = 3.10



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Oct 5 2023

Inlet FID 6_2

Existing inlet 005514IN

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	9.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

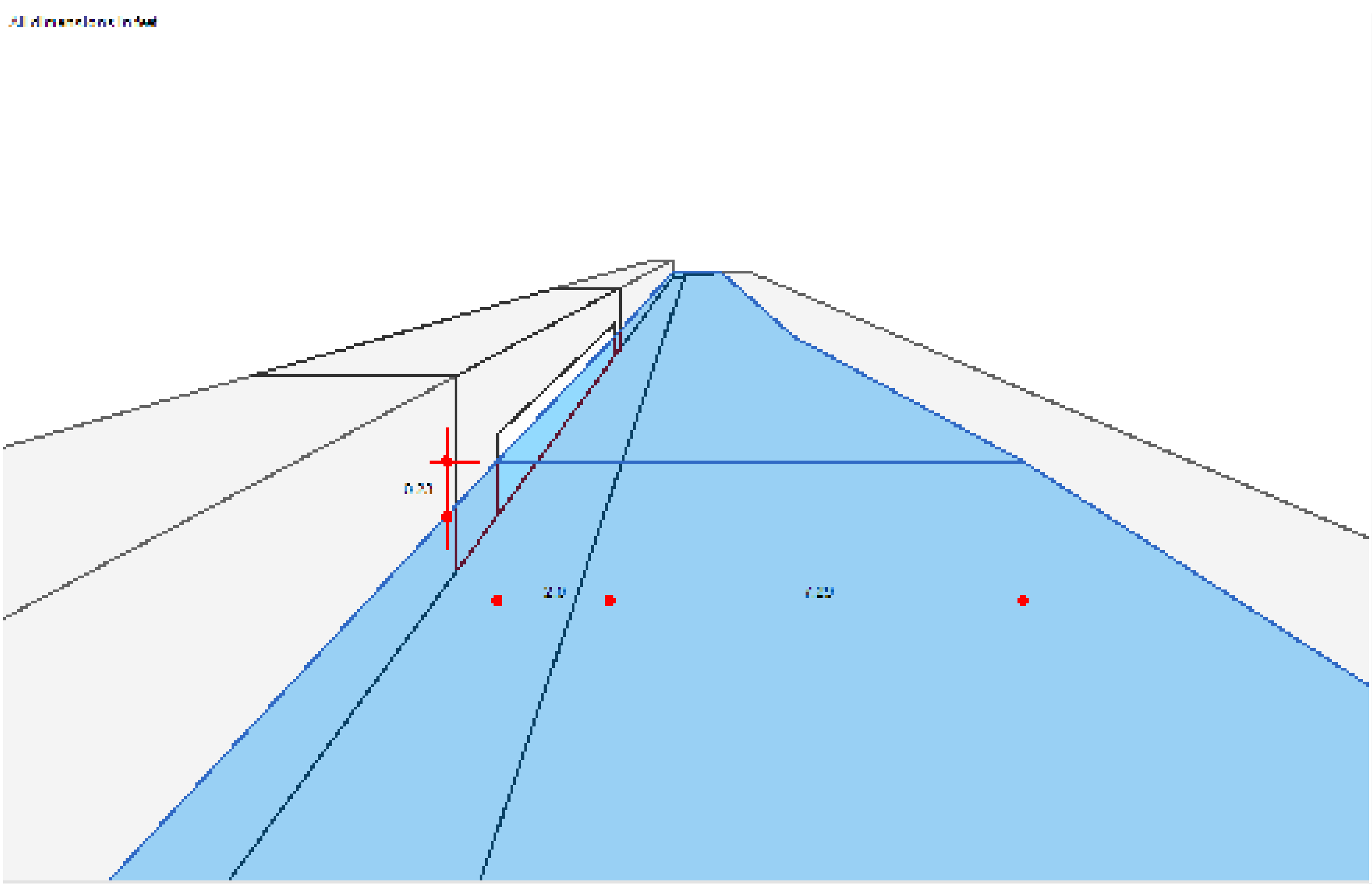
Slope, Sw (ft/ft)	=	0.040
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	-0-
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	3.10
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	4.70

Highlighted

Q Total (cfs)	=	4.70
Q Capt (cfs)	=	1.57
Q Bypass (cfs)	=	3.13
Depth at Inlet (in)	=	2.71
Efficiency (%)	=	33
Gutter Spread (ft)	=	9.29
Gutter Vel (ft/s)	=	5.20
Bypass Spread (ft)	=	7.87
Bypass Depth (in)	=	2.37



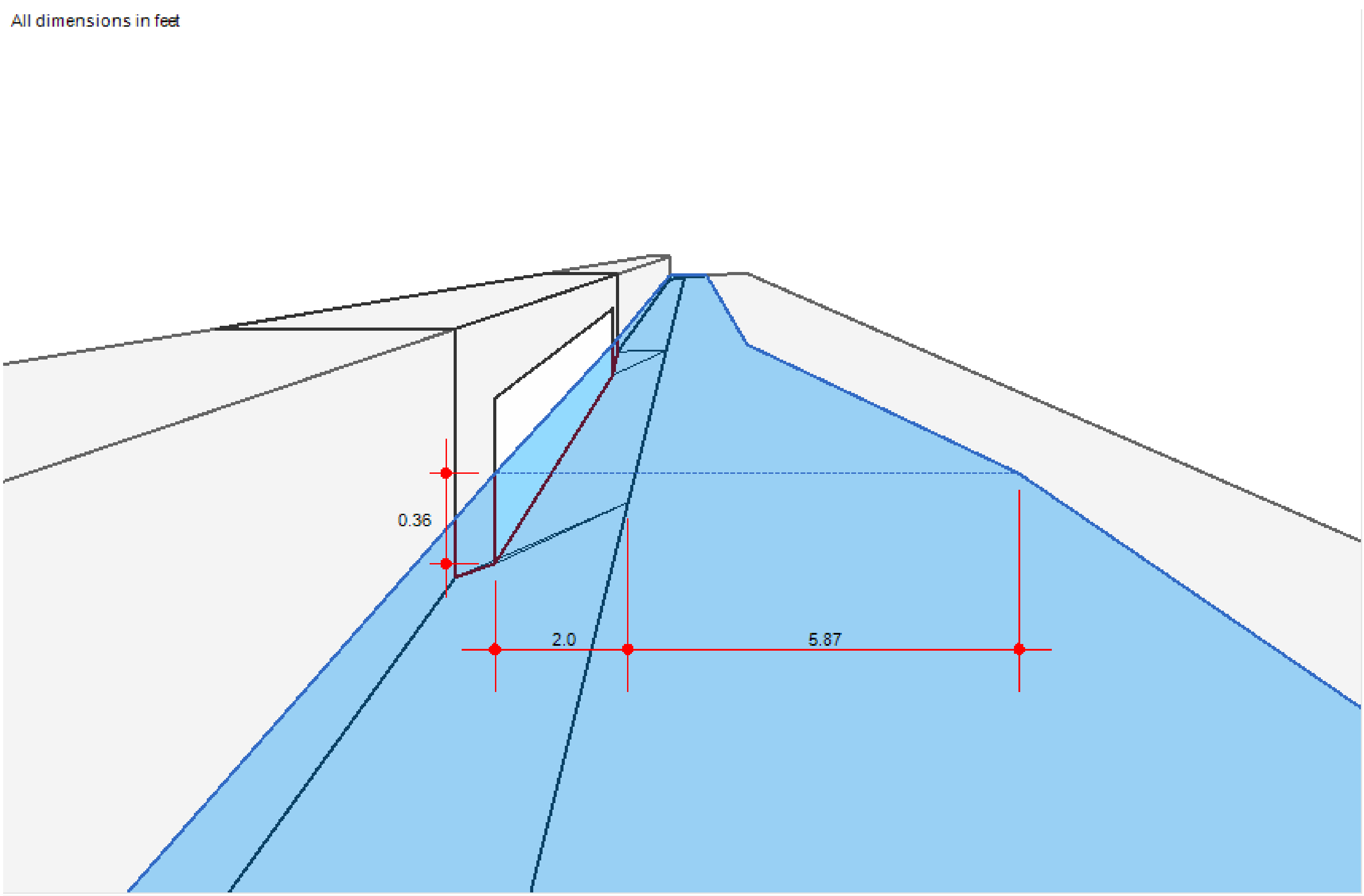
Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 6 2023

Inlet FID 6_2

Proposed Inlet replaced same size with 2" local depression at 005514IN

Curb Inlet		**Calculations**	
Location	= On grade	Compute by:	Known Q
Curb Length (ft)	= 9.00	Q (cfs)	= 3.13
Throat Height (in)	= 4.00		
Grate Area (sqft)	= -0-	**Highlighted**	
Grate Width (ft)	= -0-	Q Total (cfs)	= 3.13
Grate Length (ft)	= -0-	Q Capt (cfs)	= 2.01
		Q Bypass (cfs)	= 1.12
Gutter		Depth at Inlet (in)	= 4.37
Slope, Sw (ft/ft)	= 0.040	Efficiency (%)	= 64
Slope, Sx (ft/ft)	= 0.020	Gutter Spread (ft)	= 7.87
Local Depr (in)	= 2.00	Gutter Vel (ft/s)	= 4.75
Gutter Width (ft)	= 2.00	Bypass Spread (ft)	= 5.04
Gutter Slope (%)	= 3.10	Bypass Depth (in)	= 1.69
Gutter n-value	= 0.013		



Inlet Report

Inlet FID 11

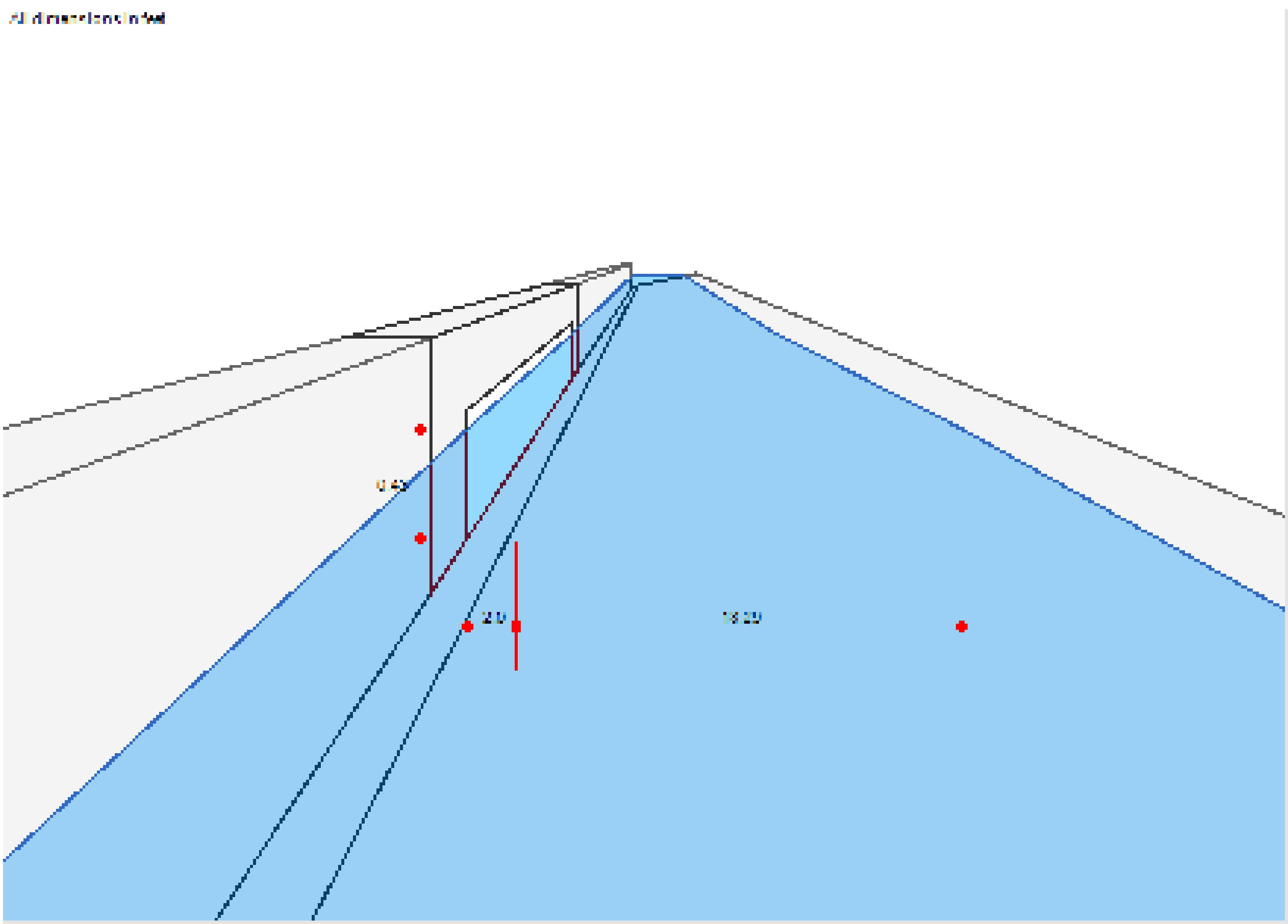
Existing Curb Inlet 005508IN

Curb Inlet		
Location	=	On grade
Curb Length (ft)	=	8.00
Throat Height (in)	=	6.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter		
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	-0-
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	2.20
Gutter n-value	=	0.013

Calculations		
Compute by:		Known Q
Q (cfs)	=	29.11

Highlighted		
Q Total (cfs)	=	29.11
Q Capt (cfs)	=	3.91
Q Bypass (cfs)	=	25.20
Depth at Inlet (in)	=	5.11
Efficiency (%)	=	13
Gutter Spread (ft)	=	20.29
Gutter Vel (ft/s)	=	7.04
Bypass Spread (ft)	=	19.21
Bypass Depth (in)	=	4.85



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 28 2023

PC Inlet FID 11 - 2inch local depression

Proposed Curb Inlet 005508IN

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	20.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

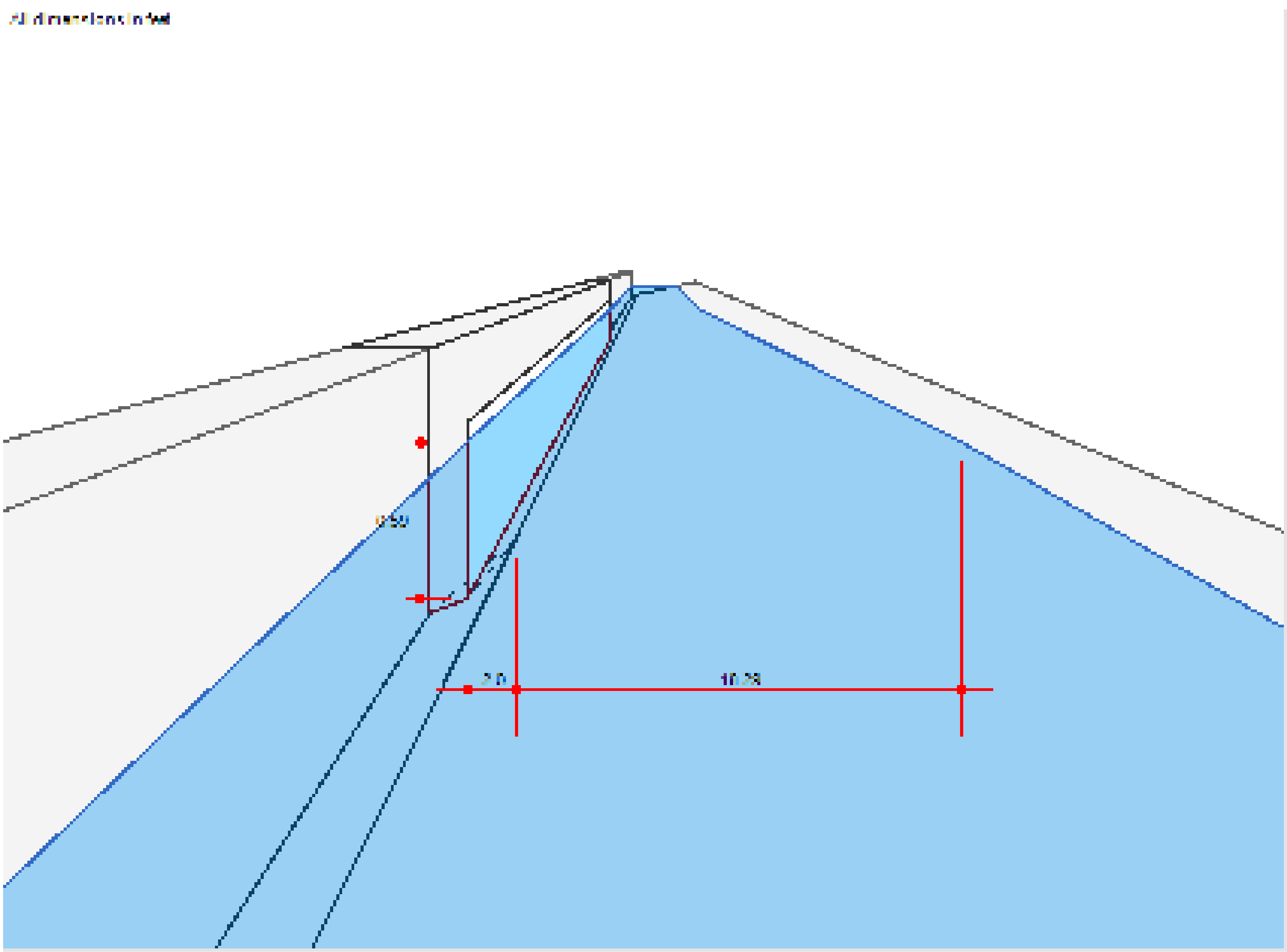
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	2.20
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	29.11

Highlighted

Q Total (cfs)	=	29.11
Q Capt (cfs)	=	13.22
Q Bypass (cfs)	=	15.89
Depth at Inlet (in)	=	7.11
Efficiency (%)	=	45
Gutter Spread (ft)	=	20.29
Gutter Vel (ft/s)	=	7.04
Bypass Spread (ft)	=	16.13
Bypass Depth (in)	=	4.11



Inlet Report

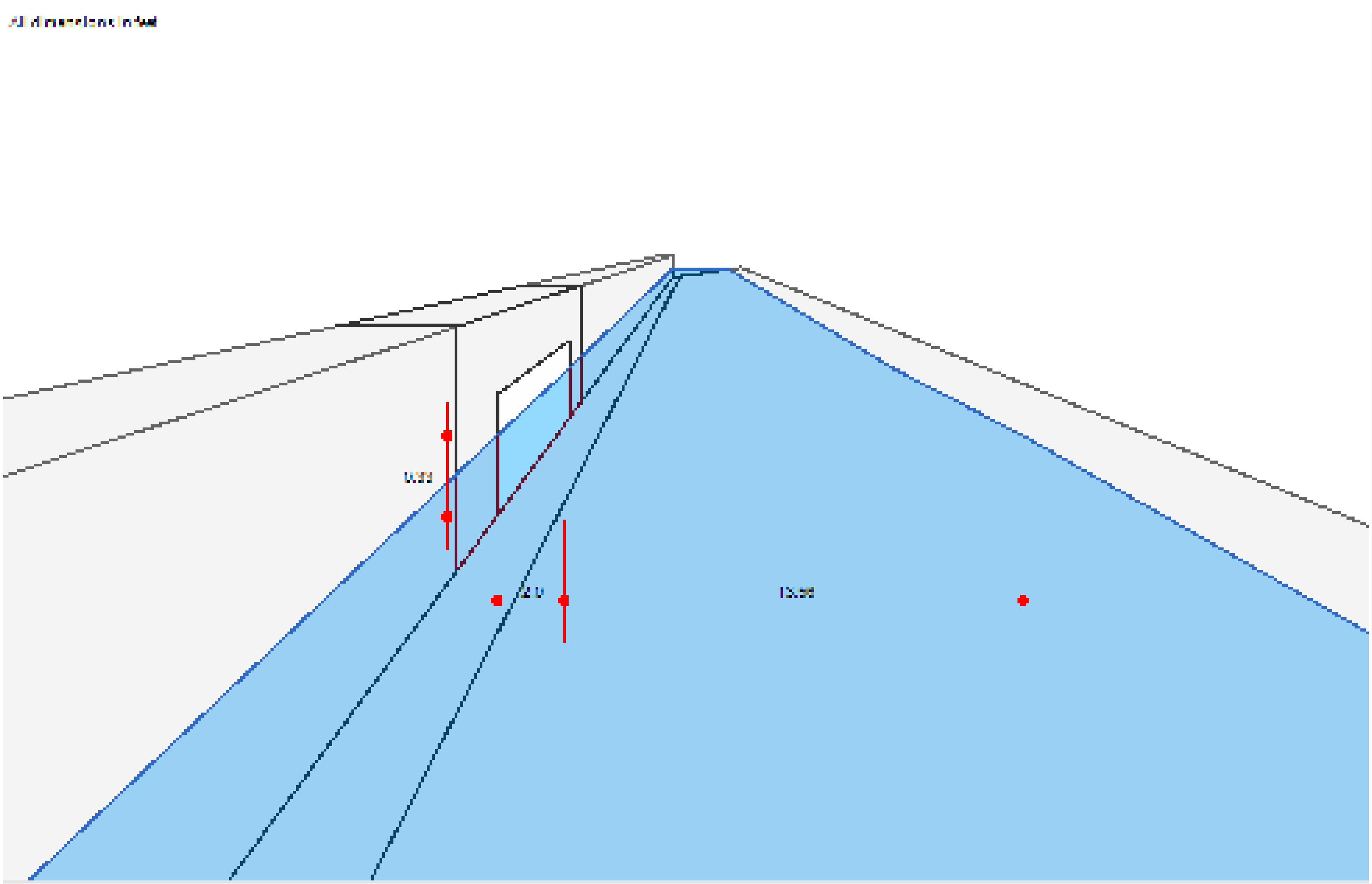
Inlet FID 12 Existing Curb Inlet 005511IN

Curb Inlet		
Location	=	On grade
Curb Length (ft)	=	3.50
Throat Height (in)	=	6.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter		
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	-0-
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	3.00
Gutter n-value	=	0.013

Calculations		
Compute by:		Known Q
Q (cfs)	=	16.88

Highlighted		
Q Total (cfs)	=	16.88
Q Capt (cfs)	=	1.18
Q Bypass (cfs)	=	15.70
Depth at Inlet (in)	=	3.97
Efficiency (%)	=	7
Gutter Spread (ft)	=	15.56
Gutter Vel (ft/s)	=	6.91
Bypass Spread (ft)	=	15.14
Bypass Depth (in)	=	3.87

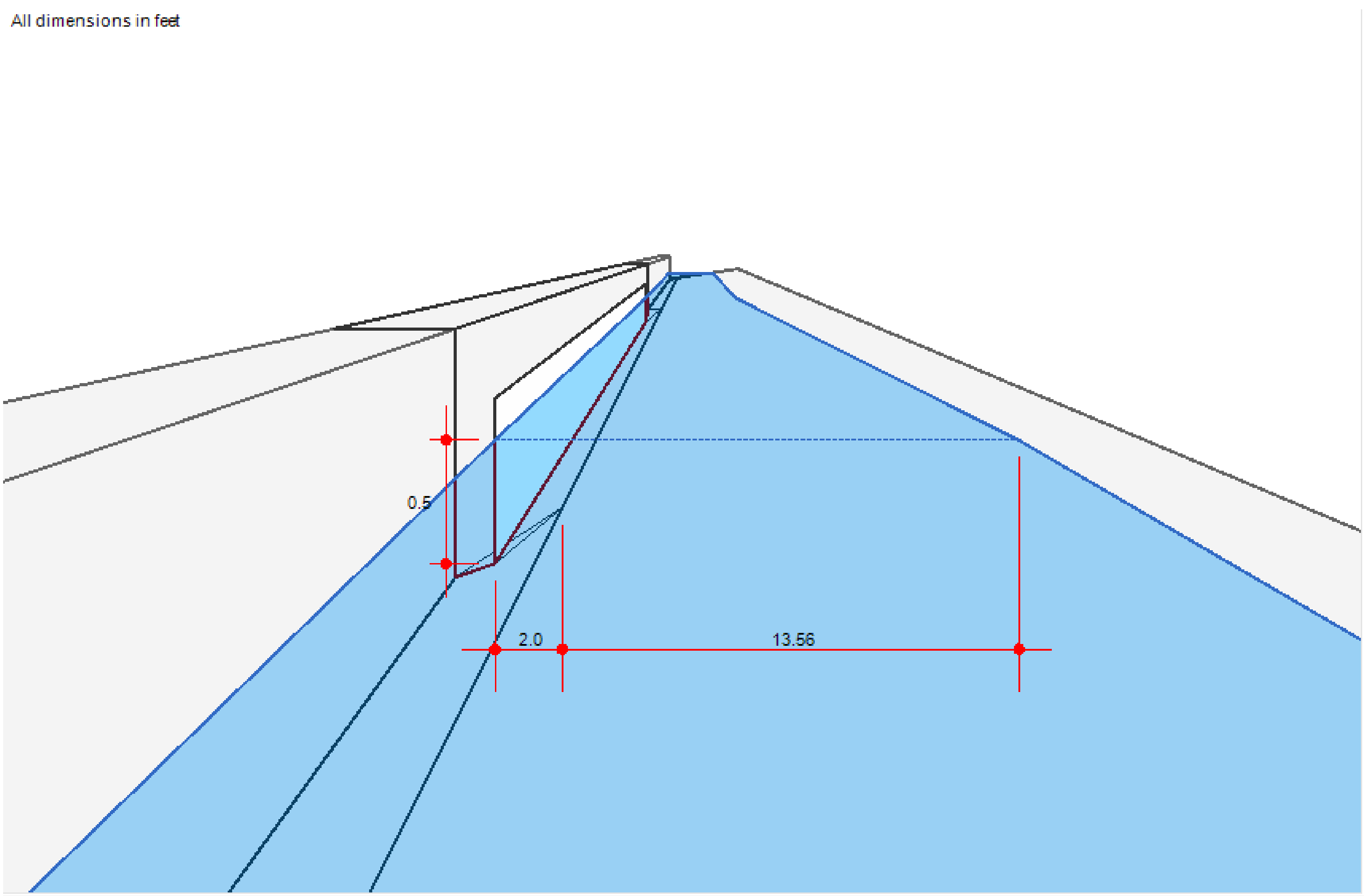


Inlet Report

PC Inlet FID 12 - 2inch local depression

Proposed Curb Inlet 005511IN

Curb Inlet		**Calculations**	
Location	= On grade	Compute by:	Known Q
Curb Length (ft)	= 20.00	Q (cfs)	= 16.88
Throat Height (in)	= 4.00		
Grate Area (sqft)	= -0-	**Highlighted**	
Grate Width (ft)	= -0-	Q Total (cfs)	= 16.88
Grate Length (ft)	= -0-	Q Capt (cfs)	= 9.23
		Q Bypass (cfs)	= 7.65
Gutter		Depth at Inlet (in)	= 5.97
Slope, Sw (ft/ft)	= 0.030	Efficiency (%)	= 55
Slope, Sx (ft/ft)	= 0.020	Gutter Spread (ft)	= 15.56
Local Depr (in)	= 2.00	Gutter Vel (ft/s)	= 6.91
Gutter Width (ft)	= 2.00	Bypass Spread (ft)	= 11.50
Gutter Slope (%)	= 3.00	Bypass Depth (in)	= 3.00
Gutter n-value	= 0.013		



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. — Thursday, Oct 5 2023

Inlet FID 19

Existing Inlet 007610IN

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	4.50
Throat Height (in)	=	6.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

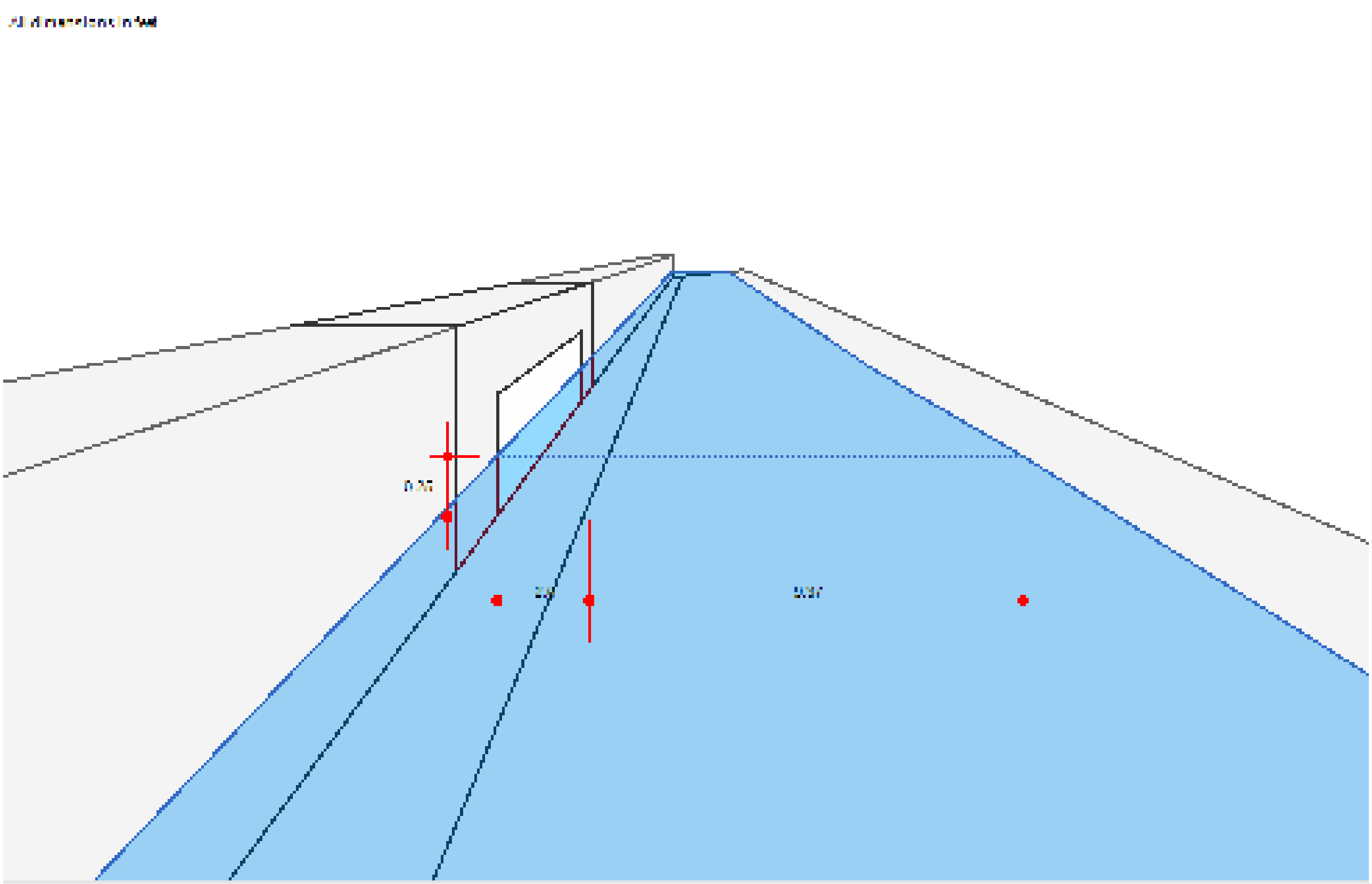
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	-0-
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	6.10
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	10.57

Highlighted

Q Total (cfs)	=	10.57
Q Capt (cfs)	=	0.95
Q Bypass (cfs)	=	9.62
Depth at Inlet (in)	=	2.97
Efficiency (%)	=	9
Gutter Spread (ft)	=	11.37
Gutter Vel (ft/s)	=	8.06
Bypass Spread (ft)	=	10.96
Bypass Depth (in)	=	2.87



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Oct 5 2023

PC Inlet FID 19.1

Proposed Inlet 007610IN

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	20.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	6.10
Gutter n-value	=	0.013

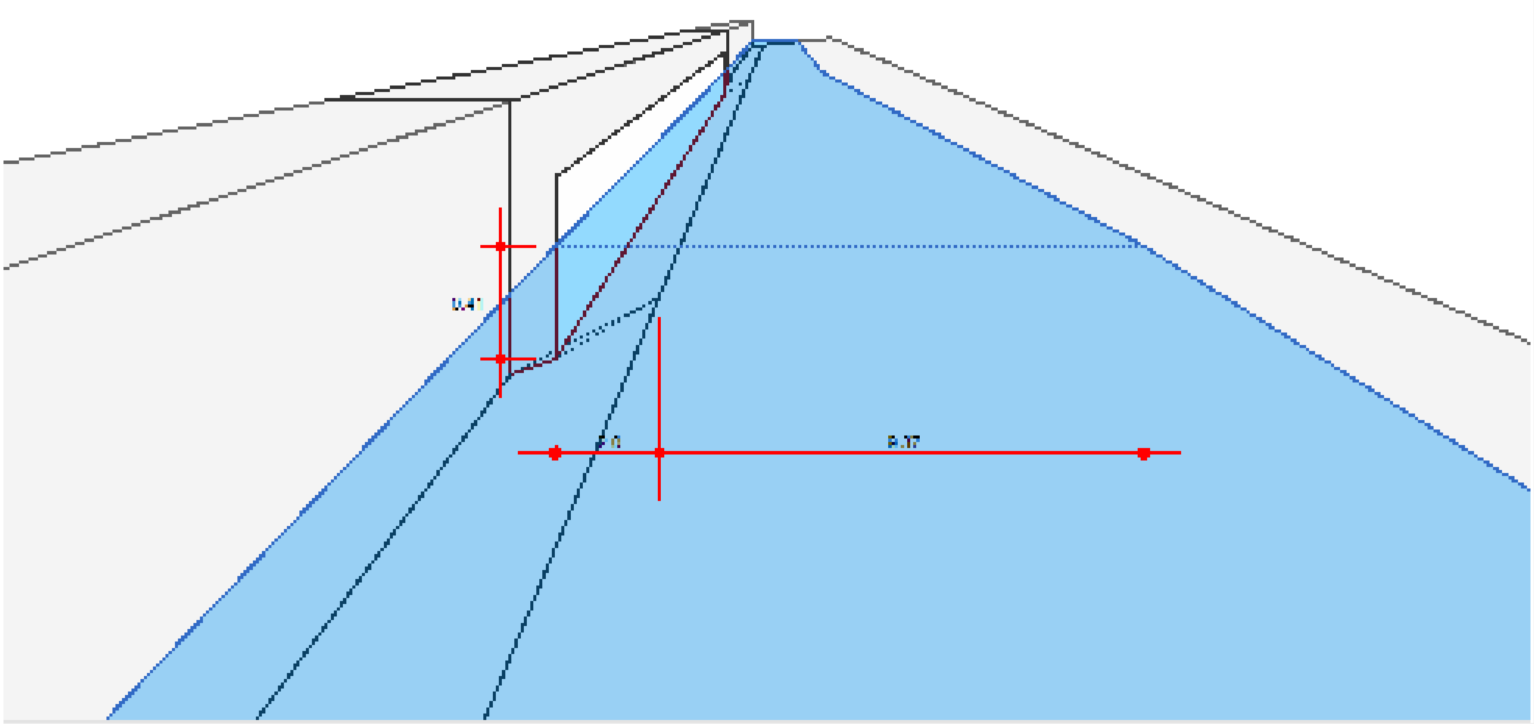
Calculations

Compute by:		Known Q
Q (cfs)	=	10.57

Highlighted

Q Total (cfs)	=	10.57
Q Capt (cfs)	=	6.22
Q Bypass (cfs)	=	4.35
Depth at Inlet (in)	=	4.97
Efficiency (%)	=	59
Gutter Spread (ft)	=	11.37
Gutter Vel (ft/s)	=	8.06
Bypass Spread (ft)	=	8.05
Bypass Depth (in)	=	2.17

All dimensions in feet



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. | Thursday, Oct 5 2023

Inlet FID 26

Existing Curb Inlet 005460IN

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	13.50
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

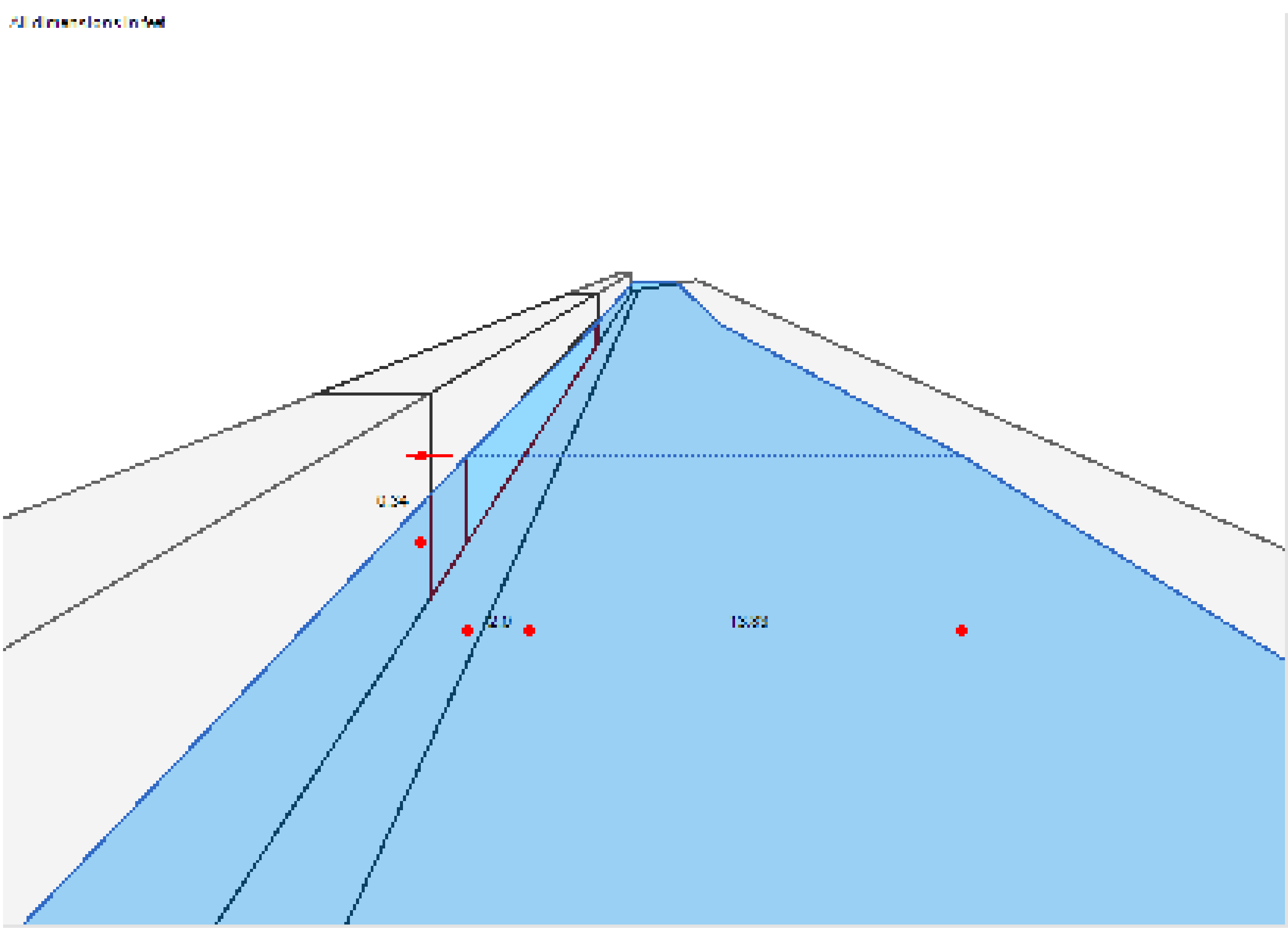
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	-0-
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	1.10
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	10.70

Highlighted

Q Total (cfs)	=	10.70
Q Capt (cfs)	=	4.29
Q Bypass (cfs)	=	6.41
Depth at Inlet (in)	=	4.04
Efficiency (%)	=	40
Gutter Spread (ft)	=	15.83
Gutter Vel (ft/s)	=	4.24
Bypass Spread (ft)	=	13.02
Bypass Depth (in)	=	3.36



Inlet Report

PC Inlet FID 26 - 2inch local depression

Proposed Curb Inlet 005460IN

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	20.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

