

# 1859 - CID510130\_RoanokeCity\_CFPF-1

## Application Details

**Funding Opportunity:** 1447-Virginia Community Flood Preparedness Fund - Project Grants - CY23 Round 4  
**Funding Opportunity Due Date:** Nov 12, 2023 11:59 PM  
**Program Area:** Virginia Community Flood Preparedness Fund  
**Status:** Under Review  
**Stage:** Final Application

**Initial Submit Date:** Nov 9, 2023 8:46 AM  
**Initially Submitted By:** Marcus Aguilar  
**Last Submit Date:**  
**Last Submitted By:**

## Contact Information

### Primary Contact Information

**Active User\*:** Yes  
**Type:** External User  
**Name\*:** Dr. Marcus F Aguilar  
Salutation First Name Middle Name Last Name  
**Title:** Civil Engineer II  
**Email\*:** [marcus.aguilar@roanokeva.gov](mailto:marcus.aguilar@roanokeva.gov)  
**Address\*:** 1802 COURTLAND RD NE  
  
ROANOKE Virginia 24012  
City State/Province Postal Code/Zip  
**Phone\*:** 540-580-7209 Ext.  
Phone  
### ### #####  
**Fax:** ### ### #####  
**Comments:**

### Organization Information

**Status\*:** Approved  
**Name\*:** ROANOKE CITY  
**Organization Type\*:** Local Government  
**Tax ID\*:** 54-6001569  
**Unique Entity Identifier (UEI)\*:** NBFNAEXRHD76

**Organization Website:**

**Address\*:** City of Roanoke  
215 Church Avenue, SW Room 364

Roanoke Virginia 24011-  
City State/Province Postal Code/Zip

**Phone\*:** (540) 580-7209 Ext.  
### ###

**Fax:** ### ###

**Benefactor:**

**Vendor ID:**

**Comments:**

## VCFPF Applicant Information

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### *Project Description*

**Name of Local Government\*:** City of Roanoke, Virginia  
Your locality's CID number can be found at the following link: [Community Status Book Report](#)

**NFIP/DCR Community Identification Number (CID)\*:** 510130

If a state or federally recognized Indian tribe,

**Name of Tribe:**

**Authorized Individual\*:** Robert Cowell  
First Name Last Name

**Mailing Address\*:** 215 Church Ave SW  
Address Line 1  
Address Line 2  
ROANOKE Virginia 24011  
City State Zip Code

**Telephone Number\*:** 540-853-2333

**Cell Phone Number\*:** 540-853-2333

**Email\*:** [bob.cowell@roanokeva.gov](mailto:bob.cowell@roanokeva.gov)

Is the contact person different than the authorized individual?

**Contact Person\*:** Yes

**Contact:** Marcus Aguilar  
First Name Last Name  
1802 Courtland Rd. NE  
Address Line 1  
Address Line 2  
Roanoke Virginia 24012  
City State Zip Code

**Telephone Number:** 540-853-5918

**Cell Phone Number:** 540-580-7209

**Email Address:** [marcus.aguilar@roanokeva.gov](mailto:marcus.aguilar@roanokeva.gov)

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

**Project Description\*:**

Restore appx. 400 LF of channelized urban stream using natural channel design; establish floodplain bench; plant 2.4 acres of native meadow and ornamental trees; remove undersized storm drain pipes and replace with vegetated swales; provide 4.2 acre-ft. of flood storage.

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\*:** Yes

Information regarding your census block(s) can be found at [census.gov](https://www.census.gov)

**Census Block(s) Where Project will Occur\*:** 517700030003003

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

**Is Project Located in a Special Flood Hazard Area?\*** Yes

**Flood Zone(s) (if applicable):** Zone AE - FLOODWAY

**Flood Insurance Rate Map Number(s) (if applicable):** 51161C0164G

## 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\*:**

Construction of swales and settling ponds, Floodplain restoration, Restoration of floodplains to natural and beneficial function, Stream bank restoration or stabilization

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\*:** High Social Vulnerability (1.0 to 1.5)

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

**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\*:** Yes

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

**Community Scale Benefits\*:**

Does this project provide community scale benefits?

**Community Scale Benefits\*:** More than one census block

Expected Lifespan of Project

**Expected Lifespan of Project\*:** Over 20 Years

**Comments:**

See also, Scope of Work narrative Section 4.8 - Criteria, which further explains all answers in this form.

## 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\*:** [CID510130\\_RoanokeCity\\_CFPF-1 - Ore Branch.pdf](#)

**Comments:**

The attached Scope of Work narrative is organized in a hierarchy that is consistent with the Grant Manual and this portal. The "Portal-Narrative Crosswalk.pdf" will also help the reviewer find pertinent information in the Scope document quickly.

### Budget Narrative

**Budget Narrative Attachment\*:** [Portal-Narrative Crosswalk.pdf](#)

**Comments:**

See Section 5 and Appendix B in Scope of Work Narrative

## Scope of Work Supporting Information - Projects

### Supporting Information - Projects

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

**Population\*:** 97847.00

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\*:** [Portal-Narrative Crosswalk.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\*:** [Portal-Narrative Crosswalk.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\*:** [Portal-Narrative Crosswalk.pdf](#)

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

**Benefit-Cost Analysis\*:** [Portal-Narrative Crosswalk.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\*:** [Portal-Narrative Crosswalk.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\*:**

See Scope of Work Narrative Section 4.1.g.ii.

Proposed project will not impact any existing structures. This site formerly contained a highly flood prone hotel and conference center that was acquired by the City and demolished in 2022 under a FEMA pre-disaster mitigation grant.

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

**Critical Facilities/Infrastructure\*:**

See Scope of Work Narrative Section 4.1.g.iii.

No critical facilities/infrastructure within project area

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\*:**

See Scope of Work Narrative Section 4.1.d. and 4.2.a.

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\*:**

See Scope of Work Narrative Section 3.2

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\*:** [Portal-Narrative Crosswalk.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\*:**

See Scope of Work Narrative Section 4.6

Project site formerly contained a highly flood prone hotel and conference center that was acquired by the City and demolished in 2022 under a FEMA pre-disaster mitigation (PDM) grant. City is now working on administrative close out of PDM grant. Project is part of the City's broader floodplain management program, which includes the \$72.5M Flood Reduction Project constructed in partnership with the U.S. Army Corps of Engineers. The City also has ~\$14.5M in additional grants either funded or under review for acquisition and demolition, constructed wetlands, stream restoration, bridge hydraulic improvements and automated flood gates across the City's service area.

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\*:** [Portal-Narrative Crosswalk.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\*:**

"Section 4.8 - Criteria" in the attached scope of work narrative provides a table that enumerates the scoring for this project with supporting information

## Budget

### Budget Summary

**Grant Matching Requirement\*:** LOW INCOME - Projects that will result in nature-based solutions - Fund 95%/Match 5%

I certify that my project is in a low-income geographic area: Yes

**Total Project Amount\*:** \$921,248.08

**REQUIRED Match Percentage Amount:** \$46,062.40

## BUDGET TOTALS

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

**Match Percentage:** 5.00%  
Verify that your match percentage matches your required match percentage amount above.

**Total Requested Fund Amount:** \$875,185.68

**Total Match Amount:** \$46,062.40

**TOTAL:** \$921,248.08

### 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
-------------	-----------------------	--------------	--------------

Construction Cost per Engineer's Estimate	\$875,185.68	\$46,062.40	Roanoke City Capital Improvement Program
	\$875,185.68	\$46,062.40	

**Contracts**

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

**Maintenance Costs**

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

**Pre-Award and Startup Costs**

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

Engineering Design and Permitting	\$71,440.00	\$3,760.00	Roanoke City Capital Improvement Program
		\$3,760.00	

**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
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No Data for Table

**Supporting Documentation**

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*Supporting Documentation*



Named Attachment	Required	Description	File Name	Type	Size	Upload Date
Detailed map of the project area(s) (Projects/Studies)		See also Appendix C.1, scope of work narrative	<a href="#">01 - Detailed project Map.pdf</a>	pdf	6 MB	11/02/2023 11:11 AM
FIRMeTte of the project area(s) (Projects/Studies)		FIRMeTte from recently approved Roanoke River LOMR (2023)	<a href="#">02 - FIRMeTte.pdf</a>	pdf	1 MB	11/02/2023 11:12 AM
Historic flood damage data and/or images (Projects/Studies)		See also Section 4.1.b. in scope of work narrative	<a href="#">Appendix D - Ore Branch Flood Photos.pdf</a>	pdf	7 MB	11/02/2023 11:13 AM
A link to or a copy of the current floodplain ordinance		<a href="https://library.municode.com/va/roanoke/codes/code_of_ordinances?nodeId=CORO1979_CH36.2ZO_ART3RESPZODI_DIV5OVDI_S36.2-333FLOVDIF">https://library.municode.com/va/roanoke/codes/code_of_ordinances?nodeId=CORO1979_CH36.2ZO_ART3RESPZODI_DIV5OVDI_S36.2-333FLOVDIF</a>	<a href="#">Portal-Narrative Crosswalk.pdf</a>	pdf	140 KB	11/02/2023 11:23 AM
Maintenance and management plan for project		See scope of work narrative Section 4.7	<a href="#">Portal-Narrative Crosswalk.pdf</a>	pdf	140 KB	11/02/2023 11:23 AM
A link to or a copy of the current hazard mitigation plan		<a href="https://rvarc.org/wp-content/uploads/2019/08/RVAR_Hazard_Mitigation_Plan_2019.pdf">https://rvarc.org/wp-content/uploads/2019/08/RVAR_Hazard_Mitigation_Plan_2019.pdf</a>	<a href="#">Portal-Narrative Crosswalk.pdf</a>	pdf	140 KB	11/02/2023 11:23 AM
A link to or a copy of the current comprehensive plan		<a href="https://planroanoke.org/city-plan-2040/">https://planroanoke.org/city-plan-2040/</a>	<a href="#">Portal-Narrative Crosswalk.pdf</a>	pdf	140 KB	11/02/2023 11:24 AM
Social vulnerability index score(s) for the project area		See Section 4.2.b. in scope of work narrative	<a href="#">Portal-Narrative Crosswalk.pdf</a>	pdf	140 KB	11/02/2023 11:24 AM
Authorization to request funding from the Fund from governing body or chief executive of the local government		See also Appendix C.13 in scope of work narrative	<a href="#">13 - Council Resolution No. 42806-101623.pdf</a>	pdf	20 KB	11/02/2023 11:25 AM
Signed pledge agreement from each contributing organization		See executed Appendix A from City Manager	<a href="#">Appendix A- Application Form.pdf</a>	pdf	348 KB	11/07/2023 01:45 PM
Maintenance Plan		See Section 4.7 in scope of work narrative	<a href="#">Portal-Narrative Crosswalk.pdf</a>	pdf	140 KB	11/02/2023 11:25 AM
<i>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.</i>						
Benefit Cost Analysis		See Section 4.1.e. in scope of work narrative	<a href="#">Portal-Narrative Crosswalk.pdf</a>	pdf	140 KB	11/02/2023 11:26 AM
Other Relevant Attachments		See Appendices D-G, scope of work narrative	<a href="#">Portal-Narrative Crosswalk.pdf</a>	pdf	140 KB	11/02/2023 11:27 AM

### Letters of Support

Description	File Name	Type	Size	Upload Date
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No files attached.

## Resilience Plan

### Resilience Plan

Description	File Name	Type	Size	Upload Date
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Resilience plan approved by City Council and DCR as of 10/31/2023	<a href="#">2023 City of Roanoke Flood Resilience Plan_DCR.pdf</a>	pdf	7 MB	11/02/2023 11:36 AM
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**AMT**



# CITY OF ROANOKE

## Flood Resilience Plan



**September 25, 2023**

### **City of Roanoke**

Department of Public Works  
Stormwater Utility  
1802 Courtland Rd, NE  
Roanoke, VA 24012

### **A. Morton Thomas and Associates, Inc.**

1166 Jamestown Road, Suite D  
Williamsburg, VA 23185  
amtengineering.com

### **Wetland Studies and Solutions, Inc.**

5300 Wellington Branch Dr.  
Gainesville, VA 20155  
wetlands.com

# CITY OF ROANOKE FLOOD RESILIENCE PLAN

## EXECUTIVE SUMMARY

The City of Roanoke’s geography and history are intertwined with the abundant water resources that flow through the Roanoke Valley – the Roanoke River, its tributaries and the salt marsh now hidden below Roanoke’s Downtown. These water resources were critical during the City’s early development, and the Roanoke River and tributaries continue to be an important natural asset for those that live, work, learn and play in its watershed. The challenge of living in proximity to these waterways is the periodic flooding that disrupts community life and the local economy. Flooding has become an increasingly important issue with the continued need for community growth, the related housing and commercial development, and the increase in rainstorm severity due to climate change. While these are important issues for Roanoke, they are not unique as urban flooding has one of the greatest social and economic impact of any natural hazard in the United States. To mitigate the growing risk of urban flooding, adoption of the principle of “flood resilience” has become a prominent strategy in communities nationwide.

The plan is organized as follows: Section 1 defines scope and purpose, Section 2 summarizes Roanoke’s flood history, Section 3 characterizes Roanoke’s demographics and vulnerabilities in the context of social equity and Section 4 adds to this knowledge based on the results of the public engagement process performed for this Plan. Section 5 is the culmination of the Plan into five key principles of flood resilience:

1. Climate Change – Does the effort internalize climate change impacts (increased rainfall intensity and temperature) into design and implementation of efforts?
2. Social Equity – Does the effort acknowledge community vulnerabilities and work towards equitable outcomes in its conception? Will the effort improve or strengthen the social fabric in vulnerable parts of the community?
3. Community Scale Benefits – Will the effort render benefits at a U.S. Census Block scale or larger? Will at least 10% of the City’s population benefit from the project? Is the effort consistent with regional efforts?
4. Economy and Land Use – Does the effort acknowledge fiscal realities and focus on cost-effectiveness? Does the effort encourage the usage and development of land that internalizes present and future flood risk? Is it consistent with best practice for floodplain management?
5. Nature-Based Approach – Will the effort leverage environmental processes and natural systems to minimize mitigate flood impacts and reduce pollutants of concern including fine sediment, pathogens and organic chemicals?

These five principles are then used to evaluate existing City efforts in Section 6 and propose future flood resilience projects in Section 7. The flood resilience efforts proposed in Section 7 are consistent with existing City efforts, and provide specific, actionable work items that will assure that long-range resilience concepts are embedded in the City’s decision-making processes with respect to floodplain management and flood-related infrastructure planning. Overall, it is anticipated that adoption and implementation of the five key flood resilience principles and the specific project proposals will further support the City Plan 2040 vision of a strong, livable, economically resilient community that exists in harmony with nature while ensuring that programs and actions are equitable for all members of the community.

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# 1. INTRODUCTION

## 1.1 STATEMENT OF PURPOSE

The term “resilience” is defined as the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, health the economy and the environment<sup>1</sup>. Resilience is a concept of major significance for communities in a rapidly changing world. In the context of flooding, resilience focuses both on minimizing the impacts of flooding and equipping a community to respond to and rebound from the impacts of flood events. This includes both the direct, short-term shocks related to a specific flood event, as well as the longer-term issues that flood risk can create in a community. The Commonwealth of Virginia recognized this challenge when it created the Community Flood Preparedness Fund in 2020.

**Flood Resilience**  
The capability to anticipate, prepare for, respond to and recover from a significant flood-related disruption or shock with minimum damage to social well-being, health, the economy and the environment

The City is growing and its vision, as expressed through our Comprehensive Plan, is to be a strong, livable, economically resilient community that exists in harmony with nature while ensuring that programs and actions are equitable for all members of the community. This is a particular challenge in an urban environment where there is a need to provide additional housing and related infrastructure. This development to support growth can occur, while understanding the needs of a diverse community, and incorporating flood resilience principles in a manner that supports community growth. This vision is consistent with the State’s vision for creating strong, resilient communities.

With an acknowledgement of the present and future flood risk in the community, and a desire to apply resilience principles to the long-range mitigation of and response to this risk, the City of Roanoke has developed this Flood Resilience Plan to identify a path to a more flood resilient Roanoke. As such, **the purpose of this document is to define the City’s principles of flood resilience, to identify gaps in existing City efforts with respect to these principles, and to provide specific action items that can be performed to make progress towards these principles.**

The plan follows the principles of the Community Flood Preparedness Fund as defined by the Department of Conservation and Recreation (DCR) and the elements and direction of City Plan 2040. Appendix A includes a cross references between DCR’s criteria for resilience plans with the contents of this document.

## 1.2 OVERARCHING THEMES AND PRINCIPLES

There are three overarching themes that apply to the City’s flood resilience:

- Roanoke is a growing city with an urban development pattern. Policy, programs and actions need to creatively account for the balance of a growing community that is becoming more resilient.
- Achieving a high level of resilience cannot be achieved by the City alone. It is a collective, community effort with the City playing a critical role in developing programs and policy as well as implementing projects.

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<sup>1</sup> From U.S. Global Change Research Program - <https://www.globalchange.gov/climate-change/glossary>

- With limited resources, being good stewards of our land and capital resources is critical and is based on an understanding of community needs.

These themes are applied to flood resilience planning principles. These principles recognize:

- The changing climate and how it will affect rainfall and flood risk for our community.
- Nature based solutions are preferred as the most sustainable options for flood resilience and can offer other community benefits beyond reducing flood risk.

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*Nature-based solutions are sustainable practices that weave natural features and processes into the built environment to promote adaptation and resilience.*

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This plan's three flood resilience themes and resilience planning principles are tied to the five key principles of flood resilience:

1. Climate Change
2. Social Equity
3. Community Scale Benefits
4. Economy and Land Use
5. Nature-Based Approach

These themes and principles support the plan's objective of providing a blueprint for the City's flood future efforts to build upon and expand on considerable stormwater and floodplain management plans, policies and projects to guide the City towards greater resilience to flood risk.

### **1.3 METHODS AND SCOPE**

In order to form a Plan that applies resilience-thinking appropriately to the City's specific context, the following document structure is used: first an introduction is provided that clarifies the purpose, methodology and scope of this Resilience Plan in Section 1. Next, Section 2 provides a summary of how Roanoke's history and hydrology shapes the present-day context for flood resilience, with a summary of other related vulnerabilities. Section 3 is focused on characterizing Roanoke's demographics and vulnerabilities in the context of social equity and Section 4 adds to this knowledge base using the public engagement process for this Plan. Section 5 assimilates the previous sections into five key flood resilience principles, which are used to evaluate existing City efforts in Section 6 and propose future flood resilience projects and programs in Section 7.