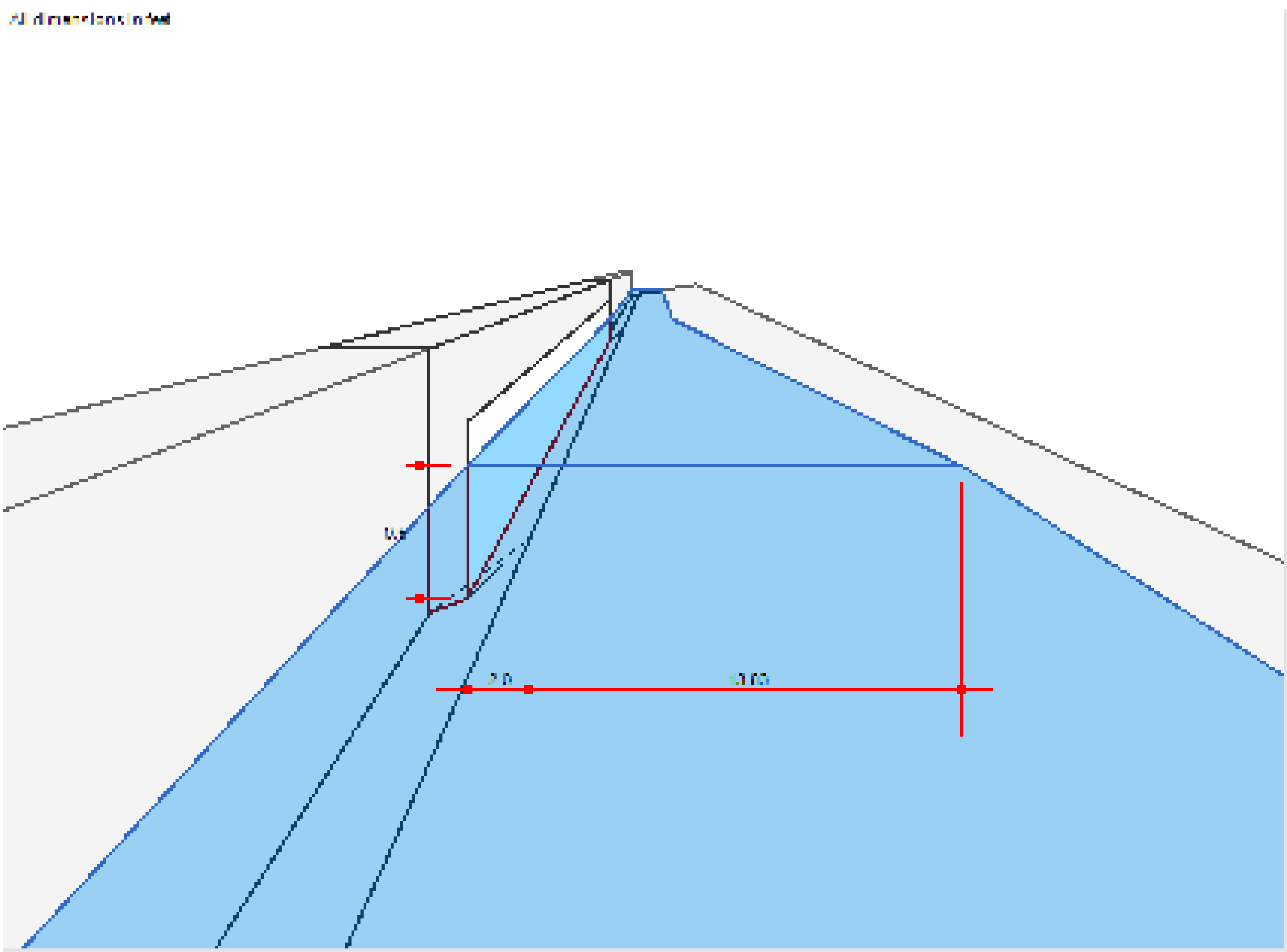
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	1.10
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	10.70

Highlighted

Q Total (cfs)	=	10.70
Q Capt (cfs)	=	8.44
Q Bypass (cfs)	=	2.26
Depth at Inlet (in)	=	6.04
Efficiency (%)	=	79
Gutter Spread (ft)	=	15.83
Gutter Vel (ft/s)	=	4.24
Bypass Spread (ft)	=	8.71
Bypass Depth (in)	=	2.33



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Oct 5 2023

Inlet FID 27 Existing Curb Inlet 005509IN

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	9.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

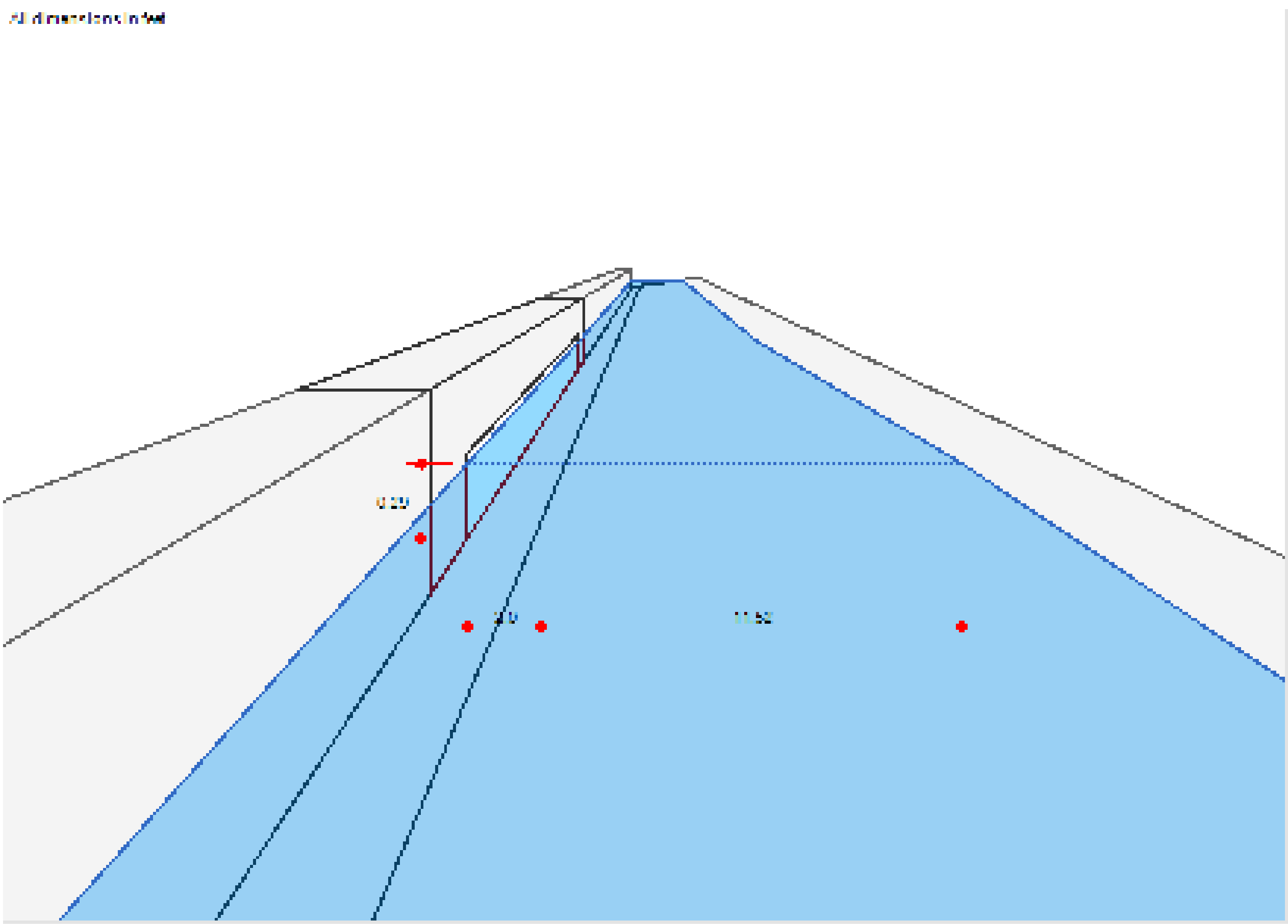
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	-0-
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	2.30
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	10.22

Highlighted

Q Total (cfs)	=	10.22
Q Capt (cfs)	=	2.38
Q Bypass (cfs)	=	7.84
Depth at Inlet (in)	=	3.48
Efficiency (%)	=	23
Gutter Spread (ft)	=	13.52
Gutter Vel (ft/s)	=	5.53
Bypass Spread (ft)	=	12.22
Bypass Depth (in)	=	3.17



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 28 2023

PC Inlet FID 27 - 2inch local depression

Proposed Curb Inlet 005509IN

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	20.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

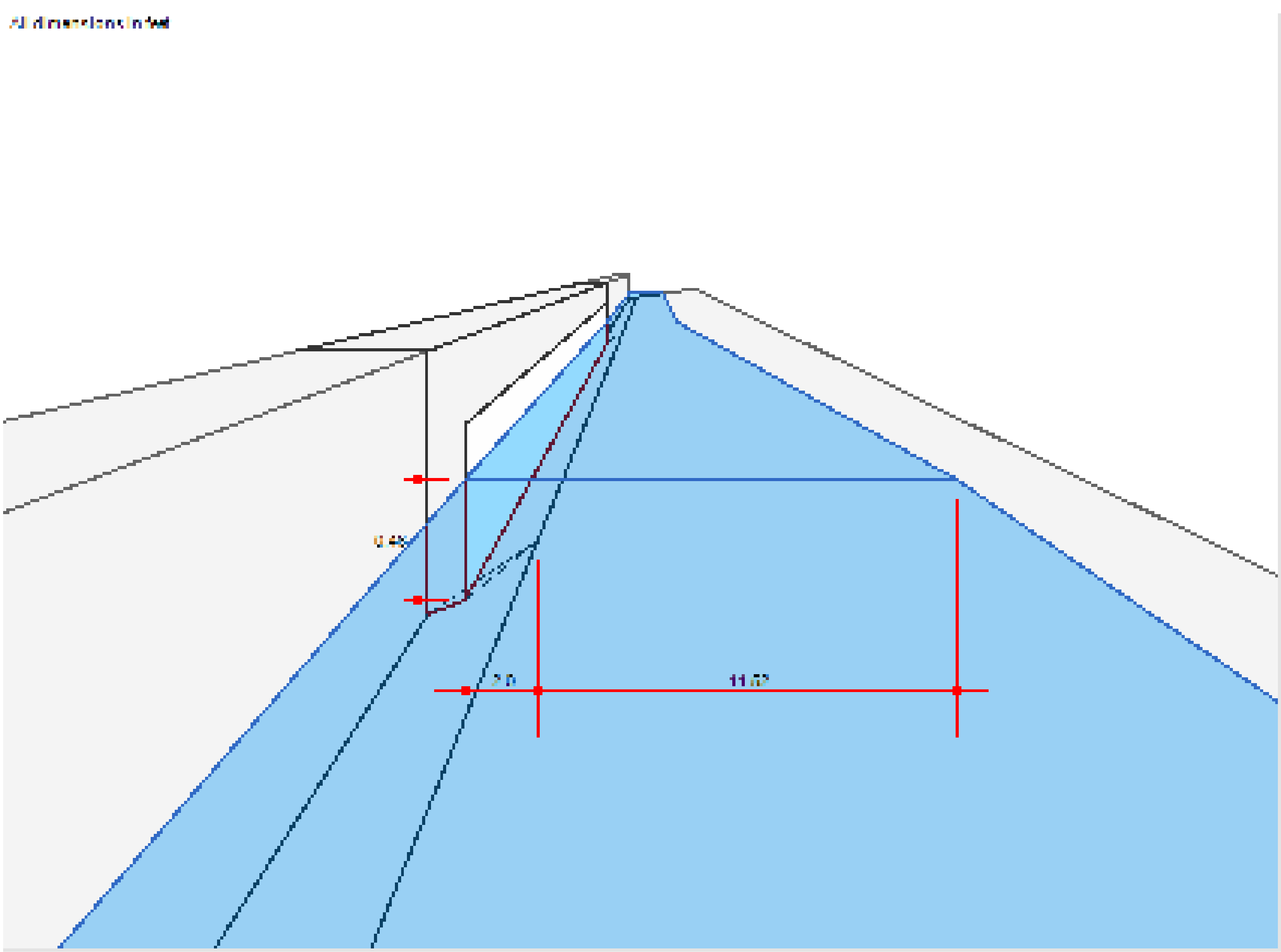
Slope, Sw (ft/ft)	=	0.030
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	2.30
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	10.22

Highlighted

Q Total (cfs)	=	10.22
Q Capt (cfs)	=	7.27
Q Bypass (cfs)	=	2.95
Depth at Inlet (in)	=	5.48
Efficiency (%)	=	71
Gutter Spread (ft)	=	13.52
Gutter Vel (ft/s)	=	5.53
Bypass Spread (ft)	=	8.38
Bypass Depth (in)	=	2.25



Ability of Alexandria to Provide its Share of the Project Cost

In response to these recurring flooding events, in May 2021 the City Council unanimously adopted an ordinance to double our Stormwater Utility Fee with a 50% increase in the rate for the May 2021 billing and an additional 50% increase in the rate for the October billing to significantly increase local resources available for investments in our storm sewer infrastructure. The development of the FY 2022 – FY 2031 Stormwater Management Utility Ten Year Plan for funding of operating and capital improvement program (CIP) costs, included the identification and funding schedule for 11 top priority flooding mitigation capacity projects that include a mix of storage, conveyance, and green infrastructure. The 10-Year Plan also includes annually increasing funding for spot improvement projects and increased maintenance activities citywide. The Stormwater Utility Fee, paid by all property owners in the City (including non-taxable properties), will enable an acceleration of major capacity projects and spot improvement projects, an increase in channel maintenance, new state-of-good repair investments, property owner grants, and new staffing in support of these projects. The City confirms that it can cover the Cost Share required for this project with funding identified in the FY 2025 Stormwater Management CIP under the Storm Sewer Spot Improvement program.

RESOLUTION NO 3251

WHEREAS, the City Council of the City of Alexandria desires to apply for an allocation of funds from the Virginia Department of Conservation and Recreation (DCR) of up to $2,160,000 for the Round 5 Virginia Community Flood Preparedness Fund (CFPF) grant, or 60% of the estimated $3,600,000 for the Valley Drive Storm Drain Improvements capital project; and,

WHEREAS, the City of Alexandria hereby supports this application for an allocation of $2,160,000 through the DCR CFPF grant program.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF ALEXANDRIA, VIRGINIA:

1. The City Council of the City of Alexandria hereby endorses this application for an allocation up to $2,160,000 through the Round 5 Virginia Community Preparedness Fund (CFPF) grant.

2. The City Council of the City of Alexandria hereby grants authority for the City Manager to execute project administration agreements for any approved revenue sharing projects.

3. The City Council of the City of Alexandria hereby commits to fund its local share of the development of the Flood Resilience Plan in accordance with the cost estimate.

Adopted: October 22, 2024

JUSTIN M. WILSON MAYOR

ATTEST:

Gloria Sitton

Gloria A. Sitton, CMC City Clerk

Benefit-Cost Analysis

The *Valley Drive Storm Drain Improvement Project* is located in the northern most subwatershed of Hooff's Run watershed. A benefit-cost analysis was performed using generic depth-damage curves from the U.S. Army Corps of Engineers flood damage reduction studies[3]. Each of the three properties subject to flood damage associated with this project were assessed based on depth, mean of damage, and standard deviation of damage associated with each structure by type. Table 1 provides a summary of the expected flood depth by property type.

Table 1. Flood Depth by Structure Type (adapted from Economic Guidance Memorandum 04-01, Generic Depth-Damage Relationships for Residential Structures with Basements)

Structure No.	Description	Depth	Mean of Damage (%)	Standard Deviation of Damage (%)
1	2 or more stories – no basement	2	20.9	2.8
2	2 or more stories – with basement	3	17.7%	1.43
3	1 story – with basement	1	32.0	0.96

Preliminary Calculations

Table 2 provides the inputs (costs / benefits) and results (BCA of 1.01) from the FEMA Benefit Cost Analysis Tool. Of note, to estimate benefits, quantified avoided damages was calculated using the 2024 tax assessed values for the three properties; actual market values may be higher.

Table 2. Valley Drive BCA

Valley Drive BCA CFPF 2025						
Project Costs						
	Total Project Costs (Planning, Design, Construction)					$ 2,346,000
	Annual Maintenance Cost (50 year life)					$ 10,000
	Discounted Maintenance Costs (3% per year)					$ 257,288
	Present Value Total Project Costs					**$ 2,603,288**
Project Benefits						
Avoided Property Damage (Per Flood Event)						
Property Damage Reduction						
	Pre-Project Damages					
	Property	Tax assessed value	Type	Flood Depth	Damage %	Damages
	Home 1	$ 1,003,946	SFR 1-story w/basement	1	0.32	$ 321,263
	Home 2	$ 896,423	SFR 2-story no basement	2	0.209	$ 187,352
	Home 3	$ 1,285,043	SFR 2-story w/basement	3	0.177	$ 227,453
	Total Pre-Project Damages					**$ 736,068**
	Post-Project Damages					
	Property	Tax assessed value	Type	Flood Depth	Damage %	Damages
	Home 1	$ 1,003,946	SFR 1-story w/basement	0.5	0.05	$ 50,197
	Home 2	$ 896,423	SFR 2-story no basement	0.5	0.05	$ 44,821
	Home 3	$ 1,285,043	SFR 2-story w/basement	0.5	0.05	$ 64,252
	Total Post-Project Damages					**$ 159,271**
	Avoided Damages (Per Flood Event)					**$ 576,797**
Benefit Over Project Lifespan (50-years)						
	Assume a **10-year design storm** has a 10% chance of occurring annually.					
	Over 50 years: Expected number of 10-year storms ? 50×0.10=550 \times 0.10					5
	Total Avoided Damages (Undiscounted)					$ 2,883,986
	Present Value of Benefits					**$ 2,641,561**
Benefit-Cost Ratio						**1.01**

$$BCR = \frac{\text{Present Value of Benefits}}{\text{Present Value of Costs}}$$

Repetitive Loss and/or Severe Repetitive Loss

Within the project area, there are no repetitive loss and/or severe reparative loss properties as indicated by FEMA.

Work Plan

The proposed project will implement three strategies in the neighborhood to help mitigate flooding: (1) add a new storm drain pipe system and new curb inlets along Crestwood Drive; (2) perform a storm drain pipe realignment at Dogwood Drive; and (3) increase storm drain inlet capacity along Valley Drive.

A new storm drain pipe system is proposed along Crestwood Drive that will share the conveyance capacity with the existing pipes on Crestwood Drive, and ultimately drain into the system along Valley Drive. This new storm drain system will provide an alternative path for water to be conveyed, thus freeing up capacity along the backyard pipe system. In addition, there will be new and upsized inlets along Crestwood Drive to provide more conveyance for stormwater, thus reducing flood inundation and bypass flows to the Crestwood Drive/Valley Drive intersection. Multiple curb inlets along Valley Drive are proposed to provide increase stormwater conveyance at multiple locations where there was significant bypass flows and gutter spread. These locations have seen substantial reduction in bypass flows and the associated storm drain pipes have been upsized to provide more capacity for the increased flows conveyed by each inlet. The last spot project involves pipe realignment and a curb inlet upsize at the Dogwood Drive intersection. This separates the two storm drain pipe systems along Valley Drive and realigns the systems to run parallel.

The project also will implement Green Infrastructure within strategically targeted areas within the City's Right-of-Way, to help further mitigate flooding.

It is anticipated that these strategies will take three years to complete as presented in Table 1, Project Timeline.

Green Infrastructure Implementation

Several green infrastructure technologies are considered feasible within the Valley Drive Storm Drain Improvement Project area City of Alexandria including: Bioretention/ Planters; Porous Pavement in ROW; Surface Storage (i.e., retrofit of inlets and catch basins to include flow regulators on streets with standard curb and gutter system so that stormwater can be stored within the roadway and slowly released back into the storm sewer system); and "Blue Streets" which provide short term surface storage on streets with relatively flat slopes and standard curb and gutter systems.

Table 1. Project Timeline

Phase	FY2026		FY2027				FY2028				FY2029	
	Q3	Q4	Q1	Q3	Q2	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Planning	X											
Design Procurement		X										
Design			X	X	X	X						
Construction Procurement							X					
Construction								X	X	X	X	
Project Closeout												X

Table 2. Milestones

Milestone	Deliverable
Project Planning	• Project Charter • Project Management Plan • Project Work Breakdown Structure • Project Schedule
Design Services Task Order	• Task Order Request based on existing contract • Task Order approval • Purchase Order and Notice to Proceed
Design Phase	• Recommendations for incorporating green infrastructure, where feasible Design Plans Sketch and/or 30% and Final Design • Construction Specifications at Final Design • Basis of Design including Hydraulic Calculations at 30% and Final Design • Cost Estimate at 30% and Final Design
Construction Procurement	• Invitation to Bid at contract award • Contractor Proposal at contract award • Purchase Order at contract award
Construction/Post Construction	• Sign & Sealed As-builts following project close out • Site photographs following project close out
Final Deliverables	• Report finalized based on project work and Team feedback • Lessons learned

The *Valley Drive Storm Drain Improvement Project* is comprised of the following specific tasks:

New Storm Drain Pipe System and New Curb Inlets along Crestwood Drive. The existing storm drain system that runs down Crestwood Drive and under the backyards of the homes on the west side of Valley Drive is surcharging along Crestwood Drive manholes and has caused flood damage to multiple homes. In addition, the only curb inlet on the south side of Crestwood Drive, near the intersection with Valley Drive is a small 4-foot-wide inlet. This inlet is over capacity, as over 21-cfs drains to this inlet, which flows over the crest of the curb and spreads downstream/south. To provide increased capacity and flow sharing between the storm drain system, a new storm drain system is being proposed as well as adding two inlets further uphill along Crestwood Drive and replacing an existing curb inlet with a larger inlet.

Storm Drain Pipe Realignment at Dogwood Drive. The proposed storm drain realignment is intended to separate the west and east storm drain system along Valley Drive, at the intersection with Dogwood Drive. The west storm drain system just south of Dogwood Drive has capacity to accept the flow from the storm drain system north of Dogwood Drive, thus relieving the eastern system which is over capacity in the existing conditions modeling near this intersection. The proposed pipe realignment includes abandoning pipe and adding a new 36-inch RCP. Since improvements are going to impact the existing curb inlet, it is recommended to replace and upsize the current curb inlet as well, to be a 4-inch x 20-foot wide opening with a 2-inch inlet local depressions, to maximize the inlet's conveyance capability.

Storm Drain Inlet Increased Capacity along Valley Drive. The current storm drain inlet placement within this neighborhood is generally located on Valley Drive or close by within an adjacent intersection. The neighborhood drainage areas drain from the west and east side of Valley Drive, towards Valley Drive, causing a significant amount of drainage to overwhelm the existing undersized curb inlets. Due to the drainage area of the existing inlets, spread calculations were completed to determine the peak flows draining to this inlet, inlet depths and gutter spread, see calculations for the existing and proposed spread analysis can be found in Appendix D. Most of the inlets evaluated are significantly overcapacity, resulting in significant amount of bypass flows and spread, that overwhelms downstream structures.

It is recommended to upsize many of the existing curb inlets and add additional new inlets that have storm drain pipes nearby, with larger 4-inch-tall x 20-foot-wide and 4-inch-tall x an additional 8-foot-wide curb opening, all that also have a 2-inch inlet depression. One set of inlets is not in great shape on the west side of Valley Drive along Summit Avenue and should be replaced with the same size inlets with the 2-inch local depression. The combined larger inlet openings, and steeper inlet local depression provides significantly greater conveyance by each inlet compared to the existing inlet openings. Due to the increased conveyance capacity of these proposed inlets the associated storm drain pipes were also upsized, if needed, to ensure drainage could be conveyed by both the inlet and the downstream pipe. These upsized inlets and pipes provide substantially more stormwater conveyance to convey efficiently, thus decreasing the amount of bypassing flow and stormwater spread throughout the intersection.

Maintenance Plan

City sewer infrastructure ‘state of good repair’ program maintenance objectives includes inspection and maintenance on a rotating 3-5 year service schedule. The City also performs inspection and maintenance in response to Alex311 service requests an in advance of forecasted storm events. The initial work will be inspected regularly early on to ensure proper functioning prior to the routine, rotating schedule being implemented. More information is available on the City’s Sewer Maintenance webpage.

Benefit-Cost Analysis

The *Valley Drive Storm Drain Improvement Project* is located in the northern most subwatershed of Hooff's Run watershed. A benefit-cost analysis was performed using generic depth-damage curves from the U.S. Army Corps of Engineers flood damage reduction studies[3]. Each of the three properties subject to flood damage associated with this project were assessed based on depth, mean of damage, and standard deviation of damage associated with each structure by type. Table 1 provides a summary of the expected flood depth by property type.

Table 1. Flood Depth by Structure Type (adapted from Economic Guidance Memorandum 04-01, Generic Depth-Damage Relationships for Residential Structures with Basements)

Structure No.	Description	Depth	Mean of Damage (%)	Standard Deviation of Damage (%)
1	2 or more stories – no basement	2	20.9	2.8
2	2 or more stories – with basement	3	17.7%	1.43
3	1 story – with basement	1	32.0	0.96

Preliminary Calculations

Table 2 provides the inputs (costs / benefits) and results (BCA of 1.01) from the FEMA Benefit Cost Analysis Tool. Of note, to estimate benefits, quantified avoided damages was calculated using the 2024 tax assessed values for the three properties; actual market values may be higher.

Table 2. Valley Drive BCA

Valley Drive BCA CFPF 2025						
Project Costs						
	Total Project Costs (Planning, Design, Construction)					$ 2,346,000
	Annual Maintenance Cost (50 year life)					$ 10,000
	Discounted Maintenance Costs (3% per year)					$ 257,288
	Present Value Total Project Costs					**$ 2,603,288**
Project Benefits						
Avoided Property Damage (Per Flood Event)						
Property Damage Reduction						
	Pre-Project Damages					
	Property	Tax assessed value	Type	Flood Depth	Damage %	Damages
	Home 1	$ 1,003,946	SFR 1-story w/basement	1	0.32	$ 321,263
	Home 2	$ 896,423	SFR 2-story no basement	2	0.209	$ 187,352
	Home 3	$ 1,285,043	SFR 2-story w/basement	3	0.177	$ 227,453
	Total Pre-Project Damages					**$ 736,068**
	Post-Project Damages					
	Property	Tax assessed value	Type	Flood Depth	Damage %	Damages
	Home 1	$ 1,003,946	SFR 1-story w/basement	0.5	0.05	$ 50,197
	Home 2	$ 896,423	SFR 2-story no basement	0.5	0.05	$ 44,821
	Home 3	$ 1,285,043	SFR 2-story w/basement	0.5	0.05	$ 64,252
	Total Post-Project Damages					**$ 159,271**
	Avoided Damages (Per Flood Event)					**$ 576,797**
Benefit Over Project Lifespan (50-years)						
	Assume a **10-year design storm** has a 10% chance of occurring annually.					
	Over 50 years: Expected number of 10-year storms ? 50×0.10=550 \times 0.10					5
	Total Avoided Damages (Undiscounted)					$ 2,883,986
	Present Value of Benefits					**$ 2,641,561**
Benefit-Cost Ratio						**1.01**

$$BCR = \frac{\text{Present Value of Benefits}}{\text{Present Value of Costs}}$$

RESOLUTION NO 3251

WHEREAS, the City Council of the City of Alexandria desires to apply for an allocation of funds from the Virginia Department of Conservation and Recreation (DCR) of up to $2,160,000 for the Round 5 Virginia Community Flood Preparedness Fund (CFPF) grant, or 60% of the estimated $3,600,000 for the Valley Drive Storm Drain Improvements capital project; and,

WHEREAS, the City of Alexandria hereby supports this application for an allocation of $2,160,000 through the DCR CFPF grant program.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF ALEXANDRIA, VIRGINIA:

1. The City Council of the City of Alexandria hereby endorses this application for an allocation up to $2,160,000 through the Round 5 Virginia Community Preparedness Fund (CFPF) grant.
2. The City Council of the City of Alexandria hereby grants authority for the City Manager to execute project administration agreements for any approved revenue sharing projects.
3. The City Council of the City of Alexandria hereby commits to fund its local share of the development of the Flood Resilience Plan in accordance with the cost estimate.

Adopted: October 22, 2024

JUSTIN M. WILSON MAYOR

ATTEST:

Gloria Sitton

Gloria A. Sitton, CMC City Clerk




Northern Virginia Hazard Mitigation Plan

Annex 2: City of Alexandria

November 2022

City of Alexandria Overview

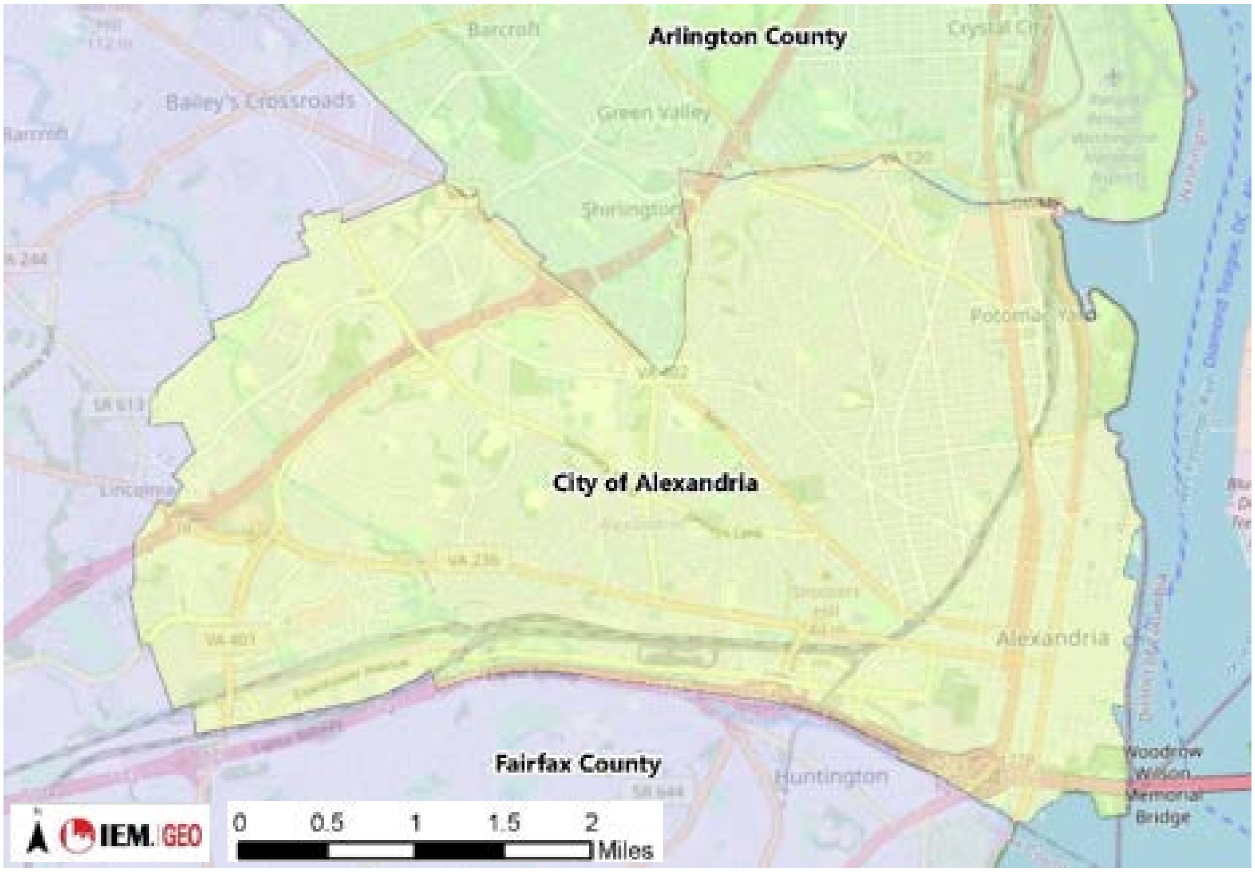


Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
Founded in 1749, Incorporated Independent City in 1870	15.75 sq. mi.	159,467	301 King Street, Alexandria, VA 22341	71,289	Flood/Flash Flood

City of Alexandria Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI),1950–June 2021

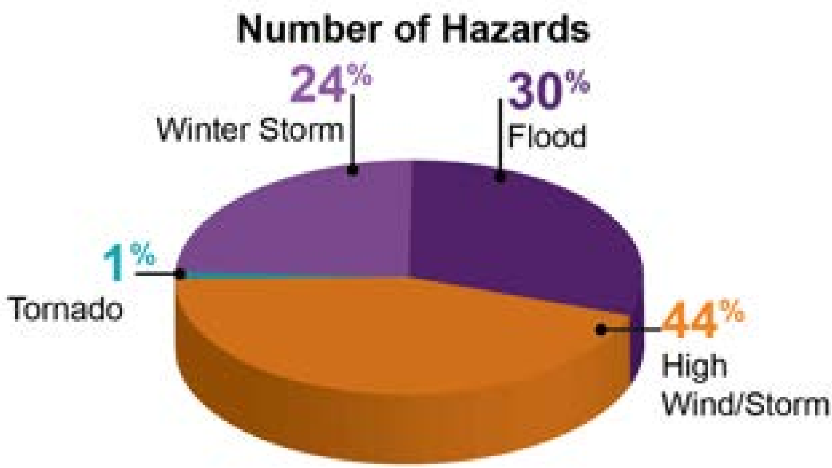


Figure 1: Percentage of Hazards

Figure 2: Reported Property Damage Percentages from Natural Hazard Events[1]

[1] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 – June 30, 2021.

Natural Hazard Risk Ranking

Table 2: Ranking of Natural Hazards by Risk

Hazard	Hazard Ranking
Winter Weather	**High**
Flood	**High**
High Wind/Severe Storm	**High**
Earthquake	**High-Medium**
Tornado	**Medium**
Drought	**Medium**
Dam Failure	**Medium**
Extreme Temperatures	**Medium**
Wildfire	**Low**
Karst/Sinkhole/Land Subsidence	**Low**
Landslide	**Low**

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	13
Food, Water and Shelter	4
Health and Medical	3
Energy	2
Communications	1
Transportation	205
Hazardous Materials	1
Education	42
Cultural/Historical	38
High Hazard Dams	0

A lifeline enables the continuous operation of government and business functions that are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity.

Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for the City of Alexandria

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Kevin Coleman Deputy Emergency Management Coordinator City of Alexandria 2003 Mill Rd., Suite 3100 Alexandria, VA 22314 703-746-5267 kevin.coleman@alexandriava.gov
Secondary Point of Contact	Curicè O. Paulüs Deputy Emergency Management Coordinator City of Alexandria 2003 Mill Rd., Suite 3100 Alexandria, VA 22314 703-746-5296 curice.paulus@alexandriava.gov

City of Alexandria

This annex presents the following jurisdiction-specific information provided by the City of Alexandria for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

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1. Jurisdiction Profile

Established	1749
Total Land Area	15.75 sq. mi.
Geographic Region	Piedmont
Persons Per Household	2.20
Persons Per Square Mile	10,125
Median Age	36
Elevation	Near sea level (~0 feet) – 39 feet

1.1. Location

Alexandria is an independent city in the Commonwealth of Virginia in the United States. Situated along the western bank of the Potomac River, the City of Alexandria is approximately seven miles south of downtown Washington, D.C.

The historic center of Alexandria is known as Old Town. With its concentration of boutiques, restaurants, antique shops, and theaters, it is a major draw for all who live in Alexandria as well for visitors. Like Old Town, many Alexandria neighborhoods are compact and walkable. It is the seventh largest and highest-income independent city in Virginia.

Alexandria's high population density and its location along the banks of the Potomac River increase the city's vulnerability to a variety of hazards, with flooding being a major concern. In addition to snow melt and rain-related river flooding episodes, Alexandria is also subjected to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a concern.

1.2. History

What is now the City of Alexandria was first settled as part of the British Colony of Virginia in the late 1660s. In 1791, George Washington included portions of the city in what was to become the District of Columbia. That portion was returned to Virginia in 1846 and the City of Alexandria was rechartered in 1852. In 1870, the City became independent of Alexandria County, with the remainder of the County changing its name to Arlington County in 1920.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in **Section 1, Base Plan** as context for the entire plan. The 2020 U.S. Census population estimate for the City of Alexandria was 159,467. The city is densely populated with 10,682 residents per square mile.

Table 6: Population and Growth Rate

Year	Population	Annual Percent Change
1980	103,217	
1990	111,183	7.7%
2000	128,283	15.4%
2010	139,966	9.1%
2020	159,467	13.9%

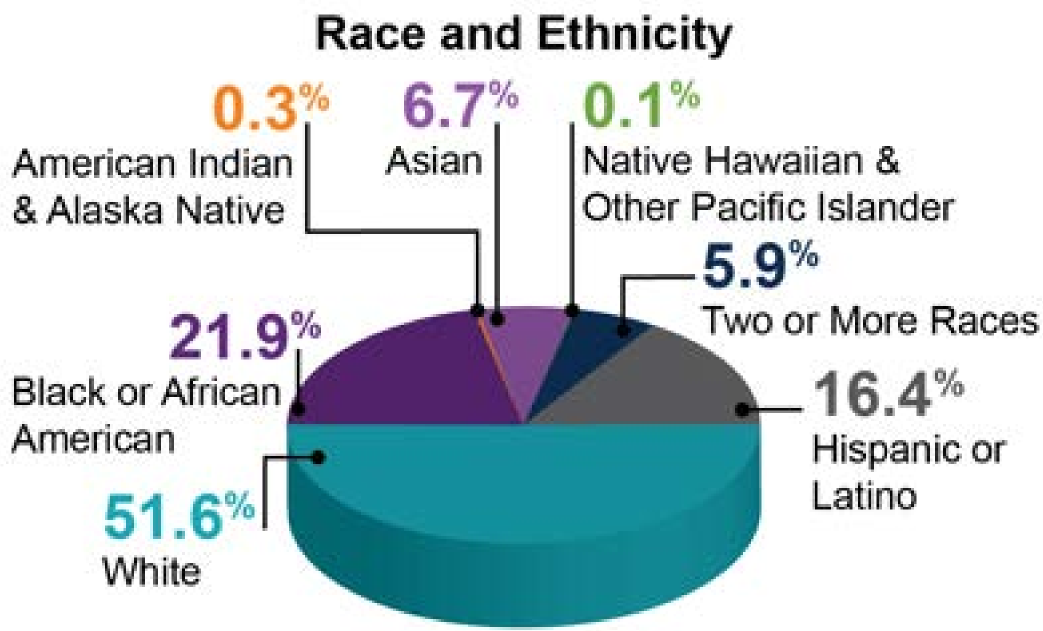


Figure 4: Race and Ethnicity Demographics from 2020 US Census

Table 7: Economic Data

Economy	Data
Median Household Income (2020)	$102,227
Unemployment Rate (Nov 2020)	5.4%[2]
Per Capita Income (2020)	$64,836
Median House or Condo Market Value (2020)	$572,900
Percentage Below Poverty (2019)	9.4%
Number of Businesses (2012)	17,540
Most Common Business (2020)	Office

[2] https://fred.stlouisfed.org/series/VAALEX5URN

Table 8: Government

Governance[3] - Independent City	Number
City Council (Mayor and Members)	7
City Boards and Commissions	70
FY 2023 Budget	$839.2 million[4]

Like the rest of Northern Virginia, modern Alexandria has been influenced by its proximity to the U.S. capital. It is largely populated by professionals working in federal civil service, the U.S. military, or for one of the many private companies that contract to provide services to the federal government. One of Alexandria's largest employers is the U.S. Department of Defense. Other large employers include the Institute for Defense Analyses, the National Science Foundation, and the U.S. Patent and Trademark Office.

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in the City of Alexandria presented in this section has been collected from multiple sources, including Hazus (Version 5.0) and City government websites. Data extracted from the Hazus Level 1 assessment indicates that the City of Alexandria has an estimated total of 304 Community Lifelines and critical assets. The City of Alexandria maintains a detailed list of Community Lifeline facilities, sites, and critical assets.

Table 9: Number of Community Lifelines and Critical Assets in the City of Alexandria

Lifelines	Number of Assets
Safety and Security	6
Food, Water, Shelter	4
Health and Medical	2
Energy	2
Communications	1
Transportation	205
Hazardous Materials	1
Education	42
Cultural/Historical	38
High Hazard Dams	0

1.4.1. Safety and Security

The City of Alexandria has one fire department and three law enforcement entities (Alexandria Police Department, Alexandria Sheriff's Office, and Northern Virginia Community College Police). The Office of

[3] City Manager, Alexandria, VA, Recruitment Brochure
[4] https://www.alexandriava.gov/Budget

Emergency Management also maintains two City Emergency Operations Centers (one primary and one secondary).

1.4.2. Food, Water, Shelter

Food commodities are available throughout the City of Alexandria from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs. Virginia American Water provides drinking water in the City and the City of Alexandria sewage/wastewater service entity, Alexandria Renew, has four wastewater treatment plants that service the system.

1.4.3. Health and Medical

The Hazus data identifies one health and medical facility, Inova Alexandria Hospital, offering patient care, urgent care, emergency rooms, and other healthcare services in the City of Alexandria. Additionally, an Inova HealthPlex, with a comprehensive emergency room, is scheduled to open in the fall of 2023.

1.4.4. Energy

Dominion Energy provides electric power and Washington Gas provides gas services for the City of Alexandria. Covanta also generates some electricity which is distributed through Dominion Energy.

1.4.5. Communications

Most communications and information systems and infrastructure in the United States are privately owned; however, the City maintains authority and control over public safety communications for fire, police, and other responding agencies. The City of Alexandria Department of Emergency and Customer Communications (DECC) operates a Public Safety Answering Point (PSAP); 911 calls are routed through the PSAP where call takers then dispatch emergency services. Increasing reliance on information and communications infrastructure by individuals, businesses, and government increases vulnerabilities in the event of a disruption of service.

1.4.6. Transportation

The City of Alexandria is served by the following major highways:

- Interstates 395 and 95/495
- U.S. Highway 1 north (Patrick Street)
- U.S. Highway 1 south (Henry Street)
- State Highways 7 (King Street), 236 (Duke Street), 400 (Washington Street), 401 (Van Dorn Street), 402 (North Quaker Lane), 420 (Janney's Lane), and 90005 (George Washington Memorial Parkway)

Rail and Light rail lines that serve the jurisdiction include:

- Metrorail – Blue and Yellow Lines and Metro stations: Braddock Rd., King St., Eisenhower, Van Dorn, and Potomac Yard (expected to open in the Fall of 2022) (DC Metro Area Service)
- Virginia Railway Express (Northern Virginia Regional Service)
- Amtrak (National Service)

- CSX and Norfolk Southern

The City of Alexandria offers public transit through fare-free DASH buses. Most DASH routes operate 7 days a week. The Washington Metro Area Transit Authority (WMATA) also serves the city with stops at each metro station. Private transit service is available through services such as Uber and Lyft. Other available transportation options include shared mobility devices to include bicycles and scooters located throughout the city.

The maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, including municipal, state, and federal highway departments, and agencies; toll and rail authorities; and the military.

The Hazus database notes a total of 205 transportation structures, facilities, or segments, including the following:

- Highway Bridges: 74
- Highway Segments: 60
- Railway Bridges: 13
- Railway Facilities: 2
- Railway Segments: 44
- Light Rail Facilities: 5
- Light Rail Segments: 7

1.4.7. Hazardous Materials

While there are no hazardous materials facilities or storage sites currently listed in the Hazus database, the City is aware of and has identified several sites. One of these sites includes the Norfolk Southern Ethanol Transloading facility located at the Thoroughbred Bulk Transfer terminal. Other hazardous materials considerations include:

- Transportation of hazardous materials through the city via rail transport (CSX and Norfolk Southern railways)
- Existence of Colonial and Plantation pipelines running underground through the city
- Ground transportation of hazardous materials, particularly via interstate travel

The City of Alexandria and Arlington County have an automatic aid agreement allowing seamless integration and sharing of hazardous material response resources between jurisdictions.

1.4.8. Education

The City of Alexandria Public School District has approximately 20 pre-kindergarten through grade 12 schools and educational centers. Basic educational services are also offered at the City's juvenile detention facility. Some of the colleges and satellite campuses within the City of Alexandria include:

- George Washington University Alexandria Education Center
- Global Health College
- Northern Virginia Community College – Alexandria Campus
- Stratford University – Alexandria Campus
- Virginia Polytechnic Institute and State University – Alexandria Campus

- Strayer University – Alexandria Campus
- Virginia Tech Innovation Campus (under construction, expected completion 2024)

1.4.9. Cultural and Historic Sites, and Assets

Many of the City's premier historic sites fall under the administration of the Office of Historic Alexandria, the department of City government charged with the conservation, interpretation, and promotion of these links to the past. These sites bring Alexandria's varied and storied history to life. The Department of Planning and Zoning, Historic Preservation Division oversees local historic districts and sites and provides technical preservation and architectural assistance to property owners. Alexandria's two historic districts are the Old and Historic Alexandria District (OHAD) and the Parker Gray (PG) district. The Office of Historic Alexandria also promotes historic preservation initiatives throughout the City and conducts ongoing community outreach to the public.

Over 40 Alexandria districts, sites, buildings, and structures are listed on the National Register of Historic Places (NRHP). The NRHP, managed by the National Park Service, is the U.S. official list of structures, sites, objects, and districts that embody the historic and cultural foundations of the United States owing to their special architectural, historic, archaeological, or cultural value they hold to residents and visitors.

1.5. Growth and Development Trends

With a 2020 population of 159,467, the City of Alexandria is the 7th largest city in Virginia and the 169th largest city in the United States. Alexandria is currently growing at a rate of 0.22% annually and its population has increased by 14.42% since the 2010 Census.

The City has exhibited steady population growth in recent decades, driven primarily by the number of jobs in the area, including roles in the U.S. military, the Department of Defense, and other government and private entities.

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, the City of Alexandria followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the Northern Virginia Hazard Mitigation Planning Group, the City supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction. The table below lists the employees who participated in the 2022 City of Alexandria Planning Group. The positions/titles listed may have changed since the final publishing and approval of this plan.

Table 10: Local Planning Group Participants

Name	Position/Title	Department/Agency
Kevin Coleman	Deputy Emergency Management Coordinator	Alexandria Fire Department/Office of Emergency Management
Ray Whatley	Acting Emergency Management Coordinator	Alexandria Fire Department/Office of Emergency Management
Emily A. Baker	Deputy City Manager	City Manager's Office

Name	Position/Title	Department/Agency
Yon Lambert	Director, Transportation & Environmental Services	Transportation & Environmental Services
William J. Skrabak	Deputy Director, Infrastructure & Environmental Quality, T&ES	Transportation & Environmental Services
Jesse E. Maines	Division Chief, Stormwater Management, T&ES	Transportation & Environmental Services
Karl Mortiz	Director, Planning and Zoning	Department of Planning and Zoning
Teresa Scott Hoggard	Former Deputy Emergency Management Coordinator	Alexandria Fire Department/Office of Emergency Management

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process and representation in the Emergency Manager's Group. The City also identified the following tasks as part of its mitigation planning responsibilities:

- Provide management support for the planning effort
- Serve as Planning Group resource/subject matter experts
- Conduct hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Conduct capabilities assessment
- Develop mitigation strategies
- Sponsor mitigation actions
- Review Plan drafts and provide input
- Conduct public outreach activities
- Implement the Plan
- Maintain the Plan

The City of Alexandria planning participants coordinated primarily by means of virtual meetings during the planning process, and as needed, worked independently to carry out planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Group meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a posting of the NOVA hazard mitigation public survey on the City's social media account and access to the draft plan for review and input.

In addition to the survey, the public was offered the opportunity to review and provide input to the Draft 2022 Plan update. Notification of the release of the Draft Plan was made through the same social media account. Documentation of the public survey and draft plan review is in **Attachment 2** of this annex.

3. Jurisdiction-Specific Hazard Event History

The City of Alexandria's comprehensive hazard history is described in **Section 5, Base Plan**. The diversity of the landscape increases the vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snowmelt and rain-related river flooding episodes, low-lying areas of the City along the Potomac River are also subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low-lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2015–2016 winter season, which resulted in a Federal Disaster Declaration.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 460 recorded natural meteorological events that took place in the City between January 1, 1950 and June 2021. The City has been included in three federal emergency and disaster declarations between May 2017 and May 2021.

Table 11: Federal Disaster and Emergency Declarations (2017-2021), City of Alexandria[5]

Declaration	Date	Hazard	Assistance Type
DR 4512	Apr. 2020	Virginia COVID-19 Pandemic	PA-B
EM 3448	Mar. 2020	Virginia COVD-19	PA-B
EM 3403	Sep. 2018	Virginia Hurricane Florence	PA-B

In addition to the hazard events profiled in **Section 5, Base Plan**, the City identified additional significant events that occurred since 2001.

Table 12: Significant Hazard Events Identified by the City of Alexandria (2001–2021)[6]

Date	Hazard	Event and Description
October 2021	Flooding	Alexandria experienced a high tidal event and concurrent period of heavy rains resulting in severe coastal flooding. The Potomac River gauge indicated moderate flood stage flooding of historic Old Town.
September 2021	Flash Flooding	This was a 10-year flood event based on the City's IDF curve. Impacts were primary centralized around Beach Park, but heavy rainfall and flooding occurred in SE Del Ray and near Mount Vernon.
August 2021	Flash Flooding	An intense overnight storm dropped between 3 to 5 inches of rain in an hour with heavier localized rainfall. The highest rain gauge reading was at George Mason Elementary, which recorded 3.19 inches in 30 minutes and a total of 4.43 inches in an hour. Based on the City's Intensity-Duration-Frequency (IDF) curves, these rainfall totals correspond to a 200–500-year event. Primary impacts included widespread flooding, power outages, sanitary backups, and sink holes.

[5] FEMA, Federal Disaster Declarations.
[6] https://www.alexandriava.gov/flood-action/severe-storm-and-flash-flood-events

Date	Hazard	Event and Description
September 2020	Severe Thunderstorms	The September 10, 2020 rainfall event dropped approximately 2.5 to 4 inches at a rate as high as 3 inches in 10 minutes. This was an intense, regional storm that caused widespread flooding throughout Alexandria, particularly in the eastern portion, and included storm sewer line surges and sanitary backups.
July 2020	Severe Thunderstorms	Heavy rain and strong winds from a line of strong storms caused City-wide flooding and downed trees.
July 2019	Severe Thunderstorms	On July 8, Alexandria received a month's worth of rain in approximately one hour, which resulted in widespread flooding. This historic weather event caused significant damage to public facilities, roads, businesses, and homes.
September 2018	Flooding	Old Town Alexandria experienced a coastal flooding event during high tide approximately 1 week prior to anticipated Hurricane Florence impacts. While Florence did not directly impact Alexandria, receipt of any anticipated rainfall (up to 16 inches was forecasted) would have exacerbated already saturated soils and high-water levels.
June 2012	Derecho	On Friday night, June 29, 2012, a widespread derecho event traveled 700 miles across the Mid-Atlantic states. More than 1.5 million customers in the NCR lost power as a result of this event. Some Alexandrians experienced prolonged power outages, all public schools closed the following Monday, and debris was scattered across the city.
August 2011	Earthquake	A 5.8 magnitude earthquake stuck near Mineral, Virginia. Alexandria experienced damage to chimneys and other buildings. In Old Town Alexandria, historic Gadsby's Tavern and City Hall sustained damage, as well as several other historic buildings.
November 2010	Thunderstorm	A tree was knocked onto a car and several six-inch limbs were also down near the intersection of Van Dorn Street and Taney Avenue.
June 2005	Lightning	An upper-level disturbance, in conjunction with a very warm, moist, and unstable airmass, caused a large outbreak of severe weather. Associated with this event was a large squall line of strong to severe thunderstorms. Damage was reported in portions of the Washington and Baltimore Metropolitan areas. Strong winds also occurred on the maritime waters of the Potomac River and Chesapeake Bay.

4. Hazard Risk Ranking

After developing hazard profiles, the City of Alexandria Planning Group conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in **Section 4, Base Plan**.
The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard sub-sections in **Section 5, Base Plan**, and local details are provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in **Volume II** of this Plan.

Table 13: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.3	3.5	6.8	**High**
Flood	2.0	4.2	6.2	**High**
High Wind/Severe Storm	2.7	3.3	6.0	**High**
Earthquake	2.3	4.7	7.0	**High-Medium**
Tornado	1.3	4.5	5.8	**Medium**
Drought	2.3	3.3	5.6	**Medium**
Dam Failure	1.0	4.4	5.4	**Medium**
Extreme Temperatures	2.7	2.5	5.2	**Medium**
Wildfire	1.0	3.0	4.0	**Low**
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	**Low**
Landslide	1.0	2.5	3.5	**Low**

Table 14: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	3.0	5.7	8.7	High
Terrorism	1.0	5.9	6.9	High
Cyberattack	2.0	4.4	6.4	High
Civil Unrest	1.0	4.7	5.7	Medium
Communication Disruption	1.3	3.5	4.9	Medium
Hazardous Materials	1.0	3.9	4.9	Low
Active Violence	1.3	3.0	4.4	Low

Based on the hazard risk scores, the City of Alexandria evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high, medium-high, or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, Flood (riverine/flash flood), and High Wind/Severe Storm
- **Medium-High:** Earthquake (this hazard is ranked as such due to the potential for severe impacts should one of significant magnitude strike the region.)
- **Medium:** Dam Failure, Drought, Extreme temperatures, and Tornado

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, and Cyber Attack
- **Medium:** Civil Unrest and Communication Disruption

All other hazards were ranked as “low,” signifying a minimal risk to the City of Alexandria.

4.1. Additional Hazard Risk Considerations

4.1.1. Dam Failure

There are no dams located in the City of Alexandria; any effect from a dam breach would come from the Lake Barcroft dam in Fairfax County towards the northern border. The last reported failure of Lake Barcroft dam was in 1972 as a result of Hurricane Agnes.

4.1.2. Flood/Flash Flood

This table presents the number of flood events documented in the NCEI Storm Events Database, including flood, flash flood, and impacts on people, property, and crops.

Table 15: Flood/Flash Flood Events in the City of Alexandria 1950–June 30, 2021[7]

Impact	Data
Flood/Flash Flood Events	40
Direct Deaths	0
Direct Injuries	0
Property Damage	$695,000
Crop Damage	$0
Total Property and Crop Damage	$695,000

4.1.3. High Wind/Severe Storm

This table presents the number of severe storm events documented in the NCEI Storm Events Database, including high wind, and impacts on people, property, and crops.

Table 16: High Wind Events in the City of Alexandria, 1950–June 30, 2021[8]

Impact	Data
High Wind and Severe Storm Events	14
Direct Deaths	0
Direct Injuries	0
Property Damage	$4,533,000
Crop Damage	$0
Total Property and Crop Damage	$4,533,000

4.1.4. Tornado

This table presents the number of tornado events documented in the NCEI Storm Events Database, including tornadic wind, and impacts on people, property, and crops.

Table 17: Tornado Events in the City of Alexandria, 1950–June 30, 2021[9]

Impact	Data
Tornado Events	2
Direct Deaths	0
Direct Injuries	0
Property Damage	$7,500
Crop Damage	$0
Total Property and Crop Damage	$7,500

[7] NOAA, National Centers for Environmental Information, Storm Events Database, 1950–June 30, 2021.
[8] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 – June 30, 2021.
[9] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 – June 30, 2021.

4.1.5. Winter Weather

Table 18 presents the number of winter weather events documented in the NCEI Storm Events Database, including blizzard, heavy snow, winter storm, and winter weather.

Table 18: Winter Weather Events in the City of Alexandria, 1950-June 30, 2021[10]

Impact	Data
Winter Storm Events	31
Direct Deaths	0
Direct Injuries	0
Property Damage	$405,000
Crop Damage	$0
Total Property and Crop Damage	$405,000

Other hazard information for the City of Alexandria is presented in the **Base Plan**.

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

The City of Alexandria is a participant in the National Flood Insurance Program (NFIP). In addition, the City participates in the voluntary Community Rating System (CRS) program under the NFIP with a CRS Class of 6, which is associated with a 20 percent flood insurance discount for policyholders. The *Floodplain Management Plan, Progress Report*, September 2019, describes the 24 mitigation actions related to flood developed since 2006 that were presented in the 2017 NOVA HMP. These actions cover a broad range of project types, including planning and regulatory, structural, natural system protection, and public outreach and education. The Progress Report provides an update as of September 2019 for maintenance of the City's CRS program, which documents continuing progress on the implementation of these actions.

[10] NOAA, National Centers for Environmental Information, Storm Events Database, 1950 – June 30, 2021.

Table 19: National Flood Insurance Program Status, City of Alexandria[11]

Initial FHBM Identified	Initial FIRM Identified	Current Eff FIRM Date	Reg-Emer Date	CRS Entry Date	Current Eff CRS Date	CRS Class	% Disc SFHA	% Disc Non-SFHA
8/22/1969	8/22/1969	6/16/2011	6/16/2011	10/1/1992	10/1/2021	6	20	20

Table 20: NFIP Policy Status, City of Alexandria[12]

Policies In-Force	Premiums Paid	Total Coverage
1,487	$1,375,830	$ 479,512,900

Table 21: NFIP Status, as of September 14th, 2021

Category	NFIP Topic	Source of Information	Comments
Staff Resources	Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes. Certified Floodplain Manager (ASFPM)
Staff Resources	Is floodplain management an auxiliary function?	Community FPA	No, Primary
Staff Resources	Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Alexandria has a Class 6 designation in FEMA's Community Rating System (CRS), First in Virginia
Staff Resources	What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	None
Compliance History	Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Compliance History	Are there any outstanding compliance		None

[11] National Flood Insurance Program (NFIP) Community Status Report, as of March 31, 2022
Community Rating System | FEMA.gov
[12] NFIP Community Status Report, as of March 31, 2022

Category	NFIP Topic	Source of Information	Comments
	issues (i.e., current violations)?		
Compliance History	When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		FEMA's last review of the CRS program in Alexandria was 2018; the result of the CRS Cycle Verification Visit was a confirmation of the Class 6 designation by FEMA dated February 12, 2021

5.2. Population

The Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. The CDC SVI depicts the vulnerability of communities at Census tract level, by county, into 15 Census-derived factors grouped into four themes—socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, and to human-caused threats, such as toxic chemical spills.

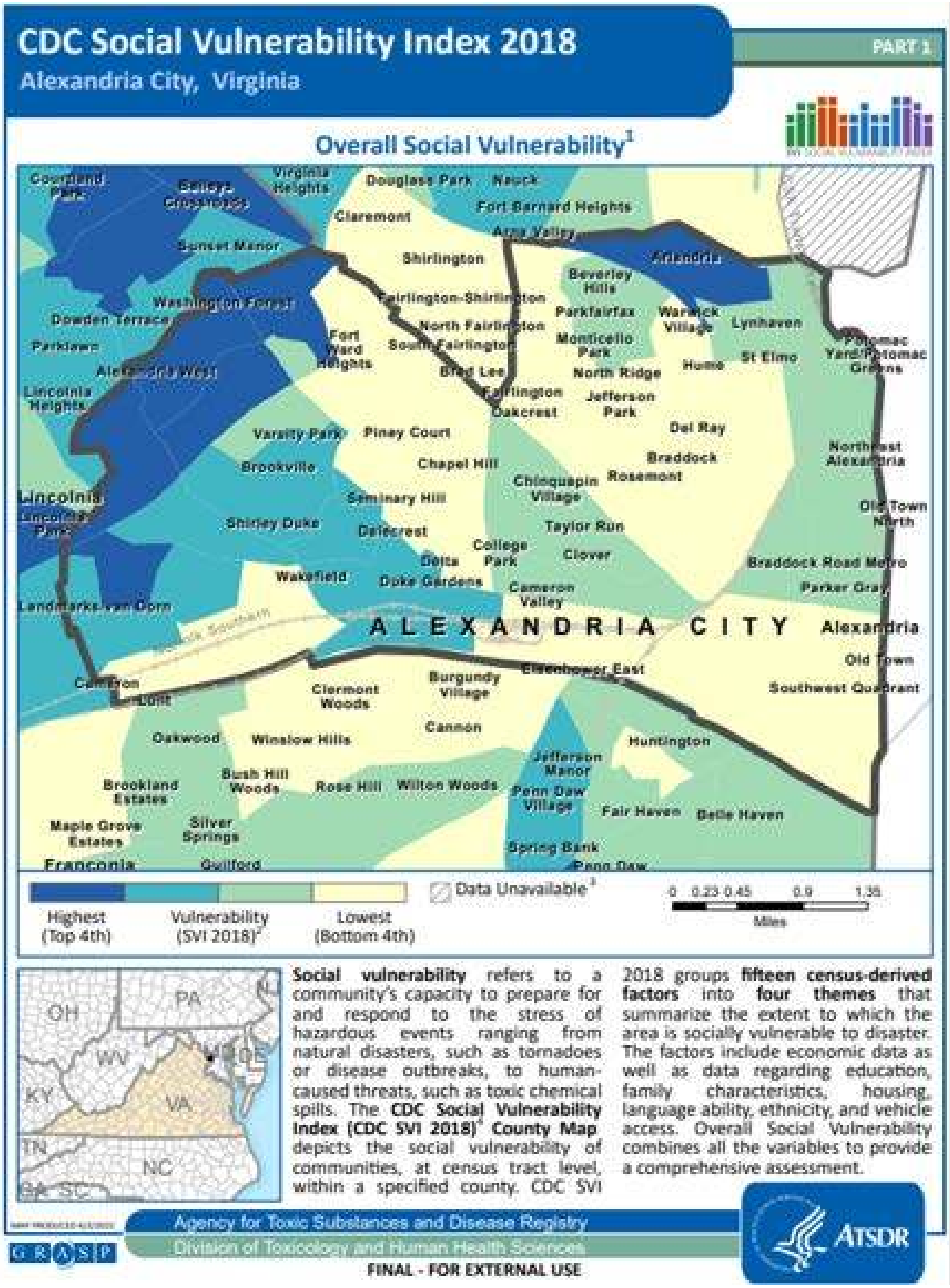


Figure 5: Overall Social Vulnerability (2018), City of Alexandria[13]

[13] Centers for Disease Control and Prevention, Social Vulnerability Index, Virginia, 2018. Retrieved at: [Virginia2018_Alexandria city.pdf (cdc.gov)]

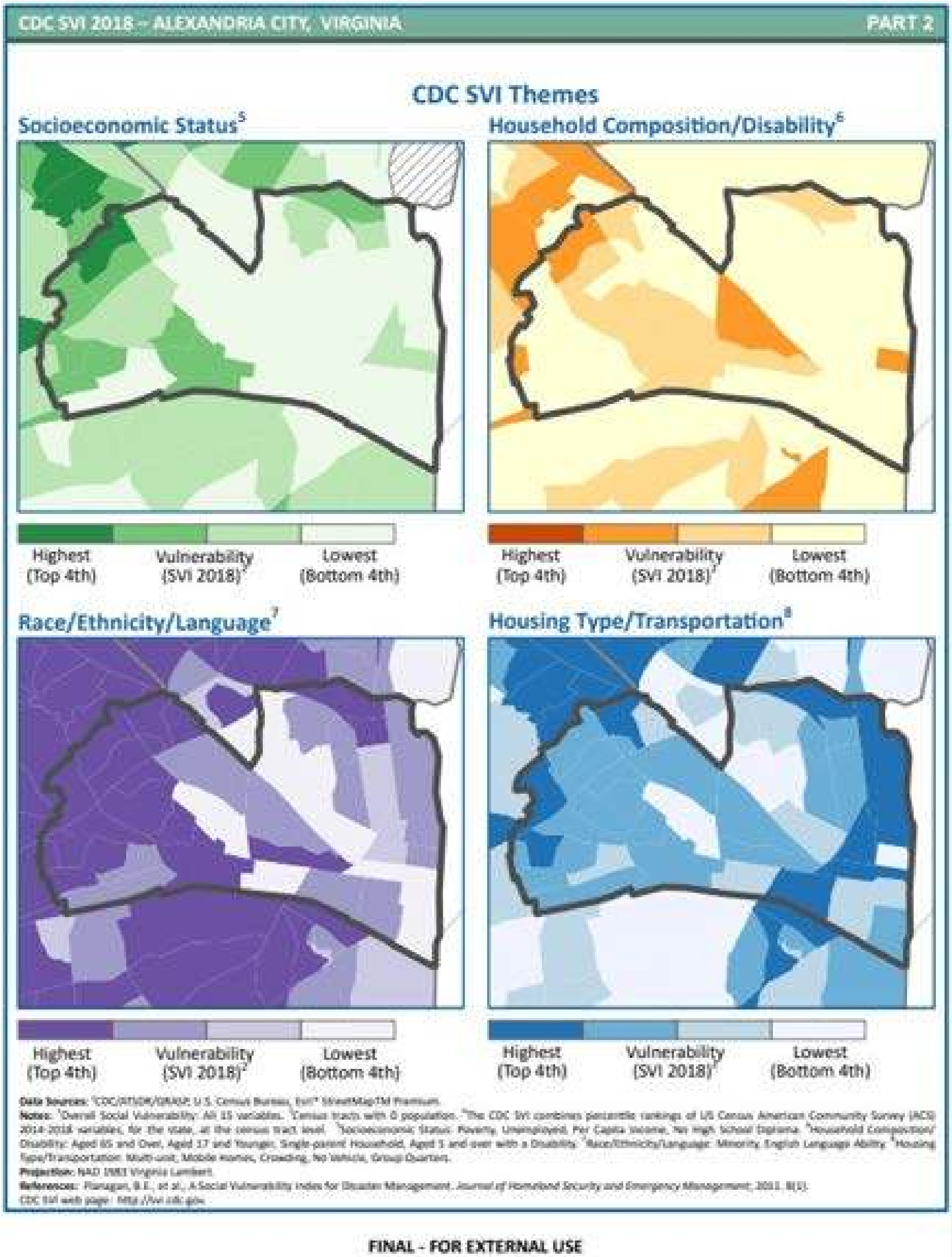


Figure 6: Social Vulnerability, by Theme, City of Alexandria[14]

[14] Centers for Disease Control and Prevention, Social Vulnerability Index, Virginia, 2018. Retrieved at: [Virginia2018_Alexandria city.pdf (cdc.gov)]

The themed maps illustrate the City’s higher level of vulnerability within the race/ethnicity/language theme, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in alternate formats and multiple languages.

5.3. Built Environment

Based on data currently available through Hazus, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquake, flood, and hurricane winds.

Table 22: Building Stock Exposure by General Occupancy

Type	Amount
Residential	$18,477,776,000
Commercial	$3,608,216,000
Industrial	$304,079,000
Agricultural	$20,655,000
Religious	$567,753,000
Government	$128,869,000
Education	$919,729,000
TOTAL	**$24,027,077,000**

5.4. Community Lifelines and Assets

The City of Alexandria reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events. The vulnerability of critical infrastructure is presented in the lifeline sector categories identified by FEMA. The data is extracted from the Hazus scenario models for flood, earthquake, and hurricane.

Table 23: Critical Facilities Exposed to FEMA Floodplains, City of Alexandria

Facility Type	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Wastewater Treatment Plants	4	2	0
Schools	42	1	2
Railway Segments	44	10	5
Highway Bridges	74	27	7
Highway Segments	60	11	3
Light Rail Facilities	5	0	4
Light Rail Segments	3	2	1
Police Stations	3	0	2
Railway Bridges	13	9	0

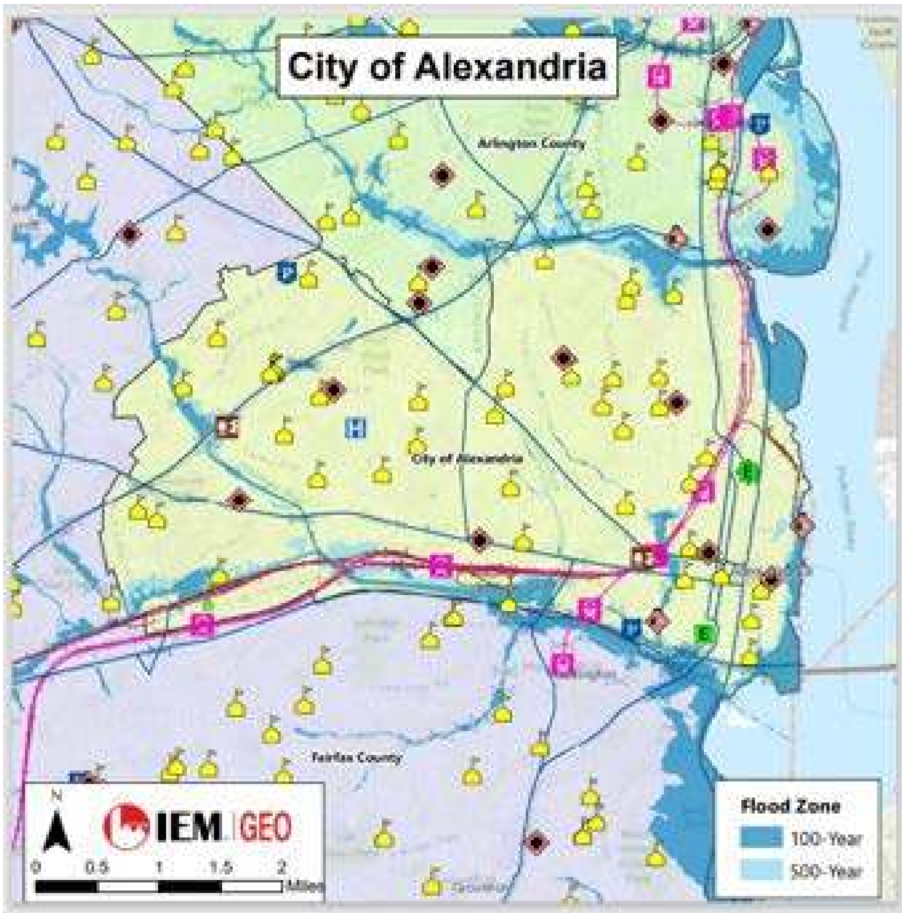


Figure 7: Critical Facilities in Flood Zones, City of Alexandria[15]

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the **Base Plan**.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the **Base Plan**. Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event, 100-year flood event, and probabilistic hurricane wind event are identified by Hazus for specific assets.

[15] FEMA Flood Insurance Rate Maps; Hazus Flood Scenarios (100- and 500-Year), August 3, 2021.

Table 24: Direct Economic Losses Related to Earthquake, Flood and Hurricane Wind

Hazard	Buildings (capital stock and income)	Transportation	Utilities
Earthquake	$284,828,000	$6,294,000	$5,377,000
Flood	$162,402,000	0	0
Hurricane Wind	$15,168,000	0	0

5.7. Cultural/Historical

Information related to vulnerability of cultural and historical assets are presented in the hazard-specific sections of the **Base Plan**.

Historic structures and sites are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites.

Table 25: Cultural and Historic Properties Exposed to FEMA Floodplains, City of Alexandria[16]

Total Facilities	In 100-year Floodplain	In 500-year Floodplain
810	350	460

6. Capability Assessment

The City of Alexandria reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
  - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
  - City staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
  - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
  - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions

[16] City of Alexandria Planners

- Education and outreach
  - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, the City of Alexandria completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the levels of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis, as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities and can implement a few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities, but improvement is needed to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities, as demonstrated by its authorities, programs, plans, and/or resources, and it can implement most mitigation actions.

Table 26: Capability Assessment Summary Ranking

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	Moderate
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The City utilizes the all-hazards approach when developing any jurisdictional plans, including the Emergency Operations Plan, Continuity of Operations Plan, and the Hazard Mitigation Plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Comprehensive Plan
- Capital Improvements Plan
- Local Emergency Operations Plan
- Flood Action Alexandria – local website

Capability Analysis: High

Significant planning and regulatory tools are in place within the City of Alexandria and bring to light successes in integrating hazard mitigation planning with existing planning mechanisms. This demonstrates that the jurisdiction recognizes the benefit of incorporating hazard mitigation in local planning and regulatory processes such as the Comprehensive Plan, the Capital Improvement Plan, and floodplain regulations, as well as how to use these to develop and implement mitigation actions. The City recognizes improvement opportunities for updating codes and ordinances as science and information improves and continually implementing best practices based on after action reports.

6.1.2. Administrative and Technical Capabilities Summary

- Planning and Zoning staff include planners and engineers with an understanding of natural and non-natural hazards who are integrated into mitigation planning.
- Transportation and Environmental Services (T&ES) staff includes a Floodplain Manager and CRS Coordinator.
- The City maintains an Information Technology department with GIS personnel.
- City emergency management and other staff are familiar with the community's hazards.
- City administration has a grant writer who coordinates with the hazard mitigation program.

The City identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan.

- Code Administration
- Emergency and Customer Communications
- Emergency Management
- Fire Department
- General Services
- Health Department
- Planning and Zoning
- Police Department
- Public Works Services
- Sheriff's Office
- Transportation and Environmental Services

Capability Analysis: High

The City of Alexandria has a robust staffing capability that enables a high level of coordination for the purpose of mitigation planning and action implementation. As a result of COVID-19, the City increased its staffing levels, resulting in enhanced administrative and technical capabilities. There is a need to continue funding these positions and to provide ongoing education and training. Staffing models should be evaluated to ensure adequate response capability and current technologies should be monitored to find appropriate uses, where applicable. The City should continue to refresh training and update policies and procedures to implement best practices and lessons learned.

6.1.3. Safe Growth Capabilities Summary

- Growth guidance instruments discourage development or redevelopment in natural hazard areas.
- Transportation limits access to hazard areas.
- Environmental policies provide incentives for development located outside protective ecosystems.

Capability Analysis: High

The City of Alexandria has well-established safe growth regulatory and enforcement capabilities to limit or prevent inappropriate development in identified hazard areas and protect the natural environment. No additional enhancements are identified at this time.

6.1.4. Financial Capabilities Summary

- Capital Improvements projects: Storm management infrastructure
- Fees for water and sewer maintenance
- Federal funding: UASI, HMGP, and BRIC

Capability Analysis: Moderate

Rising operational costs and limited financial resources are an everyday challenge for most local governments. The process for identifying potential grants, developing and submitting applications, and managing grant-funded projects is both time-consuming and challenging, especially if multiple disasters are occurring simultaneously. In addition, onsite work restrictions imposed during the COVID-19 pandemic have presented challenges in staff availability and coordination. To address these shortfalls, the jurisdiction may access technical assistance available to potential applicants provided by many grant programs or expand its capabilities to develop and manage mitigation actions through contracted services. It should maintain awareness of potential grant programs and take advantage of them and evaluate effective use of budgetary funds and invest where it is most cost effective.

6.1.5. Education and Outreach Capabilities Summary

Community Rating System initiatives within the NFIP program can increase public awareness of and involvement in hazard mitigation.

- Work with local citizen groups and non-profits such as CERT and Volunteer Alexandria.
- Provide ongoing public education and information programs: community academy, and government, fire station, and police programs, for example.

Capability Analysis: Moderate

Jurisdictions have multiple opportunities to promote hazard mitigation and increase involvement of stakeholders and the public. There is a critical need to inform additional stakeholders and the public about the benefits of hazard mitigation planning and implementation. Virginia Department of Emergency Management mitigation staff can provide technical assistance to support increased jurisdictional involvement. Many hazard mitigation educational tools and materials are available from state agencies and disaster preparedness and response organizations, such as the American Red Cross, FEMA, as well as faith-based organizations with disaster response missions. It is important to locate best practices programs for educating and informing the public and capitalize on volunteer resources when implementing training programs.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, the City of Alexandria identified activities related to each natural hazard that support risk reduction. They are listed in the following table.

Table 27: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Capability
Drought	• Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	• State and International building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	• Public education and operational plans address preparedness and response to reduce risk.
Flood/Flash Flood	• Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. • Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	• State and International building codes provide for wind load design regulations.
Karst/Sinkhole/Land Subsidence	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	• Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	• Public education and operational plans address preparedness and response to reduce risk.
Wildfire	• Public education and operational plans address preparedness and response to reduce risk.
Winter Storm	• Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	• Public education and operational plans address preparedness and response to reduce risk. • Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	• Ongoing resilience planning will allow for identification and mitigation of climate change related issues in future planning cycles.

7. Resilience to Hazards

7.1. National Risk Index

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of "low risk" is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience. The levels of risk are described in Figure 8.

Community Report – Alexandria City, Virginia | National Risk Index (fema.gov)

Figure 8: Summary of National Risk Index Findings, City of Alexandria[17]

Table 28: Comparison of City of Alexandria Scores with Virginia and National Average[18]

Index	City of Alexandria	Virginia Average	National Average
Risk	5.14	6.50	10.60
Expected Annual Loss	11.97	9.22	13.33
Social Vulnerability	19.75	35.32	38.35
Community Resilience	53.09	54.92	54.59

Table 29: City of Alexandria Risk Ranking[19]

Index	Rank
Risk	Very Low
Expected Annual Loss	Relatively Low
Social Vulnerability	Very Low
Community Resilience	Relatively Moderate

[17] National Risk Index. Retrieved at: Community Report - Alexandria City, Virginia | National Risk Index (fema.gov)
[18] Ibid.
[19] Ibid.

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help identify communities in the United States at risk for 18 types of natural hazards. Hazard risk is calculated based on data for a single hazard type and reflects the relative risk for that hazard type. However, it should be considered only as a baseline relative risk measurement for the purpose of a general comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from the hazards in this plan, so a direct hazard-to-hazard comparison of risk cannot be determined.

Based on the NRI findings, the highest five hazards by risk rating for the City of Alexandria are as follows: Winter Weather, Strong Wind, Tornado, Cold Wave (known within this plan as Extreme Cold), and Heat Wave (known within this plan as Extreme Heat). Lightning, Ice Storm, Hail, and Riverine Flooding received lower risk ratings; however, 14 of the 15 hazards rated for risk were all determined to be "very low," with one hazard (Heat Wave) determined as "relatively low."

Hazard Types	Risk Index Rating	Risk Index Score
Avalanche	Not Applicable	--
Coastal Flooding	Very Low	3.23
Cold Wave	No Rating	0.00
Drought	No Rating	0.00
Earthquake	Very Low	2.09
Hail	Very Low	3.65
Heat Wave	Relatively Low	7.62
Hurricane	Very Low	3.99
Ice Storm	Very Low	4.42
Landslide	Very Low	7.47
Lightning	Relatively Low	10.37
Riverine Flooding	Very Low	5.13
Strong Wind	Relatively Low	9.75
Tornado	Relatively Low	9.83
Tsunami	Not Applicable	--
Volcanic Activity	Not Applicable	--
Wildfire	No Rating	0.00
Winter Weather	Very Low	7.44

Figure 9: Hazard Type Risk Index, National Risk Index[20]

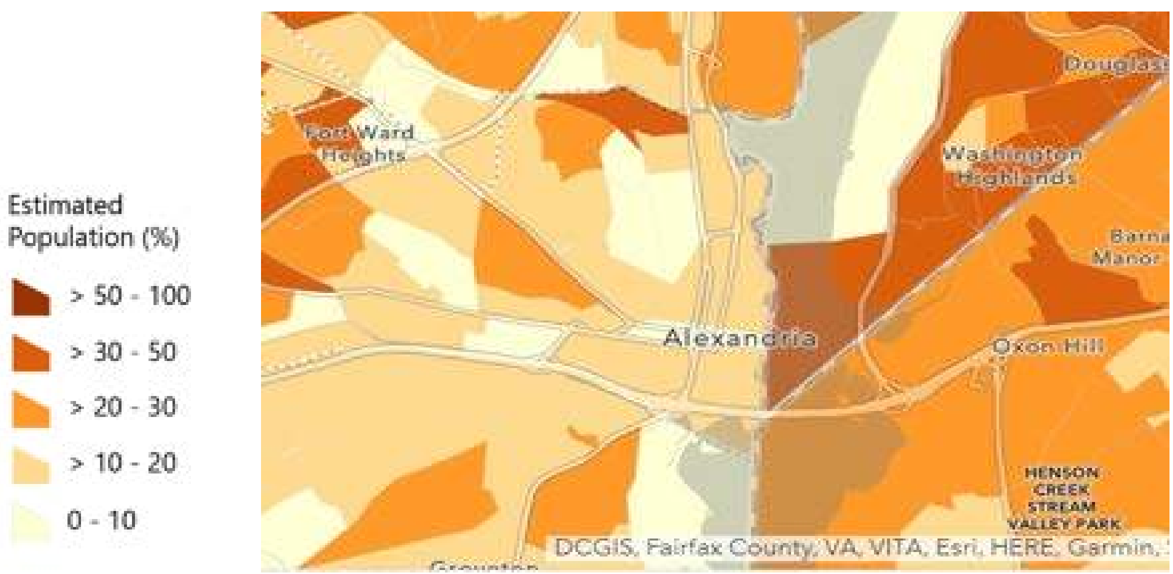
The NRI calculation does not follow the same criteria and formulas used in the hazard risk ranking methodology for this plan but is provided as a comparative measurement tool.

7.2. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household level risk factors.

The index produces aggregate-level (Census tract, county, and state) small area estimates, thus providing a tool for evaluating how at-risk specific neighborhoods might be to disasters due to characteristics that potentially make specific segments of the population more vulnerable to the impacts and consequences of disasters. The ten risk factors[21] include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barriers
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)
10. No broadband internet access (household)



[20] National Risk Index, Community Report – Alexandria City, Virginia. Retrieved at: [Community Report - Alexandria City, Virginia | National Risk Index (fema.gov)]

Figure 10: Community Resilience Estimate, City of Alexandria[22]

The estimate is categorized into three groups: zero risks, one or two risks, and three or more risks. The combination of data and analysis described in this section provides a comprehensive representation of the City's risk, vulnerability, and resilience to all hazards.

7.3. New Hazard Risk Challenges or Obstacles to be Monitored in the Next Planning Cycle

- The risk of cyber-related incidents on critical infrastructure and key resource sites
- Impacts of climate change
- Increases in the number of excessive rainfall events that impact new areas with flooding

8. Mitigation Actions

8.1. Goals and Objectives

The City of Alexandria Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**.

8.2. Status of Previous Actions

The comprehensive list of previous mitigation actions, including descriptions of progress made and the current status, is presented in **Attachment 3** of this annex.