The planning team consisted of City staff from the Departments of Public Works, Planning, Building and Development, and Parks and Recreation and a consultant team from A. Morton Thomas, Inc. (AMT) and Wetland Studies and Solutions Inc. (WSSI). Public outreach for the plan was conducted from January 2023 to March 2023. The plan was reviewed by pertinent City leadership prior to presentation to and adoption by City Council. While this document memorializes the resilience-thinking and public outreach completed to date, it is acknowledged that community engagement is an ongoing, project specific process that will continue as the proposed ideas in this plan make their way to implementation. This plan is therefore subject to future revisions, as concepts of flood resilience and community perspectives evolve.

Finally, it is important to understand that the focus of this plan is flood resilience and not resilience more broadly (e.g. economic, health, energy) as a broader evaluation of other known threats and hazards and the complex interdependencies between the different types of critical infrastructure during emergency events is outside of the scope of this work. Notwithstanding, the methods, analysis, findings and recommendations in this plan are carefully crafted to support a broader application of resilience thinking across these domains.

## **2. BACKGROUND**

### **2.1 HISTORY AND HYDROLOGY**

The City of Roanoke is a mid-sized locality (population ~100K, 43 mi<sup>2</sup>) in southwest Virginia located near the bottom (i.e. downstream terminus) of a 513 mi<sup>2</sup> watershed known as the “Upper Roanoke River Watershed” (Figure 1). The watershed is comprised of steep Appalachian and Blue Ridge Mountain slopes, with relatively thin soils that drain into flatter river floodplains as the Roanoke River flows into Roanoke County, City of Salem, City of Roanoke and subsequently into Smith Mountain Lake and the Virginia Piedmont. In addition to the approximately 10 miles of Roanoke River within the City, drainage within the City’s service area is comprised of 13 smaller tributary waterways amounting to 63 stream miles and an additional 450 miles of storm drainpipe and nearly twenty-two thousand related drainage structures (manholes, inlets, outfalls, etc.).





The abundant availability of water resources was an important aspect of the settlement of the Roanoke Valley, and in particular the position of the City at the bottomlands of the river valley is due in part to the availability of three critical water resources at the time Roanoke (formerly Big Lick) was settled around the turn of the 20<sup>th</sup> century: (1) fresh drinking water springs, (2) a number of salt marshes near present-day Downtown Roanoke that provided hunting grounds, and (3) the ability to dispose of sewage via the multitude of streams in the area. Early settlement followed this pattern in numerous locales on the eastern seaboard, and while the proximity to water resources was critical to the City’s early survival and continues to be a critical element of water resilience context in the Roanoke Valley, this proximity has become problematic as the City has expanded in footprint and population and because the City is the downstream recipient of runoff from most of the developed and developing land in the remainder of the Upper Roanoke River Watershed.

As of the date of this plan, it is estimated that the Upper Roanoke River Watershed is on average 24% developed and that the City’s service area is 87% developed land and 38% impervious cover. As a result of this changing land cover and the related removal of vegetation and grading/compaction of soils, the hydrology of the Roanoke River and its tributaries has changed considerably from the early days of its settlement, and Roanoke is now subject to two separate but related flooding processes: riverine and pluvial. In general, riverine flooding is caused by longer duration rainfall (tropical storms or frontal systems) while pluvial flooding is caused by shorter duration but very intense rainfall (convective or “burst” storms) – the impacts of these two processes are further expanded in the following subsections.

### **2.1.1 Riverine Flooding**

Riverine flooding occurs during longer duration precipitation events that exceed the infiltration limits of the soils in the Upper Roanoke River Watershed and cause flooding along the Roanoke River corridor. The most well-known example of riverine flooding is the flood of record in the Roanoke Valley - commonly known as the Election Day Flood of 1985, or simply the “**Flood of ‘85**”. In this significant historical event, the remnants of Hurricane Juan moved slowly up the eastern seaboard and then stalled in the mid-Atlantic by a cold front from the west, resulting in five consecutive days of heavy rainfall. On November 4, the system produced a record-breaking 6.61 inches of rainfall over a 24-hour period, resulting in major flooding of the Roanoke River and its tributaries and causing ten deaths and an estimated \$225M (1985 USD) in property damages in Roanoke alone<sup>2</sup>. While the Flood of ‘85 was the largest flood to date, riverine flooding is not unusual along the Roanoke River as the River has exceeded the National Weather Service’s (NWS) “Major Flood Stage” of 16 ft. seven times in recorded history, with the most recent event related to the remnants of Hurricane Michael on October 11, 2018 (Figure 2).

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<sup>2</sup> For further reading on the Flood of ‘85, see: Corrigan, P. (2020). *The Floods of November, 1985: Then and Now* (pp. 1–13). NOAA Central Region Headquarters. [https://www.weather.gov/media/rnk/past\\_events/Flood%20of%201985\\_Then-Now\\_2020.pdf](https://www.weather.gov/media/rnk/past_events/Flood%20of%201985_Then-Now_2020.pdf)



**Figure 2 – The Roanoke River at S. Jefferson St. and Carillion Roanoke Memorial Hospital on October 11, 2018. Flooding resulted from the remnants of Hurricane Michael is it passed through southwest Virginia.**

One issue of particular importance that was identified during the Flood of '85 was the impact of flooding on **critical facilities** along the Roanoke River and tributaries – namely the flooding of the basement and first floor of Roanoke Memorial Hospital (now Carillion Roanoke Memorial Hospital, CRMH). A critical facility is one that functions as a community lifeline, and a disruption in service may lead to health and public safety issues – this includes hospitals, fire stations, police stations, storage of critical records, etc. While CRMH has implemented several flood-proofing measures since the Flood of '85, there are still 22 critical facilities within the City's SFHA that present a particular risk during Riverine flooding events and would benefit from additional flood protection efforts and well- documented/rehearsed flood-day operations manuals.

The extent and impacts of riverine flooding can generally be summarized using FEMA's mapped floodplain – known as the “Special Flood Hazard Areas” (SFHAs, Figure 1) – as these areas portray the inundation extent along streams and rivers with drainage areas greater than approximately 1 mi<sup>2</sup>. However, there are smaller tributaries that may experience flooding that are not mapped as a SFHA, including Horton's Branch in the Loudon-Melrose, Shenandoah West and Villa Heights neighborhoods, and the western portion of Trout Run in the Gilmer neighborhood. Along with the SFHA, there are areas of repetitive loss and damage from flooding across the City that may or may not be in the SFHA (Figure 1). There are 67 repetitive loss properties in the City of Roanoke and 10 severe repetitive loss properties.

The floodplain boundaries are based on the extent of inundation during the 0.2% and 1% Annual Chance<sup>3</sup> floods (Previously known as the 500-year and 100-year floods) and the regulatory Floodway, which is the zone of highest flood risk. Most of the City's known flooding issues – referred to as “repetitive loss” or “severe repetitive loss” areas are subject to riverine flooding and are therefore located in a mapped FEMA

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<sup>3</sup> The 0.2% and 1% Annual Chance floods have historically been referred to as the 500-year and 100-year floods respectively,

SFHA. However, there are known flood prone locations throughout the City that are not adjacent to a stream or river, but nonetheless experience flooding during brief, intense rainfall.

### **2.1.2 Pluvial Flooding**

In comparison to the long duration rainfall systems that cause riverine flooding, pluvial flooding is generally caused by short duration, localized, intense bursts of rainfall over more highly developed land. This type of flooding generally impacts the storm drain system and smaller tributaries as excess runoff generated from urbanized sub-watersheds exceeds their capacity and causes brief periods (5 minutes – 30 minutes) of surface flooding. While pluvial flooding is a different process from riverine flooding, the impacts of pluvial flooding can sometime be exacerbated if the river is at flood stage and therefore a downstream impedance to drainage of the tributaries. The impacts of pluvial flooding were especially notable in 2018 as the City’s rainfall surpassed the average annual rainfall accumulation of 41.25 inches by over 20 inches, achieving a new historical record of 62.45 inches.

In particular, the Trout Run watershed which drains the City’s Downtown is subject to recurring pluvial flooding, as are certain sections of the smaller tributaries and storm drain system. When intense rainfall occurs over the Trout Run watershed, the pipes and tunnel systems draining through the Downtown are overwhelmed with runoff because of (1) the intensity of precipitation; (2) the position of the Downtown atop a historical salt marsh and (3) the undersized tunnels that drain the Downtown dating back to the 1880’s. Various other areas of the City are subject to pluvial flooding issues related to intense precipitation and legacy infrastructure that was not designed to modern day engineering standards.

## **2.2 LEGACY INFRASTRUCTURE AND STANDARDS**

The City dates to the late 1880s with much of the City’s growth occurring before the 1960s. The age of drainage infrastructure generally reflects the age of the development of the various areas of the City. Among other issues, this means that a large proportion of the City’s flood-related infrastructure:

- May be undersized because it pre-dates modern-day (or any) hydraulic engineering methods or because it was sized based on a now-dated rainfall atlas.
- Was built using materials (e.g. vitrified clay, corrugated metal) that are susceptible to damage/at the end of their service life or methods (e.g. unsuitable backfill material, poorly formed connections, no maintenance access) that present significant maintenance burdens.
- Did not consider impacts on downstream channel erosion or surface water quality.

As of the date of this Plan, the City’s Stormwater Capital Improvement Program (CIP) has a list of over 200 projects valued at over \$150M that would address some of the flooding related to the issues listed above. In addition, a recent technical report proposed an additional \$80-90M of projects to address Downtown flooding, beyond those listed in the CIP. Furthermore, the City’s estimated capital outlay to build the required water quality projects (as required by the TMDLs, see Section 6.3.2) is in the \$150M range amounting to a total estimated capital investment of approximately \$380M – note that this does not include the substantial cost of maintaining existing storm drain infrastructure throughout the City. While the City has been working to address these legacy infrastructure issues, it is important to understand that the age, scale and right-of-way needed to address these issues means that the volume and rate of depreciation of aging infrastructure will continue to surpass the City’s replacement capabilities (funding, staff, equipment, etc.) for the foreseeable future as the annual project delivery capability is in the \$7 - 9M

range. This gap is further widened by the rapid inflation in the cost of construction products<sup>4</sup> and the potential impacts of climate change on pipe sizing calculations (see Section 2.3). These factors suggest that while traditional drainage improvement projects are still beneficial in certain circumstances, community-wide flood resilience cannot be achieved by simply replacing and updating legacy infrastructure - a more diverse portfolio of strategies will be needed.

The City's age also means that the development in much of the service area pre-dates modern day flooding-related development standards. A few examples of this are:

- Construction of buildings or other capital assets in the floodplain or floodway prior to the availability of floodplain maps (i.e. Flood Insurance Rate Maps, FIRMs) and prior to the National Flood Insurance Program (NFIP) in the 1970s.
- Land development prior to modern-day stormwater and erosion/sediment control regulations resulting in unmitigated discharges of runoff from developed land applying to development since the 1980s.

While the City has adopted floodplain, stormwater, erosion and sediment control regulations and other development standards to control runoff and/or reduce flood risk, older developments do represent a risk. That risk may be associated with buildings and structures on the immediate property or the effect of that development on downstream properties. As properties are redeveloped and modified over time, there is the opportunity to retrofit improvements to reduce runoff from properties and/or make the properties more resilient related to flooding. Over time some, but not all risk can be managed through redevelopment and renovation. The City actively works to reduce this risk through floodplain acquisition of highly flood prone properties, including demolition of flood prone structures.

In summary, the age of the City's infrastructure presents a particular challenge because of the complexity and cost of retrofitting legacy developed land to a disposition that reflects modern-day standards. An additional complication is that modern-day standards assume that historical rainfall and hydrology patterns are representative of present and future patterns. However, it is likely that this is not actually the case, and the specter of a warming climate further exacerbates the issues outlined in this Section.

## **2.3 CLIMATE CHANGE**

In general, climate forecasts suggest that average temperatures in Virginia will increase by 4°F by the year 2100 and Roanoke's climate will feel more like the present-day climate in Tuscaloosa, Alabama<sup>5</sup>. These higher temperatures and corresponding moisture holding capacity of the atmosphere will likely cause more frequent and intense rainfall and flood events<sup>6</sup>. Expert guidance suggests that the City of Roanoke should expect an estimated 5% increase in average annual precipitation by 2035 and an 11%

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<sup>4</sup> Concrete pipe (for example) has increased in unit cost by 13% since July 2022, 37% since July 2021 and 40% since July 2020 nationally. See U.S. Bureau of Labor Statistics [WPU1332](#)

<sup>5</sup> For more detailed information on temperature impacts in Virginia, see the [National Climate Assessment, Southeast Region](#), the [Climate Impact Lab](#) and University of Maryland's [Climate Analog Tool](#).

<sup>6</sup> See Intergovernmental Panel on Climate Change (IPCC) [2022 Report](#)

increase by 2060, potentially increasing streamflow (i.e. the volume of water flowing through the City’s streams during flood events) by 1.5 times present day streamflow<sup>7</sup>.

While the total annual rainfall increase is substantial, the greatest impact to flood resilience is the increasing intensity and frequency of individual storm and rainfall events. To quantify this impact, the National Oceanographic and Atmospheric Administration's (NOAA’s) Mid-Atlantic Regional Integrated Sciences and Assessments (MARISA) Team has developed a tool to predict rainfall intensities of future storm events. This tool can be used to predict rainfall for future design storms in Roanoke based on planning horizons (year 2070 or 2100) and two scenarios for level of action taken to reduce the effects of climate change (steady state RCP 8.5 or optimistic reductions RCP 4.5) and several storm events pertinent to hydraulic engineering are summarized in Table 1.

As the table shows, predictions can be complicated based on a range of factors. However, the projected increase in precipitation and storm events necessitates a new vision for managing stormwater and flood adaptation. Two highlights are:

- The 10-year storm (or 10% Annual Chance): This rainfall event is typically used for storm drain and culvert sizing, will increase in size by 14% - 19% by 2070 and by as much as 23% - 28% by 2100, making it more like the present day 25-year rainfall. This means that in fifty years, storm drainpipes that are sized to present day standards will no longer achieve the designed level-of-service and may flood on a more frequent basis than anticipated. (note, that because of the City’s age, much of the City’s drainage infrastructure was not even designed to a 10-year storm event, see Section 2.2).
- The 100-year storm (or 1% Annual Chance): Rainfall is projected to increase by 20-25% from present-day estimates, making it more like the present day 200 – 500-year rainfall event. While these storms may be infrequent, it means that major riverine floods would be larger and more frequent, and that flood risk would increase for floodplain properties.

**Table 1 - Estimated Impacts of Climate Change on Rainfall Amounts**

Rainfall Duration	Current Rainfall (in)	Projected 2070		Projected 2100	
		Rainfall (in)	Change from Current (in)	Rainfall (in)	Change from Current (in)
10-Year Return Period (10-Year Storm)					
10 min.	0.81	0.92	+ 0.11	1.04	+ 0.23
1 hr.	1.94	2.21	+ 0.27	2.48	+ 0.54
24 hr.	4.70	5.36	+ 0.66	6.02	+ 1.32
25-Year Return Period (25-Year Storm)					
10 min.	0.92	1.08	+ 0.16	1.23	+ 0.31
1 hr.	2.30	2.69	+ 0.39	3.08	+ 0.78
24 hr.	5.72	6.69	+ 0.97	7.66	+ 1.94

<sup>7</sup> See EPA’s [Streamflow Projections Map](#)

Rainfall Duration	Current Rainfall (in)	Projected 2070		Projected 2100	
		Rainfall (in)	Change from Current (in)	Rainfall (in)	Change from Current (in)
100-Year Return Period (100-Year Storm)					
10 min.	1.07	1.31	+ 0.24	1.35	+ 0.28
1 hr.	2.85	3.48	+ 0.63	3.59	+ 0.74
24 hr.	7.50	9.15	+ 1.65	9.45	+ 1.95
<b>Notes:</b>					
<ol style="list-style-type: none"> <li>1. Estimates for Roanoke Regional Airport for time periods 2020 – 2070 and 2050 – 2100 from NOAA’s Mid-Atlantic Regional Integrated Sciences and Assessments Team.</li> <li>2. Rainfall estimates based on a low emission scenario, RCP 4.5, are shown in this table. This assumes that was used for this table, RCP 4.5 is a moderate scenario in which greenhouse gas emissions peak around 2040 and then begin to decline.</li> </ol>					

While the estimated changes to precipitation patterns are now available, it is more difficult to translate changes in precipitation patterns to impacts on infrastructure cost and floodplain structures. This is because the relationship between rainfall intensity and corresponding runoff, stream flows and flood depths are non-linear (i.e. a 14% increase in rainfall does not necessarily lead to a 14% increase in runoff or streamflow) and the cost of infrastructure and impacts to floodplain structures varies, depending on a wide number of factors. The complexity involved in understanding how changes in precipitation result in on-the-ground impacts means that the formulation of policies and protocols aimed at these long-term changes requires additional study. Recommendations with respect to hydraulic engineering calculations and floodplain management that address this complexity are provided in Section 7, though the reader should understand that the field of climate change adaptation for local flood resilience is still relatively new, and that best practice will evolve rapidly as communities experiment with different adaptation strategies.

In general, the best available practice that has formed around hydraulic engineering design for climate change is to shift from a principle of “protection” to that of “adaptation”. While these concepts may sound similar, protection is focused on repelling and diverting flood waters, while adaptation acknowledges the eventuality and increasing probability of flooding with climate change and focuses on replacing risk with natural assets. Levees and concrete floodwalls are a simple example of a flood protection structure, as they are built to repel floodwaters from developed land up to their design flood; though the major issue is that when they overtop (which they are more likely to do in the context of climate change), the failure is typically catastrophic. The adaptive alternative to levees and floodwalls is called a riparian buffer, which replaces flood risk along the river with trees and other vegetation that will not be subject to damages if flooded. As previously mentioned, there is an economic tradeoff from the use of adaptive solutions, and their implementation requires careful weighing of benefits and costs – though it is critical that these types of adaptive, nature-based solutions be considered as a viable project alternative in the context of drainage improvements and other flood-related projects. This is discussed further in Section 5 and 7 of this Plan.

## **2.4 RELATED HAZARDS**

A flood resilience plan would not be complete without addressing flood-related hazards. There are several flood-related hazards pertinent to the City that are considered here with respect to flood resilience. The proposed efforts in this Plan will also work towards City objectives related to water quality, dam safety and landslides.

### **2.4.1 Water Quality**

It is well known that hydrology – the volume, rate, energy and frequency of flow – is a master variable that drives water quality. While the focus of this plan is flood resilience, it is anticipated that the principles and projects outlined here would also support the City’s efforts to improve water quality in the Roanoke River and its tributary streams. In particular, the Roanoke River and several tributaries have been designated as “impaired” by the Virginia Department of Environmental Quality (DEQ) for aquatic life, bacteria and a category of organic chemicals known as polychlorinated biphenyls (PCBs). The DEQ has designated regulatory pollutant reduction requirements for all three of these impairments, known as “total maximum daily loads” (TMDLs), and as such, the City is required to demonstrate progress towards mitigation of these water quality impairments. A more thorough summary of these impairments and mitigation efforts are provided in the City’s TMDL Action Plan documents<sup>8</sup>.

More specifically, the aquatic life impairment results from long-term assessment of aquatic insects indicating an unhealthy lack of diversity. Excessive fine sediment from urban runoff is a primary cause of this issue. In general, efforts to mitigate the volume and rate of urban runoff that flows into the City’s waterways will make the City more resilient to flooding and will improve the health of streams. Similarly, issues related to bacteria in the Roanoke River are multi-faceted, but at least part of this issue can be mitigated by controlling excess runoff during storm events. This is because excess runoff can infiltrate the sewer system during periods of heavy rainfall leading to overflows and contamination of downstream waterways.

### **2.4.2 Landslides**

Another hazard related to severe rainfall and localized flooding is that excessive water can induce landslides in the high slope topography in and around Roanoke. While this hazard is more prominent in the areas surrounding Roanoke that have a significant amount of high slope land, the area around Mill Mountain and other parts of the City where the landscape has been steeply graded are also subject to this potential hazard. The risk of landslides can be reduced by minimizing disturbance and grading on existing steep slopes, and by establishment of suitable soil and slope stabilization methods where necessary.

### **2.4.3 Dam Safety**

There are two ‘High Hazard’ dams upstream from the City of Roanoke that present the possibility of probable loss of life or serious economic damage in the event of dam failure. Both impoundments are owned and operated by the Western Virginia Water Authority.

The Carvins Cove Dam (1946) is located on Tinker Creek, a tributary of the Roanoke River, in Botetourt and Roanoke counties. The Clifford D. Craig Memorial Dam (1993) at the Spring Hollow Reservoir is

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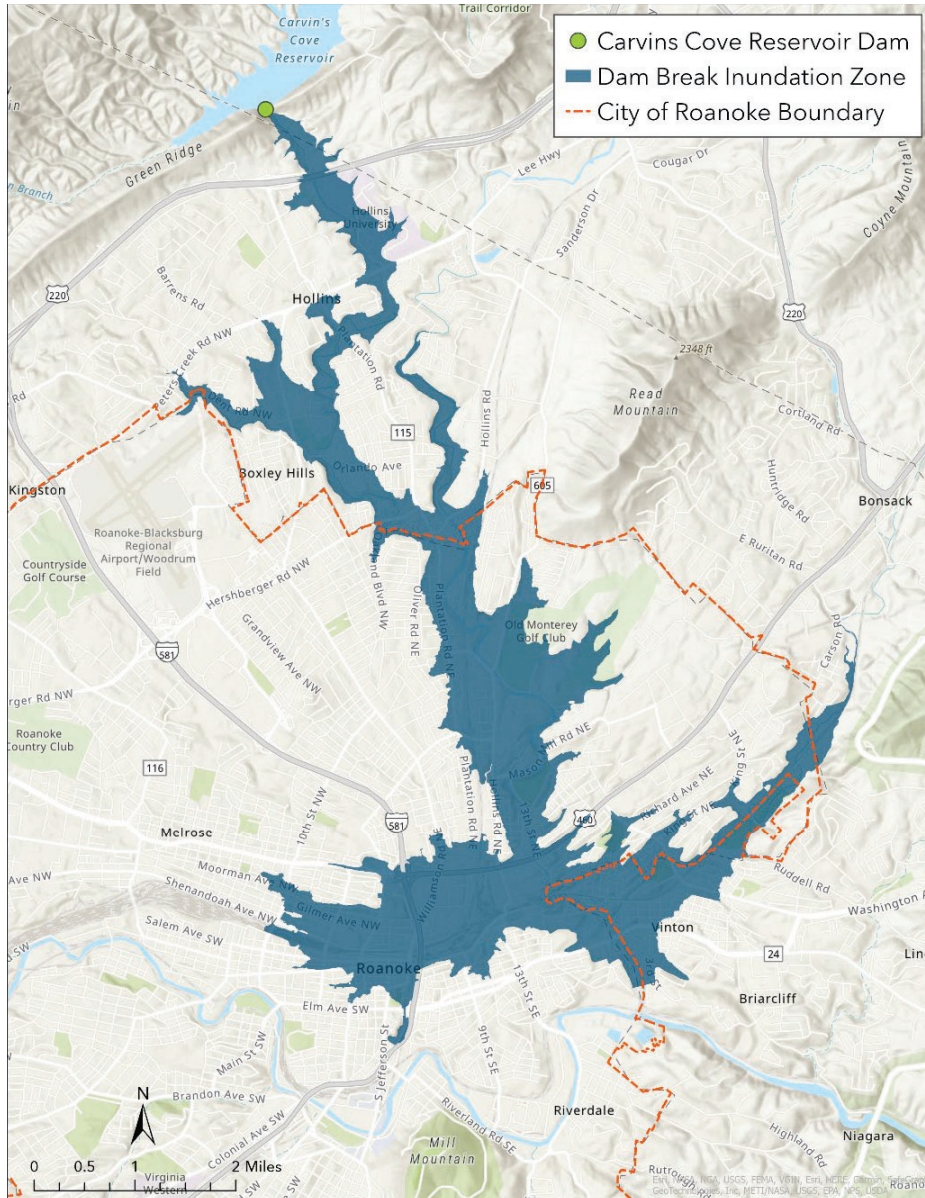
<sup>8</sup> The TMDL Action Plans are available at: <https://www.roanokeva.gov/2275/Municipal-Separate-Storm-Sewer-System-MS>



located in the Glenvar area of Roanoke County, adjacent to the Roanoke River. The dam at Spring Hollow is of a type that has never experienced a structural failure and is unaffected by rainfall or peak mean flow of any rivers or streams. However, if the dam would fail, inundation would significantly raise the Roanoke River levels in the City.



**Figure 3 - The Spring Hollow Dam Break Inundation Zone and City of Roanoke Boundary. Zone boundary from the Virginia Department of Conservation and Recreation (DCR) Virginia Dam Safety and Inventory System (DSIS).**



**Figure 4 - The Carvins Cove Dam Break Inundation Zone and City of Roanoke Boundary. Zone boundary from the Virginia Department of Conservation and Recreation (DCR) Virginia Dam Safety and Inventory System (DSIS).**

In addition, there are two smaller privately held dams within the City of Roanoke. Windsor Lake Dam (1960, with modifications in 2007) and Spring Valley Lake (1960) are both considered ‘Significant Hazard’ dams that, upon failure, might cause loss of life or appreciable economic damage. Dam owners are responsible for:

- Proper design, construction, operation, maintenance, and safety of their dams
- Reporting abnormal conditions at the dam to the Police Department, the City Manager, and the Coordinator of Emergency Management
- Recommending evacuation of the public below the dam if it appears necessary.

Owners of dams that exceed 25 feet in height and impound more than 50 acre-feet (100 acre-feet for agricultural purposes) of water must develop and maintain an Emergency Action Plan.

Procedures are in place between the City of Roanoke and respective Dam Owner/Operators to ensure timely notification of changes in dam condition or threat of failure. There are established procedures during different alert levels and the public will be notified of conditions at an affected dam. More information can be found in the Dam Safety Support Annex to the City Emergency Operations Plan.

Increased frequencies and durations of storm events create additional dam safety risk in a variety of ways. The increased volume of water that accumulates behind impounding structures puts more frequent and greater pressure on these structures, impacting the integrity of such structures, particularly for earthen structures or those that have not been properly maintained. The region has a number of dams on private property where responsibility for maintenance falls on the homeowner; these expenses can be difficult for such owners and maintenance is often postponed. Additionally, many impounding structures were designed and built before current day engineering requirements were in place and may have difficulty withstanding these effects. Increased storm events due to climate change and their hydrologic impacts result in additional dam safety risk.

## 2.5 SUMMARY OF VULNERABILITIES

The following table summarizes potential risks and vulnerabilities associated with flooding and related hazards.

<b>High Likelihood</b>		
<i>Type of Hazard</i>	<i>Vulnerability</i>	<i>Potential Actions/Adaptations</i>
Riverine Flooding	High along Roanoke River and tributaries	The City has little ability to reduce floodwaters themselves but can adapt development regulations and the physical floodplain.  Acquisition/restoration of flood prone land to contain flood waters and remove highly vulnerable structures.  Adequately elevate or flood proof structures per development regulations/retrofits.
Pluvial Flooding	High for tributaries vulnerable to flash flooding and for development along former natural drainage.	Effects of pluvial flooding are localized, reducing direct discharges from impervious surfaces may reduce some flood risk.  Acquisition/restoration of flood prone land to contain flood waters and remove highly vulnerable structures.  Adequately elevate or flood proof structures per development regulations/retrofits.

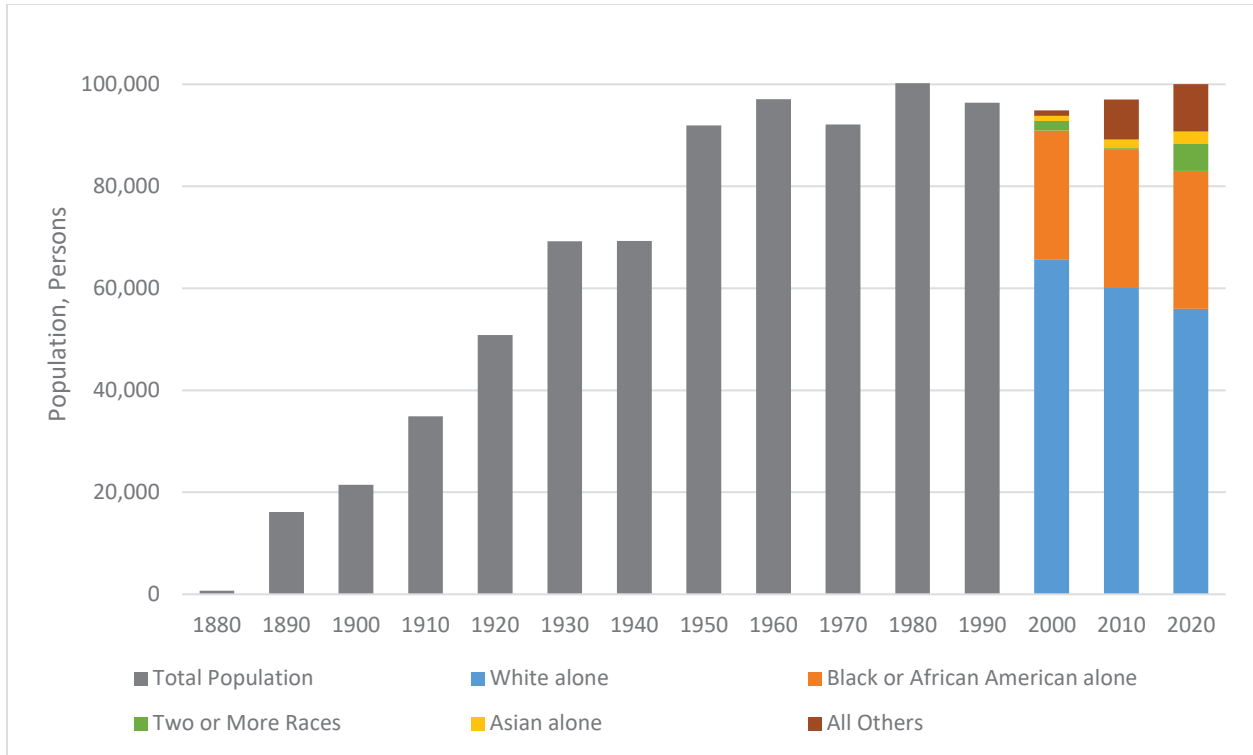
<b>Moderate Likelihood</b>		
<i>Type of Hazard</i>	<i>Vulnerability</i>	<i>Potential Actions/Adaptations</i>
Aging Infrastructure	Moderate across the City but high in areas with aging or undersized infrastructure.	Green infrastructure/ infiltration and detention practices to reduce runoff. Upsizing pipes/culverts where bottle necks exist. Update design practices to account for future precipitation. Infrastructure can be adapted to handle larger flows based on available funds and impacts on other parts of the system (improvements in one area can create issues downstream).
<b>Low Likelihood</b>		
<i>Type of Hazard</i>	<i>Vulnerability</i>	<i>Potential Actions/Adaptations</i>
Dam Safety	High, similar to large scale flood event.	Monitor through state safety programs. The City does not own any of the dams and does not control inspection or maintenance.
Land Slides	Low	Periodically review standards/ regulations for best practices related to development on slopes. Slope issues on new developments can be evaluated as part of plan review process

### **3. PEOPLE, LAND, ECONOMY AND EQUITY**

In addition to the City’s history of development and hydrology, the community’s character is a fundamental element of resilience planning including assessment of vulnerabilities. Residents’ goals, issues, demographics, and economic situations all provide the context for project planning, funding and delivery. The purpose of this section is to contextualize any assessment of flood resilience and all proposed solutions with regards to Roanoke’s local community – people, land and economy. While community information that is pertinent to flood resilience is presented in this section, this is not a comprehensive summary, and the reader is referred to the City’s demographics analysis in City Plan 2040 and various resources noted in this section.

From the City’s incorporation in the 1880s through the 1950s, Roanoke experienced rapid growth from a small community to a city of over 90,000 people. Recently, the population of the City has since been steady with a population ranging between 90,000 – 100,000 (Figure 5). From the 1960s to the 1980s, population growth was driven largely by land annexation, with actual population density decreasing. Since 2000, the City’s population has gradually increased along with the desire for walkable neighborhoods and urban amenities, leading to slow but steady growth, and this moderate growth is expected to continue in the future.

The City is the most diverse in the region with a population as of the 2020 census that is 56% White, 27% African American, 5% two or more races, 2.5% Asian and 9% all others with 8.5% ethnic Hispanic/Latino. In general, the City’s population is increasing in racial and ethnic diversity (Figure 5). Table 2 shows general socio-economic and demographic information for the City, region and the state for comparison, indicating that the City is diverse from racial, ethnic, and socioeconomic perspectives. The City has lower levels of educational attainment and lower household incomes compared to the Roanoke Region (i.e. metropolitan statistical area), and the entire City of Roanoke is designated as a low-income geographic area by DCR.



**Figure 5 – The City of Roanoke’s total population from 1880-2020 with demographic data generalized for available years 2000-2020. Note that the “All Others” category contains three additional categories that were aggregated because of their small size for visibility. Data abstracted from the following U.S. Census Bureau publication or data sources: “Census of Population: 1950” (1880-1950); “Census of Population: 1980” (1960-1980); Census Table PHC-T4 (1990); Census Table DP1 (2000); Census Table P9 (2010-2020).**

**Table 2 – Demographic characteristics of Roanoke City as compared to the Roanoke Metropolitan Statistical Area (MSA) and the Commonwealth of Virginia. Data from U.S. Census Bureau QuickFacts and from American Community Survey (ACS) via CensusReporter.org. Note that Roanoke City data are slightly different than that presented in Figure 3 and narrative, as ACS data is dated July 1, 2022.**

U.S. Census Bureau Statistic	City of Roanoke	Roanoke Region	Virginia
Total Population	97,847	315,442	8,683,619
<i>Racial/Hispanic Origin</i>			
White alone, percent	60.1%	76%	68.5%
Black or African American alone, percent	29.3%	13%	20.0%
Asian alone, percent	3.2%	2%	7.3%
All Others, percent	7.4%	9%	4.2%
Hispanic or Latino, percent	6.6%	4%	10.5%
<i>Educational Attainment</i>			
High School Degree or higher	88.3%	91.2%	90.8%
Bachelor’s Degree or higher	26.8%	30.8%	40.3%
<i>Income and Poverty</i>			
Per Capita Income	\$30,379	\$34,652	\$43,267
Median Household Income	\$48,476	\$59,630	\$80,615
% Below Poverty Level	18.4%	12.5%	10.2%

This increasing diversity along with the increasing immigrant and refugee population likely corresponds with a greater proportion of the City's population that is non-English speaking. With respect to flood resilience, this means that a language barrier may inhibit access to flooding information and resources (i.e. grant funding, technical support, post-disaster support). This is further exacerbated by a lack of internet connectivity, as approximately 16% of the City's population does not have internet access; three census tracts have 30-40% without access, and one tract has approximately 50% without access<sup>9</sup>. A number of recommendations are provided in Section 7 that would improve equitable delivery of flood resilience services to an increasingly diverse community that may not otherwise have access to these resources.

In general, the City's population is characterized by a wide variability of wealth, education, and employment indicators that factor into a community's social and economic vulnerability. A number of indices now exist that compile socioeconomic factors into a single index of vulnerability to hazardous events. For this plan, the Center for Disease Control's (CDC'S) "Social Vulnerability Index" (SVI) is used, which scores vulnerability on a 0 (low) to 1 (high) vulnerability scale<sup>10</sup>. The City's overall SVI is 0.92 (high), and within the City, there are three census tracts with low vulnerability, nine with moderate and thirteen with high vulnerability. This means that in general, the community's ability to respond to and recover from a hazardous event (flooding, for the purposes of this plan) are affected by several social conditions, such as poverty, mobility, health, etc. The community's vulnerability is of particular importance to flood resilience where high SVI overlaps with flood prone areas; this is manifest in several examples, listed below:

- Low-income households are less likely to have income or savings that could be used to recover from flood damage<sup>11</sup>
- Areas with high unemployment may have less access to paid time off or health insurance that would help cover costs during the time needed to recover from a flood<sup>12</sup>
- Lower educational attainment can mean that the practical and bureaucratic hurdles to cope with and recover from a flood would be more challenging<sup>13</sup>
- Households with a larger number of dependent children or elderly, single parent households and households with disabled persons would likely require additional financial support, transportation, medical care during and after a flood disaster<sup>14</sup>

In the City, areas of high social vulnerability intersect with flood prone areas along Peters Creek, Lick Run and limited parts of Hortons Branch and Trout Run (Figure 1); with this in mind, some

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<sup>9</sup> See American Community Survey – Internet Access by Income Variables - <https://hub.arcgis.com/maps/9edc0cbeeb2a4259910e158dfba01881/about>

<sup>10</sup> <https://www.atsdr.cdc.gov/placeandhealth/svi/index.html>

<sup>11</sup> See Morrow (1999) and Cutter et al. (2003)

<sup>12</sup> See Brodie et al. (2006)

<sup>13</sup> See Morrow (1999)

<sup>14</sup> Flanagan et al. (2011)

recommendations on how to incorporate social vulnerability in flood resilience projects are provided in Section 7.5.