8.3. New Mitigation Actions

In addition to the actions carried forward from previous plans, the City of Alexandria Planning Team identified two new mitigation actions to include in this plan to address expansion and strengthening of the Office of Emergency Management and Homeland Security's continuity program by increasing the resilience of City operations and coordinating with FEMA to re-evaluate flood zones and update Flood Insurance Rate Maps (FIRMs) as a basis for future National Flood Insurance Program Activities. **Attachment 3** of this annex includes a table that summarizes each new and continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Action Plan for Implementation and Integration describes how the City's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 30: Action Plan for Implementation and Integration, City of Alexandria

[22] Community Resilience Estimate, 2019. Retrieved at: 2019 Community Resilience Estimates (arcgis.com)

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	When the City’s comprehensive emergency operations plan undergoes updates, add mitigation action goals and action items into the plan, as applicable.
Review/update land development regulations for consistency with mitigation goals.	Ensure Mitigation Goals are accounted for during annual building development review. Additionally, ensure input to the Commonwealth building code updating process reflects mitigation goals.
Review/update building/zoning codes for consistency with mitigation goals.	Ensure Mitigation Goals are accounted for during annual building development review. Additionally, ensure input to the commonwealth building code updating process reflects mitigation goals.
Maintain regulatory requirements of floodplain management program (NFIP).	This is maintained in the floodplain ordinance that has higher standards than the NFIP minimum requirements.
Enhance floodplain management through Community Rating System (CRS).	Ensure annual CRS report includes progress with mitigation goals.
Review/Update economic development plan and policies for consistency with mitigation goals.	
Continue public engagement in mitigation planning.	Continue holding events to educate the public about mitigation planning efforts during National Preparedness Month.
Identify opportunities for mitigation education and outreach.	Reach out to local NGOs to learn about potential community outreach opportunities that we can join.
Review/update stormwater plans and procedures for consistency with mitigation goals.	Mitigation goals are a review point when stormwater plans and procedures are updated.
Review/update emergency plans to address evacuation and sheltering plans.	
Maintain ongoing enforcement of existing policies.	All departments with mitigation goals consistently enforce existing policies.
Monitor funding opportunities.	Monitor for grant funding opportunities and complete budget-building process for longer term projects.
Incorporate goals and objectives into day-to-day government functions.	
Incorporate goals into day-to-day development policies, reviews, and priorities.	All departments include awareness of mitigating risks in the development of policies, reviews, and priorities.

9. Annex Maintenance Procedures

9.1. Maintenance of the NOVA HMP, Base Plan

The point of contact for the Northern Virginia Mitigation Project Team is the facilitator for the process to monitor, evaluate, and update the **NOVA HMP, Base Plan**. This facilitator is responsible for initiating the annual activities, convening the NOVA Planning Team (made up of the Emergency Managers Group and Planning Group), and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 31: City of Alexandria Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan (Base Plan)

Activity	Responsibilities
Monitoring the Plan	• Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	• Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	• Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.2. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP Base Plan**, the City of Alexandria Mitigation Planning Coordinator will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.2.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in the fifth year

Table 32: City of Alexandria Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the *Mitigation Action Implementation Worksheet* (**Section 3, Attachment A, NOVA HMP Base Plan**).	• Produce an annual report that includes the following: ▪ Status update of all mitigation actions ▪ Summary of any changes in hazard risk or vulnerabilities and capabilities ▪ Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	1. Schedule the annual plan evaluation with jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities, and hazard mitigation capabilities using the *Planning Considerations Worksheet* (**Section 3, Attachment C, NOVA HMP Base Plan**).	• Submit the annual report to the NOVA HMP Planning Team Point of Contact
Updating the Annex	1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan.	• Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.

The City of Alexandria will continue to be a planning partner with multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce the risk of the hazards identified in this plan.

10. Annex Adoption

The City of Alexandria Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan*.

11. Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of Public Participation
- Attachment 3: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this Jurisdiction]

11.2. Attachment 2: Documentation of Public Participation

The participants of the Northern Virginia All Hazards Mitigation Plan Update provided a survey link to the general public using public outreach on social media, county or city websites, and other means of outreach to their citizen for their comments and concerns about the natural and non-natural hazards that affect their area.

The survey was opened on August 8th, 2021, and closed on November 3rd, 2021, with over 1,000 responses coming in over that period of time. The City of Alexandria had 15 responses. A detailed summary of the survey is available in Appendix A of the Base Plan

There were 2 questions that got almost the same answer from everyone that took the survey, and those responses identified the natural hazard of climate change and the non-natural hazard of the pandemic to be the most concerning hazards for those who resided in the Northern Virginia Area.

From:	Alexandria eNews
To:	Kevin Coleman
Subject:	Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8
Date:	Tuesday, September 13, 2022 12:05:12 PM

Public Input Wanted on Northern Virginia Hazard Mitigation Plan; Comment Period Open Through October 8

For Immediate Release: September 13, 2022

Winter weather, flooding, high wind/severe storms, and human infectious diseases are the natural disasters most likely to cause widespread economic loss and personal hardship in Northern Virginia. Public input on the draft 2022 Northern Virginia Hazard Mitigation Plan (NOVA HMP) will help identify steps needed to minimize damage from natural disasters.

The Federal Disaster Mitigation Act of 2000 requires communities to update their plan every five years to maintain eligibility for FEMA's Hazard Mitigation Assistance (HMA) grant programs. The NOVA HMP aims to minimize the long-term risk to human life and property from known hazards such as floods, winter weather high winds, and other major disasters. Hazard mitigation efforts could include projects such as flood channel clearing, road and bridge design changes, property buy-outs, building code changes, or public alert systems improvements.

The 2022 NOVA HMP is a multi-jurisdictional plan that covers the cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park; the counties of Arlington, Fairfax, Loudoun, and Prince William; and the towns of Clifton, Dumfries, Haymarket, Herndon, Leesburg, Lovettsville, Middleburg, Occoquan, Purcellville, Quantico, Round Hill, and Vienna. The plan update also incorporates the concerns and needs of other stakeholders.

"The City of Alexandria has experienced flooding in various parts of the jurisdiction for years, and it continues to be a hazard for our area," said Acting Emergency Manager Ray Whatley. "The Office of Emergency Management strongly encourages the Alexandria community to provide feedback on the draft NOVA Hazard Mitigation Plan to help guide future preparedness, prevention, and improvement efforts."

Community feedback and comments are currently being accepted. View the draft plan at https://www.nvers.org/hmp. Comments, questions, and feedback should be submitted no later than 5 p.m. Saturday, October 8, 2022, at NOVA2022PublicComment@iem.com.

For more information about the draft 2022 NOVA HMP, contact Deputy Emergency Manager Kevin Coleman at (703) 746-5267 or kevin.coleman@alexandriava.gov.

For media inquiries only, contact Raytevia Evans, Senior Public Information Officer, at (703) 746-5190 or raytevia.evans@alexandriava.gov.

###

This news release is available at alexandriava.gov/go/3954.


12:29
74%
Office of Emergency Manageme...
Office of Emergency Management, City of Alexandria, VA
11 minutes ago
Your feedback on the Northern Virginia Hazard Mitigation Plan (NOVA HMP) is needed to help identify the necessary steps to minimize damage from natural disasters. Learn more about the plan and provide feedback:
alexandriava.gov/go/3954
CITY OF ALEXANDRIA VIRGINIA
alexandriava.gov
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11.3. Attachment 3: Mitigation Actions

Table 33: Previous Mitigation Actions

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006-1	Adopt revised FIRM.	Transportation and Environmental Services	Flood, Wind, Severe Storm	Internal funding	11-May	Complete final adoption public review as prescribed by NFIP.	Critical	Completed
2006-6	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.	Transportation and Environmental Services	Flood, Wind, Severe Storm	FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	Promotion of mitigation is included as part of the City's annual outreach program associated with FEMA's Community Rating System (CRS) annual recertification.
2010-3	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	Transportation and Environmental Services	Flood, Wind, Severe Storm	Internal funding	Ongoing	Develop outreach materials or identify appropriate outreach materials for dissemination by June 2011.	Medium	Included as part of the City's annual outreach program associated with FEMA's Community Rating System (CRS) annual recertification.

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-4	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	Emergency Management	Flood, Wind, Severe Storm	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staff as to effectiveness of provided information regarding the structural review.	Medium	Submitted LEMPG for generators
2010-5	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Transportation and Environmental Services	Flood, Wind, Severe Storm	Local program	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	The City's floodplain ordinance was revised in April 2011 to comply with NFIP minimum standards. The city conducted a Repetitive Loss Area Analysis in 2012. Annual report updates are published as part of the annual CRS recertification.
2010-7	Re-grade section of lower King Street, Union Street and The Strand to improve drainage and minimize flooding.	Project Implementation	Flood, Wind, Severe Storm	Alexandria Capital Improvement Project funding	Ongoing	Integrate into capital improvement budgets; complete design and permitting.	Low	Engineering Feasibility Study completed in 2013. Project now part of the Water Front Plan Implementation.

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-8	Construct an elevated walkway along Potomac riverfront to elevation 6.0 feet (NAVD88) to mitigate flooding.	Project Implementation	Flood, Wind, Severe Storm	Alexandria Capital Improvement Project funding and developer contributions	Ongoing	Integrate into capital improvement budgets; complete design and permitting.	Low	Part of the Waterfront Plan Implementation. Design contract in place February 2016.
2016-1	Build permanent standalone EOC.	Emergency Management	All Hazards	CIP	Dec-18	Entering Phase 2 of construction process.	High	Completed
2016-2	Identify and exploit the most effective tools for communications with the public during emergencies, including leveraging emerging technologies.	Emergency Management	All Hazards	Internal funding	Ongoing	3,000 new subscribers to e-News for receipt of emergency alerts by end of 2018.	Medium	No
2016-3	Four Mile Run Stream Restoration.	Transportation and Environmental Services	Flood, Wind, Severe Storm	Internal funding	Nov-18	Complete final adoption public review as prescribed by NFIP.	High	Project completed.
2016-4	Litter control infrastructure to provide a capture area for debris before it flows into the Potomac River.	Recreation, Parks, Cultural Activities	Flood	Alexandria Capital Improvement Project funding with matching funds from Arlington County	Nov-18		Medium	Approved FY 2017 - FY 2026 CIP. Page 126

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2016-5	Excavate sediment from channel bed of Cameron Run - I495 bridge to upstream, as needed.	Transportation and Environmental Services	Flood	City of Alexandria CIP	Ongoing	Secure funding for project by March 2011	High	The City does excavate sediment from Cameron Run starting at the I495 bridge to upstream as needed.

Table 34: New Mitigation Actions

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2022-1	Identify and exploit the most effective tools for communication and coordination with all internal agencies and stakeholders in the EOC.	Emergency Management	All Hazards	Internal funding	Ongoing		Medium	
2022-2	Alexandria Flood Action Initiative	Transportation and Environmental Services	Flood, Wind, Severe Storm	Alexandria Operating Budget	Ongoing	Communication and engagement of the community for flooding related information, large stormwater capital infrastructure projects, small stormwater spot improvement projects, updates on maintenance activities, grant programs, etc.	High	Initiative to provide improved communications to the community and consolidate improvements to city infrastructure, including maintenance activities, storm sewer capital improvements, and flood early warning. Serves as a portal to stormwater and flooding related activities citywide.
2022-3	Public Flood Watch Rain Gauge Portal	Transportation and Environmental Services	Flood	Alexandria Operating Budget	Ongoing	Publicly available on October 1, 2021	High	Part of the Flood Action initiative for engagement. Allows anyone to view near real-time rainfall and monitor storms as they move through the city, providing residents an early-warning in the case of extreme rainfall.

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2022-4	E Glebe & Commonwealth & Ashby Storm Sewer Capacity Project	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding	25-Mar	When contracts executed for Design & Construction.	High	Major storm sewer infrastructure capacity improvement in the Four Mile Run Watershed.
2022-5	Hooffs Run Timber Branch Bypass.	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding	25-Mar	When contracts executed for Design & Construction.	High	Major storm sewer infrastructure capacity improvement in the Hooffs Run Watershed.
2022-6	Hume Ave Inlets & Check Valve.	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding and ARPA funding	22-May	When contracts executed for Design & Construction.	High	Local storm sewer system spot improvement. Addresses inlet capacity at the curb and installs a check valve to improve local neighborhood drainage in flood prone neighborhood.
2022-7	Hume Ave Storm Sewer Bypass.	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding and ARPA funding	23-Mar	When contracts executed for Design & Construction.	High	Local storm sewer system spot improvement. Addresses storm sewer capacity with a new pipe alignment to improve local neighborhood drainage in flood prone neighborhood.

Project Number	Agency/Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2022-8	Mt Vernon Ave cul de sac Storm Sewer Improvements.	Transportation and Environmental Services	Flood	Alexandria Capital Improvement Program funding and ARPA funding	23-Mar	When contracts executed for Design & Construction.	High	Local storm sewer system spot improvement. Addresses inlet capacity with new inlets, storm sewer extension, and check valves to improve local neighborhood drainage in flood prone neighborhood.

Historic Flooding Data and Hydrologic Studies Projecting Flood Frequency

The City is experiencing more frequent and severe flash flooding from extreme precipitation events which have occurred more frequently in the last few years. These flash flood events may damage residential and commercial properties, impact critical assets, and cause day-to-day disruptions and economic losses. The City has experienced several major flooding events since 2019, including July 8, 2019, July 23, 2020, September 10, 2020, August 15, 2021, and September 16, 2021. These events are characterized between 50 to 500-year level rainstorm events. The City's Intensity-Duration-Frequency (IDF) curves developed in the 1980's were compared to other localities in the region and available climate predictions during the CASSCA study, completed in 2016, and were found to be more conservative than many surrounding localities' design storms, more conservative than NOAA Atlas-14, and were found to compare favorable to climate predictions available in 2016. The City is currently planning to further analyze these local IDF curves in comparison to regional efforts and more recent climate predictions.

The August and September 2021 storms were recorded by recently installed rain gauges that expand the City's gauge network to gather more localized storm information. Actual accumulation of over 5-inches in two hours, to be between 100 and 500-year level rain when compared to the statistical expectations derived for the City's curves developed in the 1980's for the City, which are more conservative than NOAA's predictions for the region. Meaning, what NOAA would call a 12-hour 25-year rainfall, Alexandria would call it closer to a 15-year rainfall.

The project area is not in a mapped floodplain; however, residents indicated their property has flooded five times within a six-year period with the August 15, 2021, storm causing the most damage (see Image). Other dates that would have impacted this neighborhood are July 2019, July 2020, and September 2020, as described above. Damage occurred to residential properties and includes impacts to basements, garages, and first floors. Further, based on videos and testimonials from residents, it appears that vehicles also may have been damaged during these severe flooding events.

Maintenance Plan

City sewer infrastructure 'state of good repair' program maintenance objectives includes inspection and maintenance on a rotating 3-5 year service schedule. The City also performs inspection and maintenance in response to Alex311 service requests an in advance of forecasted storm events. The initial work will be inspected regularly early on to ensure proper functioning prior to the routine, rotating schedule being implemented. More information is available on the City's Sewer Maintenance webpage.

Task Order 52: Further Investigation of Neighborhood Flooding

Presented to Valley Drive Neighborhood

January 23, 2024

Meeting Agenda

1. Introduction
2. Background
3. Project Updates
4. Site Evaluation Findings
5. Project Goal
6. Potential Solutions
7. Cost Estimations
8. Estimated Project Timeline
9. Question and Answer

Introduction

1. Brian Rahal
2. Daniel Medina
3. Mitch Dillon
4. Lisa Jaatinen
5. Gregory Toohey
6. Garry Truyens

Background

- Between 1972 and 2020, four extreme storm events adversely affected the City.
- Over a 14-month period between 2019 and 2020, there have been four major storm events that have had similar impacts.
- August 15, 2021, is the recent extreme storm event.
- Received several calls, emails and Alex311 requests from property owners about flooding concerns in the area.
- We started studying the cases to formulate and identify solutions to help mitigate flooding in the impacted neighborhoods.
- City team, AECOM and residence of Vally Drive had a meeting on <u>June 20, 2023,</u> to discuss potential stormwater improvements as part of the Flood Action Alexandria Program.

Neighborhood Boundary

Project Updates

Investigation of Neighborhood Flooding study is completed.

- Site Evaluation
- CCTV Inspection
- Hydraulic Model Verification
- Solution Development
- Cost Estimates

Site Evaluation Findings

- Old system but fairly in good condition.
- Insufficient capacity to effectively capture the drainage.
- Low spot in the backyard that flooding ponds.
- City staff Inspected the stormwater lines to make sure all the structures are in a good state of repair and clear of any obstructions.

Project Goal

- Convey the City's standard 10-year, 24-hour storm event without flooding and control larger events to the maximum extent feasible.
- Minimize and mitigate future localized flooding occurrences.
- No negative impacts to downstream residents.

<u>Potential Solutions</u>

1. Floodproofing
2. Spot Projects

Floodproofing

Potential Solutions

- By the property owners
- Can help to mitigate the flooding impacts.
- Residence who are experiencing issues related to flooding may be eligible to receive reimbursement for their installed floodproofing measures.
- City Stormwater Engineers are available for onsite consultation. Email us for more info - floodgrant@alexandriava.gov and there are also webinar for Flood Mitigation Grant and SWU Credit Program.
- Below information was sent on June 21, 2023.

Flood Mitigation Grant program: https://www.alexandriava.gov/flood-action/flood-mitigation-grant-program

City Assistance Program for Sewer Backflow Prevention: https://www.alexandriava.gov/sewers/city-assistance-program-for-sewer-backflow-prevention

ALEX311: https://alex311.alexandriava.gov/customer/request/TESSEWER/location

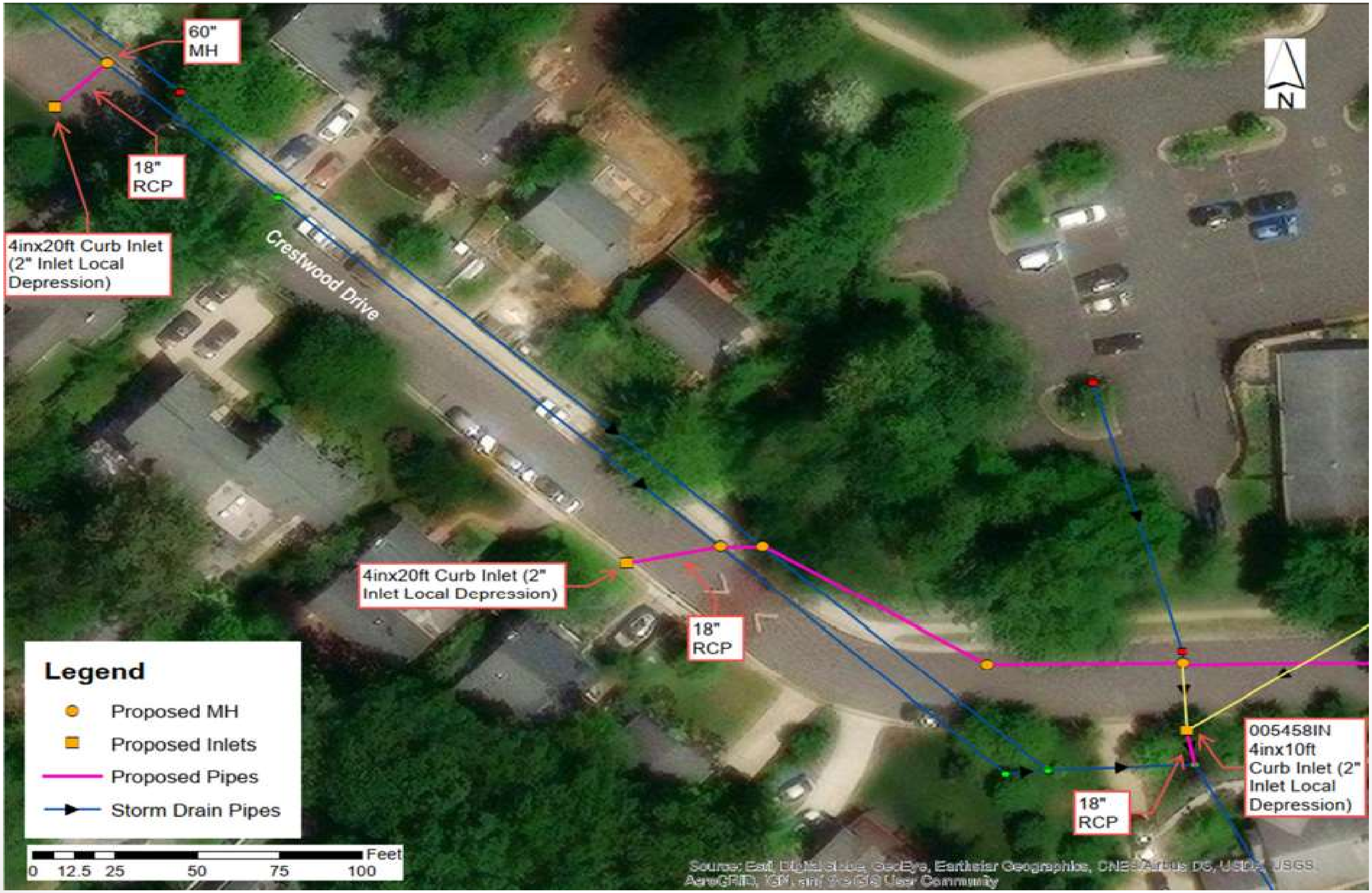
Webinar for Flood Mitigation Grant, SWU Credit Program: https://apps.alexandriava.gov/Calendar/Detail.aspx?si=57026

Spot Project

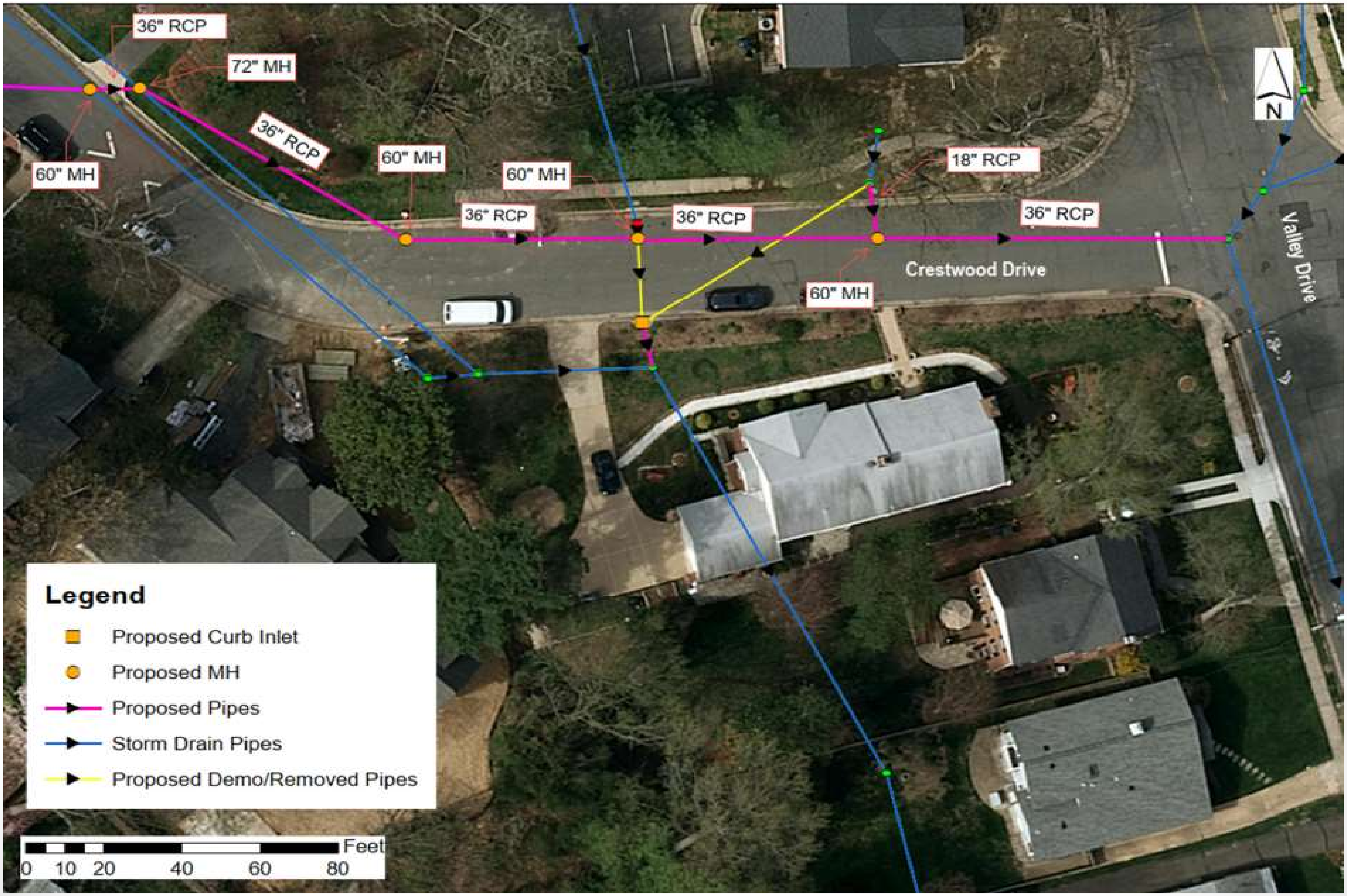
Potential Solutions

- Upsize the pipes
- Increase Inlets capacity
- Storm drain pipe realignment
- New system with sufficient capacity to share flow with the existing system
- Expected to reduce flooding
- Accommodate additional rainwater without increasing flood risk elsewhere.

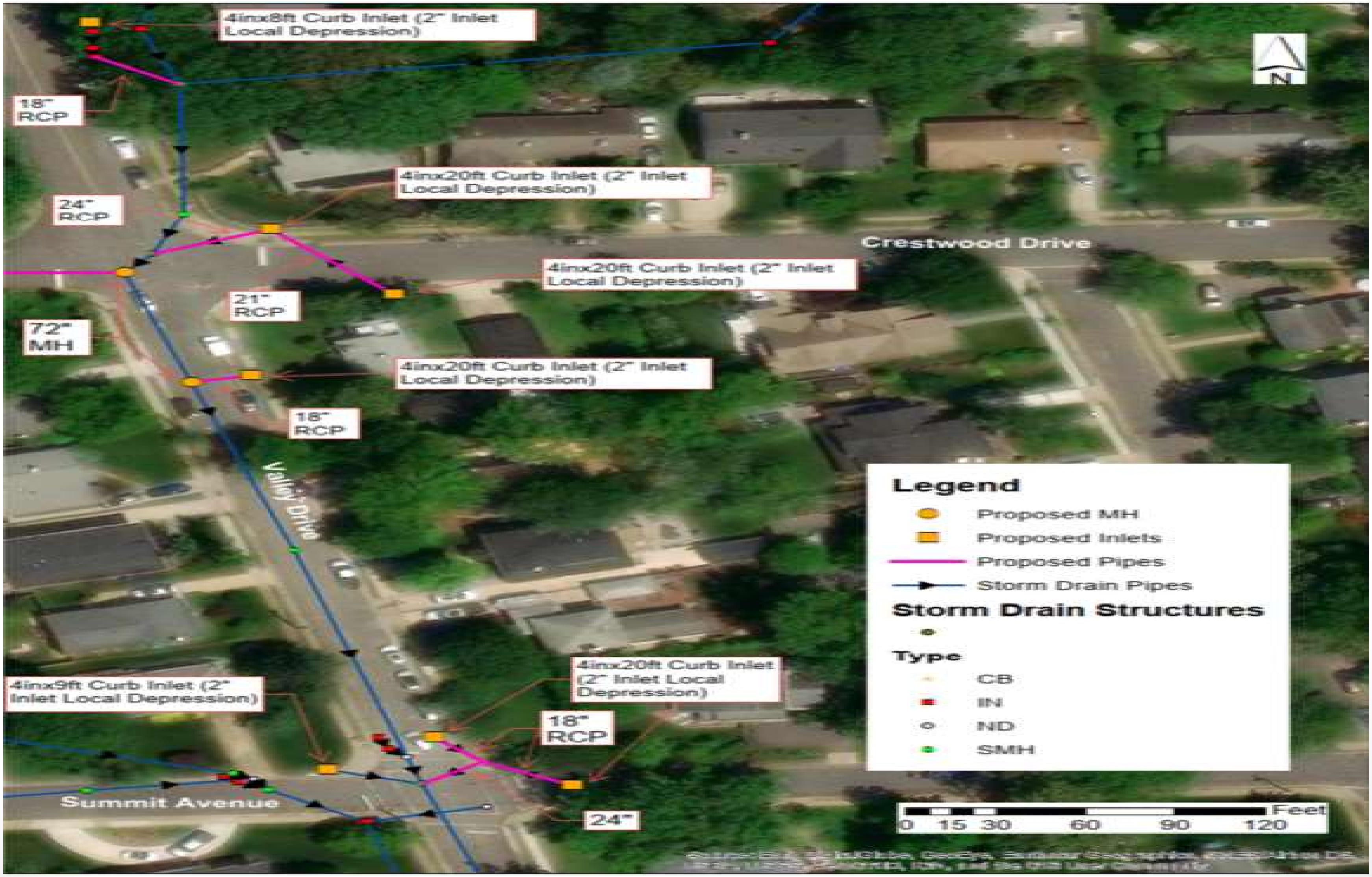
Proposed Curb Inlets along Crestwood Drive



Proposed Storm Drain System along Crestwood Drive



Valley Drive Inlet Upsizing and Storm Drain Pipe Locations



Dogwood Drive Storm Drain Pipe Realignment

Cost Estimations

- Crestwood Drive Improvements $1,100,000 approx.
- Dogwood Drive Improvements $80,000 approx.
- Valley Drive Improvements $960,000 approx.

Total Project Budget Estimated

$3,700,000.

(Design+Construction+CMI+Contingencies)

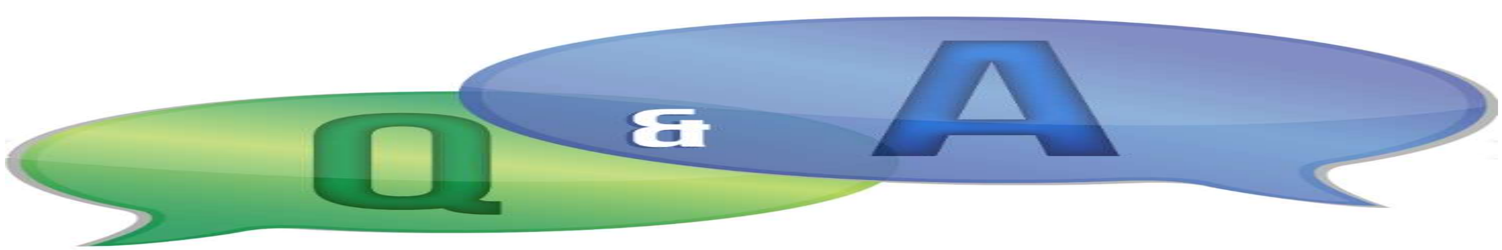
Estimated Project Timeline

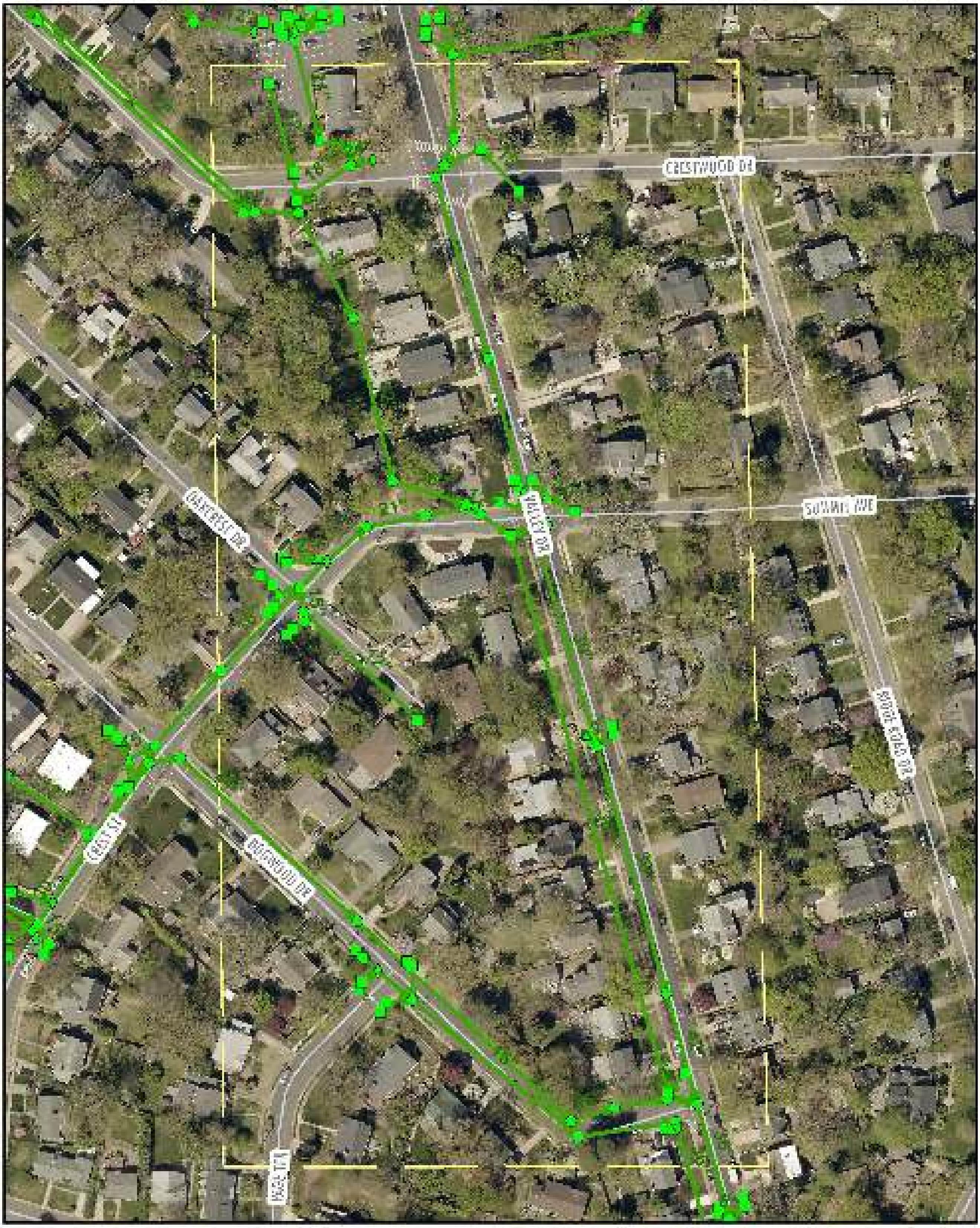
This will be added on Spot Project List
Proposed Funding Schedule

FY2025 for Design
and
FY2026 for Construction

City Of Alexandria Team/AECOM

Question and Answer





Legend

- Node
- Catch Basin
- Manhole
- Inlet
- Neighborhood Boundary

0 0.025 0.05 0.1 Miles

N

Sec. 6-300 Floodplain district.

6-301 Purpose and intent.

(A) This ordinance is adopted pursuant to the authority granted to localities by Va. Code § 15.2-2280, as well as the authority specifically granted to the city in its Charter. The purpose of these provisions is to prevent: the loss of life and property, the creation of health and safety hazards, the disruption of commerce and governmental services, the extraordinary and unnecessary expenditure of public funds for flood protection and relief, and the impairment of the tax base by:

(1) Regulating uses, activities, and development which, alone or in combination with other existing or future uses, activities, and development, will cause unacceptable increases in flood heights, velocities, and frequency;

(2) Restricting or prohibiting certain uses, activities, and development from locating within districts subject to flooding;

(3) Requiring all those uses, activities, and developments that do occur in flood-prone districts to be protected and/or flood-proofed against flooding and flood damage; and,

(4) Protecting individuals from buying land and structures which are unsuited for intended purposes because of flood hazards.

6-302 Applicability.

(A) These provisions shall apply to all privately and publicly owned lands within the jurisdiction of the City of Alexandria and identified as being in a Special Flood Hazard Area (SFHA) identified by the community or included in the Federal Emergency Management Agency {FEMA) flood insurance study (FIS) or shown on the flood insurance rate map (FIRM) that are provided to the City of Alexandria by FEMA dated January 11, 2024.

(B) The floodplain district regulations in section 6-300 are adopted in compliance with floodplain management criteria set forth in regulations promulgated by FEMA.

(C) This section shall be applicable to all applicants for development permits in the floodplain SFHA.

(D) All buildings, not previously mapped into the SFHA by FEMA and are newly mapped partially or wholly into the SFHA by new effective FEMA maps, for which a building permit shall have been duly and regularly issued by the director of the Department of Code Administration before January 11, 2024, which permit has not expired, may be completed without the necessity of complying with the floodplain district regulations in section 6-300, but after completion, any such building or structure and the land on which it is situated shall be subject to all the provisions of said section.

(E) All preliminary site plans, not previously mapped into the SFHA by FEMA and are newly mapped partially or wholly into the SFHA by new effective FEMA maps, which have been duly and regularly approved before January 11, 2024, and which have not expired, may be completed without the necessity of complying with the floodplain district regulations in section 6-300, but after completion, any building or structure on said site plan together with the land included in said site plan shall be subject to all the provisions of said section.

(F) All final site plans, not previously mapped into the SFHA by FEMA and are newly mapped partially or wholly into the SFHA by new effective FEMA maps, which have been duly and regularly approved and released before January 11, 2024, and which have not expired may be completed without the necessity of complying with the floodplain district regulations in section 6-300, but after completion, any building or structure on said site plan together with the land included in said site plan shall be subject to all the provisions of said section.

(G) Any building or structure, not previously mapped into the SFHA by FEMA and are newly mapped partially or wholly into the SFHA by new effective FEMA maps, which is in existence before January 11, 2024, or for which a preliminary or combination site plan, building permit or subdivision approved before January 11, 2024, continues in force and effect shall not be deemed a nonconforming use provided, that any such building or structure which, beginning January 11, 2024, is the subject of substantial improvement shall comply with the floodplain regulations in effect at the time of such improvement.

6-303 Definitions.

For the purposes of this section 6-300 the following terms and phrases shall have the meaning ascribed as follows below. Should any uncertainty occur with respect to the definition of any word, term or phrase used in this section, the applicable definitions set out in 44 CFR 59.1, as amended, shall apply.

(A) *A Zone.* An area of the 1-percent annual chance flood as shown on the Flood Insurance Rate Map. This zone is also referred to as the Approximated Floodplain District.

(B) *AE Zone.* An area shown of the 1-percent annual chance flood on the flood insurance rate map for which corresponding base flood elevations have been provided. This zone is also referred to as the Special Flood Hazard Area District.

(C) *Base flood.* The flood having a one percent chance of being equaled or exceeded in any given year. May also be referred to as the 100-year flood.

(C.1) *Appurtenant or accessory structure.* A non-residential structure which is on the same parcel of property as the principal structure and the use of which is incidental to the use of the principal structure. Accessory structures located in the SFHA are not to exceed 600 square feet.

(D) *Base flood elevation (BFE).* The water surface elevations of the base flood, that is, the flood level that has a one percent or greater chance of occurrence in any given year. The water surface elevation of the base flood in relation to the datum specified on the community's Flood Insurance Rate Map. For the purposes of this section, the base flood is the 1-percent annual chance flood.

(E) *Basement.* Any area of a building (including parking) having its floor subgrade (below ground level) on all sides.

(E.1) *City Vertical Datum.* For purposes of the National Flood Insurance Program, the North American Vertical Datum (NAVD) of 1988 to which base flood elevations shown on a community's FIRM are referenced.

(F) *Development.* Any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, temporary structures, the construction of streets, the installation of utilities and other activities or operations involving paving, filling, grading, excavating, mining, dredging, drilling, or other land-disturbing activities or permanent or temporary storage of equipment or materials.

(G) *Existing construction/structures.* "Existing construction" may also be referred to as "existing structures" and "pre-FIRM." For floodplain management purposes, the term "existing structure" refers to buildings that predate a community's adoption of its first floodplain management regulations.

(H) *Flood/flooding.*

(1) A general and temporary condition of partial or complete inundation of normally dry land areas from:

(a) The overflow of inland or tidal waters;

(b) The unusual and rapid accumulation or runoff of surface waters from any source; or,

(c) Mudflows which are proximately caused by flooding as defined in paragraph (1)(b) of this definition and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.

(2) The collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature such as flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding as defined in paragraph (l)(a) of this definition.

(H.1) *Flood damage-resistant material.* Any building product capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage." The term "prolonged contact" means at least 72 hours, and the term "significant damage" means any damage requiring more than cosmetic repair. "Cosmetic repair" includes cleaning, sanitizing, and resurfacing of the material.

(I) *Flood insurance rate map (FIRM).* An official map of a community, on which FEMA has delineated both the special flood hazard areas and the risk premium zones applicable to the community. A FIRM that has been made available digitally is called a digital flood insurance rate map (DFIRM). The official Flood Insurance Rate Map for the City of Alexandria shall be the in the digital format prepared by FEMA, Federal Insurance Administration, dated January 11, 2024, as amended.

(J) *Flood insurance study (FIS).* An examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluation and determination of mudflow and/or flood-related erosion hazards. The official Flood Insurance Study for the City of Alexandria shall be the flood insurance study prepared by FEMA, Federal Insurance Administration, dated January 11, 2024, as amended.

(K) *Floodplain or flood prone area*. Any land area susceptible to being inundated by water from such watercourse, or a land area which is subject to the unusual and rapid accumulation or runoff of surface waters from any source.

(L) *Floodplain district.* The areas encompassed by the 1-percent annual chance floodplain as shown on the flood insurance rate map.

(M) *Reserved.*

(N) *Floodproofing.* Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

(O) *Floodway.* The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than 0.5 feet at any point within the community.

(P) *Freeboard.* A factor of safety usually expressed in feet above a specified flood level for purposes of floodplain management. "Freeboard" tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization in the watershed.

(P.1) *Functionally dependent use.* A use which cannot perform its intended purpose unless it is located or carried out in close proximity to water. This term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and shipbuilding and ship repair facilities, but does not include long-term storage or related manufacturing facilities.