An equitable distribution of flood resilience investment in Roanoke should also consider the pertinent issues in the local housing market and business economy; these issues are generally summarized as follows. First, the availability and affordability of housing in the City appears to be a significant issue, with greater than one third of Roanoke’s households categorized as “cost-burdened” with respect to mortgage or rent payments<sup>15</sup>. While this housing disparity may be due to a number of factors, a shortage in housing stock appears to be at least one major driver of this issue. An important aspect of the housing shortage that is pertinent to flood resilience is that 1,511 residential properties, or approximately 5% of all residential properties in the City are in one of the FEMA designated Special Flood Hazard Areas (SFHAs, i.e. “floodplains”, Table 3). This suggests that the already at-risk local residential real-estate economy is subject to potential damages from flooding which could further exacerbate the housing shortage issue. Several recommendations to this end are provided in Section 7.4 of this Plan.

**Table 3 – Summary of properties in the City within FEMA Special Flood Hazard Areas (SFHAs) by property type. Table was generated using July 1, 2022 parcel layer and PROPERTYDESC field.**

Property Type	Citywide	Within Any SFHA	% of Citywide
Residential	31,422	1,511	4.8%
Commercial/Industrial	3,239	624	19.3%
Vacant or Other	9,644	1,492	15.5%
<i>TOTAL</i>	<i>44,305</i>	<i>3,627</i>	<i>8.2%</i>

Similar considerations apply to commercial and industrial real estate in the City, as 19% of all commercial/industrial parcels lie within a SFHA – which suggests that a major flood event would likely have significant impacts on the local economy by way of business damages, closures, foregone revenue, lost wages, etc. Inversely, reduction of flood risk at commercial/industrial properties would reinforce the local economy’s ability to continue operations during and after a major flood event. Strategies for protection of commercial real estate depend on site-specific variables (e.g. topography, business model, development type, etc.), though in general, elevation of assets above flood elevations, relocating out of the floodplain, or flood-proofing are the three primary methods that can be used. With respect to equity, implementation of commercial flood-proofing can require a significant amount of capital and technical expertise that is probably not widely achievable for small or mid-sized businesses – although these businesses bring an important measure of adaptability to the local economy.

Finally, the age of the City means that most of the readily developable land has already been used in some fashion, and the housing shortage and commercial development needs mean that the remaining land will be needed to support the necessary growth of the local economy. This context and demand create a land issue for flood resilience, as most types of flood resilience projects require a significant land footprint to provide a material reduction in flooding (e.g. acquisition/demolition projects, land conservation, retention ponds, riparian buffer). On the one hand, there is a need to create additional housing units and working spaces, but the addition of more developed land could lead to more runoff and flooding, further diminishing the land needed to provide flood resilience projects. As such, the pathway to flood resilience

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<sup>15</sup> <https://housingforwardva.org/toolkits/sourcebook/affordability-costburden/>



in Roanoke will likely need to integrate flood-resilient design into land development – the development of some technical resources is proposed in Section 7.4.

## 4. COMMUNITY ENGAGEMENT

The social, economic and demographic summary provided in Section 3 provides helpful high-level community context for this Plan, but it was imperative that the perspectives of individual community members be collected as part of this planning effort. As such, an extensive community engagement effort was performed that included both a survey and in-person meetings, to further develop the community's perspective on flooding and resilience. This section summarizes the methods and findings of the Resilience Plan Community Engagement effort and discusses how this new information supplements the significant engagement, education and outreach programs that already existed prior to this planning effort; these existing efforts are summarized in Section 6.2.4 .



Figure 6 – Images of public outreach events during community engagement efforts, March 2023.

### 4.1 METHODS

Public outreach for the 2023 Roanoke Flood Resilience Plan was done primarily with public survey followed by in person public meetings. A 10 minute survey on flooding was created by the City, available in English and Spanish, on a dedicated Resilience Plan website. The survey was promoted through social media, five local news segments (television, radio, and RVTV filmed videos), local partners and non-profit groups, and with signs with QR codes placed in public areas such as the greenways and parks. Additionally, a flyer was created to promote the in person meetings, which was mailed with the City's annual Repetitive Loss Area outreach letter to 345 residents.

The public survey received 146 responses. Of the survey respondents a majority were under 65 and over 18 (33% 18-39, 43% 40-65), white (84%, 6% African American, 7% did not say), City residents (88% live in City of Roanoke), and half live in the southwest quadrant of the City (55.5% in either 24014, 24015, or 24016 zip codes). The most common occupational status was full time employment (62%) followed by retired (24%).

In person public meetings were held at 5 of the City libraries in March 2023 along with one virtual Zoom meeting option. At these meetings, a brief presentation was given providing general information about flooding and flood resilience, followed by an open forum for the community to ask questions, express concern, and discuss flooding with staff and consultants. Public meetings garnered a total of 12 participants, however the level of interaction of the participants was high and beneficial. Follow up public outreach is planned to allow for dissemination of plan results and to answer community questions after adoption of the plan document. Future feedback will inform plan updates.

## **4.2 SUPPLEMENTAL OUTREACH**

The project team also developed a custom GIS-based online survey and mapping application. This GIS mapping application was designed to facilitate automated capture of basic flood occurrence data and visualization of issues in a geographical context. The application employed a crowdsourcing workflow to create an accessible and easy to use survey application to obtain flooding occurrences from City residents. The tool offers a means for residents to provide basic information and attach photos documenting areas of concern. The public facing interface allows residents to see where issues are occurring, while allowing City staff to catalogue and archive reports of flooding while controlling access to detailed source information. The tool was provided on the project website and also brought to the public through radio and television, including a brief segment on the local evening news.

During this Resilience Plan outreach it received 14 reports of flooding issues from the public. Reports included street flooding, local drainage issues, and stream or river flooding. The reports were largely from the North and southwest areas of the City. A few responses were from outside of City boundaries at Smith Mountain Lake, these were passed along to appropriate organizations as necessary; they also illustrate downstream flooding impacts. The mapping application will be kept open beyond the plan development phase to allow for ongoing reporting.

## **4.3 SUMMARY OF RESPONSES**

This section provides a summary of the findings of the Resilience Plan Community Engagement effort, though the full survey results are included in Appendix E of this Plan. Over two thirds of respondents felt flooding currently poses a moderate (55%) or serious (24%) challenge to their community with only 5% feeling it is an extreme challenge. When looking at the risk flooding poses in the next 20-40 years, 17% felt flooding will pose an extreme challenge.

About one quarter of respondents' homes have flooded (27%) while only a minority reported flooding of a business (7%). The most common commentary on flooding experienced was basement or land (backyard or street/driveway/sidewalk) due to either large storms, drainage issues, or stream overbanking. One third have not experienced any type of property damage from flooding, but when damage occurred, the most common damage was to basements (38%) followed by street flooding (34%) and debris/trash deposits (26%). Relatedly, the most common negative impact reported was damage to transportation (62%) as well as trash and debris (41%).

Most respondents are not interested or concerned about moving due to flooding; however, 21% are considering relocation due to flooding issues and 7% of those have issues that prevent them from relocation. For those that have put in mitigation measures on their homes, the most common is a sump pump (24%), french-drains (21%), or elevation of property/utilities (19%). About an equal number do not have any mitigation measures on their homes (27%).

As far as solutions, the most popular suggestion was the persevering/creating natural space for flood water storage (80%). Other options such as buy-outs, changing design standards, increasing capacity for drainage, funding for flood-proofing, increased outreach, and real estate disclosures for flood prone properties were all equally popular.

The main discussions at in the in person meetings were regarding existing, long term flooding issues from residents and how they might find solutions or be helped by the Resilience Plan. There was overall excitement for a focus on flooding and resilience but disappointment in the length of time for meaningful

solutions to be implemented for complex flooding issues. Additional understanding of specific flooding problems were relayed to City staff as well as the emotional and financial burden on those residents.

Even though somewhat limited in responses, this feedback from the community survey supports the City's Resilience Planning efforts, as flooding is clearly expressed as a real threat to its residents and nature based solutions are positively received. The responses also help this plan to focus on local solutions for property damage and street flooding that residents commonly experience. Using community feedback helps align this plan with the community's needs and desires.

While responses to this initial outreach effort were limited, past efforts at engagement and outreach also support the City's understanding of the community. Robust educational and engagement efforts, outlined in 6.2.4, help guide the City's plan for flooding resilience. The City highly values incorporating education, engagement, and outreach with the community as a fundamental part of building resilience. Direct community engagement encourages accountability, creates connectedness between city and citizen and instills a sense of ownership and pride in one's community.

## 5. PRINCIPLES OF FLOOD RESILIENCE

In this section, the background context related to flooding, community vulnerabilities and equity provided in Sections 2 and 3 are combined with the information gained from the Community Engagement survey for this Resilience Plan effort in Section 4 to support Roanoke’s five basic principles of flood resilience. These principles acknowledge and internalize the nature of flooding in Roanoke (i.e. a combination of pluvial and riverine), with the challenge of retrofitting legacy land with modern day infrastructure and standards in the face of a changing climate. The principles also acknowledge the large variability in social vulnerability in the City and incorporate social equity as one of the principles. The principles are derived from parameters given in DCR’s 2023 Community Flood Prevention Fund Grant Manual but are adapted to Roanoke City’s specific context based on the extensive work performed in the previous Sections of this Plan. The five key principles are described as follows; note that in each principle the term “effort” is used, as it includes any type of planning document, internal protocol or program, policy or technical/construction project that the City may perform.

1. **Climate Change** – Does the effort internalize the potential impacts of climate change, such as increased rainfall intensity and temperature into planning, design and implementation of efforts?
2. **Social Equity** – Does the effort acknowledge community vulnerabilities and work towards equitable outcomes in its conception? Will the effort improve or strengthen the social fabric in vulnerable parts of the community?
3. **Community Scale Benefits** – Will the effort render benefits at a U.S. Census Block scale or larger? Will at least 10% of the City’s population benefit from the project? Is the effort consistent with regional efforts?
4. **Economy and Land Use** – Does the effort acknowledge fiscal realities and focus on cost-effectiveness? Does the effort encourage the usage and development of land that internalizes present and future flood risk? Is it consistent with best practice for floodplain management?
5. **Nature-Based Approach** – Will the effort use or leverage environmental processes and natural systems including (but not limited to) vegetation, soil, biota to minimize flooding and mitigate flood impacts? Will the effort encourage a reduction in key pollutants of concern for Roanoke’s waterways, including fine sediment, pathogens and organic chemicals?

Resilience Principle	CFPF Program Perspective	Related City Vision
Climate Change	Potential impacts of climate change, such as increased rainfall intensity and temperature into planning, design and implementation of efforts	The City Plan 2040 and the City’s Climate Action Plan recognize that our climate is changing, and action is needed. This plan lays out the provision for the City to adapt to and mitigate impacts of climate change as they relate to increases in rainfall and potential for flooding.

<b>Resilience Principle</b>	<b>CFPF Program Perspective</b>	<b>Related City Vision</b>
Social Equity	Efforts acknowledge community vulnerabilities and work towards equitable outcomes in their conception. Efforts will improve or strengthen the social fabric in vulnerable parts of the community.	City Plan 2040 recognizes that equitable outcomes need to be evaluated in all City Actions. The Department of Public Works Equity Action Plan further recognizes the need to understand community needs as projects are planned, developed and implemented.
Community Scale Benefits	Will the effort render benefit at a U.S. Census Block scale or larger? Will at least 10% of the City’s population benefit from the project? Is the effort consistent with regional efforts?	The Stormwater Utility recognizes that stormwater and flood projects need to be evaluated within the overall context of the watershed and community they are planned in. Projects need to account for the watershed so that a project does not create upstream or downstream issues. More importantly, projects need to be assessed holistically based on the community and how a resilience project can be part of broader community development efforts.
Economy and Land Use	Does the effort acknowledge fiscal realities and focus on cost-effectiveness? Does the effort encourage the usage and development of land that internalizes present and future flood risk? Is it consistent with best practice for floodplain management?	City Plan 2040 recognizes the need to adapt to climate change will creating a more resilient community. Resilience efforts will focus on effective use of City and leveraged resources and other community resources to adapt to a changing climate. Efforts will include land use practices including preservation and restoration of highly flood prone areas, reduction of flood risk though appropriate projects, and adapting to climate change through appropriate development standards.
Nature-Based Approach	Will the effort use or leverage environmental processes and natural systems including (but not limited to) vegetation, soil, biota to minimize flooding and mitigate flood impacts? Will the effort encourage a reduction in key pollutants of concern for Roanoke’s waterways, including fine sediment, pathogens and organic chemicals?	City Plan 2040, Stormwater Utility monitoring efforts and general best practices for flood resilience all point to the value of flood plains and use of natural process, such as infiltration, to help reduce the impacts of flooding and increased rainfall/runoff. Use of nature-based solutions, at least in part, are preferred for projects. It is recognized that in a compact urban environment, traditional engineering practices are still necessary as part of a holistic process to be resilient community.

It is important to understand that these principles are focused on flood resilience – the scope of this plan. While these principles do not explicitly internalize other known threats and hazards or the complex interdependencies between different types of critical infrastructure during an emergency event, they are crafted carefully to support a broader application of resilience thinking across these domains.



**Figure 7 - The Five Principles of Flood Resilience**

The following Sections use these principles to evaluate efforts to date related to flooding (Section 6) and to propose recommendations that would further advance Roanoke as a flood resilient community (Section 7). While these principles represent knowledge of the community and best practice with respect to flood resilience as of the date of this plan, it is anticipated that these principles could be revised in future versions of this plan, as community dynamics shift and flood resilience practice evolves.

## **6. EFFORTS TO DATE**

In this section, the five principles of flood resilience are used to evaluate existing City efforts to date related to flooding and flood resilience. City efforts are organized into the categories of planning documents, internal protocols and programs, external facing policies, and engineering/construction projects. Each section contains a summary of the effort, a description of how the effort relates to flood resilience, and an analysis of the degree to which each effort incorporates the five key principles of flood resilience. As existing efforts are evaluated, a gap analysis is performed to identify if and how the key principles of flood resilience may be missing from individual efforts or from the collection of effort. As gaps are identified, future work is proposed in the following Recommendations Section (Section 7) and links to specific recommendations are provided throughout.

Efforts to address flood resilience can be broken into five categories:

- Plans - Documents that outline issues and establish policies and propose actions to address those issues.
- Practices and Programs – Represent best practices, studies or programs that the City implements to reduce flood risk and increase resilience and/or to help prioritize efforts.
- Regulations – Specific requirements that the City is required to follow or that the City requires of its residents/businesses.
- Projects – Actions to address flooding issues and increase resilience
- Funding – Providing monetary resources to execute work.

This section concludes with a gap analysis of current efforts and the City’s vision to become more flood resilient.

### **6.1 PLANS**

There are existing City planning documents that have undergone extensive authorship, editing, review and approval processes that have a bearing on flood resilience. The universe of documents evaluated in this section include only those documents that have been approved by City Council for adoption; other planning-type documents that have not been approved by Council are found in Section 6.2 - Practices and Programs, as these documents are primarily for internal use and prioritization of projects and are subsidiary to any Council-approved Plan.

#### **6.1.1 City Plan 2040**

The City Plan 2040<sup>16</sup> is the City’s Comprehensive Plan adopted in 2020 and provides a broad vision for the ideal future for Roanoke with recommendations for implementation over the next 20 years. The City Plan enumerates ideas, themes, design principles and land use principles at a high level and provides a pathway for implementation.

With respect to flood resilience, one of the themes that Roanoke’s City Plan for 2040 promotes is “Harmony with Nature”, described as “resilient practices for a resilient environment that nurtures

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<sup>16</sup> <https://planroanoke.org/city-plan-2040/>



community health and protects natural resources.” Some of the practices mentioned in this City Plan that directly relate to flooding are:

- Adapt the City’s approach to stormwater management with climate change in mind.
- Promote regional collaboration for stormwater and flooding goals and develop a comprehensive approach to floodplain management.
- Promote green infrastructure.
- Improve stormwater management for all development projects.
- Improve conditions of the Roanoke River.
- Promote tree stewardship by increasing tree care, increasing the percentage of tree canopy, and community education in the city.
- Sustainable land development involving policies and codes to support green building, incentivize pre-existing development to adapt green features, and reduce impervious surfaces.

Another key theme is “Interwoven Equity” and also corresponds with this plan’s focus on addressing flood resilience needs of all parts of the locality, especially underserved populations. Practices identified within the plan are:

- Equity involves the fair distribution of investments and services and the removal of institutional or structural policies that can be barriers to success.
- It is crucial that services are provided equitably and in ways that are accessible to all residents.
- Provide financial resources in neighborhoods that were formerly redlined.
- Provide quality education for all residents.
- Provide supportive interventions strategically.

Overall, the ideas, themes and action items enumerated in the City Plan are highly consistent with the five key principles of flood resilience in this Resilience Plan.

### **6.1.2 Downtown Roanoke Plan**

The Downtown Plan (2017) was created to enhance and direct public and private sector investments in Roanoke’s downtown area and to identify policy and actions towards those goals. The plan recognizes that Downtown was built above a channelized stream (Trout Run) and springs/marshland. Policies to make Downtown more flood resilient are like those in City Plan 2040 and are as follows:

- “POLICY 2-G: Support appropriate floodplain management”.
- “POLICY 2-H: Reduce flooding by encouraging stormwater and green infrastructure projects in downtown”.
- “POLICY 2-B: Repair voids in the streetscape and improve the pedestrian realm, while supporting infill development”.

A more detailed flood study has been completed since the adoption of Downtown Plan 2017 and that information is currently being adapted into new FEMA maps expected in 2025. Downtown is an area where flood resilience can best be improved through public and private initiatives. Projects identified in the flood study can remove bottle necks and achieve some detention to help manage the current 25-year storm event. Private property owners can further enhance their resilience with adaptations and protections such as flood shields that can be deployed during large storm events.

### **6.1.3 Climate Action Plan**

The City's Climate Action Plan for 2015-2020 (n.d.) identifies a broad range of policies to reduce the City's emissions of greenhouse gasses and reduce the impacts of climate change on the City. This document included the current status summary and recommended goals and targets to:

- "Promote and strengthen green infrastructure and natural systems".
- "Sustain and enhance the integrity of the Roanoke Valley water resources and waterways through innovative water management practices".
- "Work to ensure sustainable land use and urban development".
- "Continue to expand the urban tree canopy and achieve an equitable percentage of tree canopy across residential neighborhoods, City parks, street medians, school properties".

### **6.1.4 TMDL Action Plan (revised September 2022)**

The Action Plan speaks to the City's MS4 permit and provides information on the effects of sediment loading caused in part by stormwater runoff. It also outlines the City's processes to address pollution in its impaired streams. Water quality efforts focus on reducing the volume of stormwater runoff from smaller storms affecting sediment load. Reducing runoff and sediment deposition reduces risk from flooding, at least during smaller storm events, and potentially larger storms if sediment block stormdrain systems.

### **6.1.5 Urban Forestry Plan (2003)**

This document provides a more in-depth look into the City's urban canopy and discusses how trees and vegetation can help to mitigate flooding.

### **6.1.6 Parks and Recreation Master Plan**

**The Parks and Recreation Master Plan (2019)** – With plans to be updated sometime this year, this master plan report highlights the current and planned park systems, which includes green spaces, greenways and trails. The City works with planners, consultants, and residents to improve tree canopy, innovative use of impervious surfaces and natural vegetation, and promotes a more fostering relationship to local rivers with sustainably designed access (City of Roanoke, 2019). All of these factors can help to inform the current and future direction of flood planning within the City.

### **6.1.7 Neighborhood Plans**

A helpful resource in conceptualizing future urbanization, neighborhood and area plans have been written and are at various stages of implementation since 2002 (City of Roanoke, 2020). These plans depict finer details of the greater land use vision of the City as a whole and can give us a glimpse of future resiliency measures in the form of stormwater improvements, streetscape improvements (involving the use of more street trees), and recommendations of more green space.

### **6.1.8 City-Wide Brownfield Redevelopment Plan**

**City-Wide Brownfield Redevelopment Plan (2008)** – Adopted by the City in 2008, this plan informs the Roanoke River Corridor, amongst others, on implementation of green space development and promotes more efficient land use in areas that likely contain brownfield sites. A brownfield is a property,

redevelopment or reuse of land which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant (EPA, n.d.).

### **6.1.9 Roanoke Valley Greenway Plan (2018)**

This plan incorporates surrounding municipalities and localities that assess the current interconnected greenway routes of the Roanoke Valley and reports progress on goals for development and improvements, compared with the originally Conceptual Greenway Plan from 2007 (Roanoke Valley Greenways, 2018). The improvement of greenways and trails within the City helps to inform progress of new green space and natural trail innovation against the challenges of development.

### **6.1.10 Various Flooding Impact Documents**

Helpful research and analysis pertaining to the preparation of flooding events is the City’s Repetitive Loss Area Analysis, issued in 2021. This analysis provides community members with information about the National Flood Insurance Program’s Repetitive Loss Areas per FEMA criteria, the Community Rating System (CRS), and project recommendations to help reduce the effects of these Repetitive Loss flooding areas. Similarly, Roanoke Valley’s Alleghany Regional Hazard Mitigation Plan, issued September 16, 2019, captures past flood events, provides CRS and Repetitive Loss statistics, provides past flooding data, and provides a comparison of this data to Roanoke County and several neighboring counties.

The City of Roanoke not only informs the public of how to stay prepared for flooding events but has its own internal and-state approved procedures in place when a hazardous flooding event occurs. In 2022, Roanoke approved an updated “Basic Plan” Emergency Operations Plan that describes the City’s hazard vulnerabilities, including flash flooding, and the distribution of City and agency-based responsibilities in case of an event. Like the Basic Plan, two annex documents were issued by the City relating specifically to flood emergency response. The Flood Incident Annex was aimed at describing public health and safety measures in the event of flooding such as training, equipment, and technology involved in an emergency process. For dam flooding or failure emergencies, the Dam Safety Support Annex determines procedures for evacuation of downstream residents if there is imminent or impending dam failure. The Western Virginia Water Authority is also responsible for preparing an Emergency Action Plan applicable to dams throughout the Western Virginia Region.

### **6.1.11 Summary**

The existing planning documents summarized in this Section represent a significant body of work directing the City’s efforts towards major themes, ideas and principles. Together the results of the City’s flood resilience planning and study cover the entirety of the City’s watersheds.

In general, the five key principles of flood resilience presented in Section 5 of this plan already appear in existing planning documents in various forms. However, as the scope and level of specificity of these other plans varies widely, the value of this Resilience Plan is that it collates flood related ideas that are already enumerated in other existing documents into a single document which can then provide helpful categories to scope and direct specific projects to make progress towards the high-level goals and ideas. With that in mind, several construction projects and technical studies are proposed in Section 7 to advance the themes that were already approved in other planning documents but are repackaged here with a focus on flood resilience.

## **6.2 PRACTICES AND PROGRAMS**

Protocols and programs help to create structure for City staff for implementation of flood prevention and mitigation strategies and also provide guidance when flooding and the associated hazard of an event

impacts the community. Roanoke continues to advance flood resilience through the issuance of these various procedures, protocols and policies as seen in the City’s development procedures, and their flood-related protocols. This continuously evolving process demonstrates that stormwater management and flood prevention remain high priorities for Roanoke.

### **6.2.1 Flooding Assistance Protocols**

The City has established flooding assistance protocols to safeguard its residents during flood events. The first step of flooding assistance is keeping the community informed of the flooding event. The City has provided public information and outreach to the community regarding severe weather preparedness and preparation, in addition to more in-depth hazard information that can be found in the Roanoke Valley-Alleghany Regional Hazard Mitigation Plan. The City maintains several flood warning gauges throughout the City – known as the Stream Hydrology and Rainfall Knowledge System (SHARKS, see also Section 6.2.4) – and uses the Star City Alerts system to issue important warnings<sup>17</sup> Additionally, information on evacuations and designated shelters for displaced individuals have been published on the City’s website. After a flood has occurred, federal flood relief support for the City has been established through the City’s participation in the National Flood Insurance Program (NFIP) and Community Rating System Program (see next section for more details).

### **6.2.2 FEMA Community Rating System Program**

FEMA provides flood mitigation and flood event relief assistance through federal grants and programs, one of these is the National Flood Insurance Program’s (NFIP’s) Community Rating System (CRS). The CRS is a national flood readiness rating system that identifies various best practices that a locality can implement to improve responsiveness to flood events and reduce the impacts of floods when they occur. Based on the City’s participation in this program, property owners receive discounts for NFIP insurance premiums. A few examples of flood risk reduction activities that contribute to a community’s CRS score are:

- Requiring permits that assess if new development is located within flood-prone areas
- Requiring that new or improved developments are elevated above “base flood level”
- Ensuring proper flood-proofing measures are in place for new or improved development within certain zones
- Ensuring the “prohibition of encroachments” for any kind of development within a floodway (with a few exceptions)
- Ensuring that the central portion of a riverine floodplain carries deep and fast-moving water
- Enforcing requirements to protect buildings from intense rainfall and storm surges
- Ensuring that all other permits associated with new development have been approved

The CRS ranks participating communities on a 1-10 scale, with 1 designating the highest level of effort with respect to floodplain management and risk mitigation. As of October 1, 2023, the City will advance from a Class 7 to a Class 6 community, which will provide a 20% discount for properties within the

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<sup>17</sup> <https://www.roanokeva.gov/2788/Star-City-Alerts>

SFHA and a 10% discount for properties outside of the SFHA<sup>18</sup>. This advancement was the result of improved floodplain management activity and the documentation thereof by City staff.

### 6.2.3 Watershed Master Plans

The City’s Stormwater Division was formed in 2014 to address issues related to flooding and water quality in the City, and at the time of its inception a strategic plan was needed to (1) summarize the numerous regulatory requirements related to stormwater; (2) characterize the City’s streams and watersheds based on data to-date; (3) propose a portfolio of projects that would lead to improved water quality and reduce flooding. As such, the Division funded Watershed Master Plan (WMP) documents that provided guidance to this end, though it is important to note that these documents are internal strategy documents only and have not been through a public engagement or Council review process.

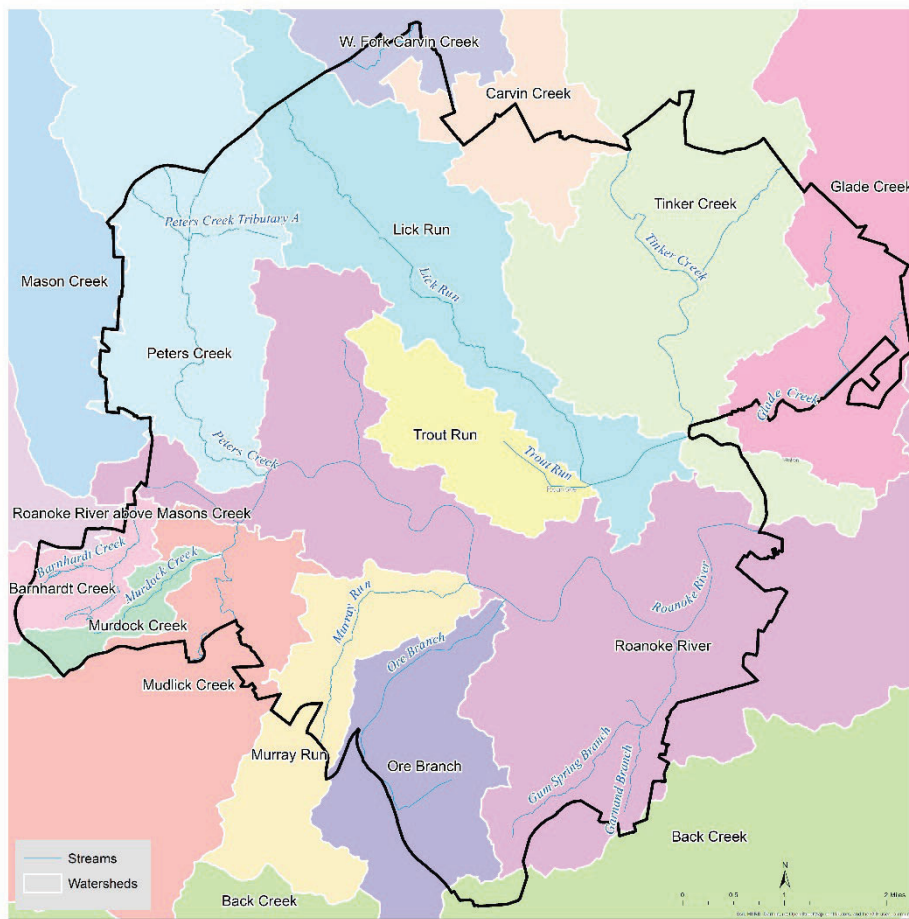


Figure 8 - City of Roanoke Watershed Map.

<sup>18</sup> The City had been a Class 7 community since 2008, which provide 15% and 5% discount for properties within and outside the SFHA respectively.

These plans focused on individual watersheds or groups of watersheds, and thus far plans for Lick Run, Trout Run, Carvins Creek, Tinker Creek, Glade Creek and Peters Creek have been completed. More recently, staff have changed the strategy to evaluate projects across all watersheds in a single plan, as this would allow for a comprehensive City-wide project identification and ranking system. In general, the principles and objectives of the WMP documents are consistent with the five key flood resilience principles in this Plan; the WMP goals are copied verbatim below for reference:

- 1. Maximize watershed resiliency and sustainability**
  - A. Restore more natural surface water processes (abiotic hydrology, geomorphology, and chemistry)
  - B. Revitalize ecosystem health (biotic species habitat and diversity)
  - C. Augment capacity to endure and recover from short term hazards (drought and flood)
  - D. Enhance adaptability to long-term hazards (land development and climate change)
- 2. Minimize watershed hazard to public health, safety, and property**
  - A. Prioritize and construct Capital Improvement Projects that both mitigate neighborhood flood hazards and improve downstream water quality (ISI Envision checklist)
  - B. Increase Community Rating System (CRS) ratings for progressive floodplain management activities
  - C. Delist from the 303(d) report all impairments including bacteria, sediment, PCBs, and Mercury in fish tissue
- 3. Connect residents, businesses, students, and other stakeholders to their watershed**
  - A. Provide the community with life-long learning opportunities about their watershed (natural processes, ecosystem health, and pollution prevention)
  - B. Engage the community in revitalizing watershed ecosystem health (BMPs, green infrastructure, and low impact design)
  - C. Coach the community to participate in outdoor recreation and stewardship opportunities within their watershed

As the goals of the WMP are similar to and consistent with the principles enumerated here, the projects that were proposed in the WMPs are also generally consistent with the principles here. However, one important gap in the WMPs is that the proposed projects were identified and prioritized based on hydrologic and water quality assessments and the WMPs did not explicitly consider social vulnerabilities or equity in the planning scheme. Another shortcoming of the WMPs is that they use GIS analysis to identify potential projects, but do not leverage hydraulic/water quality modeling or structural condition assessment information as these data were not available at the time the WMPs were written.

#### **6.2.4 Flood-Related Community Education, Outreach and Engagement**

The City prioritizes community engagement, education and outreach as part of building a resilient City for those that live, work, learn, and play in the City of Roanoke. This Resilience Plan is only part of the ongoing efforts the City has undertaken for community engagement. A variety of engagement tools or strategies are utilized to help residents connect with and help shape their own community including councils and committees, educational events or programs, and curated outreach materials. See Appendix C for a more detailed summary of the City's outreach and educational efforts.

## **6.3 REGULATIONS**

Like all municipalities and localities, the City of Roanoke is subject to regulatory measures that aim to protect, and improve the well-being of its residents, infrastructure, and the environment. Fortunately, local, state and federal regulations are intersecting with flood resiliency objectives increasingly as our society begins to see the importance of natural events amidst the built environment.

The City's Zoning Code (Section 36.2 of the City code) plays a major role in how land is developed in Roanoke and includes provisions to promote flood resilience and the conservation of open space along the Roanoke River and its tributaries. This is strongly demonstrated in Roanoke's Floodplain Overlay District and River and Creek Corridors District ordinances, as well as in general development standards that apply to all projects.

### **6.3.1 Floodplain Management**

As previously described, Community Rating System and NFIP are two federal programs under FEMA that assists Roanoke through federally back flood insurance and discounted rates based on applying best practices. While participation in these programs is voluntary, they are important as they:

- Provide a significant risk-management tool for property owners in the floodplain through flood insurance
- And significant cost savings on that insurance based on the federal backing and CRS discounts.

The NFIP Community Rating System Repetitive Loss Area (RLA) Analysis has been instrumental in visually depicting the City's RLAs and providing recommended property owner actions to mitigate flood risk. Although this analysis directly targets these RLA regions, flooding or mitigation measures in the form of specific project recommendations were not specified. Generalized recommendations include redeveloping structures with higher elevation, utilizing flood proofing techniques, improving road drainage, and planning additional stormwater infrastructure within certain RLA regions (Roanoke Stormwater, 2021). The City of Roanoke has extracted these recommendations and assessed the logistical feasibility of implementation within certain RLA regions.

By participating in the NFIP, the City uses the FEMA Flood Insurance Rate Maps (FIRMs) as the primary tool to assess flood zones and flood elevations. The FEMA regulations associated with the NFIP includes minimum standards related to development in flood zones, such as building elevation and flood proofing standards. It should be noted that the Uniform Statewide Building Code requires construction consistent with FEMA and related standard. FEMA regulations are administered at the state level by the Virginia Department of Conservation and Recreation (DCR) and at the local level through the City's Zoning Ordinance at Section 36.2-333. - Floodplain Overlay District.

The Floodplain Overlay District (i.e. the "floodplain ordinance") reinforces the basic principles of FEMA's NFIP federal program, defining flood zones based on the applicable FIRMs designating how often a flood may occur in that area, what kind of flooding may occur, and to what extent. The section outlines the minimum standards of the NFIP including:

- Standards for flood proofing and/or elevating new structures.
- Requirements for improvements to existing structures (to bring those structures into NFIP compliance or closer to compliance).

- Criteria to limit filling/encroachments in the floodway.
- Requires that decisions related to development are based on the height of a 1-percent chance storm (100-year storm).
- Requirements for substantial improvements to structures in the floodplain.

The Floodplain Overlay District includes provisions that are more conservative than the NFIP program such as:

- Requires structures be elevated or flood proofed to two feet above base flood elevation (free board).
- Restricts permitted uses in the floodway, the most flood prone portion of the flood plain with typically the highest flow velocity.
- Requires substantial improvement determinations be evaluated based on work over a five-year period.

These more restrictive regulations help to reduce the potential for a rise in flood elevation from placing fill in the floodway and the free board requirement provides some safety to structures should fill occur and allows some factor of safety for increases in rainfall or storm events that are larger than the current 1-percent chance storm.

A permit from the Zoning Administrator is required for all development occurring within a flood zone. These permits require various types of information including site plans, flood elevation data, and sometimes verification from a licensed surveyor or engineer in order to be accepted. The permit is then reviewed and approved by the City before the development can proceed. Detailed procedures for floodplain review including substantial improvements are enclosed as Appendix B.

### **6.3.2 Stormwater Management**

The City of Roanoke's stormwater management program is regulated and implemented through programs that are derived from the federal Clean Water Act and administered through the Virginia Department of Environmental Quality (DEQ). These programs include:

- Municipal Separate Storm Sewer System (MS4) - regulates City owned and operated stormwater infrastructure and permits discharge from the City's MS4 into the Roanoke River and its tributaries.
- Virginia Stormwater Management Program (VSMP) - provides standards for managing stormwater quantity and quality at land development sites once construction is complete
- Total Maximum Daily Load (TMDL) - designates specific pollutants of concern and requires the City to report steps taken to reduce transport of these pollutants into waters of the United States in the City's annual MS4 permit report and TMDL Action Plan.

The MS4 program is a water quality program and is not specifically focused on flooding, though it is well understood that a reduction in stormwater runoff magnitude, volume and frequency improves both water quality and reduces flooding. The City's MS4 permit requires demonstration of progress towards six programmatic Minimum Control Measures (MCMs) designed to reduce stormwater pollutant loads into the MS4. Three of these MCM are largely requirements of the City to Provide public education and outreach (MCM #1), public participation (MCM #2) and to carry out good housekeeping in municipal operations (MCM #6).



The other three MCMs are outward facing. MCM #3 relates to illicit discharge detection and elimination. This is regulated through Chapter 11.3 - Stormwater Discharge Requirements of City code. This section restricts non-stormwater discharges into the City's MS4 and provides penalties for violations. While illicit discharges may be associated more with pollution (e.g., allowing chemical to flow into a drain), dumping debris and trash into drains can create flooding issues. Such debris, sediment or material can clog drains that leads to flooding conditions.