(Q) *Highest adjacent grade.* The highest natural elevation of the ground surface prior to construction next to the proposed walls of a structure.

(R) *Historic structure.* Any structure that is:

(1) Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;

(2) Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district;

(3) Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of the Interior; or,

(4) Individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either by an approved state program as determined by the Secretary of the Interior or directly by the Secretary of the Interior in states without approved programs.

(R.1) *Hydrologic and Hydraulic Engineering Analysis.* Analyses performed by a licensed professional engineer, in accordance with standard engineering practices that are accepted by the Virginia Department of Conservation and Recreation and FEMA, used to determine the base flood, other frequency floods, flood elevations, floodway information and boundaries, and flood profiles.

(R.2) *Letters of Map Change (LOMC).* A Letter of Map Change is an official FEMA determination, by letter, that amends or revises an effective Flood Insurance Rate Map or Flood Insurance Study. Letters of Map Change include:

Letter of Map Amendment (LOMA). An amendment based on technical data showing that a property was incorrectly included in a designated special flood hazard area. A LOMA amends the current effective Flood Insurance Rate Map and establishes that a land as defined by meets and bounds or structure is not located in a special flood hazard area.

Letter of Map Revision (LOMR). A revision based on technical data that may show changes to flood zones, flood elevations, floodplain and floodway delineations, and planimetric features. A Letter of Map Revision Based on Fill (LOMR-F), is a determination that a structure or parcel of land has been elevated by fill above the base flood elevation and is, therefore, no longer exposed to flooding associated with the base flood. In order to qualify for this determination, the fill must have been permitted and placed in accordance with the community's floodplain management regulations.

Conditional Letter of Map Revision (CLOMR). A formal review and comment as to whether a proposed flood protection project or other project complies with the minimum NFIP requirements for such projects with respect to delineation of special flood hazard areas. A CLOMR does not revise the effective Flood Insurance Rate Map or Flood Insurance Study.

(R.3) *Lowest adjacent grade.* The lowest natural elevation of the ground surface next to the walls of a structure.

(S) *Lowest floor.* The lowest floor of the lowest enclosed area (including basement). A parking structure that is below grade on all sides is considered a basement and therefore the lowest floor. An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage, in an area other than a basement area (the enclosure is not below grade on all sides) is not considered a building's lowest floor; provided, that such enclosure is not built so as to render the structure in violation of the applicable floodproofing non-elevation design requirements of this section 6-300.

(T) *Manufactured home.* A structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without permanent foundation, when connected to the required facilities, and which includes the plumbing, heating, air conditioning and electrical systems contained in the structure. A manufactured home shall include park trailers and other similar vehicles when placed on a site for greater than 180 days.

(U) *Mixed-use building.* Any building or structure that is used or intended for use for a mixture of nonresidential and residential uses in the same building or structure. For floodplain management purposes, a mixed-use building is subject to the same rules and conditions as a residential building unless all of the provisions set forth more specifically herein are met.

(V) *New construction.* Structures for which the start of construction commenced on or after the effective date of this floodplain management ordinance and includes any subsequent improvements to such structures. Any construction started after effective date of community's first floodplain management ordinance adopted by the community and before the effective start date of this floodplain management ordinance is subject to the ordinance in effect at the time the permit was issued, provided the start of construction was within 180 days of permit issuance.

(W) *Nonresidential building.* Any building or structure which is not a residential building or a mixed-use building.

(W.1) *Pre-FIRM structures.* A structure for which construction or substantial improvement occurred before May 8, 1970.

(W.2) *Post-FIRM structures.* A structure for which construction or substantial improvement occurred on or after May 8, 1970.

(X) *Recreational vehicle.* A vehicle which is:

(1) Built on a single chassis;

(2) Four hundred square feet or less when measured at the largest horizontal projection;

(3) Designed to be self-propelled or permanently towable by a light duty truck; and,

(4) Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational camping, travel, or seasonal use.

(X.1) *Repetitive Loss Structure.* A building covered by a contract for flood insurance that has incurred flood-related damages on two occasions in a 10-year period, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

(Y) *Residential building.* Any single-unit dwelling, two-unit dwelling, townhouse dwelling, or multi-unit dwelling, including any mixed-use building not meeting the criteria for nonresidential and any accessory building or structure.

(Y.1) *Severe Repetitive Loss Structure.* A structure that:

(1) Is covered under a contract for flood insurance made available under the NFIP; and

(2) Has incurred flood related damage:

(a) For which 4 or more separate claims payments have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or

(b) For which at least 2 separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

(Z) *Shallow flooding area.* A special flood hazard area with base flood depths from one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable and indeterminate, and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

(AA) *Special flood hazard area (SFHA).* The land in the floodplain subject to a one percent or greater chance of being inundated in any given year as determined in section 6-304(A).

(BB) *Start of construction.* For other than new construction and substantial improvement, under the Coastal Barriers Resource Act (P.L. - 97-348), means the date a building permit was issued, provided that the actual start of construction, repair, reconstruction, rehabilitation, addition, placement, substantial improvement, or other improvement was within 180 days of the permit issuance date. The actual start of construction means either the initial placement of permanent construction of a structure on the site, such as the pouring of footings or a slab, the installation of piles, the construction of columns or any work beyond the state of excavation. Permanent construction does not include land preparation, such as clearing, grading, and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement or for, footings, piers or foundations, or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units and not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not the alteration affects the external dimensions of the buildings.

(CC) *Structure.* For floodplain management purposes, a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.

(DD) *Substantial damage.* Damage of any origin sustained by a building or structure whereby the cost of restoring the building or structure to its before damaged condition would equal or exceed 50 percent of the market value of the building or structure before the damage occurred.

(EE) *Substantial improvement.* Any repair, reconstruction, rehabilitation, addition or other improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the building or structure before the start of construction of the improvement. The term does not, however, include either:

(1) Any improvement of a building or structure to correct existing violations of state or local health, sanitary or safety code specifications which have been identified by appropriate officials of the state or city and which are the minimum necessary to assure safe living conditions; or

(2) Any alteration of a "historic structure," provided that the alteration will not preclude the structure's continued designation as a "historic structure."

(3) Historic structures undergoing repair or rehabilitation that would constitute a substantial improvement as defined above, must comply with all ordinance requirements that do not preclude the structure's continued designation as a historic structure. Documentation that a specific ordinance requirement will cause removal of the structure from the National Register of Historic Places or the State Inventory of Historic places must be obtained from the Secretary of

the Interior or the State Historic Preservation Officer. Any exemption from ordinance requirements will be the minimum necessary to preserve the historic character and design of the structure.

(FF) *Violation.* The failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required in this ordinance is presumed to be in violation until such time as that documentation is provided.

(GG) *Watercourse.* A lake, river, creek, stream, wash, channel, or other topographic feature on or over which waters flow at least periodically. Watercourse includes specifically designated areas in which substantial flood damage may occur.

6-304 Description of Special Flood Hazard districts.

(A) *Description of Special Flood Hazard districts*. The various special flood hazard districts shall include the special flood hazard areas described below. The basis for the delineation of these districts shall be the flood insurance study and the flood insurance rate maps for the City of Alexandria prepared by FEMA, Federal Insurance Administration, dated January 11, 2024, and any subsequent revisions and amendments thereto.

The City of Alexandria may identify and regulate local flood hazard or ponding areas that are not delineated on the FIRM. These areas may be delineated on a "Local Flood Hazard Map" using best available topographic data and locally derived information such as flood of record, historic high-water marks, or approximate study methodologies.

The boundaries of the SFHA Districts are established as shown on the FIRM which is declared to be a part of this ordinance, and which shall be kept on file at the City of Alexandria offices.

(1) The Floodway District is in an AE Zone and is delineated, for purposes of this ordinance, using the criterion that certain areas within the floodplain must be capable of carrying the waters of the one percent annual chance flood without increasing the water surface elevation of that flood more than 0.5-feet at any point. The areas included in this District are specifically defined in Table 23 of the above-referenced FIS and shown on the accompanying FIRM. The following provisions shall apply within the Floodway District of an AE zone [44 CFR 60.3.(d)]:

(a) Within any floodway area, no encroachments, including fill, new construction, substantial improvements, or other development shall be permitted unless it has been demonstrated through hydrologic and hydraulic analysis performed in accordance with standard engineering practice that the proposed encroachment will not result in any increase in flood levels within the community during the occurrence of the base flood discharge. Hydrologic and hydraulic analyses shall be undertaken only by professional engineers or others of demonstrated qualifications, who shall certify that the technical methods used correctly reflect currently accepted technical concepts. Studies, analyses, computations, etc., shall be submitted in sufficient detail to allow a thorough review by the director of the department of transportation and environmental services or the Floodplain Administrator. Development activities which increase the water surface elevation of the base flood may be allowed, provided that the applicant first applies - with the City of Alexandria's endorsement - for a Conditional Letter of Map Revision (CLOMR) and receives the approval of the Federal Emergency Management Agency. If 6-304(A){l)(a) is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of 6-307 through 6-310.

(b) The placement of manufactured homes {mobile homes) is prohibited.

(2) The AE or AH Zones on the FIRM accompanying the FIS shall be those areas for which one percent annual chance flood elevations have been provided and the floodway has not been delineated. The following provisions shall apply within an AE or AH zone [44 CFR 60.3(c)] where FEMA has provided base flood elevations:

Until a regulatory floodway is designated, no new construction, substantial improvements, or other development (including fill) shall be permitted within the areas of special flood hazard, designated as Zones A, AE, or AH on the FIRM, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than 0.5-feet at any point within the City of Alexandria.

(3) The A Zone on the FIRM accompanying the FIS shall be those areas for which no detailed flood profiles or elevations are provided, but the one percent annual chance floodplain boundary has been approximated. For these areas, the following provisions shall apply [44 CFR 60.3{b)]:

The Approximated Floodplain District shall be that floodplain area for which no detailed flood profiles or elevations are provided, but where a one percent annual chance floodplain boundary has been approximated. Such areas are shown as Zone A on the maps accompanying the FIS. For these areas, the base flood elevations and floodway information from Federal, State, and other acceptable sources shall be used, when available. Where the specific one percent annual chance flood elevation cannot be determined for this area using other sources of data, then the applicant for the proposed use, development and/or activity shall determine this base flood elevation. For development proposed in the approximate floodplain the applicant must use technical methods that correctly reflect currently accepted practices, such as point on boundary, high water marks, or detailed methodologies hydrologic and hydraulic analyses. Studies, analyses, computations, etc., shall be submitted in sufficient detail to allow a thorough review by the floodplain administrator. The director of the department of transportation and environmental services or the floodplain administrator reserves the right to require a hydrologic and hydraulic analysis for any development. When such base flood elevation data is utilized, the lowest floor shall be elevated to or above the base flood level plus 1-foot. During the permitting process, the floodplain administrator shall obtain:

(a) The elevation of the lowest floor (in relation to City Vertical Datum), including the basement, of all new and substantially improved structures: and,

(b) If the structure has been floodproofed in accordance with the requirements of this article, the elevation (in relation to City Vertical Datum) to which the structure has been floodproofed.

Base flood elevation data shall be obtained from other sources or developed using detailed methodologies comparable to those contained in a FIS for subdivision proposals and other proposed development proposals that exceed 50 lots or five acres, whichever is the lesser.

(4) The mapped floodplain includes all of the above regions and also the regions designated as having a 0.2-percent annual chance of flooding on any flood map or flood insurance study. In this area no emergency service, medical service, or governmental records storage shall be allowed except by special exception using the variance process.

(B) The delineation of any of the floodplain districts may be revised by the City of Alexandria where natural or man-made changes have occurred and/or where more detailed studies have been conducted or undertaken by the U.S. Army Corps of Engineers or other qualified agency, or an individual documents the need for such change. Updates to the effective regulatory delineation of the floodplain districts require approval from both the City of Alexandria and FEMA.

(C) Any uncertainty on the floodplain district map, or flood insurance rate map, with respect to the boundary of any floodplain district, either A or AE zone, shall be determined by the director of transportation and environmental services or the floodplain administrator by scaling and computation from the map or by land survey information for the purposes of these development regulations. Individual property owners or developers must receive this determination from FEMA for the purposes of determining the federal requirement for flood insurance.

6-305 Administration.

(A) The director of the department of transportation and environmental services shall be responsible for the administration of the floodplain management regulations and shall hereby designate a floodplain administrator to administer and implement these regulations. The floodplain administrator may:

(1) Do the work themselves. In the absence of a Floodplain Administrator, the duties are conducted by the City of Alexandria chief executive officer or authorized designee; or

(2) Delegate duties and responsibilities set forth in these regulations to qualified technical personnel, plan examiners, inspectors, and other employees; or

(3) Enter into a written agreement or written contract with another community or private sector entity to administer specific provisions of these regulations. Administration of any part of these regulations by another entity shall not relieve the community of its responsibilities pursuant to the participation requirements of the National Flood Insurance Program as set forth in the Code of Federal Regulations at 44 C.F.R. Section 59.22.

(B) *The duties and responsibilities of the floodplain administrator*.

(1) Review applications for permits to determine whether proposed activities will be located in the Special Flood Hazard Area (SFHA) and that the site is reasonably safe from flooding.

(2) Interpret floodplain boundaries and provide available base flood elevation and flood hazard information.

(3) Review applications to determine whether proposed activities will be reasonably safe from flooding and require new construction and substantial improvements to meet the requirements of these regulations.

(4) Review applications to determine whether all necessary permits have been obtained from the Federal, State, or local agencies from which prior or concurrent approval is required; in particular, permits from state agencies for any construction, reconstruction, repair, or alteration of a dam, reservoir, or waterway obstruction (including bridges, culverts, structures), any alteration of a watercourse, or any change of the course, current, or cross section of a stream or body of water, including any change to the 1-percent annual chance frequency floodplain of free-flowing non-tidal waters of the State.

(5) Verify that applicants proposing an alteration of a watercourse have notified adjacent communities, the Virginia Department of Conservation and Recreation (Division of Dam Safety and Floodplain Management), and other appropriate agencies (VADEO, USACE), and have submitted copies of such notifications to FEMA

(6) Advise applicants for new construction or substantial improvement of structures that are located within an area of the Coastal Barrier Resources System established by the Coastal Barrier Resources Act that Federal flood insurance is not available on such structures; areas subject to this limitation are shown on Flood Insurance Rate Maps as Coastal Barrier Resource System Areas (CBRS) or Otherwise Protected Areas (OPA).

(7) Approve applications to develop in flood hazard areas if the provisions of these regulations have been met or disapprove applications if the provisions of these regulations have not been met.

(8) Inspect or cause to be inspected, buildings, structures, and other development for which permits have been issued to determine compliance with these regulations or to determine if non-compliance has occurred or violations have been committed.

(9) Review Elevation Certificates and require incomplete or deficient certificates to be corrected.

(10) Submit to FEMA, or require applicants to submit to FEMA, data and information necessary to maintain FIRMs, including hydrologic and hydraulic engineering analyses prepared by or for the City of Alexandria, within six months after such data and information becomes available if the analyses indicate changes in base flood elevations. The community or applicant should submit data via a LOMR.

(11) Maintain and permanently keep records that are necessary for the administration of these regulations, including:

(a) Flood insurance studies, flood insurance rate maps (including historic studies and maps and current effective studies and maps), and letters of map change; and

(b) Documentation supporting issuance and denial of permits, elevation certificates, documentation of the elevation (in relation to the datum on the FIRM) to which structures have been floodproofed, inspection records, other required design certifications, variances, and records of enforcement actions taken to correct violations of these regulations.

(12) Promote enforcement of the provisions of these regulations including investigation of violations, issuance of notices of violations or stop work orders, and requiring permit holders to take corrective action.

(13) Advise the city council regarding the intent of these regulations and, for each application for a variance, prepare a staff report and recommendation.

(14) Administer the requirements related to proposed work on existing buildings:

(a) Make determinations as to whether buildings and structures that are in flood hazard areas and that are damaged by any cause have been substantially damaged.

(b) Make reasonable efforts to notify owners of substantially damaged structures of the need to obtain a permit to repair, rehabilitate, or reconstruct. Prohibit the non-compliant repair of substantially damaged buildings except for temporary emergency protective measures necessary to secure a property or stabilize a building or structure to prevent additional damage.

(15) Undertake, as determined appropriate by the floodplain administrator due to the circumstances, other actions which may include but are not limited to: issuing press releases, public service announcements, and other public information materials related to permit requests and repair of damaged structures; coordinating with other Federal, State, and local agencies to assist with substantial damage determinations; providing owners of damaged structures information related to the proper repair of damaged structures in special flood hazard areas; and assisting property owners with documentation necessary to file claims for increased cost of compliance coverage under NFIP flood insurance policies.

(16) Notify the Federal Emergency Management Agency when the corporate boundaries of the City of Alexandria have been modified and:

(a) Provide a map that clearly delineates the new corporate boundaries or the new area for which the authority to regulate pursuant to these regulations has either been assumed or relinquished through annexation; and

(b) If the FIRM for any annexed area includes special flood hazard areas that have flood zones that have regulatory requirements that are not set forth in these regulations, prepare amendments to these regulations to adopt the FIRM and appropriate requirements, and submit the amendments to the governing body for adoption; such adoption shall take place at the same time as or prior to the date of annexation and a copy of the amended regulations shall be provided to Department of Conservation and Recreation (Division of Dam Safety and Floodplain Management) and FEMA.

(17) Upon the request of FEMA, complete and submit a report concerning participation in the NFIP which may request information regarding the number of buildings in the SFHA, number of permits issued for development in the SFHA, and number of variances issued for development in the SFHA.

(18) It is the duty of the director of the department of transportation and environmental services or the floodplain administrator to take into account flood, mudslide and flood-related erosion hazards, to the extent that they are known, in all official actions relating to land management and use throughout the entire jurisdictional area of the community, whether or not those hazards have been specifically delineated geographically (e.g. via mapping or surveying).

(19) Take into account flood, mudslide and flood-related erosion hazards, to the extent that they are known, in all official actions relating to land management and use throughout the entire jurisdictional area of the Community, whether or not those hazards have been specifically delineated geographically (e.g. via mapping or surveying).

(20) The director of the department of transportation and environmental services or the floodplain administrator may require information from the applicant, including, but not limited to, an engineering study of the floodplain. Upon a determination that the land on which the proposed use or development is located in a floodplain, the floodplain administrator shall determine whether such use or development may be permitted in accordance with the provisions of section 6-307 through 6-309 or requires the approval of a variance as set forth in section 6-312.

(21) The director of the department of transportation and environmental services or the floodplain administrator shall be responsible for the collection and maintenance of records necessary for the city's participation in the National Flood Insurance Program. Base flood elevations may increase or decrease resulting from physical changes affecting flooding conditions. As soon as practicable, but not later than six months after the date such information becomes available, the floodplain administrator shall notify or require the applicant to notify the FEMA Federal Insurance Administrator of any change in base flood elevation or the boundaries of any special flood hazard area depicted on the city's flood insurance rate map by submitting technical and scientific data to FEMA for a letter of map revision.

(C) *Permit requirement*. All uses activities and development occurring within any floodplain district, including placement of manufactured homes, shall be undertaken only upon the issuance of a permit. Such development shall be undertaken only in strict compliance with the provisions of this ordinance and with all other applicable codes and ordinances, as amended, such as the Virginia Uniform Statewide Building Code (VA USBC) and the City of Alexandria Subdivision Regulations. Prior to the issuance of any such permit, the floodplain administrator shall require all applications to include compliance with all applicable State and Federal laws and shall review all sites to assure they are reasonably safe from flooding. Under no circumstances shall any use, activity, and/or development adversely affect the capacity of the channels or floodways of any watercourse, drainage ditch, or any other drainage facility or system.

(D) *Site plans and permit applications*. An applicant must apply for a permit and issuance of the permit is required prior to the start of any development within the special flood hazard area. No site plan, subdivision plat or building permit application which proposes to construct or make substantial improvements within any floodplain district shall be approved by any agency of the City of Alexandria without certification by the director of the department of transportation and environmental services or the floodplain administrator that the plan, plat or permit application meets the requirements of this section 6-300. The director of the department of transportation and environmental services or the floodplain administrator shall insure that all other required permits related to development in the floodplain from state or federal governmental agencies have been obtained.

All applications for new construction or substantial improvement within any floodplain district, and all building permits issued for the floodplain shall incorporate the following information:

(1) The base flood elevation(s) at the site;

(2) The elevation of the lowest floor (including basement);

(3) For structures to be floodproofed (nonresidential only), the elevation to which the structure will be floodproofed; and,

(4) Topographic information showing existing and proposed ground elevations.

(E) *Use and interpretation of FIRMS*. The director of the department of transportation and environmental services or the floodplain administrator shall make interpretations, where needed, as to the exact location of special flood hazard areas, floodplain boundaries, and floodway boundaries. The following shall apply to the use and interpretation of FIRMs and data:

(1) Where field surveyed topography indicates that adjacent ground elevations:

(a) Are below the base flood elevation in riverine SFHAs, or below the 1% storm surge elevation in coastal SFHAs, even in areas not delineated as a special flood hazard area on a FIRM, the area shall be considered as special flood hazard area and subject to all applicable requirements of section 6-300; or

(b) Are above the base flood elevation and the area is labeled as a SFHA on the FIRM, the area shall be regulated as special flood hazard area unless the applicant obtains a Letter of Map Change that removes the area from the SFHA.

(2) In FEMA-identified special flood hazard areas where base flood elevation and floodway data have not been identified and in areas where FEMA has not identified SFHAs, any other flood hazard data available from a Federal, State, or other source shall be reviewed and reasonably used.

(3) Base flood elevations and designated floodway boundaries on FIRMs and in FISs shall take precedence over base flood elevations and floodway boundaries by any other sources if such sources show reduced floodway widths and/or lower base flood elevations.

(4) Other sources of data shall be reasonably used if such sources show increased base flood elevations and/or larger floodway areas than are shown on FIRMs and in FISs.

(5) If a preliminary flood insurance rate map and/or a preliminary flood insurance study has been provided by FEMA.

(a) Upon the issuance of a letter of final determination by FEMA, the preliminary flood hazard data shall be used and shall replace the flood hazard data previously provided from FEMA for the purposes of administering these regulations.

(b) Prior to the issuance of a letter of final determination by FEMA, the use of preliminary flood hazard data shall be deemed the best available data pursuant to 6-304(A)(3) and used where no base flood elevations and/or floodway areas are provided on the effective FIRM.

(c) Prior to issuance of a letter of final determination by FEMA, the use of preliminary flood hazard data is permitted where the preliminary base flood elevations or floodway areas exceed the base flood elevations and/or designated floodway widths in existing flood hazard data provided by FEMA. Such preliminary data may be subject to change and/or appeal to FEMA.

(F) *Jurisdictional boundary changes*. The city floodplain ordinance in effect on the date of annexation shall remain in effect and shall be enforced by the municipality for all annexed areas until the municipality adopts and enforces an ordinance which meets the requirements for participation in the National Flood Insurance Program. Municipalities with existing floodplain ordinances shall pass a resolution acknowledging and accepting responsibility for enforcing floodplain ordinance standards prior to annexation of any area containing identified flood hazards. If the FIRM for any annexed area includes special flood hazard areas that have flood zones that have regulatory requirements that are not set forth in these regulations, the governing body shall prepare amendments to these regulations to adopt the FIRM and appropriate requirements, and submit the amendments to the governing body for adoption; such adoption shall take place at the same time as or prior to the date of annexation and a copy of the amended regulations shall be provided to Department of Conservation and Recreation (Division of Dam Safety and Floodplain Management) and FEMA.

In accordance with the Code of Federal Regulations, Title 44 Subpart (B) Section 59.22(a)(9)(v) all NFIP participating communities must notify the Federal Insurance Administration and optionally the State Coordinating Office in writing whenever the boundaries of the community have been modified by annexation or the community has otherwise assumed or no longer has authority to adopt and enforce floodplain management regulations for a particular area.

In order that all flood insurance rate maps accurately represent the community's boundaries, a copy of a map of the community suitable for reproduction, clearly delineating the new corporate limits or new area for which the community has assumed, or relinquished floodplain management regulatory authority must be included with the notification.

(G) *District boundary changes*. The delineation of any of the Floodplain Districts may be revised by the City of Alexandria where natural or man-made changes have occurred and/or where more detailed studies have been conducted or undertaken by the U.S. Army Corps of Engineers or other qualified agency, or an individual documents the need for such change. However, prior to any such change, approval must be obtained from the Federal Emergency Management Agency. A completed LOMR is a record of this approval.

(I) *Submitting model backed technical data*. A community's base flood elevations may increase or decrease resulting from physical changes affecting flooding conditions. As soon as practicable, but not later than six months after the date such information becomes available, the community shall notify the Federal Emergency Management Agency of the changes by submitting technical or scientific data. The community may submit data via a LOMR. Such a submission is necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and floodplain management requirements will be based upon current data.

(J) *Letters of map revisions*. When development in the floodplain will cause or causes a change in the base flood elevation, the applicant, including state agencies, must notify FEMA by applying for a conditional letter of map revision and then a letter of map revision.

Example Cases:

(1) Any development that causes a rise in the base flood elevations within the floodway.

(2) Any development occurring in Zones A and AE without a designated floodway, which will cause a rise of more than 0.5-feet in the base flood elevation.

(3) Alteration or relocation of a stream (including, but not limited to, installing culverts and bridges) *44 Code of Federal Regulations §65.3 and §65.6(a)(12).*

6-306 General standards.

The following provisions shall apply to all permits in all Special Flood Hazard Area districts:

(A) New construction and substantial improvements shall be built according to this ordinance and the VA USBC, and anchored to prevent flotation, collapse, or lateral movement of the structure.

(B) Manufactured homes including non-residential trailers shall be anchored to prevent flotation, collapse, or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This standard shall be in addition to and consistent with applicable state anchoring requirements for resisting wind forces.

(C) New construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.

(D) New construction or substantial improvements shall be constructed by methods and practices that minimize flood damage.

(E) Electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities, including duct work, shall be elevated to or above the base flood elevation plus 1-foot so as to prevent water from entering or accumulating within the components during conditions of flooding.

(F) New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system.

(G) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters.

In addition to provisions A—G above, in all special flood hazard areas, the additional provisions shall apply:

(1) Prior to any proposed alteration or relocation of any channels or of any watercourse, stream, etc., within this jurisdiction a permit shall be obtained from the U.S. Corps of Engineers, the Virginia Department of Environmental Quality, and the Virginia Marine Resources Commission (a joint permit application is available from any of these organizations). Furthermore, in riverine areas, notification of the proposal shall be given by the applicant to all affected adjacent jurisdictions, the Department of Conservation and Recreation (Division of Dam Safety and Floodplain Management), other required agencies, and the Federal Emergency Management Agency.

(2) The flood carrying capacity within an altered or relocated portion of any watercourse shall be maintained.

6-307 Special regulations.

Within the boundaries of any A or AE zones in any floodplain district as shown on the flood insurance rate map, buildings or structures and their extensions and accessory buildings or structures maybe be constructed or substantially improved only in accordance with the following requirements of this section 6-300 and all other applicable provisions of law.

In all identified flood hazard areas where base flood elevations have been provided in the FIS or generated by a certified professional in accordance with 6-304(A)(3) of the following provisions shall apply:

(A) *Residential construction*.

(1) New construction or substantial improvement or any residential building or structure and their extensions and accessory buildings or structures in Zones A, AE, and with detailed base flood elevations shall have the lowest floor, including basement, elevated to or above the base flood elevation plus 1-foot.

(2) No building permit for the substantial improvement of an existing residential building shall be at least one foot issued unless the building has the lowest floor (including the basement) elevated to or above the base flood elevation plus 1-foot.

(B) *Non-residential construction*.

(1) New construction or substantial improvement for any commercial, industrial, or non-residential building and any extension or accessory to a non-residential building shall have the lowest floor, including basement, elevated to or above the base flood elevation plus 1-foot.

(2) New construction or substantial improvement of any building designated as Flood Design Class 4 in the VA USBC shall have the lowest floor, including basement, elevated at least 1-foot above the base flood elevation or the 0.2-percent annual chance flood elevation, whichever is higher.

(3) Non-residential buildings located in all A, AE, and AH zones may be dry-floodproofed in lieu of being elevated provided that all areas of the building components below the elevation corresponding to the base flood elevation plus 1-foot 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. In no event shall any floor below the elevation corresponding to the base flood elevation plus 1-foot be used for human or animal habitation, food storage or food preparation. A registered professional engineer or architect shall certify the design and construction using the required FEMA floodproofing certification forms that the standards of this subsection are satisfied. Such certifications, including the specific elevation in relation to City Vertical Datum to which such structures are floodproofed, shall be maintained by the floodplain administrator.

(4) No building permit for the substantial improvement of an existing nonresidential building shall be issued unless the building, together with attendant utility and sanitary facilities, has the lowest floor (including the basement) elevated to or above the base flood elevation plus 1-foot. Should this not be feasible, no such permit shall be issued unless the existing structure is dry-floodproofed as described in section 6-307 in all areas below the base flood elevation to the classification designated by the floodplain administrator.

(5) Any mixed-use building may be considered a nonresidential building for purposes of this section 6-307 if all of the following conditions are met; otherwise, the building shall be considered a residential building:

(a) No more than 20 percent of the development site is within the boundaries of any A or AE zones in any floodplain district as shown on the flood insurance rate map;

(b) At least 20,000 square feet of finished floor area of the proposed mixed-use building is devoted to nonresidential use;

(c) Basement areas (including below grade parking) must be located outside the boundaries of any A or AE zones in any floodplain district; and

(d) All floodproofing requirements specified in this ordinance 6-300 and as specified in NFIP Technical Bulletin 3 (2021 or later) Requirements for the Design and Certification of Dry Floodproofed Non-Residential and Mixed-Use Buildings - Requirements and Certification must be met.

(C) *Space below the lowest floor*. In zones A, AE, and AH, fully enclosed areas, of new construction or substantially improved structures, which are below the base flood elevation plus 1-foot shall:

(1) Not be designed or used for human habitation, but shall be used solely for parking of vehicles, building access, or limited storage of maintenance equipment used in connection with the premises. Access to the enclosed area shall be the minimum necessary to allow for parking of vehicles (garage door) or limited storage of maintenance equipment (standard exterior door), or entry to the living area (stairway or elevator).

(2) Be constructed entirely of flood damage-resistant materials below the base flood elevation plus 1-foot.

(3) Include measures to automatically equalize hydrostatic flood forces on walls by allowing for the entry and exit of floodwaters. To meet this requirement, the openings must either be certified by a professional engineer or architect or meet the following minimum design criteria:

(a) Provide a minimum of two openings on different side of each enclosed area subject to flooding.

(b) The total net area of all openings must be at least one square inch for each square foot of enclosed area subject to flooding.

(c) If a building has more than one enclosed area, each area must have openings to allow floodwaters to automatically enter and exit.

(d) The bottom of all required openings shall be no higher than one foot above the adjacent grade.

(e) Openings may be equipped with screens, louvers, or other opening coverings or devices, provided they permit the automatic flow of floodwaters in both directions.

(f) Foundation enclosures made of flexible skirting are not considered enclosures for regulatory purposes, and, therefore, do not require openings. Masonry or wood underpinning, regardless of structural status, is considered an enclosure and requires openings as outlined above.

(D) All new and replacement public utilities, water mains and sanitary sewers shall be designed to minimize or eliminate infiltration and exfiltration and to ensure their structural integrity under flood conditions to the satisfaction of the director of the department of transportation and environmental services or the floodplain administrator.

(E) Water heaters, furnaces, electrical distribution panels and other critical mechanical or electrical installations shall not be installed below the base flood elevation. Separate electrical circuits shall serve areas below the base flood elevation and shall be dropped from above.

(F) Any proposed use of land, development and any new construction or substantial improvement of a building or structure within an A or AE zone, in conjunction with all other uses, existing or possessing a valid permit for construction, shall not increase the water-surface elevation of the l-percent annual chance flood by more than 0.5 foot. Any party proposing a land use or development or such construction or improvement within an A or AE zone shall furnish specific engineering data and information as to the effect of the proposed action on future flood heights and obtain approval from the director of the department of transportation and environmental services or the floodplain administrator prior to undertaking the action.

(G) No building permit shall be issued for the construction or substantial improvement of a building or structure unless the applicant submits to the department of code administration a certification from a duly registered architect or engineer that the proposed construction (including prefabricated homes) or improvement meets the following requirements:

(1) The construction shall be protected against flood damage;

(2) The construction shall be designed (or modified) and anchored to prevent flotation, collapse or lateral movement of the building and structure;

(3) The construction shall be built using materials and utility equipment that are resistant to flood damage; and,

(4) The construction shall be built using methods and practices that will minimize flood damage. The certification required in section 6-307(H)(1) and (2) shall be based on the 1-percent annual chance flood level as noted on the flood insurance rate map.

(H) Wherever floodproofing is utilized within the scope of this section 6-300, such floodproofing shall be done by approved methods. A registered professional engineer or architect shall certify the adequacy of the floodproofing design to withstand the stresses of the base flood and such plan shall cite the elevation to which the structure is floodproofed. All certified floodproofing shall be designed as passive and without the need for human intervention. Certifications must be in accordance with the NFIP Technical Bulletin 3, latest version. Such certification shall be provided on Federal Emergency Management Agency, National Flood Insurance Program, elevation certificate and/or floodproofing certificate as deemed applicable by the floodplain administrator. The building or code official shall maintain a file of such certifications, including the elevation of the lowest floor for structures that are elevated in lieu of watertight floodproofing.

(I) Wherever pilings or columns are used for new construction and substantial improvements the following provisions shall apply:

(1) The bottom of the lowest horizontal structural member of the lowest floor (excluding the pilings or columns) is elevated to or above the base flood level plus 1-foot. If the lowest horizontal structural member is parallel to the direction of wave approach or elevated at least two feet above the base flood level if the lowest horizontal structural member is perpendicular to the direction of wave approach; and

(2) The pile or column foundation and structure attached thereto is anchored to resist flotation, collapse, and lateral movement due to the effects of wind and water loads acting simultaneously on all building components. Wind and water loading values shall each have a one percent chance of being equaled or exceeded in any given year *(one* percent annual chance).

(3) A registered professional engineer or architect shall develop or review the structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction to be used are in accordance with accepted standards of practice for meeting the provisions of 6-307(J).

(4) The floodplain administrator shall obtain the elevation (in relation to City Vertical Datum) of the bottom of the lowest horizontal structural member of the lowest floor (excluding pilings and columns) of all new and substantially improved structures. The floodplain administrator shall maintain a record of all such information.

(5) All new construction and substantial improvements shall have the space below the lowest floor either free of obstruction or constructed with non-supporting breakaway walls, open wood-lattice work, or insect screening intended to collapse under wind and water loads without causing collapse, displacement, or other structural damage to the elevated portion of the building or supporting foundation system. For the purpose of this section, a breakaway wall shall have a design safe loading resistance of not less than 10 and no more than 20 pounds per square foot. Use of breakaway walls which exceed a design safe loading resistance of 20 pounds per square foot (either by design or when so required by local codes) may be permitted only if a registered professional engineer or architect certifies that the designs proposed meet the following conditions:

(a) Breakaway wall collapse shall result from water load les than that which would occur during the base flood: and

(b) The elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (structural and nonstructural). Maximum wind and water loading values to be used in this determination shall each have a one percent chance of being equaled or exceeded in any given year.

(6) The enclosed space below the lowest floor shall be used solely for parking of vehicles, building access, or storage. Such space shall not be partitioned into multiple rooms, temperature-controlled, or used for human habitation. The enclosed space shall be less than 300 square feet.

(7) The use of fill for structural support of buildings is prohibited. When nonstructural fill is proposed in a coastal high hazard area, appropriate engineering analyses shall be conducted to evaluate the impacts of the fill prior to issuance of a permit.

6-308 Other conditions.

(A) No filling of any kind shall be allowed within the boundaries of any A or AE zone except where such filling, when considered in conjunction with all other uses, existing and proposed, will not increase the base flood elevation more than 0.5 foot. Persons proposing such filling shall furnish specific engineering data and information as to the effect of their proposed action on future flood heights and shall obtain approval from the director of the department of transportation and environmental services or the floodplain administrator prior to any filling.

(B) All uses, activities and development occurring within any floodplain district shall only be undertaken in strict compliance with the Virginia Uniform Statewide Building Code (VA USBC).

(C) No wall, fence or other outdoor obstruction shall be constructed in any floodplain district unless such structure is approved by the director of the department of transportation and environmental services or the floodplain administrator; provided that open mesh wire fences of not less than No. 9 wire, with mesh openings of not less than six inches times six inches, whose supports shall be securely anchored in concrete and whose wire shall be securely fastened to the supports, may be erected without any review by or approval of the director of the department of transportation and environmental services or the floodplain administrator under this section 6-300.

(D) The provisions of this section 6-300 shall not be construed to prevent the remodeling (not amounting to substantial improvement), maintenance or floodproofing of buildings and structures now existing, or prevent the surfacing or resurfacing of existing streets or parking lots within two inches of the existing grade.

6-309 Subdivision requirements.

(A) All subdivision proposals shall be consistent with the need to minimize flood damage;

(B) All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage;

(C) All subdivision proposals shall have adequate drainage provided to reduce exposure to flood hazards; and

(D) Include base flood elevation data. Where no base flood elevation data is determined, base flood elevation data shall be obtained from other sources or developed using detailed methodologies, hydraulic and hydrologic analysis, comparable to those contained in a Flood Insurance Study for subdivision proposals and other proposed development proposals that exceed fifty lots or five acres, whichever is lesser.

6-310 Trailer camps, manufactured homes, mobile homes, recreational vehicles, and septic tank systems.

(A) In zones A, AE, and AH, all trailer camps, manufactured homes, and mobile homes are not permitted in any floodplain district.

(B) All recreational vehicles in the floodplain must be on the site for fewer than 180 consecutive days, be fully licensed and ready for highway use (a recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices and has no permanently attached additions).

(C) Installation of septic tank systems in any floodplain district is prohibited.

6-311 Projects in floodplain areas.

(A) *Existing structures*. Any structure or use of a structure or premises must be brought into conformity with these provisions when it is changed, repaired, or improved unless one of the following exceptions is established before the change is made:

(1) The director of the department of transportation and environmental services or the floodplain administrator has determined that:

(a) Change is not a substantial repair or substantial improvement; and

(b) No new square footage is being built in the floodplain that is not compliant; and

(c) No new square footage is being built in the floodway; and

(d) The change complies with this ordinance and the VA USBC.

(2) The changes required to comply with a citation for a health or safety violation.

(3) The structure is a historic structure and the change required would impair the historic nature of the structure.

(B) *Flood prevention projects*. Nothing in sections 6-304 through section 6-309 shall be construed to prohibit the City of Alexandria or any person from undertaking lawful filling, draining, construction, realignment or relocation of stream channels or any other improvement that is intended to eliminate or reduce the danger of flooding, provided:

(1) The improvement is in accord with the City of Alexandria's flood improvement plan for the floodplain district involved and the director of the department of transportation and environmental services or the floodplain administrator has issued a certificate to that effect;

(2) The improvement is under the general supervision of the director of the department of transportation and environmental services or the floodplain administrator;

(3) The realignment or relocation of any stream channel is designed and constructed so that there will be no reduction in the natural valley storage capacity of the area with respect to the 1-percent annual chance flood, unless such relocation or realignment is designed to contain the 1-percent annual chance flood within the banks of the channel;

(4) Notification, in riverine situations, is provided to adjacent communities, Virginia Department of Conservation and Recreation, FEMA, and other required agencies prior to any alteration or relocation of a watercourse; and,

(5) The requirements of section 6-307(G) and section 6-308(A) must be met.

6-312 Variances.

(A) Variances shall be issued only upon (i) a showing of good and sufficient cause, (ii) after city council has determined that failure to grant the variance would result in exceptional hardship to the applicant, and (iii) after the city council has determined that the granting of such variance will not result in (a) unacceptable or prohibited increases in flood heights, (b) additional threats to public safety, (c) extraordinary public expense; and will not (d) create nuisances, (e) cause fraud or victimization of the public, or (f) conflict with local laws or ordinances.

(B) The city council may, for good and sufficient cause, permit less than full compliance with or waive the provisions of sections 6-304 through 6-311, provided:

(1) Written application is made stating the hardship which will occur if the variance is not granted;

(2) A public hearing is held;

(3) The decision is made by a majority vote of the entire membership of city council upon finding that the variance is the minimum necessary, considering the flood hazard, to afford relief;

(4) The director of the department of transportation and environmental services or the floodplain administrator states in writing that the variance(s) will not result in unacceptable or prohibited increases in flood heights, additional threats to public safety, extraordinary public expense; and will not create nuisances, cause fraud or victimization of the public, or conflict with local laws and ordinances; and,

(5) The director of the department of transportation and environmental services or the floodplain administrator notifies the applicant in writing that the issuance of a variance to construct a structure below the base flood elevation will result in increased insurance premium rates for flood insurance and that such construction will increase the risks to life and property.

(C) While the granting of variances generally is limited to a lot size less than one-half acre, deviations from that limitation may occur. However, as the lot size increases beyond one-half acre, the technical justification required for issuing a variance increases. Variances may be issued by city council for new construction and substantial improvements to be erected on a lot of one-half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the base flood level, in conformance with the provisions of this section.