MCM #4 and #5 relate to managing runoff from construction activities and then maintaining and installing stormwater management facilities at new and re-development sites. This is administered through the City's adoption of the VSMP (Chapter 11.6 - Stormwater Management of City code). The most important element of the VSMP with respect to flood resilience, is the requirement that downstream channel adequacy be evaluated, and that detention is provided to manage downstream erosion and flooding. These requirements apply to development sites that disturb more than 10,000 square feet of area. These facilities are periodically inspected to make sure they are properly maintained. Reducing runoff from property as it is developed or redeveloped is an important element of the City flood resilience.

The final pertinent stormwater management program is the TMDL program which limits the amount of sediment, bacteria and an organic chemical known as polychlorinated biphenyls (PCBs) that can be discharged to the Roanoke River and its tributaries. The City is required to reduce the presence of sediment, bacteria, and PCBs and to annually report progress towards meeting these goals in an annual MS4 report. As previously noted, efforts to improve water quality align with flood resilience goals of reducing the amount of runoff.

### **6.3.3 Erosion and Sediment Control**

City Ordinance, Chapter 11.7 - Erosion and Sediment Control focuses on the control of soil erosion and sediment transport during construction and related activities that disturb more than 2,500 square feet of land. As with the City's stormwater management regulations, this program derives from state and federal regulations. The disturbance of land leaves exposed or stockpiled soil and similar materials exposed to runoff that can carry the material into the storm drain system and on to the Roanoke River or its tributaries. Sedimentation can affect water quality (impair habitat for fish and insects) and can also accumulate and create clogs or flow constrictions that can create or exacerbate flooding conditions.

### **6.3.4 Riparian Buffer Standards**

The City's Zoning Ordinance, Section 36.2-335 - River and Creek Corridors District (RCC) establishes development standards for the protection/re-establishment of riparian buffers along the Roanoke River and its tributaries, where mapped (not all tributaries are mapped as part of this district). This section contains rules that establishes riparian buffers in mapped areas where the district applies. The intent is to primarily protect water quality and has the benefit of limiting fill and disturbance in buffers that typically coincide with the floodplain. This provision serves to maintain or reestablish natural functions along the Roanoke River and its tributaries and helps reduce flooding through natural vegetation and buffers and encourages proper soil drainage and decreased impervious surface cover through limited and strategic land use.

## **6.4 PROJECTS**

This section presents the five broad categories of flood resilience projects that the City currently undertakes and is likely to continue to implement under this plan. These types of projects are listed in the following Table with brief description of the type of work and examples of recent completed projects.

It is important to note that project scopes can be broad and can fit into more than one category. An example is the recent acquisition and demolition of the former Ramada Inn on Franklin Road. That project falls into the acquisition and demolition category. The project also includes restrictions on land use and a future phase of work to further enlarge the flood plain on the property. That part of the work falls into the land preservation and restoration category. There are other instances where projects could fall into multiple categories, such as:

- Acquisition of a highly flood prone property with the intent that the flood prone structure could be removed and the property redeveloped in a more resilient fashion (Acquisition and Demolition and Adaptation).
- Constructing traditional storm drain systems that include bioretention area, vegetated swales, etc. to reduce runoff (Gray and Green Infrastructure)

<b>Acquisition and Demolition</b>	
<i>Description</i>	<i>Recent Examples</i>
Acquisition of highly flood prone property, typically repetitive loss, and the demolition or removal of structures form the property to remove flood risk.	<ul style="list-style-type: none"> <li>• Ramada Inn property acquisition</li> <li>• Cee Breeze property acquisition</li> <li>• Property acquisition along Garnand Branch, Peters Creek and Mud Lick Creek.</li> </ul>
<b>Land Preservation and Restoration</b>	
<p>Acquisition of property or easements to protect open space that is valuable for future flood resilience. Typically, this is flood plain and riparian areas along the Roanoke River or a tributary.</p> <p>The intent is to remove obstructions, high-risk structures, and restore flood storage capacity, thereby reducing flood risk.</p>	<ul style="list-style-type: none"> <li>• Stream restoration on Lick Run at Washington Park, Highland Farms and Blacksburg Roanoke Regional Airport</li> <li>• Glade Creek Stream Restoration</li> <li>• Peters Creek Constructed Wetland</li> <li>• Roanoke River Flood Reduction Project (property acquisition and bench cuts)</li> <li>• Property acquisition along Garnand Branch, Peters Creek and Mud Lick Creek.</li> <li>• Cee Breeze and Ramada Inn property acquisitions and restorations.</li> </ul>
<b>Adaptation</b>	
Includes a range of measures to protect new or existing structures from flooding or reduce the risk from flooding	<ul style="list-style-type: none"> <li>• Flood proofing measures at the City Market Building</li> <li>• Roanoke River Flood Reduction Project – berms/training walls</li> </ul>

<b>Green Infrastructure</b>	
<p>A wide range of practices for encouraging infiltration and/or collection and reuse of stormwater. Measures can range from a rain barrel to park land that functions as a stormwater facility.</p>	<ul style="list-style-type: none"> <li>• Permeable pavement/paving systems on Bullitt Avenue at Elmwood Park, Norfolk Avenue at the Amtrak platform, Raleigh Court Library parking, Garden City Greenway</li> <li>• Bioretention/bioswales at Williamson Road Library, and Fire Station 3</li> <li>• Green Roof at Municipal Building</li> <li>• Narrows Lane channel improvements</li> <li>• 24<sup>th</sup> Street drainage improvements (permeable pavement)</li> </ul>
<b>Gray Infrastructure/Traditional Engineering Practices</b>	
<p>Traditional storm drainage facilities such as pipes, ditches and basins.</p>	<ul style="list-style-type: none"> <li>• Sample/Crown Point, Westover Avenue, Templeton Ave, and Sweetbriar Ave drainage improvements</li> <li>• Deyerle Road drainage improvements (hybrid, includes a natural channel along with a piped conveyance)</li> <li>• Chapman and 19<sup>th</sup> Drainage Improvements (include bioretention area along with traditional drainage measures)</li> </ul>

Special considerations apply when the City considers acquisition of property for flood mitigation purposes, either for demolition or for preservation purposes. Broadly, there are two mechanisms the City can use. One would be an involuntary acquisition through a condemnation process. It is unlikely that the City would take such an approach and determining the acquisition price would be subject to federal and state requirements to ensure that compensation is fair and equitable.

Generally, the City acquires flood prone property through voluntary acquisition working with property owners who are willing to sell. In developing an offer for such property, the City evaluates the property including land area, type of structures and condition of the property and structures to assess the value. From there, a price is negotiated with the owner. If the City and owner come to a mutually agreeable price, the acquisition can move forward. If a property is occupied by a tenant, federal relocation practices are followed to make sure the tenant has access to equivalent, safe housing.

Voluntary acquisition at a mutually agreed price is consistent with the City's vision of interwoven equity and being fair in our processes. Appendix D contains the Stormwater Division's standard procedures for property acquisition.

**6.5 FUNDING**

To create a sustainable funding source to address issues related to stormwater management and flooding, the City created a Stormwater Utility. The utility is funded by a dedicated stormwater utility fee as outlined in Chapter 11.5 - Stormwater Utility of City code. The Stormwater Utility is a Division of the City's Department of Public Works and the fee provides the utility with a dedicated funding source to carry out its work which generally includes mitigation of flooding, improvement of water quality and maintenance of the storm drain system. The fee provides operating budget that allows for progress

towards these three goals, compliance with regulations described in this Section, equipment, planning and research, etc.

It is important to understand that the fee only provides a small amount of funding for capital construction projects – these are typically funded using bonds leveraged with external grant funding. The Stormwater Utility’s current budget for capital projects includes \$3,500,000 in cash and bonds with a goal to match that with grant funds for a targeted capital budget of \$7,000,000/ year. Typical grant programs include:

- Virginia Department of Transportation Revenue Sharing – improvement related to City streets and runoff to/from streets (addresses localized flooding issues)
- DEQ Stormwater Local Assistance Fund – Water quality projects including stream restoration that can preserve and restore floodplain areas and provide for other improvements.
- FEMA Hazard Mitigation Grant Program – Allows for acquisition of highly flood prone property and other related projects to reduce flood hazards.
- FEMA Building Resilient Infrastructure and Communities program – Allows for various projects that reduce flood risk through a wide range of project types.
- DCR CFPF grants - Allows for a wide range of projects to reduce flooding and increase resilience.

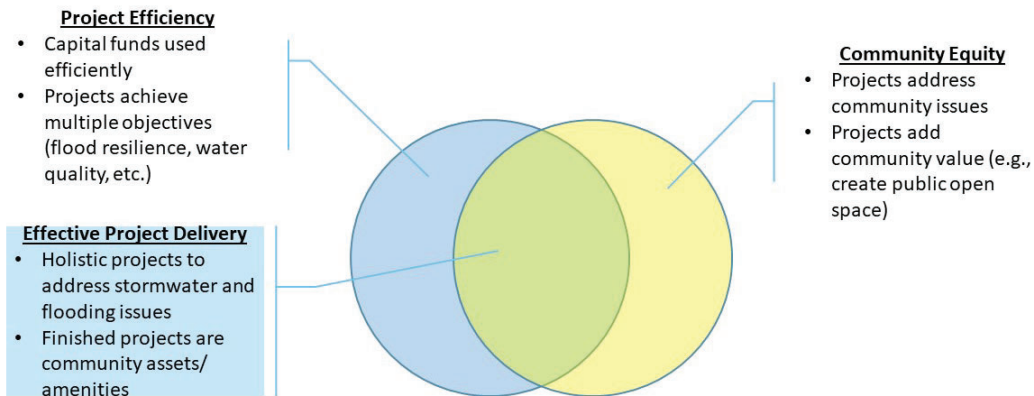
The fee itself is based on the total amount of impervious cover on a given parcel and the fee structure also includes a credit system which allows fee payers to reduce their annual fee by implementing flooding or water quality best practices on their parcel. The credit program and outreach and education efforts can lead to reductions in runoff that can become significant as these practices become accepted/adopted in the community.

In general, the structure of the fee and the operations of the Stormwater Utility is consistent with the five key principles provided in this document, and it is likely that most of the proposed flood resilience work will be carried out by staff in the Utility. The Utility’s operating budget is reviewed as part of the City’s annual budget adoption process. The operating budget is based on expected revenues and services needed to meet regulatory requirements, debt service and overarching City goals.

The Utility’s capital improvement program identifies large construction type projects, such as those listed in Section 6.4, that will be undertaken in a five-year window. The CIP outlines expected capital expenditures over the five-year window and the projects that are expected to be executed. The operating budget and CIP are both reviewed and approved by City Council.

As noted earlier in this plan, the backlog of stormwater related projects is substantial. To advance the City’s vision of flood resilience. A holistic approach to managing stormwater runoff and improving flood resilience must be holistic. Projects, to the extent possible need to address multiple facets of stormwater management/flood resilience and be developed in a way that supports broader community growth as illustrated in the figure below. This mindset recognizes that there are often multiple engineering solutions to a problem. The methods that best addresses broad community objectives should be pursued.

## Holistic Approach to Project Delivery



**Figure 9 – City of Roanoke approach to Project Delivery.**

### 6.6 GAP ANALYSIS

Based on the City’s vision and current efforts there are some logical next steps that can be considered. These efforts are outlined in the Table below with more specific recommendations in the following section. Generally, these gaps and next steps are logical extensions of implementing the recently adopted City Plan 2040, continuing to assess likely impacts of climate change and how that influences City programs and continuing to move forward with holistic stormwater projects to reduce flood risk.

Current Efforts	Gaps	Potential Actions
Plans	<ul style="list-style-type: none"> <li>City Plan 2040 and related planning documents outline broad strategies to increase flood resilience. Specific implementation steps need to be developed.</li> </ul>	<ul style="list-style-type: none"> <li>Studies to define mechanisms to balance floodplain and riparian area preservation/restoration with urban development patterns and identify programmatic updates.</li> </ul>

Current Efforts	Gaps	Potential Actions
Practices and Programs	<ul style="list-style-type: none"> <li>• Monitoring efforts are ongoing with USGS and others. Identify means to use data for local predictions and decision making.</li> <li>• Watershed master plans completed for some watersheds, not all and currently do not incorporate climate change.</li> <li>• Assess outreach efforts for usefulness for all segments of the community.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue working with partners (USGS, etc.) on predictive data tools and tailored decision making based on local data.</li> <li>• Continue to evaluate flood resilience best practices through the CRS program and programs of other localities and agencies.</li> <li>• Complete watershed master planning process for the City including assessment of climate change impacts.</li> <li>• Continue outreach efforts that maximize impact and usefulness for all segments of the community.</li> </ul>
Regulations	<ul style="list-style-type: none"> <li>• Regulations generally derive from state code requirements. These state codes currently do not account for climate change/increased rainfall/flooding.</li> </ul>	<ul style="list-style-type: none"> <li>• Assess options for accounting for climate change in regulatory programs balancing current and future costs and impacts.</li> </ul>
Projects	<ul style="list-style-type: none"> <li>• The City implements a wide range of infrastructure and other projects that can benefit flood resilience, ensure strategies are in place to program work in the Capital Improvement Program and have flexibility to take advantage of unexpected opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>• Continuous assessment of ranking and selection criteria to ensure projects that have the most impact are implemented (multiple benefits for flooding, water quality, etc. And for impact on vulnerable communities)</li> <li>• Develop CIP to allow some flexibility to adapt to opportunities to address resilience (need funding sources, opportunities to partner with other entities, etc.)</li> </ul>
Funding	<ul style="list-style-type: none"> <li>• The backlog of stormwater management and flood resilience work is substantial compared the City’s annual maintenance and capital budgets.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue to assess project selection and scoping to maximize project value.</li> <li>• Assess a variety of funding sources to leverage City funds.</li> <li>• Look at programs and partnerships to ensure that development activities and day-to-day maintenance of property aligns with City efforts.</li> </ul>

## **7. RECOMMENDED PROJECTS FOR FLOOD RESILIENCE**

In this final section, studies, planning efforts and capital projects are proposed that will advance the City's existing efforts towards flood resilience consistent with the five key principles designated in this plan.

### **7.1 IDENTIFIED PLANS STUDIES AND PROJECTS**

Several studies, plans and projects to improve the City's flood resilience are already identified and are listed in the summary table of projects describing the project and flood resilience benefits in general terms. Each project is evaluated against the five key resilience principles from this plan, and a cost opinion and estimated timeframe for each project is provided.

Proposed studies and planning efforts are based on broad recommendations from existing City policy, largely from City Plan 2040, that can be further developed into actionable measures. These studies and planning efforts may be funded through annual operating budget with potential support funds from grant sources.

Proposed projects include those specifically identified in the current Capital Improvement Plan (CIP) as well as other efforts that are more general. These general items include funds that are programmed for acquisition of flood prone properties and for green infrastructure work that can be incorporated as part of the City's annual street paving program (repaving), streetscape projects (construction of new curb, gutter and sidewalk), or other capital projects (e.g., new building construction).

### **7.2 INCORPORATING NEW PROJECTS, PLANS AND STUDIES**

Much of resilience relates to being best prepared for events that can happen unexpectedly. While the City carefully plans its funding, unexpected opportunities do present themselves that need responses. Such items could include new project priorities identified in watershed plans, unexpected issues that arise that are not programmed into a capital program, an owner of a highly flood prone property that is willing to sell, or simply an opportunity to build flood resilience efforts into another effort or project. In these instances, the City needs to be prepared to assess these opportunities and act as appropriate. The following tables provide decision trees for assessing the type of work that may make sense and determining if the work is urgent or represents an opportunity that warrants a timely action or if the project should be ranked and programmed with other capital projects.

The following graphics provide guidance on how a new project can be assessed for programming into the City's CIP or considered for a quicker action when the opportunity to address an issue arises unexpectedly. The first tool (Figure 10) is decision tree for project screening and the second tool helps define when different approaches to a project can be considered.

## Flood Resilience Project Decision Tree: Evaluation of Potential Projects

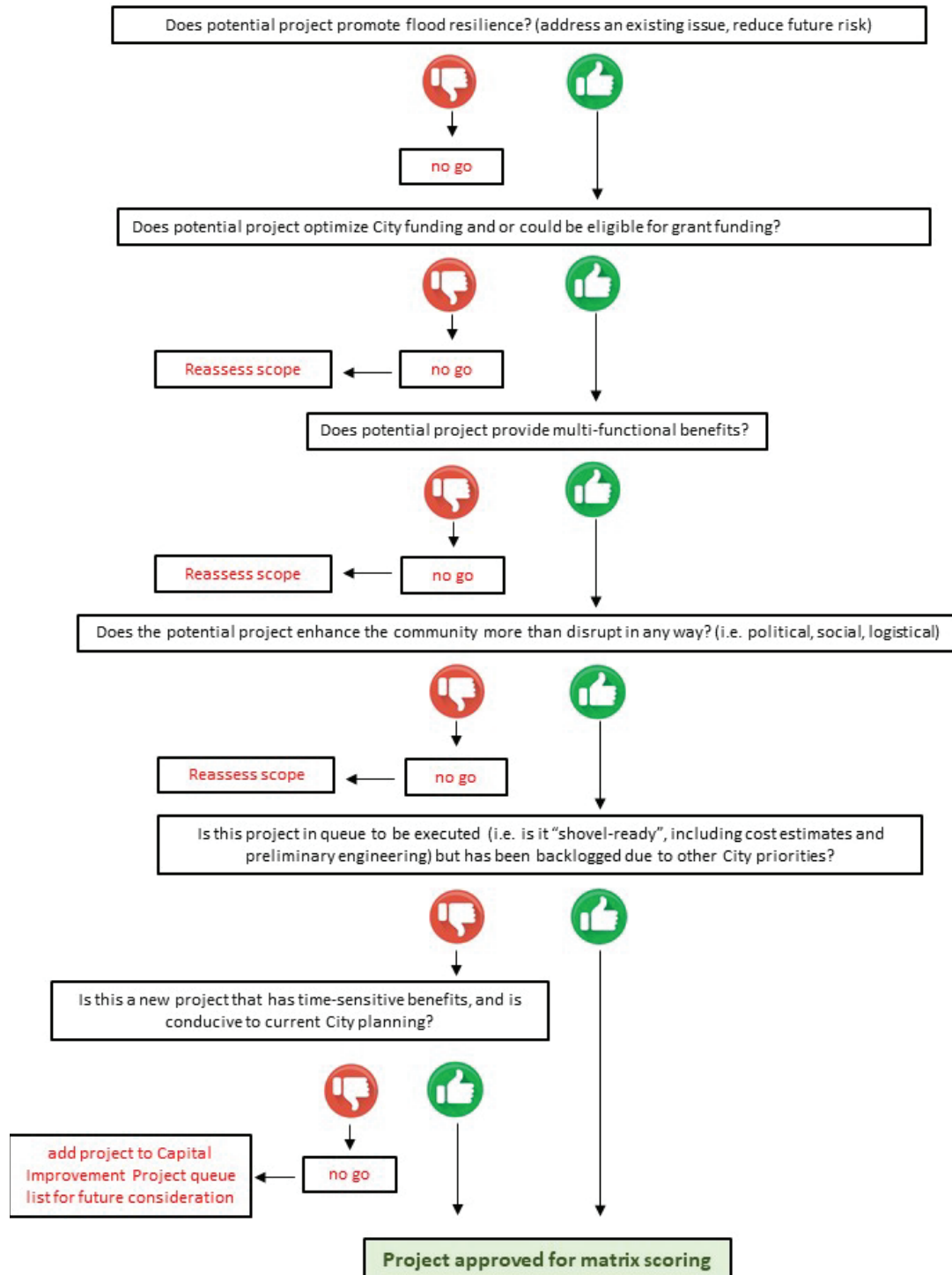


Figure 10 – Decision tree for guidance on how projects could be assessed for programming and City action.



**Potential Project Scoping Decision Tree for Flood Resilience**

<b>Project Type</b>	<b>Evaluation Criteria</b>	<b>Descriptors</b>
<b>Acquisition and Demolition</b>	Description	<ul style="list-style-type: none"> <li>Acquisition of property with the intent of demolishing existing structures</li> </ul>
	Applicability	<ul style="list-style-type: none"> <li>Typically for areas of riverine flooding, may apply to other property with major drainage issues</li> <li>Highly flood prone, protection/adaptation not feasible</li> </ul>
	Other factors	<ul style="list-style-type: none"> <li>Potential for use of site after demolition – open space or possible reuse</li> </ul>
	Who initiates Description	<ul style="list-style-type: none"> <li>Property owner or City may initiate a request</li> <li>Acquisition likely by City when use is for open space</li> <li>City or a private entity may initiate acquisition if there is a reuse option.</li> </ul>
<b>Land Preservation and/or Restoration</b>	Description	<ul style="list-style-type: none"> <li>Acquisition of property or easement to protect open space that is valuable for future flood resilience</li> </ul>
	Applicability	<ul style="list-style-type: none"> <li>Typically for areas of riverine flooding</li> <li>Highly flood prone</li> <li>High environmental value (flood plain or riparian area)</li> <li>Low development/economic value (high risk)</li> </ul>
	Other factors	<ul style="list-style-type: none"> <li>If structures are present, consider demolition if high risk or possible preservation if adaptation or protection is feasible.</li> <li>Hybrid option could allow for preservation of high risk/high environmentally valuable areas while the balance of the property remains available for appropriate development.</li> <li>Availability of nearby land to support community needs</li> </ul>
	Who initiates	<ul style="list-style-type: none"> <li>Acquisition likely by City</li> <li>Easement would be initiated by a land holder through the City or a third party.</li> </ul>
<b>Adaptation and Protection</b>	Description	<ul style="list-style-type: none"> <li>Includes a range of measures to protect new or existing structures from flooding/reduce the risk from flooding</li> </ul>
	Applicability	<ul style="list-style-type: none"> <li>Existing flood prone structures that have historic, economic or cultural value.</li> <li>New facilities that are constructed in flood prone areas in a manner to minimize risk</li> <li>Other structures that can be reasonably adapted to reduce flood risk.</li> </ul>

Project Type	Evaluation Criteria	Descriptors
	Other factors	<ul style="list-style-type: none"> <li>• Incorporation of protections that consider historic characteristics of a building</li> <li>• Maintaining neighborhood character/appeal</li> </ul>
	Who initiates	<ul style="list-style-type: none"> <li>• Typically building owner or developer to comply with development regulations, to reduce risk, and/or reduce insurance costs.</li> </ul>
<b>Green Infrastructure</b>	Description	<ul style="list-style-type: none"> <li>• A wide range of practices for encouraging infiltration and/or collection and reuse of stormwater. Measures can range from a rain barrel to park land that functions as a stormwater facility</li> </ul>
	Applicability	<ul style="list-style-type: none"> <li>• Scalable based on the space available and intended result</li> <li>• Work well in a compact, urban areas where space is at a premium</li> <li>• Protect existing infrastructure from increasing flows/reduce pollutant loads</li> </ul>
	Other Factors	<ul style="list-style-type: none"> <li>• Can be incorporated as part of most development projects when planned</li> <li>• Details of implementation can be tailored to preferences of immediate neighbors/community</li> <li>• Routine maintenance required to maintain function.</li> <li>• Can be designed to serve multiple functions (e.g., public space, landscape/aesthetics)</li> </ul>
	Who initiates	<ul style="list-style-type: none"> <li>• City as part of public infrastructure and public facilities</li> <li>• Property owners as part of development projects or retrofits</li> </ul>
<b>Grey Infrastructure / Traditional Civil Engineering Practices</b>	Description	<ul style="list-style-type: none"> <li>• Traditional storm drainage facilities such as pipes, ditches and basins.</li> </ul>
	Applicability	<ul style="list-style-type: none"> <li>• Issues related primarily to capacity and volume.</li> <li>• Drainage problem that can be readily solved by connecting to an existing storm drain system (e.g., adding an inlet along an existing drain)</li> <li>• Undersized infrastructure causing property damage</li> <li>• Tight spaces limit other options.</li> </ul>
	Other Factors	<ul style="list-style-type: none"> <li>• Upsizing infrastructure can exacerbate downstream drainage issues/flooding</li> </ul>
	Who initiates	<ul style="list-style-type: none"> <li>• Generally, city initiated to address drainage issues.</li> <li>• Can be part of development or redevelopment projects</li> </ul>

Table 4: Summary of Recommended Projects – LF = linear feet, ac = acre

Project	Description and Flood Resilience Benefits	Flood Resilience Principles	Cost Opinion	Estimated Timeframe	Priority
<b>Capital Projects</b>					
<b>Acquisition and Demolition</b>					
Peters Creek Rd. NW & North Rd. NW (PC-4)	Mitigate floodway structures through acquisition and demolition or relocation. Acquisition, abatement, and demolition of 7 structures and 1 outbuilding. All floodway properties. Large scale floodplain benching and riparian planting in the 3.5-acre open space.	1, 2, 3, 4, 5	\$1,481,385	Potential	Score: 65
<b>Land Preservation and Restoration</b>					
Ore Branch Stream and Site Restoration	350 LF of stream restoration using natural channel design; 2.4 acres of pollinator meadow, tree plantings. Increase floodplain storage capacity; improve green space, tree canopy, stream ecology	1, 2, 3, 4, 5	\$830,000	FY 2025	Score: 65
Garnand Branch Stream Restoration	1,000 LF of stream restoration using natural channel design; Increase floodplain storage capacity; improve green space, tree canopy, stream ecology; reduce stream bank erosion	1, 2, 3, 4, 5	\$1,305,000	FY 2025	Score: 70
Peters Creek at Strauss Park Stream Restoration	2,100 LF of stream restoration using natural channel design; Increase floodplain storage capacity; improve green space, tree canopy, stream ecology; reduce stream bank erosion	1, 2, 3, 4, 5	\$2,600,000	FY 2028	Score: 75
Countryside Riparian Buffer	1,200 LF of riparian buffer invasive species removal and tree planting along Lick Run within City-owned Countryside property, consistent with Countryside Master Plan	1, 2, 3, 4, 5	\$75,000	Early Concept	Score: 70
<b>Green Infrastructure</b>					
Campbell Avenue Upper Watershed Improvements	Identify, design and build a combination of small detention storage, bioretention, permeable pavement, underground storage along Campbell Ave. west of Downtown to mitigate Downtown flooding at 25-yr. flood.	1, 2, 5	\$9.5M	2030	
Luck Avenue Upper Watershed Improvements	Identify, design and build a combination of small detention storage, bioretention, permeable pavement, underground storage along Luck Ave. and Franklin Rd. south of Downtown to mitigate Downtown flooding at 25-yr. flood	1, 2, 5	\$21M	2035	
Melrose Avenue Crossing Improvements	Study flooding at Melrose Ave @ Forest Park Blvd; design and build combination of detention storage, culvert upsizing, stream restoration to reduce roadway flooding and structure damages	1, 2, 3, 5	\$3M	FY 2026	Score: 75
Moorman Avenue/Trout Run Green Infrastructure	Work with Gilmer and Harrison neighborhoods to identify projects along Trout Run to complement an upcoming streetscape project along Moorman Avenue. The streetscape itself will include bioretention areas and new trees. Additional work could include day lighting parts of Trout Run and restoring portions of the floodplain/creating public spaces.	1, 5	\$2-5M	2030	
Annual Green Infrastructure Projects	Install bioretention bump-outs; tree lawns and other green infrastructure coincident with annual street paving and streetscape projects; increase flood storage, improve water quality	1, 2, 3, 5	\$500K/yr.	Annual	Score: 75
<b>Gray Infrastructure/Traditional Engineering Practices</b>					
Salem Ave. & 1st Street "L-Tunnel"	Upsize 15 – 36" storm drain to 4'H x 6'W rectangular tunnel to reduce flooding in Downtown at 25-yr flood. Improve maintenance access; move primary drainage from present location underneath existing building.	1, 5	\$2.0M	FY2024	Score: 60
Trout Run Watershed Detention Storage	Identify, design and build approximately 81 acre-ft of detention storage in Trout Run watershed; project will significantly mitigate Downtown risk at 25-yr flood; improve water quality; incorporate nature-based strategies	1, 5	\$45M	2030 - 2050	
Shenandoah/Jefferson Diversion Tunnel	Divert runoff around core of Downtown by constructing 1,000 LF of new storm drain tunnel and repurposing existing pedestrian tunnel; mitigate Downtown risk at 25-yr. flood	1, 5	\$12M	2025-2030	
Downtown Tunnel Operations Upgrades	Install nine oversized maintenance access vaults with sump pits at key hydraulic locations in Downtown tunnels to allow for safe entry and periodic removal of sediment, trash and other debris.	1, 5	\$4.2M	2030	
Peters Creek Rd. NW & North Rd. NW (PC-4)	Mitigate floodway structures through acquisition and demolition or relocation. Acquisition, abatement, and demolition of 7 structures and 1 outbuilding. All floodway properties. Large scale floodplain benching and riparian planting in the 3.5-acre open space.	1, 2, 3, 4, 5	\$1.5M	Potential	Score: 65
<b>Technical Studies and Programmatic Approaches</b>					
Watershed Master Plans	City wide master planning to replace original, individual watershed planning. City-wide master planning takes in account USGS and Virginia Tech research. Focusing on processes and project types that can applied to all watersheds. Effort may be coordinated with Neighborhood Planning efforts to evaluate land use, etc.	2, 3, 5	\$80,000	Potential	Score: 75
Evaluation of Floodplain, Riparian Buffer and Other Land Preservation Practices	Evaluate flood prone lands across the City including floodplains and associated riparian buffers to assess a range of practices to preserve and/or restore such areas, where possible. The study would consider various economic impacts and land use and development practices to support flood reduction through the beneficial effects of managed flood plains and buffers and balanced needs of our urban community. Evaluate the economic, social, and environmental impacts and potential hydrologic effects of applying different land conservation policies.	2, 3, 5		Potential	Score: 75
Evaluate Predicted Precipitation and Design Practices and Standards	Evaluate predicted rainfall and determine how that impacts our current design standards, practices and regulatory programs. Identify options to consider for how those standards, practices and programs can be updated so that planning efforts, infrastructure and development is resilient considering future rainfall and flood potential. The effort could include a review of the City's infrastructure to assess bottlenecks and flood potential under increased	5			Score: 70

	rainfall to further assist in decision making with infrastructure and development. The study could provide an economic evaluation of short-term cost of improvements compared to long-term costs associated with increased rainfall and flooding.				
Evaluate Land Management/Green Infrastructure Strategies	Evaluate the costs and benefits of strategies that can be used to minimize impervious surface while encouraging resilient, compact urban development in the City. The evaluation would look at options to encourage use of applicable practices and would cover a wide range of actions from increasing tree canopy to various urban BMPs based on natural processes or collection and reuse of harvested water. The study would look at example programs in other jurisdictions and how they were implemented.	2, 3, 5			Score: 70
Review Stormwater Utility Fee Credit Program	Evaluate the utility fee structure to determine if the credits reward efforts that provide the most benefits for water quality and runoff reduction. In particular credits for the protection/restoration of riparian buffers or conversion of paved surfaces and manicured lawns to natural cover (land cover conversion).	2			Score: 70

\*DCR Criteria: (1) Project-based, focused on flood control and resilience; (2) Incorporates nature-based infrastructure; (3) Enhances social equity; (4) Includes local and inter-jurisdictional coordination and a schedule; (5) Based on climate change science.

\*\*In Progress indicates a project has already been approved by the City and is in various stages of completion: planning, design, or construction.

### 7.3 CONSTRUCTION PROJECTS

There are several specific construction projects evaluated in this plan. These projects advance the City’s flood resilience goals and are already identified in the Stormwater Utility’s capital improvement program and/or in watershed master plans. New projects are regularly identified based on watershed studies, resident complaints, opportunities to collaborate on other City projects etc. This section provides more detail on currently identified resilience projects and further describes how future projects will be assessed for feasibility/inclusion in the Resilience Plan and the City’s capital improvement program/processes.



**Figure 11 – Map of projects currently identified for resilience. Summary of each project in Section 7.1.1.**

#### 7.1.1 Existing Construction Projects that Advance Resilience Objectives

##### **Demolition/Acquisition**

##### *Peters Creek Rd. NW & North Rd. NW (PC-4)*

Peters Creek is subject to flash floods and repetitive losses at Peters Creek Road, NW and North Road, NW, an area with moderate to high social vulnerability. Peters Creek has 26.9% tree canopy and very few parks and greenways to help absorb floodwaters. There are 9 commercial structures, including a car repair business, located in the 100-year floodplain (1% annual chance flood), and at least one business has closed due to flooding in this

area. At least one privately owned building has a connected structure that is dangerously close to an eroding stream bank. A nearby City-owned Fire/EMS facility is also affected by flooding.

The City plans to seek funding to mitigate floodway structures through acquisition and demolition or relocation. Acquisition would allow for future floodplain benching and riparian planting in a 3.5-acre open space. A gray infrastructure project is proposed at the 1600 block of Peters Creek and North Road to upsize the existing drainage system and relocate new inlets at ponding locations and recreate the roadside ditch along North Road to maximize runoff capture. This project is in the preliminary design phase and no project date has been established yet. Note - The City is currently underway on a project just upstream of this area which will increase floodplain storage capacity and ecological function in the area north of the confluence of Peters creek and Tributary B.

## **Preservation and Restoration**

### *Ore Branch Stream and Site Restoration*

Ore Branch is a flood-prone river, and Wiley Drive is a flood-prone road in an area with low to moderate social vulnerability. Stream and site restoration on Ore Branch, upstream of Wiley Drive, will support flood protection efforts, reversing some of the negative effects of development on biodiversity and downstream receiving waters. The riparian corridor improvements will add additional tree canopy, greenspace, and improved habitat for terrestrial and aquatic species. To help reduce repetitive flooding, the project includes the purchase and demolition of the former Ramada Inn. The project will cost \$830,000 and is planned for Fiscal Year 2025.

### *Garnand Branch Stream Restoration*

Garnand Branch is a flood-prone river in the Roanoke River watershed in an area with moderate social vulnerability. The stream restoration project will repair current and reduce future channel erosion, eliminate slope failures of the stream banks, reestablish native vegetation along the riparian edge, and restore floodplain connection to the previously acquired floodplain lots. The project will help alleviate the frequent flooding in Garden City Park and along the Garden City Greenway, both located along Garnand Branch. The current project will cost \$1,305,000 and is planned for Fiscal Year 2024-2025.

### *Peters Creek At Strauss Park Stream Restoration*

Peters Creek is a flood-prone river with a repetitive loss area located just downstream of Strauss Park. The stream restoration project will increase flood capacity and help alleviate flooding in an area with medium to high social vulnerability. The project helps achieve the recommendations in the Peters Creek watershed management plan, which call for stream projects that provide flood mitigation and water quality benefit to add flood storage and mitigate flash flooding, reduce bank erosion, and improve overall stream function. This project will restore and protect important environmental assets in a watershed that has only 26.9% tree canopy and is somewhat lacking in greenways and parks other than Strauss. Construction on this project is planned for Fiscal Year 2028.

## **Green Infrastructure:**

### *Campbell Avenue Upper Watershed Improvements*

In this project, “green streets” are proposed in the West End Neighborhood extending into Downtown. This upper watershed project will alleviate localized flooding in West Ene (10<sup>th</sup> and Campbell), detain runoff and then tie into an existing 36” RCP along Rorer Avenue SW. This potentially includes a detention basin (7.0 acre-feet) in the vicinity of the former fire station at Rorer Avenue SW and 6<sup>th</sup> Street SW, and a smaller detention basin (2.6 acre-feet) at the intersection of Patterson Avenue NW and 8<sup>th</sup> Street SW. The combination of “Green

Streets” from 10<sup>th</sup> Street SW to 6<sup>th</sup> Street SW includes permeable pavement, curb extensions with bioretention, and street trees with check dams under the pavement to detain peak discharges from the upper watershed for Campbell Avenue, thereby reducing peak discharges in the Roanoke CBD downstream. This project also provides substantial water quality and runoff reduction benefits as a demonstration project for Green Streets in the City of Roanoke, and it can be integrated into planned corridor enhancements for this neighborhood plan. The project budget is estimated at \$9.5M

#### *Luck Avenue Upper Watershed Improvements*

In this project, detention of stormwater runoff is proposed in three locations identified as flood prone areas within the upper watershed for Luck Avenue. This includes detention (5.6 acre-feet) centered on the city parking lot across the street from the YMCA and along 5<sup>th</sup> Street between Luck Avenue and Marshall Avenue, where detention is provided by permeable pavement with a series of concrete vaults underneath. It also includes detention in two private parking lots and 2<sup>nd</sup> Street, centered on Luck Avenue, where detention (13.25 acre-feet) is provided by permeable pavement with a series of concrete vaults underneath. It also includes detention near Elmwood Park on S. Jefferson Street, where storage is provided by underground vaults and by converting a turf grass plaza into a combination of bioretention basin and pervious concrete sidewalks (4.07 acre-feet). Details will need to be evaluated based on availability of property, need for phasing and adapting to site specific details. The primary benefit of this project is to detain peak discharges from the upper watershed for Luck Avenue, thereby reducing peak discharges into Downtown itself. This project also provides water quality and runoff reduction benefits through permeable pavement and bioretention areas for treating local runoff. The project budget is estimated at \$20.1M.