(D) Variances may be issued for new construction and substantial improvements and for other development necessary for the conduct of a functionally dependent use provided that the criteria of this section are met, and the structure or other development is protected by methods that minimize flood damages during the base flood and create no additional threats to public safety.

(E) In passing upon applications for variances, the director of the department of transportation and environmental services or the floodplain administrator shall satisfy all relevant factors and procedures specified in other sections of the zoning ordinance and consider the following additional factors:

(1) The danger to life and property due to increased flood heights or velocities caused by encroachments. No variance shall be granted for any proposed use, development, or activity within any Floodway District that will cause any increase in the one percent chance flood elevation;

(2) The danger that materials may be swept onto other lands or downstream to the injury of others;

(3) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owners;

(4) The importance of the services provided by the proposed facility to the community;

(5) The requirements of the facility for a waterfront location;

(6) The availability of alternative locations not subject to flooding for the proposed use;

(7) The compatibility of the proposed use with existing development and development anticipated in the foreseeable future;

(8) The relationship of the proposed use to the comprehensive plan and floodplain management program for the area;

(9) The safety of access by ordinary and emergency vehicles to the property in time of flood;

(10) The expected heights, velocity, duration, rate of rise, and sediment transport of the flood waters expected at the site;

(11) Variances will not be issued for any accessory structure within the SFHA (Note: See section 6-307(D)(l)).

(12) Such other factors which are relevant to the purposes of this ordinance.

(F) The director of the department of transportation and environmental services or the floodplain administrator may refer any application and accompanying documentation pertaining to any request for a variance to any engineer or other qualified person or agency for technical assistance in evaluating the proposed project in relation to flood heights and velocities, and the adequacy of the plans for flood protection and other related matters.

(G) Variances shall be issued only after city council has determined that the granting of such will not result in (a) unacceptable or prohibited increases in flood heights, (b) additional threats to public safety, (c) extraordinary public expense; and will not (d) create nuisances, (e) cause fraud or victimization of the public, or (f) conflict with local laws or ordinances.

(H) Variances shall be issued only after city council has determined that the variance will be the minimum required to provide relief.

(I) The director of the department of transportation and environmental services or the floodplain administrator shall notify the applicant for a variance, in writing that the issuance of a variance to construct a structure below the one percent chance flood elevation (a) increases the risks to life and property and (b) will result in increased premium rates for flood insurance.

(J) A record shall be maintained of the above notification as well as all variance actions, including justification for the issuance of the variances. Any variances that are issued shall be noted in the annual or biennial report required to be submitted to the Federal Insurance Administrator.

6-313 Compliance, liability, severability and penalties.

(A) No land shall hereafter be developed and no structure shall be located, relocated, constructed, reconstructed, enlarged or structurally altered except in full compliance with the terms and provisions of this section 6-300 and any other applicable ordinances and regulations which apply to uses within the jurisdiction of these floodplain district regulations.

(B) The degree of flood protection sought by the provisions of this ordinance section 6-300 is considered reasonable for regulatory purposes and is based on acceptable engineering methods of study but does not imply total flood protection. Larger floods may occur on rare occasions. Flood heights may be increased by man-made or natural causes, such as ice jams and bridge openings restricted by debris. Therefore, this section 6-300 does not imply that areas outside the floodplain districts, or land uses permitted within such districts, will be free from flooding and flood damages. Additionally, the granting of a permit or approval of a development in an identified floodplain district shall not constitute a representation, guarantee, or warranty of any kind by any official or employee of the City of Alexandria of the practicability or safety of the proposed use, and shall create no liability upon the City of Alexandria, its officials or employees.

(C) This ordinance shall not create liability on the part of the City of Alexandria of the practicability or safety of the proposed use, and shall create no liability upon the City of Alexandria or any officer or employee thereof for any flood damages that result from reliance on this ordinance, or any administrative decision lawfully made thereunder.

(D) If any section, subsection, paragraph, sentence, clause, or phrase of this section 6-300 shall be declared invalid for any reason whatsoever, such decision shall not affect the remaining portions of this section 6-300. The remaining portions shall remain in full force and effect; and for this purpose, the provisions of this section 6-300 are hereby declared to be severable.

(E) *Penalty for violations*. Any person who fails to comply with any of the requirements or provisions of this article or directions of the director of the planning and zoning department or any authorized employee of the City of Alexandria shall be guilty of the appropriate violation and subject to the penalties thereof.

The VA USBC addresses building code violations and the associated penalties in Section 104 and Section 115. Any person who shall engage in new construction, substantial improvement or development without a building permit as required by VA USBC and these floodplain management regulations shall be subject to the violations and associated penalties of the Zoning Ordinance of the City of Alexandria are addressed in Section 11-200 of the Zoning Ordinance.

In addition to the above penalties, all other actions are hereby reserved, including an action in equity for the proper enforcement of this article. The imposition of a fine or penalty for any violation of, or noncompliance with, this article shall not excuse the violation or noncompliance or permit it to continue; and all such persons shall be required to correct or remedy such violations within a reasonable time. Any structure constructed, reconstructed, enlarged, altered, or relocated in noncompliance with this article may be declared by the City of Alexandria to be a public nuisance and abatable as such. Flood insurance may be withheld from structures constructed in violation of this ordinance.

6-314 Abrogation and greater restrictions.

To the extent that the provisions are more restrictive, this ordinance supersedes any ordinance currently in effect in floodplain districts. To the extent that any other existing law or regulation is more restrictive or does not conflict it shall remain in full force and effect.

Any person aggrieved by a decision of the director of the department of transportation and environmental services or the floodplain administrator under this section 6-300 may appeal that decision to city council; provided, that the appeal shall be filed in writing with the city clerk within 15 days of the decision being appealed and shall describe the decision being appealed and the reasons why the person believes the decision to be invalid.

These regulations are not intended to repeal or abrogate any existing ordinances including subdivision regulations, zoning ordinances, or building codes. In the event of a conflict between these regulations and any other ordinance, the more restrictive shall govern.

6-315 Records and annual report.

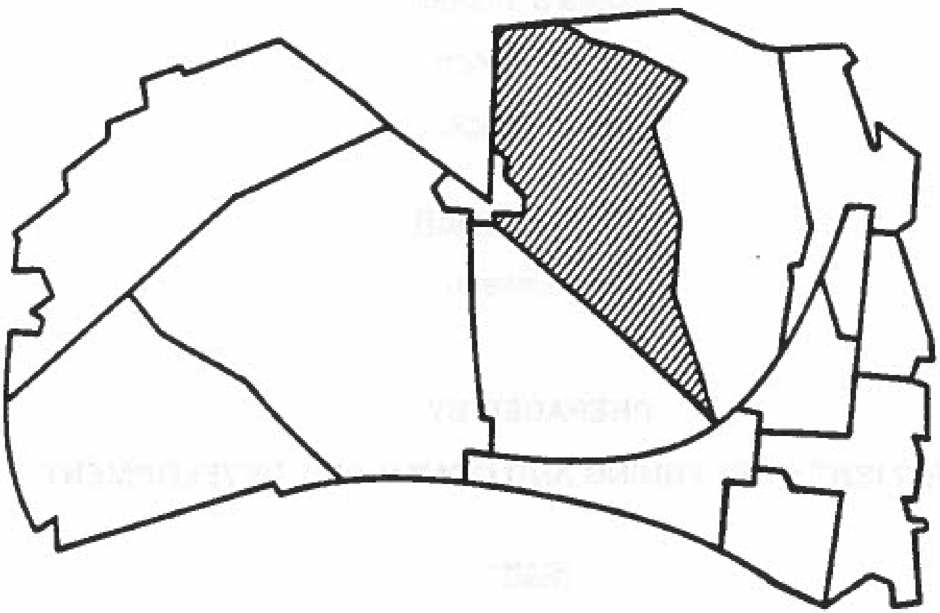
Records of actions associated with administering this ordinance shall be kept on file and maintained by or under the direction of the director of the department of transportation and environmental services or the floodplain administrator in perpetuity.

It shall be the city manager's duty to submit any reports to FEMA and the floodplain coordinator at the Virginia Department of Conservation and Recreation that may be required regarding the City of Alexandria's compliance with floodplain management regulations.

(Ord. No. 4354, § 1, 6-12-04; Ord. No. 4715, § 1, 4-16-11; Ord. No. 5515, § 6, 12-16-23; Ord. No. 5516, § 1, 12-16-23)

NORTHRIDGE/ROSEMONT

SMALL AREA PLAN



ADOPTED 1992 MASTER PLAN

ALEXANDRIA, VIRGINIA

Amended 12/12/1998, Ordinance 4030
Amended 12/16/2003, Ordinance 4321
Amended 3/18/2006, Four Mile Run Master Plan
Amended 11/12/2022, Ordinance 5462

AMENDMENTS TO NORTH RIDGE/ROSEMONT SMALL AREA PLAN - as of 1/12/2023

Master Plan Amendment #	**Ordinance #**	**Passage Date**	**Description/Address**	**Small Area Plan**	**Land Use Change**
MPA98-0003	4030	12/12/1998	Include maps of Historic Districts, Rosemont and Park Fairfax	NRR	Include maps of Historic Districts, Rosemont and Park Fairfax
MPA2003-0008	4321	12/16/2003	Intersection of W. Glebe Road and Martha Custis Drive	NRR	Change from Utility and Transportation to RM
MPA2006-0001	Unknown	3/18/06 March 2006 http://dockets.alexandriava.gov/dsr/fy06dock.nsf/536ee1fcf306fd108525704b0064fc94/a0008aa343f255188525715600646b86.html?OpenDocument	Incorporate Four Mile Run Restoration Master Plan	NRR/PW/PYPG	Incorporate Four Mile Run Restoration Master Plan
MPA2022-00004	5462	11/12/2022	2729 King Street (Woodbine)	NRR	Change in height from 35' to 45'

NORTHRIDGE / ROSEMONT

SMALL AREA PLAN

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PURPOSE OF THE PLAN

The purpose of this document is to update the Adopted 1974 Consolidate Master Plan for the North Ridge/Rosemont area and to adopt a 1989 Plan as part of the City's new Master Plan. Once adopted, the Small Area Plan will serve as the basis for future City Council policy initiatives and actions affecting land use, zoning, capital improvements and programs in the North Ridge/Rosemont area.

ORGANIZATION AND CONTENTS

The Small Area Plan is organized into two sections: Background and Issues and Plan Recommendations. The first section reviews and analyzes existing conditions and trends in the study area including physical description, demographics, land use, zoning, economic development activities and trends, transportation and urban design. This section also retraces past City policies in the area, including the 1974 Master Plan, rezoning, resolutions and capital improvement programs. Based on this analysis this section identifies issues which need to be addressed in the plan for this area.

The second section lists the goals, objectives and specific recommendations on land use, zoning, transportation and urban design.

PLANNING PROCESS

The final draft of this Plan will be sent to the Master Plan Task Force for review and to the Planning Commission and to City Council for review and adoption. Once approved, the plan will be referred to the Zoning Task Force for input into the City-wide zoning code revision effort.

BACKGROUND

DESCRIPTION OF THE AREA

The North Ridge/Rosemont study area occupies an 847.5 acre pentagon of land in the eastern half of Alexandria. The study area is delineated by Four Mile Run, Glebe Road, Russell Road, King Street and Quaker Lane. (See Map 1, Study Area.)

The Fairlington/Bradlee commercial area is not included in the study area. Instead, Fairlington/Bradlee is the subject of a separate study.

From the corner formed by the intersection of King Street and Russell Road the topography of the North Ridge/Rosemont area rises in a series of rolling hills. At 200 feet above sea level, Beverly Hills is the apogee of the rise and from there the topography falls away to Four Mile Run's flood plain.

The hilly topography lends itself well to the suburban detached housing that is now so characteristic of the North Ridge/Rosemont Area. Although streets of detached, single family houses surrounded by mature trees are typical of much of the area, the Northwest corner of North Ridge/Rosemont is the site of garden apartments and townhouses. These apartments and townhouses comprise the attractively landscaped Parkfairfax Condominium and Lloyd apartments.

HISTORY OF THE STUDY AREA

Indians lived in the North Ridge/Rosemont area as long as 12,000 years ago, but it was only in the early 19th century that many permanent homes, were built in the area. Until 1847 North Ridge/Rosemont was part of the District of Columbia; thereafter, the area was retroceded to Virginia.

During the nineteenth century North Ridge/Rosemont was the site of farms and some large houses such as Mount Ida, Lloyd House and Oaklands. As the nineteenth century waned the farms became summer residences. Later Mount Ida and the Lloyd House would become private girls schools. These houses are now part of the St. Mary's Academy and St. Agnes Episcopal School.

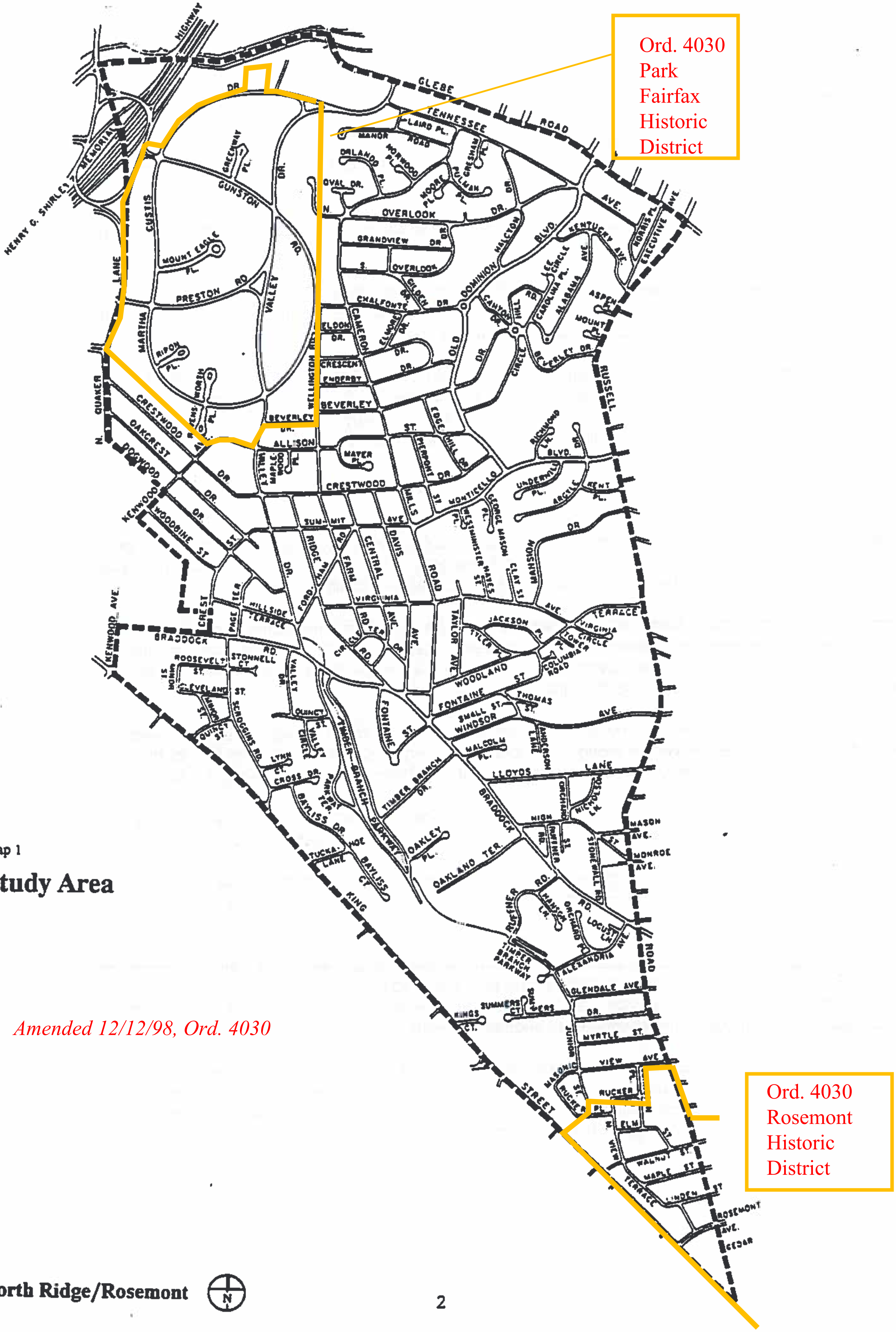
The North Ridge/ Rosemont neighborhoods were transformed into so called "street car suburbs" with the advent of an electric streetcar system along Commonwealth Avenue. Constructed at the turn of the century, the streetcar system linked North Ridge/ Rosemont with Old Town and with Washington D.C..

In 1905 the electric streetcar was joined by the railroad. The railroad moved its tracks to their present location and constructed Union Station at the intersection of King Street and Russell Road.

Rosemont has the distinctive plan of a streetcar suburb. City blocks have their short side facing the railway and their long face at right angles to the rails. This layout was meant to reduce the length of a commuters walk to the street car.

Houses began appearing in Rosemont after 1900 and in the early 1920's there was a second period of growth in Rosemont. Braddock Heights and Beverly Hills also began to be developed in the 1920's. It was also in this decade that bus service was introduced and the ownership of autos became common. Both of these innovations gave further impetus to suburban growth.

All of North Ridge/Rosemont was not incorporated into the City of Alexandria until 1930 and it was after the incorporation that the construction of housing in North Ridge began in earnest. The Permanesque Homes company offered all electric houses for $5,850 in Beverly Hills during the latter half of the 1930's. This company was responsible for most of the development in Beverly Hills.



Map 1

Study Area

North Ridge/Rosemont

The last large development to occur in North Ridge/Rosemont was Parkfairfax. Parkfairfax's 1684 apartments and townhouses were built by the Metropolitan Life Insurance Company between 1940 and 1943. The housing here ceased to be rental in 1977 when Parkfairfax was converted to condominium ownership.

The history of North Ridge/Rosemont is that of twentieth century suburban growth. It is the intent of this plan to maintain the suburban and residential nature of the area into the twenty first century.

DEMOGRAPHICS

Population

Between 1970 and 1980 the population of North Ridge/Rosemont declined by 18%, falling from 13,320 to 10,933 people. The decline was due to a trend toward smaller average household sizes. This is a long term national trend that in North Ridge/Rosemont meant the average household size was half a person smaller in 1980 than 1970 (Table 1).

TABLE 1

Population Characteristics
North Ridge/Rosemont Area

	1970	1980	1985	1990	2000
Population	13,320	10,933	10,865	10,753	10,602
Housing Units	5,068	5,049	5,084	5,148	5,196
Households	4,819	4,896	4,939	5,002	5,048
Housing Vacancy Rate	4.9%	3.0%	2.8%	2.8%	2.8%
Average Household Size	2.74	2.23	2.20	2.15	2.10

SOURCES: 1970 and 1980: U.S. Census.
1985, 1990 and 2000: COG Cooperative.

A contributing cause of the decline in average household size was the aging of the area's population. The form this aging took was the loss of children. North Ridge/Rosemont had only half the number of children in 1980 as it had in 1970.

The trend towards smaller households is expected to continue but at a slower rate. By the year 2010 the average household size may fall to 2.05 people. The decline will slow because children are now a smaller portion of the population so there are fewer children to grow up and leave the area.

In other parts of Alexandria the loss of population will be offset in the future by new housing construction. This is not possible in North Ridge/Rosemont, where the opportunities for new housing are few. Most of the vacant land that is available for new housing is in lots of less than a half acre. These lots are not conducive to large new housing developments.

Housing

The potential for new housing is limited to infill projects. These projects will yield only a few hundred units during the next two decades or average of ten units a year.

Household ownership has increased since 1970. This increase is due to the conversion of Parkfairfax and Parc East to condominium ownership.

Even with the conversion to condominium ownership, Parkfairfax and Parc East are still major sources of rental housing in North Ridge/Rosemont. Approximately 43% of all of the rental housing in the area are in these condominiums.

Employment

North Ridge/Rosemont is primarily a residential area and not the site of commerce or industry. Taking this into consideration, the Metropolitan Washington Council of Governments' "Regional Employment Census was still able to locate 944 jobs in the area in 1985 (Table 2). This, however, was little more than 1 % of all employment in Alexandria.

TABLE 2

Employment
North Ridge/Rosemont Area

	1976	1980	1985	% Change
Industrial	4	0	0	--
Wholesale/Retail	16	0	37	+131.3
F.I.R.E.	168	96	62	-63.1
Services	302	397	428	+41.7
Federal/State/Local	177	172	182	+2.8
Self Employed	119	167	235	+97.5
Total	786	832	944	+20.1

SOURCE: COG Regional Employment Census 1976, 1980, 1985.

Half of the employment in the area are service jobs. These range from the professions such as doctors and lawyers to barbers and janitors.

Between 1976, the date of the first Regional Employment Census, and 1985 employment in the area rose by 20%. Three quarters of the 156 jobs created in North Ridge/Rosemont between the two employment censuses were the result of increased self employment.

By 1990 it is estimated that there will be 1658 employees in the study area. This 75% increase in employment will result from businesses moving into Shirlington Gateway, an office building constructed in 1986. This building has 198,280 gross square feet of space.

Employment in the area is not likely to change significantly after 1990. There are no new office buildings under construction or proposed for North Ridge/Rosemont nor are there any sites for the development of large commercial buildings.

Summary - Demographics

- Over the last fifteen years the population of North Ridge/Rosemont has declined because of a national trend towards smaller average households.

- Over the last fifteen years the number of people employed in North Ridge/Rosemont grew because of the increase in self employment and the construction of a large office building.

EXISTING LAND USE

The North Ridge/Rosemont study area encompasses 847.5 acres of land. This land is used for residential, commercial, industrial, institutional and recreational purposes. By far, the major use of land is for residential purposes (Table 3 and Map 2) with the other uses scattered through the residential land.

TABLE 3

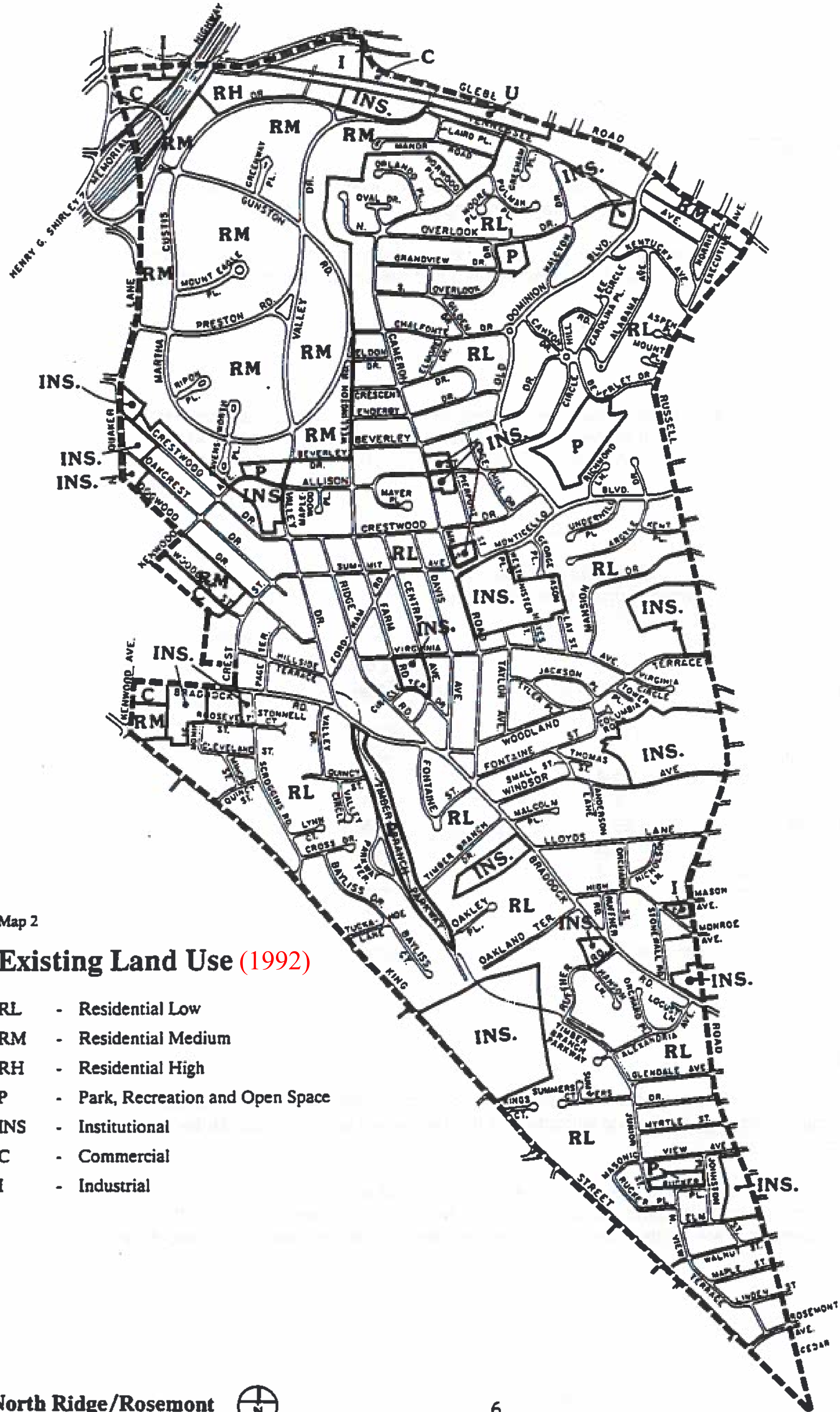
Existing Land Use
North Ridge/Rosemont Area

Land Use	Acres	% of Total
Residential	718.3	84.8
Commercial	6.1	0.7
Utility	2.6	0.3
Industrial	4.2	0.5
Institutional	83.4	9.8
Parks	16.8	2.0
Vacant-Residential	12.3	1.5
Vacant-Commercial	1.7	0.2
Common Areas	2.1	0.2
Total	847.5	100.0

Residential Land Use

Approximately 85% of the land (718 acres) is used for residential purposes. With the notable exceptions of Parkfairfax, Lloyd apartments, and Parc East almost all of the residential land is occupied by single family detached housing.

Parkfairfax and the Lloyd apartments which are in the north west of the study area are townhouses and garden apartments. The only high rise apartment building in the North Ridge/Rosemont area is the 283 unit Parc East. These apartments are located north of Parkfairfax between Martha Custis Drive and Four Mile Run.



Map 2

Existing Land Use (1992)

RL - Residential Low
RM - Residential Medium
RH - Residential High
P - Park, Recreation and Open Space
INS - Institutional
C - Commercial
I - Industrial

Inclusive of all types of housing in the study area there were an estimated 5,084 housing units in North Ridge/Rosemont. With only 12.3 acres of vacant residential land available, the number of housing units in the area is forecasted to rise by only 160 units in the next twenty years. A few acres of land now zoned for industrial use are recommended for rezoning to residential. If this land is redeveloped, the number of new houses in the study area would be slightly higher.

Commercial Land Use

Commercial land use is very limited in North Ridge/Rosemont. Only 6.1 acres are used for commercial purposes. The study area's commercial needs are served by the adjacent Fairlington/Bradlee area, an area of shops and offices.

Almost all of the land used for office uses is located in the triangle of land north of I-395. This is the location of Shirlington Gateway, a new high-rise office building.

There are few opportunities to expand commercial land use in the study area. There are only 1.7 acres of vacant commercial land in North Ridge/Rosemont area and it is unlikely that much more land will become available for commercial use.

Other Land Use

There are 4.2 acres of land used for industrial purposes in North Ridge/Rosemont. All of his acreage is adjacent to Parkfairfax and is used by this condominium for maintenance activities.

There is a small amount of land in the study area used by a utility. Virginia Power Company has a 2.6 acre parking lot on the south side of West Glebe Road which serves its office building on the north side of Glebe Road.

Institutional land use accounts for 10.3% of the land in North Ridge/Rosemont. These uses include schools, cemeteries, hospitals, churches and government uses. Much of the institutional land in the study area is occupied by schools, both public and private schools. The public schools include George Mason, Maury and Charles Barrett Schools. The private schools in the area are St. Marys Academy and St. Agnes Episcopal School. Together the schools account for over 42 acres of land in North Ridge/Rosemont.

Ivy Hill Cemetery on King Street also accounts for a large portion of the study area's institutional land. This cemetery covers 22.7 acres and is the largest single open space in the study area.

Circle Terrace hospital, the only hospital in the North Ridge/Rosemont, area has been closed. The 1.6 acres occupied by the hospital will remain in institutional use and may become a nursing home. There is an existing nursing home in the area, Woodbine, which occupies a four acre site on King Street.

Parks occupy 16.8 acres of North Ridge/Rosemont. The two largest parks are Timber Branch Parkway with 5.6 acres and Monticello Park with approximately 5 acres located on Beverly Drive.

Other parks in the study area include Beverly park on Overlook Drive - 1.9 acres, Leidner Park on Kenwood Avenue - 1.3 acres, and Beach Park on Junior Street - 1.3 acres. These parks are augmented by recreational facilities located on the area's three public school sites.

Summary - Land Use

- o Residential land accounts for 84.8% of all of the land in North Ridge/Rosemont.
- o There is little commercial land in the study area and most of that is confined to the area north of I-395.
- o There are few parks in the area accounting for 16.8 acres.
- o There is little vacant land whether for residential or commercial uses and most of the vacant land is in lots of less than a half acre.

ZONING

Almost all of the North Ridge/Rosemont area is zoned for residential development. Only 12.3 acres or less than 2% of the acreage in the study area is zoned for commercial or industrial purposes (Table 4). The non-residentially zoned land is located adjacent to I-395 and next to Fairlington/Bradlee.

TABLE 4

Existing Zoning
North Ridge/Rosemont Area

	Acres	% of Total
RA	2.1	0.2
RB	162.8	19.2
R-5	61.0	7.2
R-8	551.4	65.1
R-12	57.9	6.8
C-2	2.8	0.3
C-1	0.9	0.1
I-1	8.6	1.1
Total	847.5	100.0

Residential Zoning

R-8 is the most common residential zoning in the study area. Almost 65% of the land in North Ridge/Rosemont has this zoning. This zoning allows as many as five single family dwellings per acre, a density not uncommon in older suburbs.

One hundred and sixty-three acres in the northwest part of North Ridge/Rosemont are zoned R-B. R-B zoning allows multi-family dwellings and townhouses. It is used exclusively in the study area to zone Parkfairfax, Parc East, the Lloyd Apartments townhouses on West Glebe Road between Old Dominion Boulevard and Executive Avenue and townhouses near Fairlington/Bradlee.

The rest of the residential zoning in the study area is R5, R12 or RA. The first two zones are for areas of single family housing. R-12 zoning permits houses on lots 12,000 square feet or more while R-5 zoning is for more modest houses on lots as small as 5,000 square feet. Mansion Drive is an example of R-12 zoning while the higher density found in R-5 is characteristic of streetcar suburbs such as Rosemont.

A small area of North Ridge/Rosemont along Glebe Road is zoned RA. Although this zoning allows multifamily housing, the land in this case is used for townhouses, as well as small apartment buildings.

Non-Residential Zoning

There are small amounts of C-1, C-2 and I-1 zoning in North Ridge/Rosemont. Collectively these zones account for 12.3 acres much of which is near I-395.

In North Ridge/Rosemont, land used for commercial purposes is zoned either C-1 or C-2. Property zoned C-1 can be used for a wide variety of purposes including professional and business offices, banks, drug stores, laundries, child care homes and schools. C-2 zoning permits all of the uses allowed under C-1 zoning as well as a wider variety of retail uses, caterers, contractors, repair shops and radio and television stations. Both C-1 and C-2 allow residential uses. Uses not mentioned may be allowed in these commercial zones with a Special Use Permit.

C-2 zoning permits office buildings with up to a 3.0 Floor Area Ratio (FAR) and up to a 150 foot building height. The Shirlington Gateway building is an example of an office project developed under the C-2 zone. The FAR for this 13 story project is 1.74.

There are also over eight acres of industrially zoned property in the study area. I-1 zoning allows all of the commercial uses allowed under C-1 and C-2 and allows warehousing and manufacturing. Other uses are allowed with a Special Use Permit. Residential uses are not permitted by right. The I-I zone allows development of up to 2.5 FAR by right and buildings up to 77 feet by right.

Theoretical Development Envelope

Although there is a relatively small amount of commercial and industrial zoning in the North Ridge/Rosemont neighborhood, theoretically, under current zoning, there could be developed some 1.3 million square feet of office space in the area.

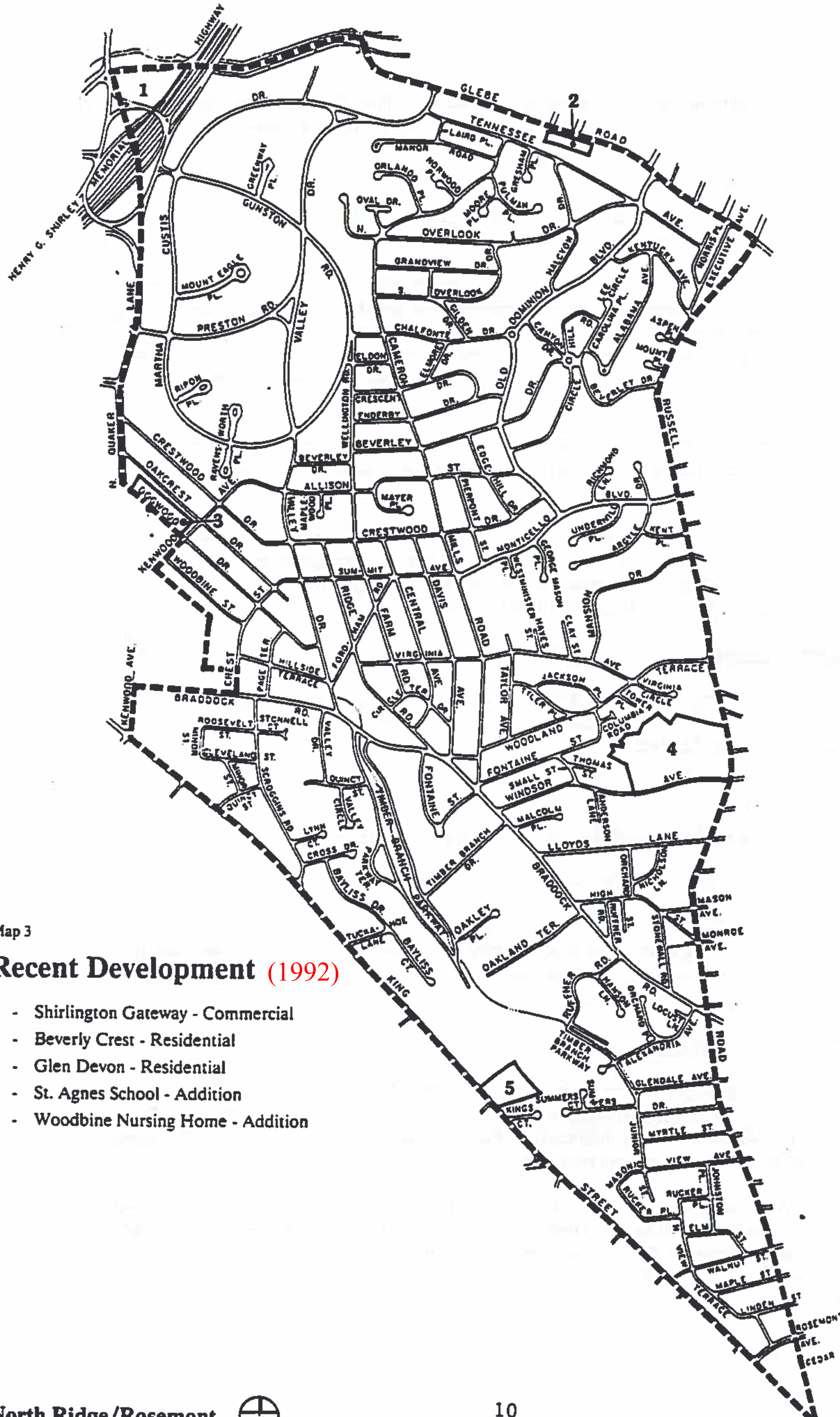
Summary - Zoning

- o Over 98% of the land in North Ridge/Rosemont is zoned residential.
- o Over 79% of the land in North Ridge/Rosemont is zoned for detached single family housing.
- o Although less than 2% of the land in North Ridge/Rosemont is zoned for commercial or industrial use, if this land was redeveloped to its maximum F.A.R, approximately 1.3 million square feet of commercial space could be built.

DEVELOPMENT ACTIVITY AND TRENDS

The study area has only one major commercial building, Shirlington Gateway, located north of I-395. There are no commercial buildings under construction or currently proposed for the North Ridge/Rosemont area. This situation is unlikely to change drastically in the future because the area only has 1.7 acres of land that are vacant and zoned for commercial purposes.

There are two new small town house developments in the study area. These are Beverly Crest on West Glebe Road and Glen Devon on the north side of Dogwood Drive (Map 3). These two developments add thirty townhouses to the approximately 5,000 dwellings already in North Ridge/Rosemont. Small increases in housing such as those created at Glen Devon and Beverly Crest are typical of possible housing development in the study area.



Map 3

Recent Development (1992)

1 - Shirlington Gateway - Commercial
2 - Beverly Crest - Residential
3 - Glen Devon - Residential
4 - St. Agnes School - Addition
5 - Woodbine Nursing Home - Addition

Large increases in the number of housing units in the area are unlikely because there are only 12.3 acres of vacant residential land in the study area. Not all of this limited amount of vacant residential land can be used because some of the land is divided into substandard lots. These lots are too small to be used for housing construction under the current zoning. A small amount of additional residential acreage could be added by rezoning industrially zoned land and this land could be redeveloped for housing in the future.

Summary - Development Activity

- Shirlington Gateway, an office commercial building of 198,280 square feet, was constructed in 1986. This is the only commercial building erected in the study area in recent years.
- Beverly Crest and Glen Devon are two small townhouse developments in North Ridge/Rosemont. These recent developments are typical of the kind of housing that might be built in the area in the future.

TRANSPORTATION

The street system in North Ridge/Rosemont is designed for local residential traffic and not through traffic. The arterial roads servicing the study area are Quaker Lane and King Street, both of which primarily run along the edge of the study area.

In Rosemont the streets form a grid pattern that is common to street car suburbs. The grid has the narrow face of the blocks facing the tram line to reduce the walk of a commuter.

In North Ridge the streets are not a strict grid but are modified to follow the area's topography. Later suburbs such as North Ridge also had curving streets because such streets had desired connotations of the countryside.

1974 Major Thoroughfare Plan

The 1974 Major Thoroughfare classified streets throughout the City into five categories: expressway, arterials, primary collectors, residential collectors and local streets. (See Map 4)

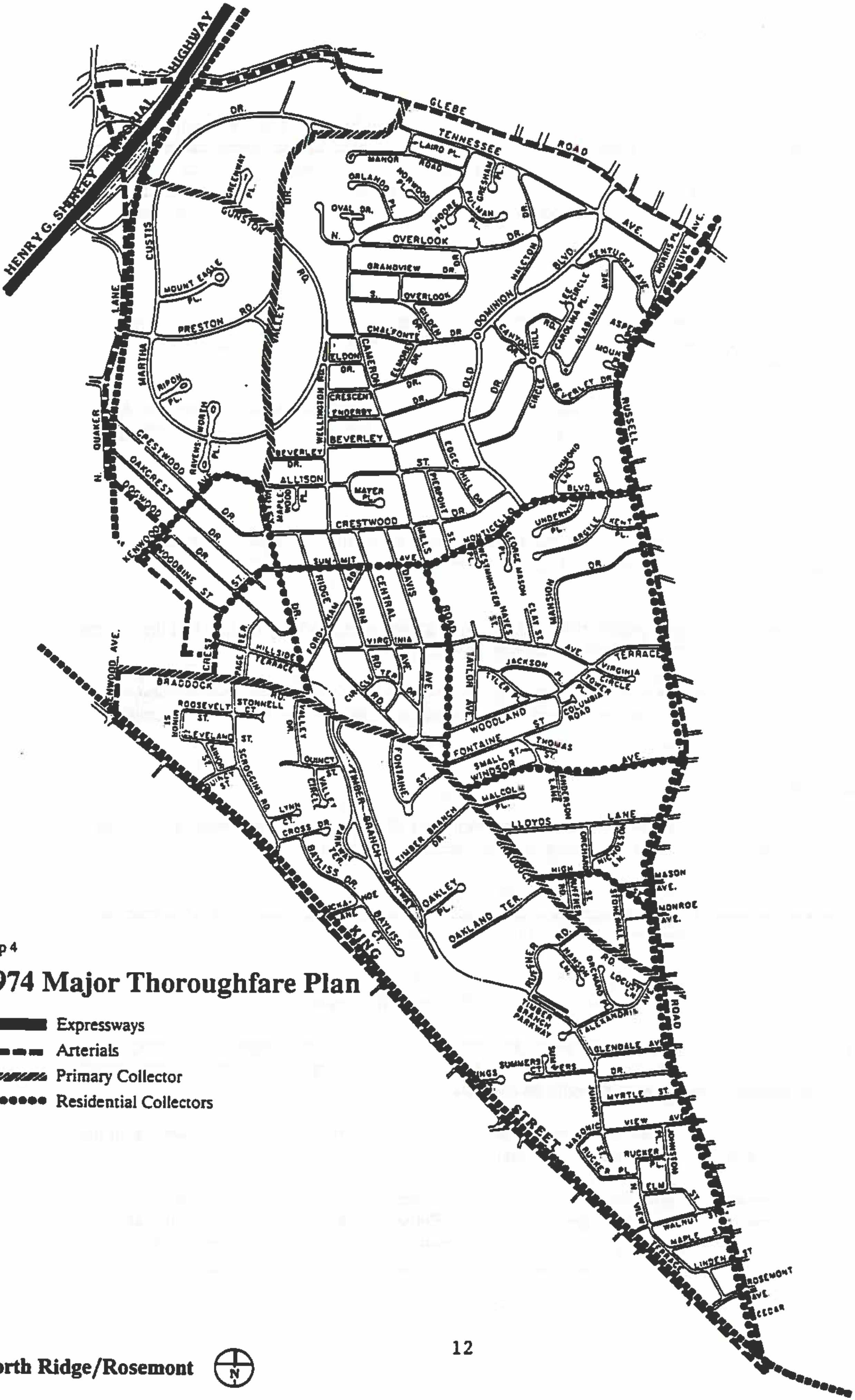
There is a small portion, less than 1,500 feet, of I-395 in the northwest corner of North Ridge/Rosemont. This is the only expressway or regional highway in the study area. I-395 does separate a small triangle of land used for commercial purposes from the rest of the study area.

Arterial streets connect the principal traffic generators within the City and handle large volumes of traffic. King Street and Quaker Lane are the only two arterial streets in the study area.

With the exception of a short length of Quaker Lane that parallels I-395, the arterials servicing North Ridge/Rosemont run along the southern and western edges of the study area. The traffic on King Street and Quaker Lane, therefore, has a limited impact on the area.

Collector streets are secondary streets that serve the City's internal traffic. Collectors move traffic between local roads and arterials or connect other collectors to arterials.

Primary collectors connect two arterials or other collectors to arterials. They serve traffic that usually is making a longer trip than the traffic on residential collectors. Primary collectors can also be alternatives to arterial roads and often provide direct links to shopping areas. In North Ridge/Rosemont, Braddock Road, Glebe Road, part of Valley Drive and a small portion of Gunston Road are primary collectors.



Map 4

1974 Major Thoroughfare Plan

- Expressways
- Arterials
- Primary Collector
- Residential Collectors

Residential collectors basically serve to connect residential areas with arterials or other collectors. Russell Road, part of Cameron Mills Road, part of Valley Drive, Kenwood Avenue, Crest Street, .pa
Summit Avenue, Monticello Boulevard, Old Dominion Boulevard, High Street and Windsor Avenue are the residential collectors in North Ridge/Rosemont.

Existing Traffic Flow

North Ridge/Rosemont's street system is adequate to serve its existing and future land uses. Traffic is mainly carried around the study area rather than through it.

Most of the roads within the study area that are not local streets function as primary and residential collectors. These streets are designed to link residential areas with other collectors or arterials. In North Ridge/Rosemont, Braddock Road and Glebe Road are primary collectors. Residential collectors are roads such as Crest Street, Valley Drive and Summit Avenue.

The majority of the streets in the study area are local streets. These streets are not continuous connecting streets like those in the Major Thoroughfare Plan System. Argyle Street, Enderby Drive, Sanford Street and Timber Branch Parkway are examples of local streets.

With the exception of I-395 none of the roads in the study area are near capacity. Even with the heavy traffic on I-395 there is rarely a backup on the Gunston Road ramps to this highway.

Traffic is increasing on King Street, but this is due to through traffic generated by development outside of North Ridge/Rosemont. Traffic on King Street is limited by two congested intersections, one at each end of the study area. There is the possibility of improving the flow at each of these intersections by altering turning movements or by changing traffic light cycles.

The traffic light cycle at King Street and Russell Road has been changed. The cycle facilitates King Street movement and provides less green time to Russell Road.

Planned Capital Improvements

There are no planned capital improvements in North Ridge/Rosemont. There are proposals for capital improvements in the areas adjacent to the study area and these improvements could smooth the flow of traffic on streets in the study area.

The Fairlington/Bradlee Plan recommends that the Quaker Lane, King Street and Braddock Road intersection be studied to determine possible improvements. Improvement to King Street near the railroad underpass will also be studied.

Bike and Pedestrian Paths

There are four designated bike trails in North Ridge/Rosemont. All of these are on street trails. One trail connects bike trails in Arlington by crossing over I-395 and running along Martha Custis Drive and Glebe Road. A second bike trail runs along Braddock Road. A third trail runs along Timberbranch Parkway and Masonic Avenue. A small part of a fourth trail runs south along Radford to King Street and from King to Chinquapin Park.

Public Transit Facilities

The North Ridge/Rosemont area is served by Metrobus and DASH. There are two DASH routes serving the study area. The A.T.4. route joins the Pentagon and Hunting Towers by running along Martha Custis Drive, Cameron Mills Road and Braddock Road. The A.T.3. route runs along Martha Custis Drive, Glebe Road, Russell Road and Braddock Road and joins the Pentagon with Old Town.

Metrobus runs a number of routes through North Ridge/Rosemont. Some of these routes originate in Fairfax County and terminate at the Pentagon. One route, the 28 AB, travels down King Street or Braddock Road and ultimately connects Tysons Corner with Old Town.

Future Traffic Flow

The opportunities for development in the North Ridge/Rosemont area are few, therefore little additional traffic will be generated internally. Future growth outside of the study area will increase the traffic on I-395 and the arterials on the periphery of the study area.

Summary - Transportation

- The capacity of the area's streets is adequate for the traffic currently generated.
- Delays along King Street could be alleviated by improvements at the King, Braddock, Quaker intersection and at the underpass east of the King and Russell intersection.

POLICY HISTORY

The adopted land use plan map for North Ridge/Rosemont is based on the 1974 Master Plan and is shown on Map 5. Most of the land in the study area is designated for residential uses with institutional uses the second most common category.

The 1974 Plan does not show any uses for the triangle north of I-395 although in 1974 the land in the triangle was used for industrial purposes.

The 1974 Master Plan expected that Planning District II, the district in which North Ridge/Rosemont is located, would remain residential with single-family homes predominating. The following recommendations are from the 1974 Master Plan:

1. Maintain the residential character of most of Planning District II.
2. Encourage the protection and upgrading of Parkfairfax as a residential community for middle income families.

Rezoning

Since 1974, rezonings have been rare in North Ridge/Rosemont. The major rezoning involved all of the W.O. & D. railway right of way which parallels West Glebe Road. The right of way was rezoned from R-8 to R-B. This rezoning allowed the construction to townhouses or multi-family housing in an area that had previously been zoned for single family housing.

The change from single family to townhouse and multi-family zoning is typical of the rezonings which have occurred in the study area. Rezonings were needed for the construction of Glen Devon and Beverly Crest. Both of these townhouse projects are located on the edge of North Ridge/Rosemont. Glen Devon is adjacent to the Parkfairfax Beverly Shopping area and Beverly Crest is on West Glebe Road opposite apartment building. These rezonings do not indicate a general policy towards higher density housing but were appropriate because of the density of development near the rezoned site.

Summary - Policy History

- The 1974 Master Plan goals for North Ridge/Rosemont emphasized the protection of the residential character of the study area.

- A limited number of rezonings that allowed townhouse development on land previously zoned for single family houses have occurred. These rezonings do not represent a general policy to introduce higher density development in the area.

ISSUES

The North Ridge/Rosemont area is almost completely developed. There has been very little additional development in the study area in recent years.

The major issues facing the North Ridge/Rosemont area are the following:

1. The need to preserve existing neighborhoods in the North Ridge/ Rosemont area.

2. The need to rezone property now zoned for high density commercial development to zones which are more compatible in uses and scale with adjacent residential areas.

3. The need to discourage through traffic in residential areas.

4. The need to deal with substandard lots.

Substandard Lots

The single family development located in the North Ridge area is part of the Jefferson Park, Braddock Heights and Beverly Hills subdivisions. The original plats for these developments were prepared between 1924, when the area was part of Arlington County, and the early 1940's, after annexation by the City of Alexandria. The lots range in area from 2300 square feet to 40,000 square feet and have lot frontages which start at as little as 50 feet. A large number of the lots in the subject area are in the 5,000, 6,000 and 7,000 square foot range.

When the current zoning code was adopted in 1951, the R-8 single family residential zone was applied to most of the single family land in the North Ridge area. This zone required a minimum lot area of 8,000 square feet of land, a minimum lot frontage of 65 feet and a minimum width of 65 feet at the front building line. Because many of the lots in North Ridge did not conform to these minimums, the lots became sub-standard.

The main consequence of substandard platted lots is that, by virtue of a later City Council action, a sub-standard lot which is in the same ownership as an adjacent lot cannot be developed. Recently, City Council voted to revise that provision to allow those substandard lots to be developed with a special use permit if they meet one of two tests which assures that the substandard lot is substantially the same size and width as most of the lots in the same block face.

A second consequence of substandard lots is that under the current zoning code, buildings located on these substandard lots may not conform to the yard restrictions of the zone in which they are located. Consequently, these homeowners have not been permitted to make improvements such as adding a porch, making an addition, or adding a patio or deck as a matter of right. Instead, they have been forced to apply to the Board of Zoning Appeals for a variance, and to make a case for hardship.

GOALS AND RECOMMENDATIONS

GOALS AND OBJECTIVES

The goals of this plan are to protect and preserve existing residential areas and to protect the residential neighborhoods from non-local traffic. These goals translate into the following objectives:

- Protect the residential nature of the study area by changing commercial and industrially zoned sites to zones more appropriate adjacent to residential areas and by controlling professional home occupations in residential zones.
- Protect the density and scale of existing residential areas by allowing the development of substandard vacant lots with a SUP only when the size and dimensions of the lots are essentially identical to existing developed lots.
- Ensure preservation of existing open space and, if opportunities occur, expand the amount of recreational or open space in the area.
- Discourage improvements to local streets when such improvements will bring through traffic into the study area.

LAND USE RECOMMENDATIONS

Map 5 shows the existing (1974) land use plan for the area. The proposed land use concept is shown on Map 6, and the specific proposed land use is shown on Map 7. The land use reflects the existing primarily residential character of the area. There are significant institutional land uses throughout the study area and several parks.

There are four areas of commercial use in North Ridge/Rosemont. These include the triangle north of I-395, the west end of Dogwood Drive, a funeral home at Braddock and Kenwood Roads, and an auto repair shop at Four Mile Run and West Glebe Road.

The land north of Charles Barrett School and along the south side of West Glebe Road, previously designated for industrial use, has been proposed for redesignation to commercial, residential and park uses.

Each of the proposed changes to the land use plan is shown on Map 8 and described below.

Recommendations:

1. From Undesignated on the 1974 Land Use Plan to Office Commercial High

   The existing use is primarily the Shirlington Gateway office building. The change reflects this use.

2. From Commercial to Residential Medium

   The existing use is the Parkfairfax maintenance yard and buildings, an accessory use to the Parkfairfax residential condominium.

3. From Commercial to Commercial General

   The existing use of this site is an auto repair garage. Commercial General is appropriate for auto-related commercial uses.

4. From Commercial to Utility/Transportation

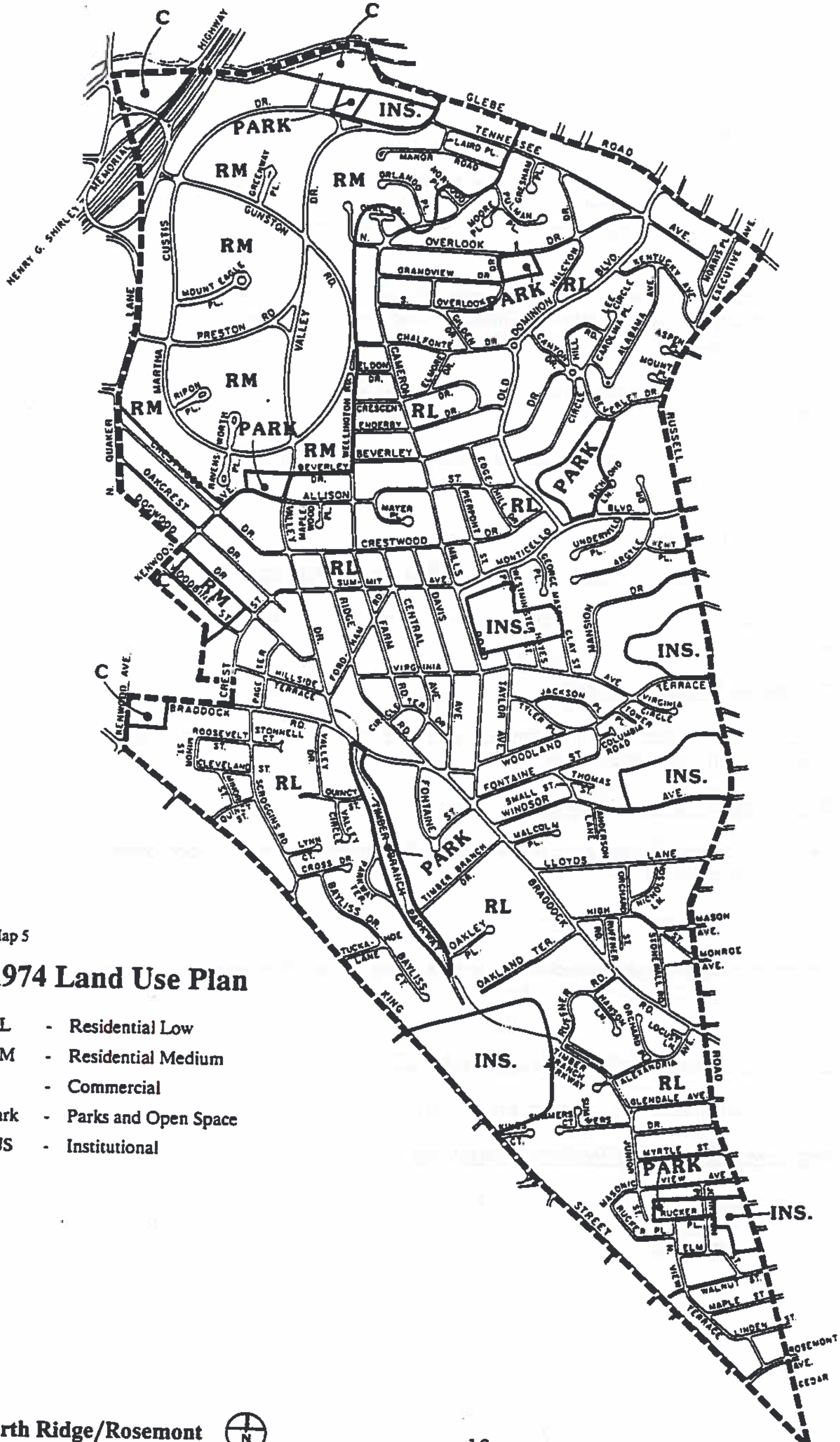
   The property is former railroad right-of-way that runs along the south side of West Glebe Road just north of the Charles Barrett school. This strip of land is owned by VEPCO but has easements that allow it to be used by the school for recreational purposes.

5. From Residential Low and Residential Medium to Utility/Transportation

   This change reflects the current use of the site as a parking lot for VEPCO.

6. Residential Low and Residential Medium to Institutional

   The existing uses on these sites are the Fair Park Baptist Church and the Church of St. Clement. The change would reflect the current use and be in keeping with the townhouses that share the block.



Map 5

1974 Land Use Plan

RL - Residential Low

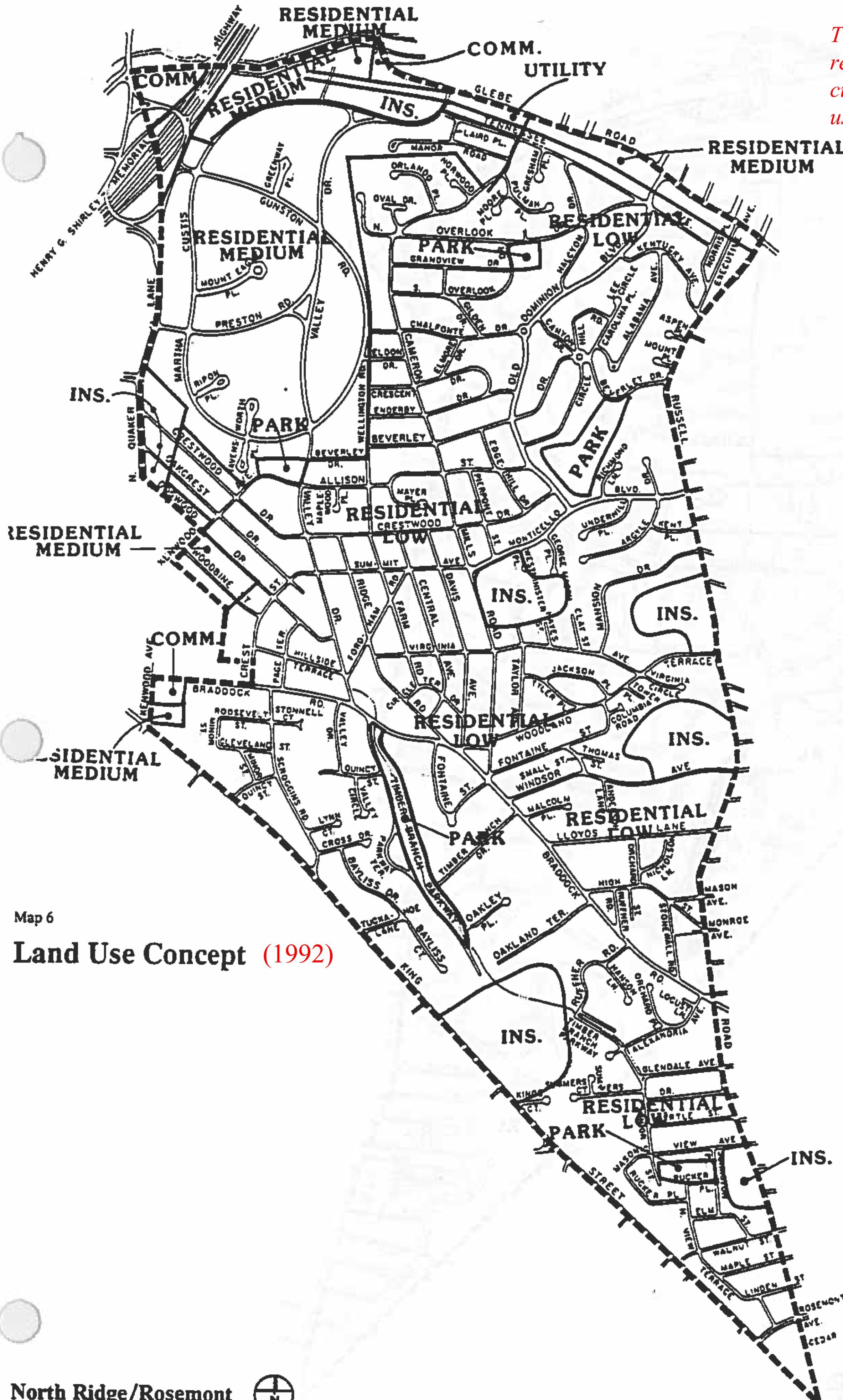
RM - Residential Medium

C - Commercial

Park - Parks and Open Space

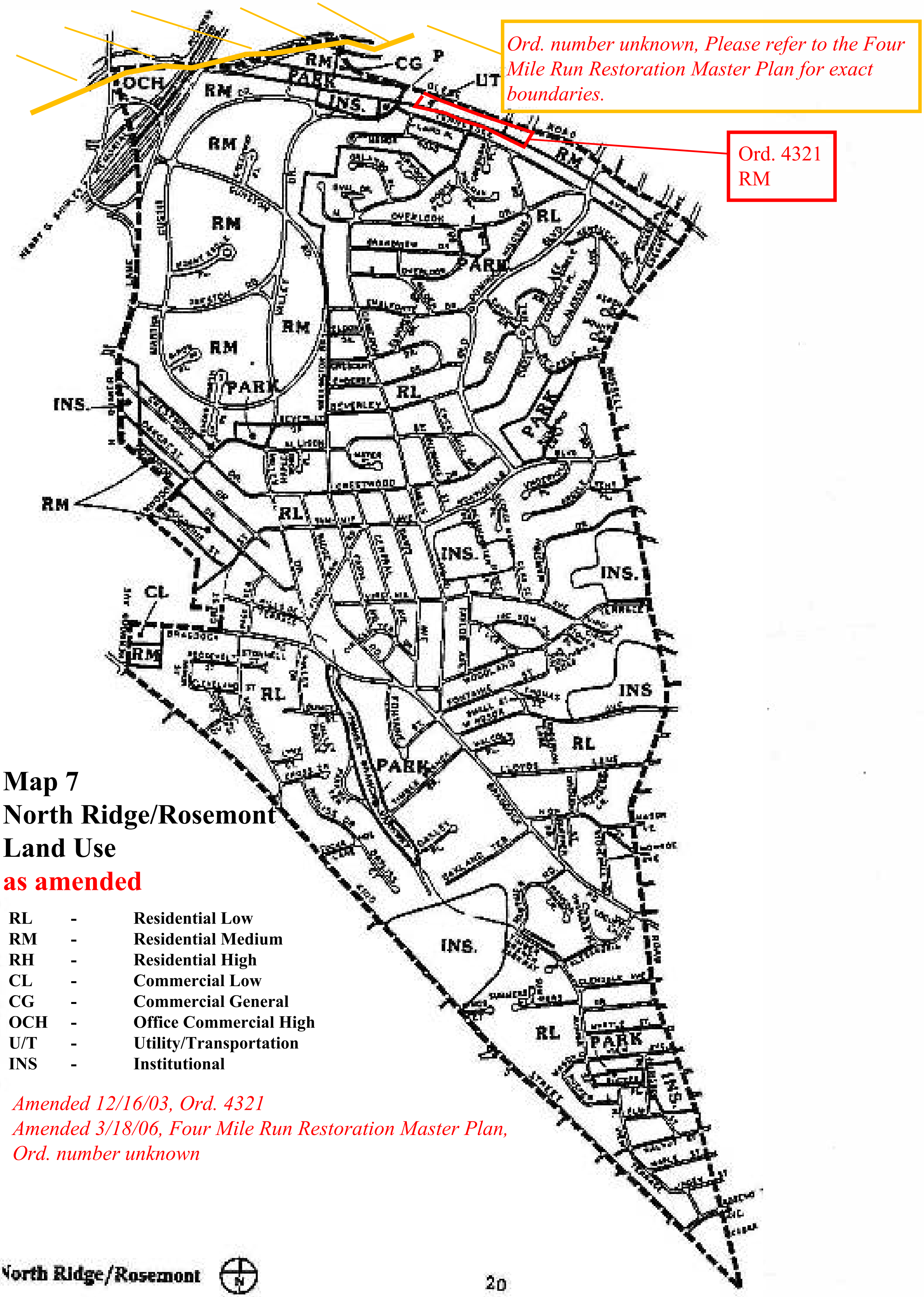
INS - Institutional

This map is for historic reference only. For currently approved land use, please see Map 7.



Map 6

Land Use Concept (1992)

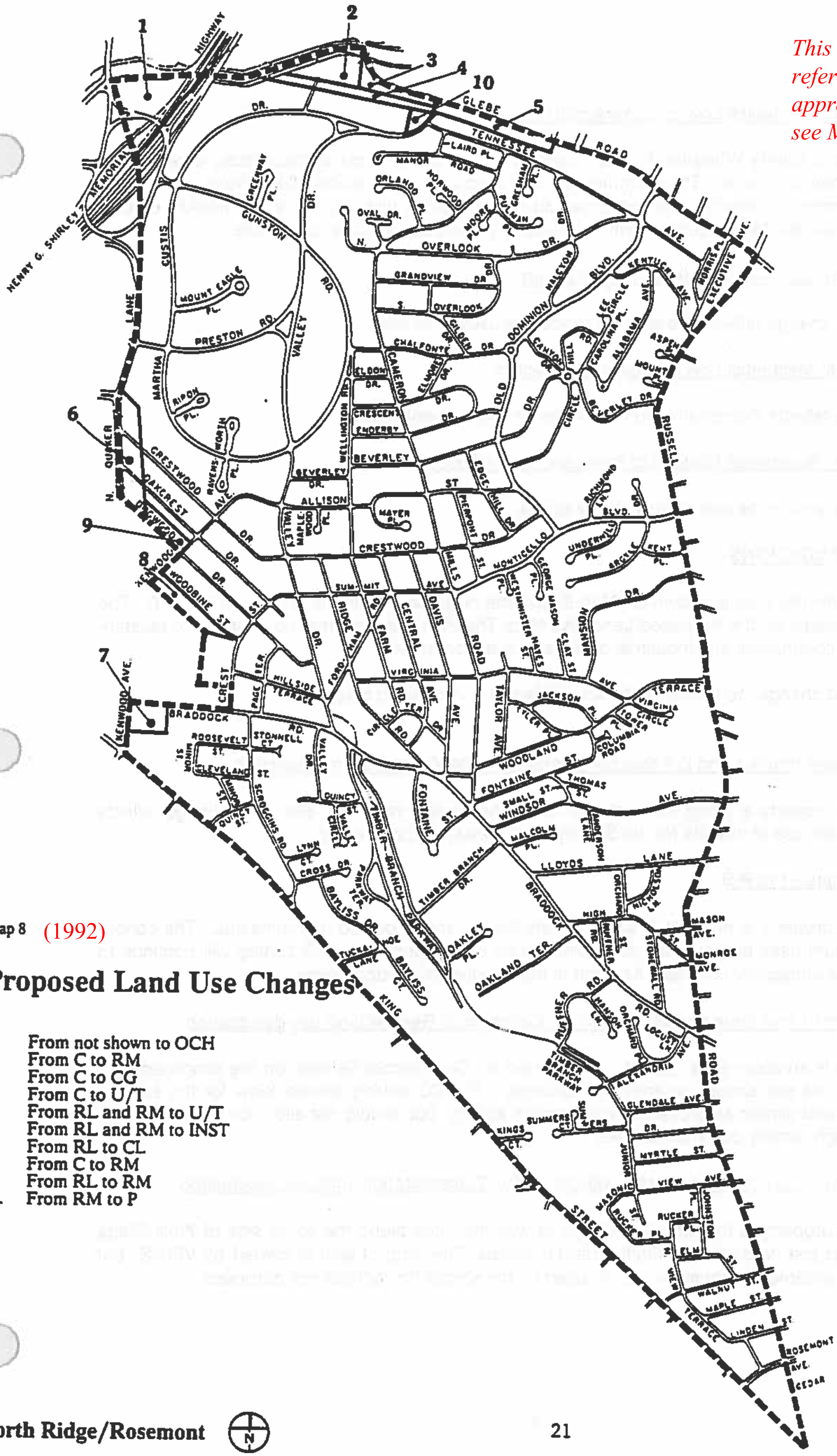


Map 7
North Ridge/Rosemont
Land Use
as amended

RL	**-**	**Residential Low**
RM	**-**	**Residential Medium**
RH	**-**	**Residential High**
CL	**-**	**Commercial Low**
CG	**-**	**Commercial General**
OCH	**-**	**Office Commercial High**
U/T	**-**	**Utility/Transportation**
INS	**-**	**Institutional**

Amended 12/16/03, Ord. 4321
Amended 3/18/06, Four Mile Run Restoration Master Plan, Ord. number unknown

This map is for historic reference only, For currently approved land use, please see Map 7.



Map 8 (1992)

Proposed Land Use Changes

1. From not shown to OCH
2. From C to RM
3. From C to CG
4. From C to U/T
5. From RL and RM to U/T
6. From RL and RM to INST
7. From RL to CL
8. From C to RM
9. From RL to RM
10. From RM to P

7. <u>From Residential Low to Commercial Low</u>

This is Everly Wheatley funeral home, a use which is most appropriately located in a commercial area. The Commercial Low land use designation allows very low density commercial development, which would be compatible with the adjoining medium density residential. More intense commercial activity is not appropriate for this site.

8. <u>From Commercial to Residential Medium</u>

This change reflects the existing residential use of the site.

9. <u>From Residential Low to Residential Medium</u>

This reflects the construction of the Devon Place townhouses.

10. <u>From Residential Medium to Parks and Open Space</u>

This reflects the existing use of the space.

ZONING RECOMMENDATIONS

Please see Map 7 for currently approved land use.

The existing zoning for the area is shown on Map 9, and the proposed zoning is shown on Map 10. The proposed zoning is based on the Proposed Land Use Map. The Plan recommends no changes to residential zones. All of the commercial and industrial designations are changed.

Each of the proposed changes to zoning is shown on Map 11 and detailed below.

1. <u>Rezone from I-1 and C-2 to a zone consistent with Office Commercial High</u>

The property is along the northern half of the triangle north of I-395. The change reflects current use of this site for the Shirlington Gateway office building.

2. <u>Rezone I-1 to R-B</u>

The property is north of Charles Barrett School and is owned by Parkfairfax. The condominium uses this property for maintenance and repair work. RB zoning will continue to allow accessory uses as a function of the Parkfairfax condominium.

3. <u>From I-1 to a zone consistent with the Commercial General land use designation</u>

This is an auto-repair garage. Designated for Commercial General on the proposed land use, the site should be zoned accordingly. The CG zoning should allow for the existing use and similar auto-oriented commercial activity, but should not allow for redevelopment in high density commercial uses.

4. <u>From I-1 to a zone consistent with the Utility/Transportation land use designation</u>

The property is former railroad right of way that runs along the south side of West Glebe Road just north of the Charles Barrett school. This strip of land is owned by VEPCO but has easements that allow it to be used by the school for recreational purposes.

This map is no longer being updated. For current zoning, please refer to the citywide zoning map on the GIS Standard Maps page, www.alexandriava.gov/gis.

Map 9 - Existing Zoning

This map is no longer being updated. For current zoning, please refer to the citywide zoning map on the GIS Standard Maps page, www.alexandriava.gov/gis.

Map 10 - Proposed Zoning

This map is no longer being updated. For current zoning, please refer to the citywide zoning map on the GIS Standard Maps page, www.alexandriava.gov/gis.

Map 11 - Proposed Zoning Changes

5. From I-1 and RA to a zone consistent with the Utility/Transportation land use designation

This is a VEPCO parking lot. The proposed Utility/Transportation zone would allow the existing use or some other VEPCO related use. The Utility zone would be designed to restrict use of the site to utility related functions whereas the existing industrial zone allows a wide variety of uses including high density office which is not appropriate near lower density residential areas.

6-11. From RB, R-8 and R-5 to a zone consistent with the Park and Open Space land use designation.

These are all public parks within the North Ridge/Rosemont Area.

12. From C-2 to RB

This is the St. Clemens Church. Although designated Institutional on the land use plan to reflect the church use, an Institutional zone is not envisioned for the City. The site is recommended for rezoning to the RB zone which is located on all of the surrounding parcels. If the church was ever to leave, this would ensure residential redevelopment.

13. From C-1 to a zone consistent with the Commercial Low land use designation

The Everly Wheatley Funeral Home was designated Commercial Low in the land use plan. The CL zoning should allow for this existing use and only very low intensity commercial uses which would not impact the surrounding medium density residential areas. Residential uses would also be appropriate for this site.

Other Zoning Recommendations

14. Study the desirability of changing the R-8 zone

Any change in the existing R-8 zoning would have two purposes. First, to make it easier to improve existing property and second, to protect residential areas from redevelopment at excessive densities.

15. Promote Affordable Housing

A study of alternatives will be developed with the consultation of residents in order to promote the area's "fair share" of affordable housing, while preserving the current housing stock and the value thereof for current residents.

For current zoning, please refer to the citywide zoning map located on the GIS Standard Maps page, www.alexandriava.gov/gis.

HEIGHT RECOMMENDATIONS

Map 12 shows the existing height limits, and Map 13 shows the proposed height limits for the area. Map 14 details the differences between the existing and proposed height limits. The height limits are those dictated by the proposed zoning.

TRANSPORTATION RECOMMENDATIONS

Delays along King Street could be alleviated by improvements at the King, Braddock, Quaker intersection and at the underpass east of the King and Russell intersection. However, these improvements will increase the amount of traffic flow, and mitigating alternatives such as those addressed in Plan Recommendations will need to be pursued.

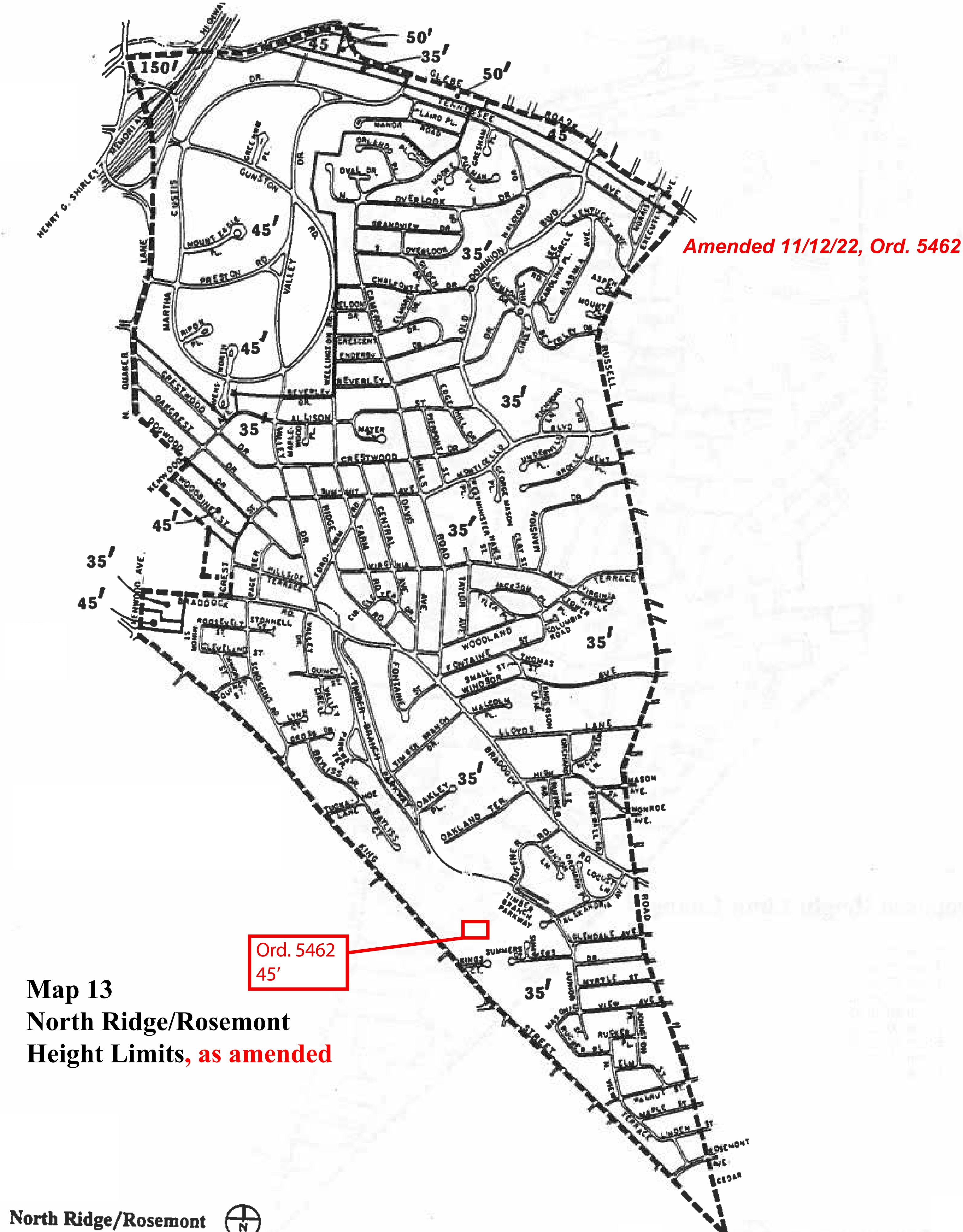
Valley Drive from West Glebe Road to Allison Street and Gunston Road from Quaker Lane to Valley Drive should be designated residential collectors instead of primary collectors.

The City should undertake a comprehensive transportation study and identify the transportation systems management actions needed for efficient traffic flow.

Map 12 (1992)

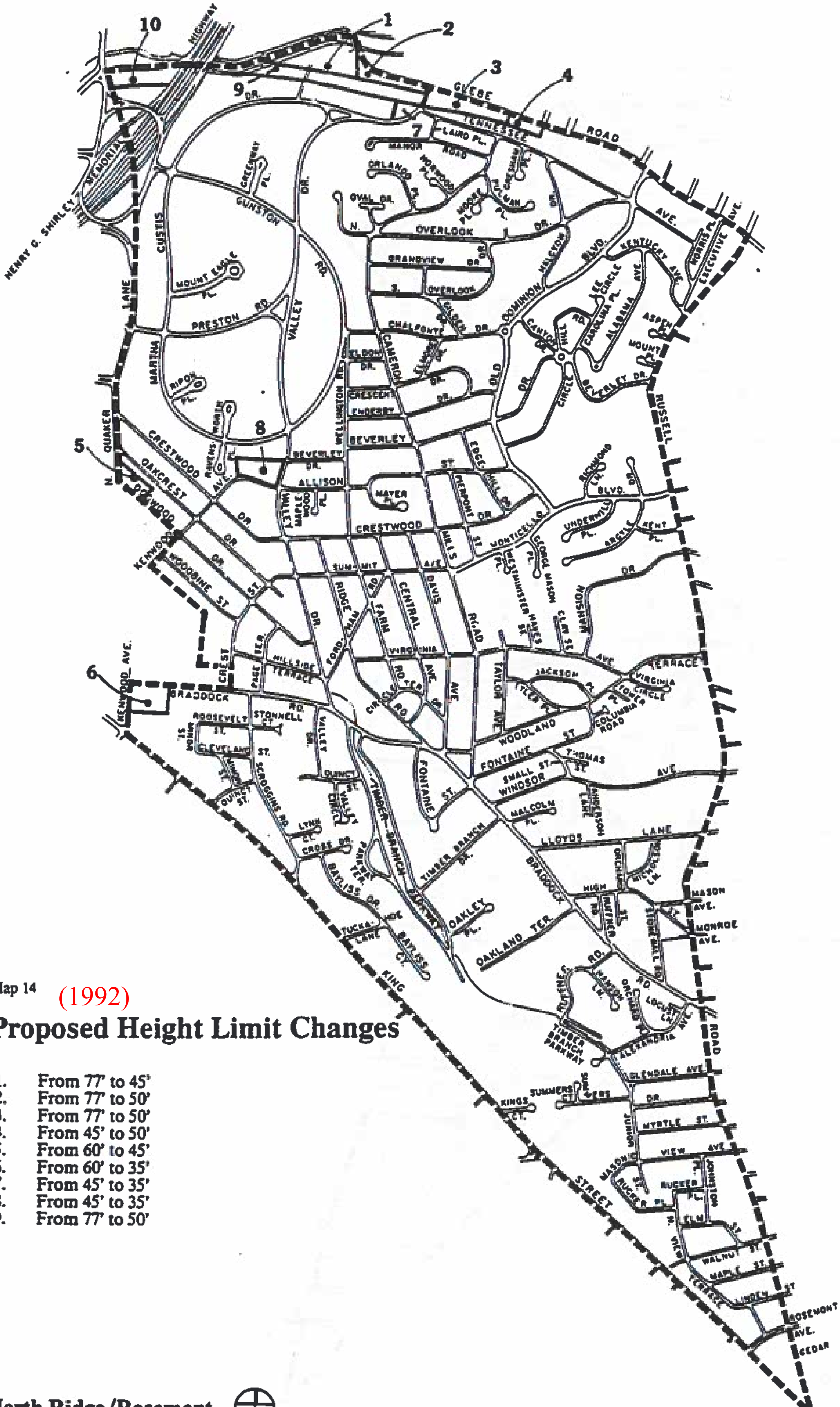
Existing Height Limits

North Ridge/Rosemont



Map 13
North Ridge/Rosemont
Height Limits, as amended

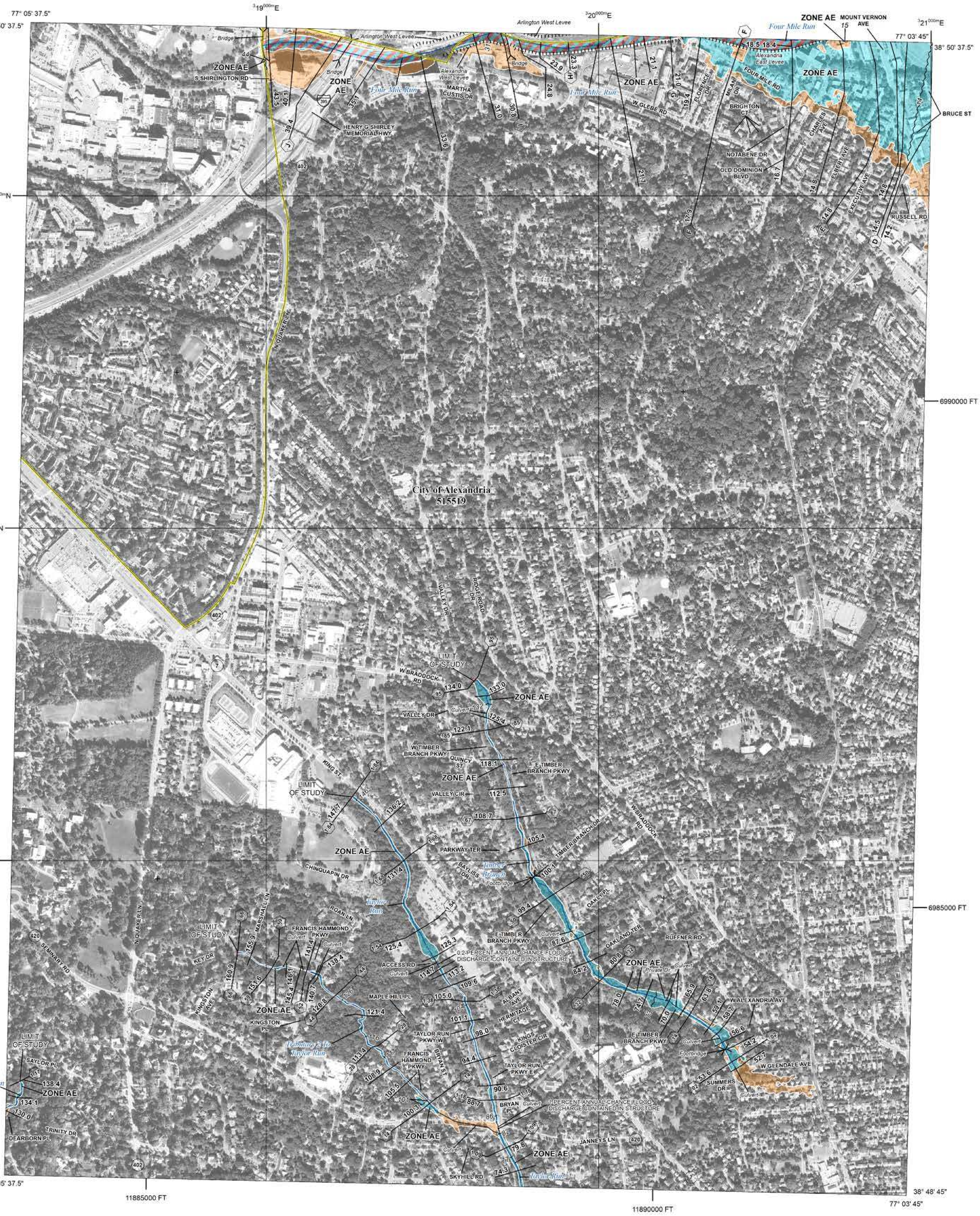
North Ridge/Rosemont



Map 14 (1992)

Proposed Height Limit Changes

1. From 77' to 45'
2. From 77' to 50'
3. From 77' to 50'
4. From 45' to 50'
5. From 60' to 45'
6. From 60' to 35'
7. From 45' to 35'
8. From 45' to 35'
9. From 77' to 50'



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	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 X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Areas of Minimal Flood Hazard *Zone X*
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	E 18.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Mapping and Insurance eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the United States Department of Agriculture - Aerial Photography Field Office (USDA - APFO), National Agriculture Imagery Program (NAIP). This information was derived from digital orthophotography at a 2-foot resolution from photography dated 2019.

NON-ACCREDITED LEVEE SYSTEM: This panel contains a levee system that has not been accredited and is therefore not recognized as reducing the 1-percent-annual-chance flood hazard.

SCALE

Map Projection:
NAD 1983 UTM Zone 18N;
Western Hemisphere; Vertical Datum: NAVD 88

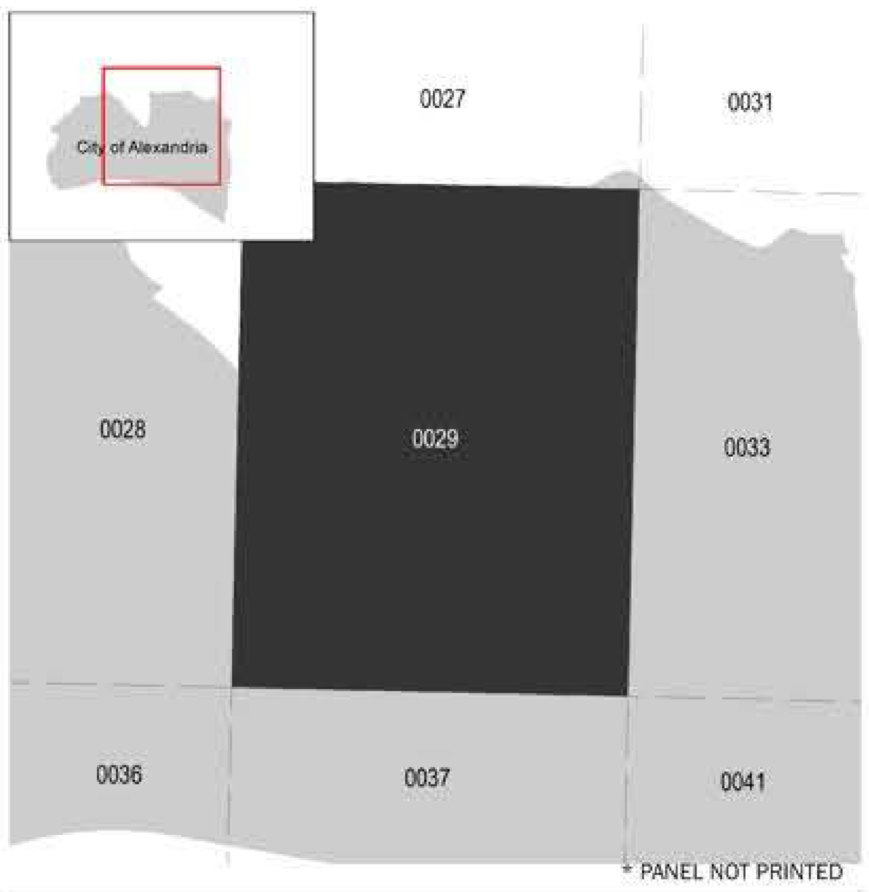
N

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



* PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

ALEXANDRIA, VIRGINIA
Independent City

PANEL **29** OF **45**

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALEXANDRIA, CITY OF	515519	0029	F

VERSION NUMBER
2.6.4.6

MAP NUMBER
5155190029F

MAP REVISED
JANUARY 11, 2024

January 24, 2025
CID515519_Alexandria_CFPF-1

Social Vulnerability for Census Tracts 2009

Census Tract ID	Index Classification	Vulnerability Index Score
2009	Very Low	-1.1

City of Alexandria Resilience Plan | September 2021

In response to the resilience planning requirements of the **Community Flood Preparedness Fund** ("the CFPF" or "Fund") outlined within the 2021 CFPF Grant Manual (Appendix G: Elements of Resilience Plans), the City of Alexandria ("the City") prepared the following Resilience Planning Overview of formal and relevant plans used to prioritize potential projects, and to assist the City in securing funding for critical resilience plans, studies, and projects.

The **Elements of Resilience Plans** in Appendix G of the 2021 CFPF Grant Manual lists elements that should be included in resilience plans for communities applying for CFPF grant funding. These elements include:

1. *It is project-based with projects focused on flood control and resilience.*
2. *It incorporates nature-based infrastructure to the maximum extent possible.*
3. *It includes considerations of all parts of a locality regardless of socioeconomics or race.*
4. *It includes coordination with other local and inter-jurisdictional projects, plans, and activities and has a clearly articulated timeline or phasing for plan implementation.*
5. *It is based on the best available science, and incorporates climate change, sea level rise, storm surge (where appropriate), and current flood maps.*

Alexandria's resilience planning elements are not currently contained within an adopted "stand alone" plan; however, the City has previously dedicated funding to this effort and is in the process of procuring consulting services to develop a 'stand alone' plan that incorporates the above elements and others germane to the City. This Resilience Planning Overview identifies how various resilience planning documents of the City of Alexandria satisfy all the CFPF Resilience Plan elements.

The following plans and studies for the City of Alexandria each have components which satisfy elements of the Resilience Plan requirements. Together they form a Resilience Plan. ***Specific excerpts from each plan that satisfy the requirements outlined in Appendix G: Elements of Resilience Plans is found on page 12 of this document.***

- Northern Virginia Hazard Mitigation Plan (2017)
- City of Alexandria Storm Sewer Capacity Analysis (CASSCA, 2016)
- FY 2022 – FY 2031 Storm Sewer Capacity Projects
- FY 2022 - FY 2031 Stormwater Management Utility Ten-Year Plan
- Four Mile Run Restoration Master Plan
- Alexandria's Waterfront Plan
- Alexandria Floodplain Ordinance
- Emergency Operations Plan (EOP)
- Flood Action Alexandria
- Alexandria's Masterplan and Small Area Masterplans
- Alexandria's Housing Masterplan

- Resilient Alexandria Charter
- CRS Community Certification
- Eco-City Charter
- Eco-City Action Plan 2040
- Flood Response Plan

Appendix G of the 2021 first round CFPF Grant Manuel also includes examples of elements of plans that would be "appropriate for inclusion in a submission." These elements are listed in bold below. Below each element, the City has identified a corresponding Plan and specific plan section that addresses that item, thereby fulfilling the Resilience Plan requirement.

Equity based strategic polices for local government-wide flood protection and prevention.

Northern Virginia Hazard Mitigation Plan (2017), Section 9.7.1 Alexandria Mitigation and Action Plan prioritizes actions across local government departments including the Department of Transportation, Environmental Services, and Emergency Management. The actions range from compliance with FEMA's NFIP and participation in the Community Rating System, to nature-based solutions, infrastructure upgrades, and building protections to enhance the resilience of residents.

Alexandria's Floodplain Ordinance No.4715 ensures that future development and major retrofits comply with flood-resilient building standards, which protect residents living in the floodplain.

Proposed projects that enable communities to adapt to and thrive through natural or human hazards.

Northern Virginia Hazard Mitigation Plan (2017), Section 9.7.1. Alexandria Mitigation and Action Plan prioritizes protection against natural and human hazards through the range of actions described above.

The Four Mile Run Restoration Masterplan and Tidal Restoration Demonstration Project advance the resilience of the Four Mile Run sub-basin through restoration of the streambank, the creation of a new recreation and green space, and enhancement of the riverine floodplain to better handle future floods.

Additionally, The City launched Flood Action Alexandria in Spring 2021 to expedite infrastructure improvements, including 11 high-priority Storm Sewer Capacity capital improvement projects and additional neighborhood Spot Improvement projects. The program also expands flood early warning systems and signage; implements a Flood Mitigation Pilot Grant Program to provide matching grants to property owners who install flood-proofing measures; increases maintenance capacity; and enhances community outreach and engagement, including monthly newsletters. In May 2022, City Council approved the FY 2022 – FY 2031 Stormwater Management Utility Ten-Year Plan that included a new doubling of the Stormwater Utility Fee to increase operating and capital funding to implement Flood Action Alexandria elements, including a new $197 million 10-year stormwater capacity and spot improvement capital program (with $136 million planned for the next five years).

The recently-launched Flood Mitigation Grant Program for property owners impacted by a recent flood event. A brief description of the grant program announcement is included below.

> "The City of Alexandria will now begin accepting applications for its new Flood Mitigation Pilot Grant Program on Monday, August 30. The program offers matching reimbursement grants to property owners who have installed flood mitigation measures on properties impacted by recent flash flooding events dating back to July 2019. Property owners may receive up to 50% reimbursement for completed project costs, up to a maximum of $5,000, for implementing eligible flood-proofing measures on their property. Applications will be accepted on an ongoing basis."

Flood Action Alexandria is an initiative to protect residents citywide from the impacts of flooding through the following programs and actions:

- Storm Sewer Capacity Projects – The 2016 Storm Sewer Capacity Analysis (CASSCA) included a modeling effort that identified 90 *problem areas* in the City where the model found potential capacity and flooding concerns. The top 11 capacity projects from CASSCA were prioritized based on planning-level cost-benefit analysis and identified capacity issues. These projects, which are funded in the City's Capital Improvement Program, are intended to mitigate flooding for the greatest number of ratepayers, direct investment to areas where the most significant property damage is occurring and provide the greatest overall system benefit. Design of the top three projects begins in FY 2022.
- Spot improvement projects - Small capital projects managed by the Transportation & Environmental Services Stormwater Management Division (T&ES SWM) to help address localized flooding and drainage issues.
- Storm & Sanitary Sewer Section – This effort informs residents, business owners, and citizen groups of best practices to avoid sewer backups, and defines responsibilities of the City and the homeowner related to sewer connections. The ultimate goal is to reduce flooding by decreasing mainline blockages, minimizing the infiltration and inflow of storm water in the sanitary system, and evaluating the structural integrity of the entire sewer system.
- Public Outreach - The City provides information and updates on the progress of the flood mitigation program on the Flood Action Alexandria website and via subscription to the Flood Action Alexandria e-Newsletter. Residents can subscribe to receive information about how to help flood mitigation efforts, participate in community meetings, engage neighbors in the process, and provide feedback on the implementation of the program. Residents have been invited to log into Alexandria eNews and opt-in to "Flood Action Alexandria" to subscribe to this e-Newsletter.
- Early Warning and Emergency Response - The City of Alexandria Emergency Operations Plan (EOP) is a multi-discipline, all-hazards plan that establishes a single, comprehensive framework for the management of major emergencies and disasters within the city. The EOP is implemented when it becomes necessary to mobilize identified resources to save lives and protect property and infrastructure.
- Ad Hoc Stormwater Utility and Flood Mitigation Advisory Group – The Advisory Group's responsibilities include: Reviewing and advising in regards to flood mitigation activities, monitoring and measuring progress of the City's proposed flood mitigation efforts, serving as a general body for receipt and dissemination of information for the City's flood mitigation implementation efforts, and reviewing and providing recommendations on proposed

Stormwater Utility operating and capital budgets

Documentation of existing social, economic, natural, and other conditions present in the local government.

Alexandria's Masterplan and Small Area Masterplans for each of its neighborhoods provides comprehensive demographic data and a contextual overview of the population, land use and development, and open space and recreation.

Review of the vulnerabilities and stressors, both natural and social in the local government.

Alexandria's Masterplan and Small Area Masterplans address vulnerabilities and stressors within the economy including small business, the environment, and community. Each plan involved extensive community engagement to identify the neighborhoods' priorities.

Alexandria Storm Sewer Capacity Analysis assessed and addressed natural stressors to the city's infrastructure which contribute to repetitive flooding.

Alexandria's Housing Masterplan addresses inequities in housing. As a result of sharply increasing real estate costs and regional development pressures over the past decade, the City faces a severe shortage of affordable housing. Since 2000, there have been dramatic declines in market affordable rental units (more than 15,500 units have been lost between 2000 and 2018) and in opportunities for affordable homeownership for low- and moderate-income individuals and families. As the growth in housing costs continues to outpace the growth in incomes, Alexandrians are increasingly becoming housing cost burdened (defined as paying 30% or more of household income on housing-related costs).

Resilient ALX focuses on utilizing Alexandria's Citizen Corps Council (CCC) to advise the City on how to enhance community resilience. The project will include creating a Charter, and Assessment and Report. The Charter offers an overarching vision to supplement the goal of Alexandria's Strategic Plan in the area of creating a Safe and Resilient Community. Charter The CCC Charter will utilize the FEMA Lifelines to categorize data from the study. The results of which will inform the Focus Areas of the Assessment and Report. CCC will work collaboratively with related advisory bodies to create a sound and unifying vision for the City.


WHOLE COMMUNITY
RESILIENCE
LIFELINES
SOCIAL & ECONOMIC
Households & Community Associations
Community Groups
Education
Environment & Recreation
Businesses
Tourism

Forward-looking goals, actionable strategies, and priorities as seen through an equity-based lens.

Under the direction of the City's first Race and Social Equity Officer, Jaqueline Tucker, City departments and an interdepartmental work group are building a framework (in collaboration with City employees, community members, and other stakeholders) to ensure policy decisions advance race and social equity for all Alexandria residents.

Resolution 2974 All Alexandria: Committing to Race and Social Equity commits to:

1) Ensure that race and social equity is incorporated and centered in all planning, including:
   a. Center race and equity throughout the forthcoming FY 2022-FY 2027 Strategic Plan and departmental strategic planning processes;
   b. Establish specific, measurable, attainable, relevant time-based (SMART) goals race and social equity action plans for City departments;
   c. Incorporate race and social equity into all staff and leadership talent management programs;
   d. Establish, strengthen and maintain key partnerships with the Alexandria City Public Schools, other public entities serving our community, community based, non-profit, and faith-based organizations, and businesses in Alexandria to advance racial equity.

2) Implement and sustain structures and systems to advance race and social equity, including:
   a. Adopt and promote practices and policies centered on creating and ensuring racial and social equity through the use of a racial equity tool;
   b. Conduct race and social equity trainings for City Council, City staff and City boards and commissions;
   c. Create authentic community engagement best practices for use in evaluating City actions from creation to implementation;
   d. Maintain membership and active participation in the Government Alliance on Race and Equity (GARE) and Metropolitan Washington Council of Governments (MWCOG) Racial Equity Work Group and newly established Chief Equity Officers Committee.

3) Align and implement policy efforts designed to advance race and social equity goals, including:
   a. Incorporate greatly expanded language access into more City of Alexandria communications and platforms;
   b. Reduce and eliminate racial and social inequities in the allocation of City resources through the use of a budget equity tool which may entail the adjustment of budgets and funding reallocation;
   c. Present City Council with a Racial and Social Equity Action Plan, consisting of specific policy initiatives to advance the City's racial equity goals, informed by additional community engagement.

4) Ensure accountability mechanisms related to the progression and transparency of work to advance race and social equity, including:
   a. Develop equity data mechanisms, including equity indicators, equity mapping, and dashboards to transparently monitor, share, view and inform policy decisions that purposefully work toward reducing and eliminating disparities;
   b. Develop quarterly listen and learn sessions, under the direction of the Race and Social Equity

Officer, to establish ongoing conversation with the community to understand their most pressing issues and to normalize the key concepts of race, social equity and government through collective learning opportunities.

Strategies that guide growth and development away from high-risk locations that may include strategies in comprehensive plans or other land use plans or ordinances or other studies, plans or strategies adopted by a local government.

Alexandria's Floodplain Ordinance No.4715 ensures that future development and major retrofits comply with flood-resilient building standards, which protect residents citywide living in the floodplain. This ordinance also ensures that development is directed away from Special Flood Hazard Areas.

Additionally, Alexandria's Masterplan and Small Area Masterplans and Alexandria's Waterfront Plan, Chapter 2 – Section: A "Plan for Development" addresses properties along Alexandria's waterbodies and within its floodplains.

Proposed acquisition of land or conservation easements or identification of areas suitable for conservation particularly areas identified as having high flood attenuation benefit by *ConserveVirginia* or similar data driven tools.

Alexandria is mapped within the ConserveVirginia tool. Additionally, Alexandria's Floodplain Ordinance addresses areas to restrict future development due to increased flood risk.

Identification of areas suitable for property buyouts in frequently flooded areas.

The City continues to identify areas suitable for property buyouts in frequently flooded areas as needed.

Identification of critical facilities and their vulnerability throughout the local government such as water and sewer or other types identified as "lifelines" by FEMA.

Alexandria has identified and analyzed the vulnerabilities of its infrastructure system through the Alexandria Storm Sewer Capacity Analysis.

Alexandria's drinking water system through Virginia American Water has completed the EPA's requirement for a Risk and Resilience Assessment and Emergency Response Plan.

Identified ecosystems/wetlands/floodplains suitable for permanent protection.

Relevant work includes:

- Four Mile Run Restoration Master Plan
- Waterfront Masterplan
- Waterfront Schematic Landscape and Flood Mitigation Design
- Waterfront Flood Mitigation and Promenade Project

Identified incentives for restoring riparian and wetland vegetation.

Relevant work includes:

- Four Mile Run Restoration Master Plan
- City of Alexandria Landscape Guidelines

A framework for implementation, capacity building and community engagement.

The All Alexandria Initiative focuses specifically on community engagement and outreach to build equity across the city and local government actions.

Strategies for creating knowledgeable, inclusive community leaders and networks.

Through All Alexandria, the city is using the GARE framework to empower community leaders and networks to elevate their voices in local government, and create more inclusive outcomes.

The City's racial and social equity initiative grew from the efforts of an interdepartmental Race and Social Equity Working Group, formed in 2018. These City employees developed and piloted social and racial equity programming in four City departments. The programming was based on the work of the Government Alliance on Race and Equity (GARE), a national network of governments working to achieve racial equity and advance opportunities for all. The City became a member of GARE in 2019, developing its inaugural Racial Equity Learning as part of the Metropolitan Washington Council of Governments' year-long Advancing Racial Equity Cohort.

A community dam safety inventory and risk assessment posed by the location and condition ofdams.

Extensive studies of the Alexandria dam were conducted after a major flood event. The components of these studies, flood mapping, and action plans can be found below.

- 2008 Lake Barcroft Inundation Study update
- 2008 Lake Barcroft Probable Maximum Flood Inundation Mapping
- Presentation from June 24, 2009 Public Meeting
- Draft Flood Operations Plan
- Flood Trigger Action Matrix

A characterization of the community including population, economics, cultural and historic resources, dependence on the built environment and infrastructure and the risks posed to such infrastructure and characteristics by flooding from climate change, sea level rise, tidal events orstorm surges or other weather.

Alexandria is a city with a population of 159,467 (U.S. Census Bureau, 2020). The medium household income in Alexandria in 2019 was $100,939. Of the thirty-eight census tracts in Alexandria, ten are below 80% of the median income, as shown in the map below. The census tract in which the green infrastructure pilot projects are located (201204), is not 80% below the median income. However, tract 201204 does have a diversity index score of 81, indicating a high-level of diversity. A diversity index score is measured from 0-100, where a higher diversity index score denotes a high-level of diversity; in other words, a community statistic representing the likeliness of two people chosen at random belong to different race or ethnic groups (ESRI, 2021). Median disposable income, as listed in the table below, is defined as the amount of money that an individual or household has available to save or spend on non-essentials.

Alexandria is located in Northern Virginia south across the Potomac River from Washington D.C. The city encompasses 15.75 square miles at an average elevation of 30 feet above sea level. On August 12, 2021, the U.S. Census Bureau released the first local level results from the 2020 Census. Data received indicates that the City of Alexandria’s 2020 population is 159,467, an increase of 19,501 residents over the past decade. Alexandria, founded in 1749, has a fascinating history, and many of its historic buildings are still preserved today. During its long history, Alexandria was a tobacco trading post, one of the ten busiest ports in America, a part of the District of Columbia, home to both the largest slave-trading firm in the country and a large free-black community, a Civil War supply center for Union troops, and a street-car suburb for Federal workers. Alexandria was also the hometown of George Washington, Robert E. Lee, Jim Morrison and "Mama" Cass Elliot.

There are only a few other communities in the United States that have as many existing examples of Georgian and Federal period architecture. Old and Historic District, designated in 1946, was the third historic district in the United States, after Charleston and New Orleans. The historic African American community known as Uptown was designated as the Parker-Gray Historic District in 1984, and in 2008 was approved for listing on the Virginia Landmarks Register. Several 20th century neighborhoods have also been recognized for their historic and architectural significance, which are listed below. It is important to note that these older neighborhoods have had significant impacts from flooding from these recent severe storm events. A list of the neighborhoods the City is engaging with who have experienced severe impacts from recent flash flood events is available online at: https://www.alexandriava.gov/122388.

- Del Ray and the Town of Potomac. St. Elmo and Del Ray, two subdivisions platted in 1894, were joined together in 1908 to form the incorporated town of Potomac.

- Fairlington. Fairlington is on the National Register of Historic Places, as a notable example of community planning and publicly financed housing built for defense workers and their families during World War II. Learn more about this history of this community, from the Fairlington Historical Society.

- Parkfairfax. Parkfairfax was built during 1941 to 1943 to help alleviate the acute housing shortages resulting from the depression and World War II.

- Rosemont, located northwest of the Old and Historic District of Alexandria, adjacent to Alexandria's Union Station, is an unusually intact example of an early-twentieth century middle-class trolley suburb.

National Historic Landmarks are buildings, sites, districts, structures, and objects that have been determined by the Secretary of the Interior to be nationally significant in American history and culture. This program is administered by the National Park Service In Alexandria. The Alexandria Historic District, Gadsby's Tavern, the Stabler-Leadbeater Apothecary Shop, Christ Church and the Gerald R. Ford, Jr. House have been designated as National Historic Landmarks.

More than 40 Alexandria districts, sites, buildings and structures and six Historic Districts are listed on the National Register of Historic Places, the United States of America's official list of historic properties worthy of preservation.

The City of Alexandria is experiencing more frequent and severe flood events that damage residential and commercial properties, impact critical assets, and cause day-to-day disruptions and economic losses. Extreme precipitation events have occurred more frequently in the last few years. The City has experience four major flooding events since 2019, including July 8, 2019, July 23, 2020, September 10, 2020, and most recently August 15, 2021. All of these events are characterized between 50 to 100-yr level rainstorm events. Except for August 15 of this year, which was recorded by our new gauges, with actual accumulation of 5.19-inches in 2 hours, to be between 100 and 500-yr level rain when compared to the statistical expectations derived for the city's Intensity-Duration-Frequency (IDF) curves developed in the 1980's for the City, which actually is more conservative than NOAA's predictions for the region.

The Northern Virginia Hazard Mitigation Plan identified flooding as one of Alexandria's predominant hazards due to riverine, precipitation, tidal, and storm surge flooding. The HMP ranked natural hazards for Alexandria using historical weather-related events based on the Storm Event Database by NOAA's NCDC1. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrences;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

Alexandria's watersheds have a significant percentage of impervious surfaces. 43 percent of the City's surface area is comprised of roads, buildings, parking lots, and sidewalks. Impervious surface contributes to the accumulation of stormwater because water is not able to convey and recharge. This type of flooding threatens the continuous operation of roads, emergency access, and property during precipitation events.

Strategies to address other natural hazards that would cause, affect or result from floodingevents including: Earthquakes, Storage of hazardous materials, Landslides/mud/debris flow/rock falls, Prevention of wildfires that would result in denuded lands causing flooding, mudslidesor similar events more likely, Preparations for severe weather events including tropical storms or other severe storms, including winter storms.

The Northern Virginia Hazard Mitigation Plan (2017) uses a multi-hazard approach to address the hazards listed above. Additionally, this plan provided a hazard profile for Alexandria using both historical data and a statistical analysis to understand the level of future risk caused by each of these threats, summarized in the following table.

Table 7.1: Hazard Ranking for Alexandria

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	Med-High	Med	Low	Med-Low	Med-Low

Specific Excerpts Utilized from Each Contributing Plan and Elements 1 – 5

1) It is project-based with projects focused on flood control and resilience.

Projects specific to the City of Alexandria focusing on flood control and resilience are indicated in the Northern Virginia Hazard Mitigation Plan (2017) in **Chapter 7.I, specifically, in the table on pages 7-3 through 7-6.** The 2017 Plan is currently undergoing revisions and does not yet include the specific projects outlined within the City's FY 2022 – FY 2031 Capital Improvement Program.

Page vii of the 2016 City of Alexandria Storm Sewer Capacity Analysis (CASSCA) Executive Summary report – a multi-year study that can be found on the City's website posted in separate sections here – provides a summary of priority "problem areas" for projects. These 90 "problem areas" on page vii and the associated projects to remediate the "problems" through a mix of capacity, storage, and green infrastructure practices. These projects are identified in each of the City's local watersheds across the City and will help reduce flooding and increase resilience.

Page 15.15 identifies for funding in the City's FY 2022 – FY 2031 Stormwater Management Utility Ten-Year Plan, Capital Improvement Program (CIP) for the top 11 prioritized capacity projects are currently. An overview of these projects per local watershed is indicated in Figure 1 (Table 6-1 in the CASSCA Report). **PDF page 65** of the Four Mile Run Fact Sheet in the CASSCA Executive Summary shows the top two priority projects that are denoted as problem area #101 and #102 in the Four

TABLE 6-1
Watershed-wide Alternatives Scoring and Prioritization Results
City of Alexandria Storm Sewer Capacity Analysis

Watershed	Number of Problem Areas	Total Capital Cost ($ Millions)	Total Benefit Score	Overall Benefit/ Cost	Total Flood Reduction (MG)	Cost of Flood Reduction ($/Gallon)	Preferred Alternative
Hoofts Run*	23	$18.26	978	54	7.36	$2.48	3
Four Mile Run	23	$24.46	939	38	11.53	$2.12	3
Holmes Run	9	$5.76	433	75	2.78	$2.07	2
Taylor Run	12	$4.89	516	106	4.43	$1.10	2
Cameron Run	8	$3.65	360	99	2.27	$1.61	1
Strawberry Run	3	$0.27	88	321	0.05	$5.77	3
Backlick Run	5	$3.96	229	58	1.39	$2.86	3
Potomac River	7	n/a	n/a	n/a	n/a	n/a	n/a
TOTAL	90	$61.29	3543	58	29.81	$2.06	n/a

MG = million gallons
Total existing volume of flooding in the problem areas (not including Potomac River) = 46.02 MG.

Figure 1. CASSCA Project Overview

Mile Run East local watershed.

The map on page 2-5 of the "4.2 Problem and Solution Identification and Prioritization for Four Mile Run, Alexandria, Virginia" shows problem areas 101 and 102, and subsequent pages speak to potential solutions and cost-benefit for these projects.

The Stormwater Management Utility Ten-Year Plan includes the Capital Projects slated for Utility Funding. This includes the Capacity Improvement Projects, as well as funding for GI, and other flood control and resilience measures, such as the Four Mile Run dredge project, across the City on **page**

4.

[Alexandria Waterfront Small Area Plan (2012)] provides the roadmap on the redevelopment of the Alexandria's waterfront area in Old Town, including projects focused on nature-based solutions (i.e., Windmill Hill Park) and has lead into the larger Waterfront Plan Implementation – a 20-30 year vision for the City's historic waterfront, which includes Flood Mitigation Implementation. This plan is one of a 18 Small Area Plans and has a large flood mitigation component due to it's nexus with the Potomac River. The Alexandria Master Plan is made up of 18 Small Area Plans covering neighborhoods throughout the city, as well as topical chapters of citywide relevancy, such as Historic Preservation, Urban Design, Transportation, and Open Space. The Alexandria Master Plan was adopted by the City Council on June 13, 1992, and chapters are added or updated on an ongoing basis as needed through Master Plan Amendments. The City's re-development is guided through the Master Plan and Small Area Planning process as well as the Housing Master Plan. Small Areas Plans that are more recent incorporate the goals of the Environmental Action Plan 2040 as well as the City's 2019 Green Building Policy which requires green infrastructure for stormwater treatment, thereby increasing the City's overall resilience.

2) It incorporates nature-based infrastructure to the maximum extent possible.

The 2016 City of Alexandria Storm Sewer Capacity Analysis (CASSCA) report identifies 90 "problem areas" and the associated projects to remediate the "problems" by capacity and storage activities. This report also identifies areas that could be served by nature-based infrastructure. Specifically, under "Task 4", for each watershed, Appendix D includes the "Green Infrastructure Concept Plans" per watershed. Figure 2 (Task 4, GI Program Concept Plan Locations for Hooffs Run) provides an example of what this looks like in the report. The report goes into further details about each of the concept locations for GI.

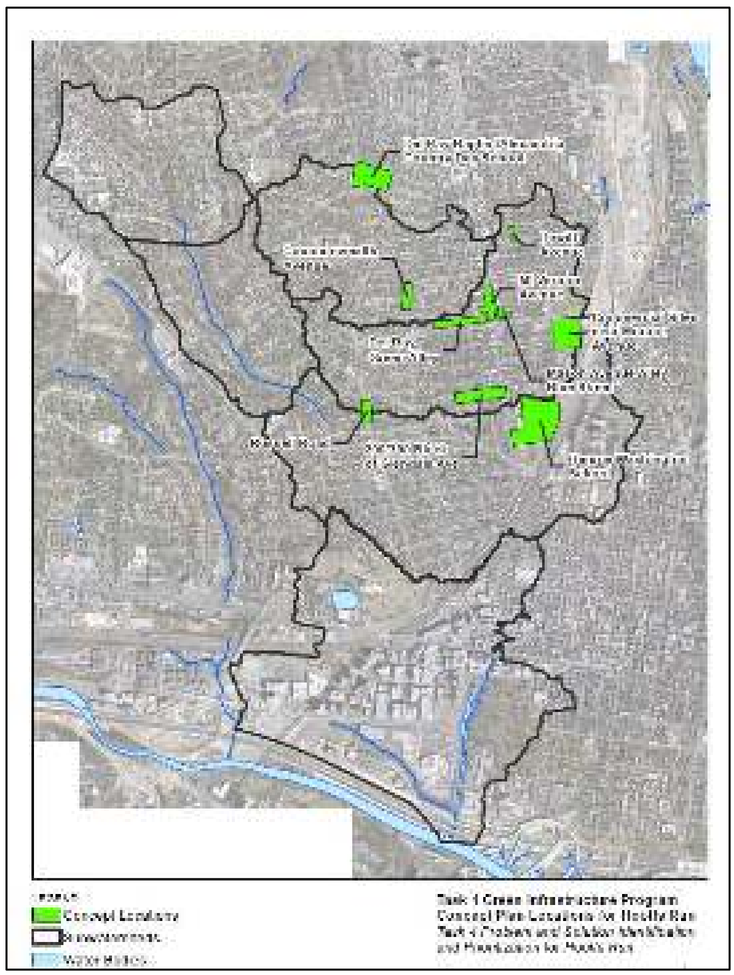


Figure 2. CASSCA Hooff's Run GI Concept Plan

3) It includes considerations of all parts of a locality regardless of socioeconomics or race.

The City recently launched ALL Alexandria – Achieving Racial and Social Equity to ensure that all parts of a locality are considered in the planning process regardless of socioeconomics or race.

Eco-City Alexandria is a collaborative strategic effort to achieve sustainability throughout the City of Alexandria. Eco-Cities work to harmonize their natural resources and environmental assets with existing policies, regional realities, and economic and business markets while engaging the community in a collaborative and transparent decision making process.

Alexandria City Council adopted the Eco-City Charter in June 2008 and was the first Environmental Charter adopted in the Commonwealth of Virginia. The Charter defined Alexandria's commitment to ecological, economic, and social sustainability:

> "Use environmentally responsible flood management, stormwater control, and wastewater treatment to protect the public's health and property." – Eco-City Charter, 2008

The core values and ten guiding principles formed the basis for the City's first Environmental Action Plan (EAP) in 2009 and the updated Environmental Action Plan (EAP) 2040. The EAP 2040 incorporates ten topic sections with an average of two goals and four to six actions in each goal.

Figure 3. Flood Action Logo

The City's Flood Action initiative was launched in early 2021 in response to the severe flood events that impacted the City in 2019 and 2020. This initiative includes an education and outreach component aimed to reach all residents of Alexandria impacted by flooding, via a new eNews channel and an eNewsletter. Figure 3 is the Flood Action Logo.

The City of Alexandria's FY 2017 to FY 2022 Strategic Plan highlights the importance of a Safe and Resilient Community. Alexandria's Citizen Corps Council (CCC) is designed to advise the City on how to enhance community resilience. The project will include creating a Resilient ALX Charter, and Assessment and Report. The Charter offers an overarching vision to supplement the goal of Alexandria's Strategic Plan in the area of creating a Safe and Resilient Community. Anticipated Resilient ALX project outcomes include:

- Clearer vision for preparedness planning in the City.
- Reduced impact of disasters and emergencies to individuals, households, businesses, nonprofit organizations, and local government agencies.
- Improved individual preparedness to reduce strain on public safety groups (such as Alexandria's first responders and volunteer organizations) during a disaster.
- Faster recovery from disasters across factors including: 1) physical; 2) financial and economic; 3) psycho-social and 4) governmental.

4) **It includes coordination with other local and inter-jurisdictional projects, plans, and activities and has a clearly articulated timeline or phasing for plan implementation.**

Coordination with other localities is prevalent in the Northern Virginia Hazard Mitigation Plan (2017), which is further described under #1. The 2017 is currently undergoing the 5-year review and revision. The updated plan will list 'capacity projects' to mitigate flooding, which right now it is more general.

The Four Mile Run Master Plan was developed and coordinated by Arlington and Alexandria to restore Four Mile Run and does include a large flood mitigation component as administered and approved by USACE. Arlington and Alexandria currently are working together to maintain the channel through dredging in 2021/2022. Visit the Four Mile Run Dredge Project website to learn more.

> "The flood control channel, constructed during the 1970s and early 1980s, has safely conveyed the high storm flows through the two jurisdictions. When the channelization project was conceived in the 1960s, the sole objective of the project was flood protection and, in this respect, the project has been a success; no floods have breached the banks along the 2.3-mile channel since its construction. Although successful in flood control, however, the channelized portion of Four Mile Run leaves much to be desired in terms of aesthetic and environmental attributes. The maintenance requirements for the channel include yearly thinning of vegetation and periodic excavation of the sediment that deposits on the channel bed."

City of Alexandria Emergency Operations Plan (2021) includes emergency operations relating to the "…City's vulnerability to a variety of hazards, most notably flooding." The EOP includes inter-jurisdictional planning efforts. Specifically, the City's Flood Response Plan outlines the response from five departments within the City as well as several support agencies. The Plan provides an overview of responsibilities and response activities.

5) **It is based on the best available science, and incorporates climate change, sea level rise, storm surge (where appropriate), and current flood maps.**

The 2009 Sea Level Rise Potential report was incorporated into the CASSCA modeling. **CASSCA, Task 1 documents** review rainfall data and the City's stormwater design criteria, develop projections for rainfall and tidal boundary conditions based on climate change, and propose potential revisions as appropriate

Waterfront Flood Mitigation plan includes flood level evaluations (Figure 5) for planning purposes in Old Town (see Figure 4).

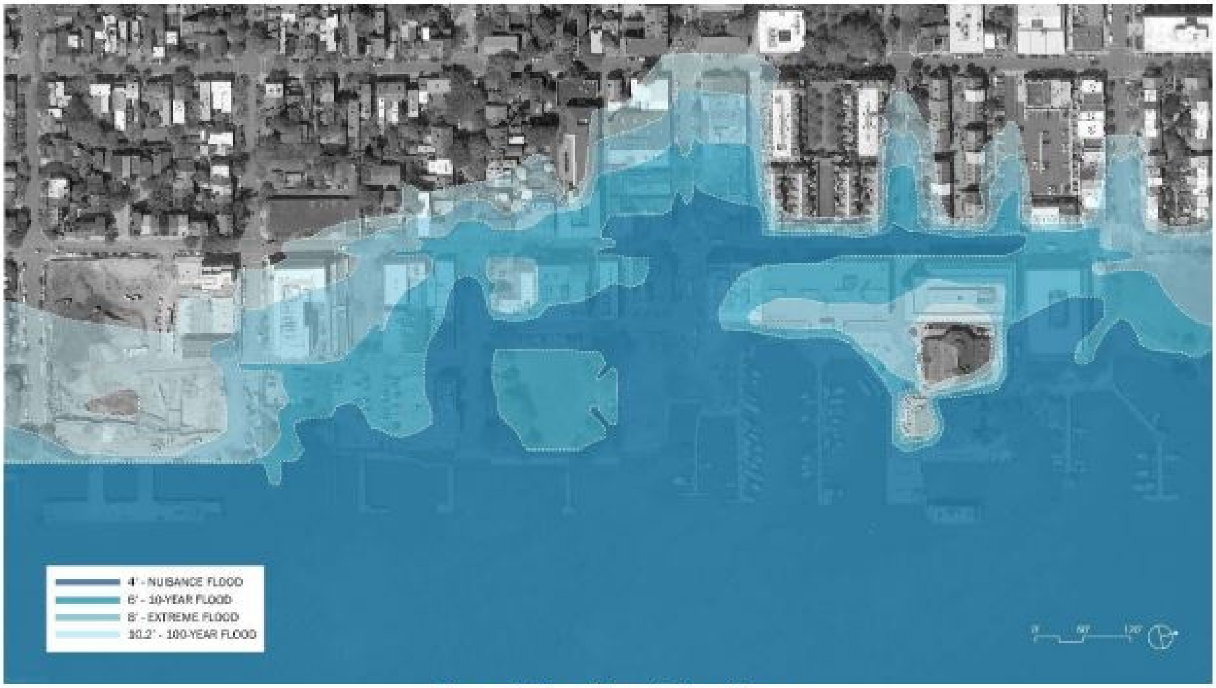


Figure 5: Flood Level Elevations

Figure 4. Waterfront Flood Mitigation Plan Flood Level Elevations (Figure 5 in the Plan)

Floodplain District Ordinance No. 4715 outlines the City's Zoning Ordinance as required by FEMA, the City's Flood Map webpage includes a comprehensive overview of the City's FEMA FIRMs. The City's FIRMs were recently updated by FEMA and are currently under review by the City and it's residents. The City is a Verified Class 6 CRS Community.

The City currently is revising the Energy and Climate Change Action Plan with the latest climate change, sea level rise, storm surge, and current flood maps. This plan was previously completed in 2012. The new Action Plan is being guided by a 13-member Task Force and continues to incorporate racial and social equity into the plan in addition to the latest science. The plan is anticipated to be launched in 2022.