#### *Melrose Avenue Crossing Improvements*

This previously identified project aims to reduce repetitive flooding in areas with medium to high social vulnerability by increasing culvert size and improving channel conditions up and down stream of Melrose Avenue at Hortons Branch. Specifically, this Capital Improvement Project will increase flow capacity under Melrose Ave. The existing 6' x 3' concrete box culvert and upstream and downstream channels are not adequate to convey stormwater that concentrates in these areas. There are signs of bank erosion and undercutting. Several homes experience flooding upstream of Melrose Avenue due to the backwater from the undersized culvert. Any culvert capacity modifications associated with this project should include a careful assessment of the capacity at the downstream end of the open channel section of Horton Branch to ensure that flooding of the neighboring development (Goodwill, library, etc.) is not exacerbated. This project may also provide a unique opportunity for enhanced education and outreach due to the advocacy and participation by a local Kiwanis club.

#### *Moorman Avenue/Trout Run Green Infrastructure*

Short-term work with the with Gilmer and Harrison neighborhoods to include green infrastructure elements in the Moorman Avenue streetscape project such as bioretention areas and new trees. Longer-term effort includes working with the communities to look at flood reduction effort s along Trout Run, which generally parallels Moorman Avenue. Additional wok could include day lighting parts of Trout Run and restoring portions of the floodplain/creating public spaces.

#### *Annual Green Infrastructure Projects*

This activity involves assessing annual streetscape (additions of sidewalk, curb and gutter to existing streets) and repaving programs to identify opportunities for green infrastructure elements such as bioretention bump-outs, tree lawns, bioswales and other urban infiltration practices. These measures can be installed cost-effectively as part of large street projects. In addition to providing flood storage and improved water quality, they can also provide public gathering spaces.

## **Gray Infrastructure**

### *1<sup>st</sup> and Salem Drainage Improvements*

The 1<sup>st</sup> and Salem Drainage Improvements project is the first of several proposed projects designed to reduce flooding in Downtown Roanoke. The project includes upsizing existing 15 – 36” diameter storm drainpipes to 4’ H x 6’ W tunnels, using an alignment that is more hydraulically efficient and that directs flow away from existing structures. The project, by itself, is designed to reduce flood depths in the area by approximately 6” during the 25-year flood and will also improve maintenance access to the downtown stormwater tunnels to assure that the pipes continue to flow as designed. (Future projects will detain and/or divert water upstream to further reduce flooding as they are implemented.) The proposed work will also include improvements to the aging water mains within the project footprint in order to provide additional benefits to the community with a single project.

### *Shenandoah/Jefferson Diversion Tunnels*

The primary benefit of this project is to divert flow from the Trout Run watershed away from the Norfolk Tunnel at the Warehouse Row diagonal tunnel and convey runoff further downstream in the new tunnel before tying back into the Norfolk Tunnel at N. Jefferson Street. The new diversion tunnel will tie into the tunnel that was previously used by the Hotel Roanoke to provide pedestrian access downtown, below the Norfolk Southern railroad tracks. The second part of this project includes a new 20’ x 16’ junction box over the Norfolk Tunnel in the alley behind Warehouse Row for improved access to the existing Norfolk Tunnel. The work will remove accumulated sediment and debris from the tunnels in that area and plug a broken weir wall that previously restricted runoff into the diagonal tunnel going towards Salem Avenue. The project is anticipated to be built entirely within city rights of way (city streets) except where it crosses under the NS railroad yard. In order to coordinate the shared use of the existing pedestrian tunnel at N. Jefferson Street to convey stormwater runoff, an access agreement will need to be acquired from the WVWA outlining construction modifications to the tunnel and long-term maintenance responsibilities for each party. The project budget is estimated at \$4.6M.

### *Norfolk Southern Railroad Yard Diversion*

In this project, two sediment basins are proposed to be constructed on railroad property to help collect runoff from the surrounding tracks in the railroad yard. The primary benefit of this project is to divert flow from the railroad yard to the CCBC detention basin. The sediment traps in the railroad yard at the upstream end of the pipe diversion will help reduce downstream maintenance needs in the 66” RCP and the CCBC detention basin from the railroad runoff. The project budget is estimated at \$4.3M.

### *Maintenance Access Upgrades*

In this project, nine (9) new junction boxes are proposed to provide the city with better access to the existing tunnels for inspections and maintenance work. These junction boxes range in size from 8’x8’ to 20’x20’, and are proposed within city rights-of-way, where they were positioned initially to minimize potential utility conflicts. In some cases, associated traffic impacts might require the junction boxes to be offset into sidewalk areas, side streets or on-street parking spaces to allow to the city to best maintain traffic during construction. The primary benefit of this project is to provide the city safer and easier access into their existing stormwater system. The project budget is estimated at \$4.2M.



## 7.4 TECHNICAL STUDIES AND PROGRAMMATIC APPROACHES

### *Watershed Master Plans*

Watershed Master Plans (WMPs) have been developed for the Lick Run, Tinker Creek & Tributaries (Carvin Creek, Glade Creek, and Lick Run-Norfolk Southern), Trout Run, and Peters Creek watersheds. The City plans on seeking funding to help complete WMPs for the remaining watersheds that will include Roanoke River, Back Creek, Ore Branch, Murray Run, Mudlick Creek, Murdock Creek, Barnhardt Creek, and Mason Creek watersheds. WMPs should ensure watershed boundaries are consistent (e.g., Lick Run, Lick Run – Norfolk Southern) in future analyses.

The City would conduct the GIS mapping and asset inventory necessary for determining:

- Where the critical environmental assets are and the linkages to stormwater infrastructure.
- Determine where bottle necks currently exist in drain systems or where they may exist in the future.

A complete set of WMPs would enable the City to take a more comprehensive look at environmental assets at the watershed scale and identify opportunities for mitigation and protection, particularly in areas with high social vulnerability. As more WMPs are developed, the findings and recommendations should be incorporated into this Resilience Plan.

The City's process of prioritizing flood resilience projects could incorporate the SVI or other similar metrics, as projects in this area would likely yield a larger improvement in flood recovery capability per dollar of investment than the same project in a less vulnerable area. **This principle is consistent with the City's definition of Equity – that different groups have different needs and should be provided services determined by their needs**<sup>19</sup>.

### *Evaluation of Floodplain, Riparian Buffer and Other Land Preservation Practices*

This project would evaluate floodplains, riparian buffers and other land preservation practices throughout the City to determine their potential for preserving or improving natural and beneficial effects of floodplains and buffers. The resulting baseline would help the City prioritize enhancement and restoration projects, aimed at improving the ability of floodplains to spread out and slow down floodwaters during heavy precipitation and storm events, thus reducing downstream erosion. This is one of the least expensive and most effective ways to increase flood resiliency. The data would also be used to focus floodplain improvements in areas with repetitive flood loss and socially vulnerable areas.

This effort could also assess the potential property and economic, social, and environmental impacts of the expanding the River and Creek Corridor (RCC) Overlay District in the City's Zoning ordinance. The RCC requires preservation of riparian buffers along the Roanoke River and certain portions of some tributaries. The study would evaluate the number and extent of impacts to existing properties, including the extent of the drainage network that would be affected. The study would evaluate the costs and benefits of extending protections of the RCC and could explore policy changes or incentives to offset economic effects.

The City could also seek funding to evaluate the economic, social, and environmental impacts and potential hydrologic effects of applying other land conservation policies. The City would identify various models implemented in other localities and consider the impacts of applying them to the City of Roanoke.

### *Evaluate Predicted Precipitation and Design Practices and Standards*

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<sup>19</sup> See City Plan 2040 | Themes: Interwoven Equity - <https://planroanoke.org/interwoven-equity/>

The City understands the upward trend in the severity of precipitation events and the associated impacts that such storms will likely have in exacerbating flooding problems. The NOAA MARISA (Miro et al., 2021) updated IDF Curve Data Tool provides the City with an opportunity to evaluate the impacts of using this new tool on stormwater management and design. The City would use future funding to evaluate the cost of implementation on existing infrastructure versus maintenance upgrades and assess potential impacts to downstream channel stability. This work would also assess how to use and/or supplement or monitoring networks to support decision making. The study could also include a review of the City's infrastructure to assess bottlenecks and flood potential under increased rainfall to further assist in decision making with infrastructure and development. The study could provide an economic evaluation of short-term cost of improvements compared to long-term costs associated with increased rainfall and flooding.

#### *Evaluate Land Management and Green Infrastructure Practices*

Evaluate the costs and benefits of strategies that can be used to minimize impervious surface while encouraging resilient, compact urban development in the City. The evaluation would look at a range of practices that can be used to reduce runoff and that can be incorporated into various City standards and programs. . These could range from increasing tree canopy to various BMPs based on natural processes or harvesting of rainwater for collection and reuse. The study would look at example programs in other jurisdictions and how they were implemented.

This effort would consider two factors in how the existing housing stock or commercial properties could be further protected from flood risk

1. Assess how future development of residential land can incorporate flood resilience into development plans.
2. Balance land use and development policy between acquisition of highly flood prone property for conservation while encouraging development in other areas to provide needed housing.

#### *Review Stormwater Utility Fee Credit Program*

The City recognizes the importance of native meadow and forested tracts to flood resilience. Research has quantified the decreased level of absorption and filtering associated with turfgrass relative to native meadow or forested conditions. The City may consider adoption of a stormwater utility credit for land conversion in order to maximize the potential benefits to flooding and stormwater system performance. The City would seek funding to evaluate the utility fee structure impacts and hydrologic effects of such measures

#### *Evaluate Land Preservation Protections*

The City's current credit manual was developed in 2014 and 2015 leading up to the creation of the Stormwater Utility. There have been no substantive changes since that time. As flood resilience strategies are developed, it is appropriate to review the types of work that should be eligible for fee credits – making sure the City incentives/rewards the most valuable activities. These credits should focus on runoff reduction and preservation of critical spaces (floodplains and riparian areas). In particular credits for the protection/restoration of riparian buffers or conversion of paved surfaces and manicured lawns to natural cover (land cover conversion).

## **7.5 ADDITIONAL CONSIDERATIONS**

#### *Robust Measurement of Social Vulnerability*

Realizing the variability in social vulnerability findings, greater equity may be achieved by using a more robust social vulnerability model to determine priority in the scoring matrix. The Resilience Plan presents a model combining data from three different models (Social Vulnerability Index, EPA EJSCREEN, FEMA National Risk

Index) to determine the overall level of social vulnerability, whereas the DCR's Adopt VA Social Vulnerability Index used to ascertain a score in the ranking matrix relies on a modified version of one model (Social Vulnerability Index). Though the DCR model is valid, incorporating all available data sets into a single model strengthens findings and minimizes those weaknesses inherent to a single dataset. Therefore, when determining the level of social vulnerability and corresponding weight in the future, the City recommends a shift toward using the model applied in **Section 3** of this Resilience Plan.

#### *Enhance Project Selection Tools*

To create equal evaluation and ranking for resilience projects, the Resilience Plan relies on established criteria and suggested weighting for the project selection matrix. Future efforts may find that additional local constraints or criteria would be beneficial to include in the project selection process. As the City continues to advance resilience efforts, staff would periodically consider the need for Resilience Plan updates and modifications to the project selection matrix to more effectively evaluate and rank projects in a way that prioritizes broader resilience, going beyond flooding and drainage to incorporate other social, economic, and environmental factors.

#### *Increase Inter-departmental Coordination*

For nearly a decade the City of Roanoke has had a designated funding stream for stormwater-related projects. Though funding allocations are now more predictable, the need for coordination between City staff remains critical. Often storm drainage improvement projects create opportunities for improvement in other facets of City management. For example, neighborhood drainage improvements made to reduce localized flooding may also allow for road resurfacing. The opposite is also true. Road improvements may create opportunities for enhanced stormwater management (e.g. the addition of street trees, roadside water quality treatment areas, etc.). Quarterly meetings between department management where upcoming project schedules and scope are discussed could help avoid misaligned implementation (i.e. damage to recently installed infrastructure by work from another department) and promote mutually beneficial projects.

#### *Consider Programs to Incentivize Improvements to Increase Flood Resilience*

City Plan 2040 promotes the idea of green convenience, making it easy for residents and businesses to take actions that improve our environment. The City's Repetitive Loss Area Analysis contemplates creating a program to assist residents with making improvements to make their homes or businesses more resilient. As public infrastructure projects will not quickly address flood resilience for the entire community, flood resilience efforts should work to furnish flood prone small and mid-sized local businesses with resources to reduce risk and improve recovery, particularly in areas of high social vulnerability.

The City could assess options for assisting homeowners and businesses in evaluating and supporting projects that improve flood resilience and reduce flood risk in the community. Ideally, such a program would leverage state or federal funding to support resilience efforts of residents and business owners and work to furnish flood prone small and mid-sized local businesses with resources necessary to sustain operations during and after flood events. This strategy is especially important for businesses that lie in areas of high social vulnerability.

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## APPENDIX A – DCR CROSSWALK

This crosswalk is developed to assist with review of this flood resilience plan for completeness with the City’s grant application. The plan elements included in the below table are based on the grant application submitted in the 2021 Community Flood Preparedness Fund grant round.

Plan Element	Plan Location	Notes
Acknowledge climate change and its consequences, and base decision making on the best available science	Section 2.3 Climate Change  Chapter 5 Principles of Flood Resilience	The plan focuses on 5 key principles, one of which is climate change.
Identify and address socioeconomic inequities and work to enhance equity through adaptation and protection efforts	Chapter 3 People, Land, Economy, Equity  Chapter 5 Principles of Flood Resilience	The plan focuses on 5 key principles, one of which is equity.
Utilize community and regional scale planning to maximum extent possible, seeking region-specific approaches tailored to the needs of individual communities	Chapter 4 Community Engagement  Chapter 6 Efforts to Date	The plan focuses on 5 key principles, one of which is community scale benefits. The plan builds on City-wide and watershed specific planning efforts and included a robust public outreach campaign.
Understand the fiscal realities and focus on the most cost-effective solutions for the protection and adaptation of our communities, businesses, and critical infrastructure. The solutions will to the extent possible, prioritize effective natural solutions.	Section 6.5 Funding  Chapter 7 Recommended Projects for Flood Resilience	The plan focuses on 5 key principles, one of which is economy and land use.  Cost-effectiveness of projects is a major component in project evaluation in the plan.  Nature-based solutions/green infrastructure is also major component in project evaluation in the plan.
Recognize the importance of protecting and enhancing nature-based solutions in all regions, natural	Chapters 5 Principles of Flood Resilience	The plan focuses on 5 key principles, one of which is nature-based approach.



<p>coastal barriers and fish and wildlife habitat by prioritizing nature-based solutions.</p>	<p>Section 6.4, Projects</p> <p>Chapter 7 Recommended Projects for Flood Resilience</p>	<p>Nature-based solutions/green infrastructure is a major component in project evaluation in the plan.</p>
<p>The plan is project-based with projects focused on flood control and resilience.</p>	<p>Chapters 5 Principles of Flood Resilience</p> <p>Section 6.4, Projects</p> <p>Chapter 7 Recommended Projects for Flood Resilience</p>	<p>The plan focuses on flood resilience throughout and has 5 key resilience principles.</p>
<p>The plan will incorporate nature-based infrastructure to the maximum extent possible.</p>	<p>Chapters 5 Principles of Flood Resilience</p> <p>Section 6.4, Projects</p> <p>Chapter 7 Recommended Projects for Flood Resilience</p>	<p>The plan focuses on 5 key principles, one of which is nature-based approach. Nature-based solutions/green infrastructure is a major component in project evaluation in the plan.</p>

## **APPENDIX B – FLOODPLAIN REVIEW**

Floodplain Review (Residential and Commercial) SOP attached in the following pages.



Procedure Name:  
***Floodplain Review  
(Residential and Commercial)***

Procedure #: FP-001  
Revision #: 0  
Implementation Date:  
Last Review/Update Date:  
Approval:

Procedure Owner:

Page: 1 of 15

## 1. Purpose

Describe the overall process for reviewing permits that are located on parcels that are at least partially within the Special Flood Hazard Area or Floodplain.

## 2. Scope

The scope of this procedure is based on the development, partial development or redevelopment of a parcel for commercial or residential purposes.

The development is subject to the requirements of Section 36.2-333, Floodplain Overlay District (F). This review will take place concurrently with other relevant reviews for the development (zoning, building, E&S, etc.)

This procedure applies to the Permit Center, Zoning Administration, Zoning Review, Building Review, and Planning and Building Inspections function in the department.

## 3. Permit Types/Subtypes

This procedure applies to the following permit types and the associated subtypes.

- Residential New (RNEW)
- Residential Addition (RADD)
- Residential Repair/Remodel (RMRP)
- Residential Deck Porch (RDKP)
- Residential Accessory Structure (RACC)
- Commercial New (CNEW)
- Commercial Addition (CADD)
- Commercial Repair/Remodel (CMRP)
- Commercial Deck/Porch (CDKP)
- Commercial accessory Structure (CACC)
- Subdivision (SU)
- Comprehensive Plan (CP)

This procedure will not apply to any trade permits that are in-kind replacements of existing system unless the upgrade is determined to be a substantial improvement or part of a substantial improvement to the building. However, all **NEW** trade permits must meet the NFIP requirements which mean elevating those systems 2 feet above the BFE.



Procedure Name:  
***Floodplain Review  
(Residential and Commercial)***

Procedure #: FP-001  
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Approval:

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#### 4. Prerequisites

- A signed and sealed elevation certificate has been provided with the permit application.
- A site plan, with floodplain/floodway boundaries shown on the site plan, has been submitted with the application.
- Any flood-proofing certifications have been signed and sealed certifying that dry or wet flood-proofing that is proposed meets Building Code Standards for the floodplain.

#### 5. Initialized from:

Building and Zoning permits are typically initialized from an address. However, some permits may be appropriate to initialize from a building. This is particularly important for floodplain review. If multiple buildings under one address are located within a floodplain and are on the same parcel, it is important to make clear which one of the building/s the permit is for.

#### 6. Responsibilities

- Permit Technicians – Permit initialization, assignment of reviews, document management (ensures that elevation certificate has been provided upon initialization).
- Zoning Floodplain Reviewer/Administrator –Review project sites to ensure compliance with Section 36.2 -333 Floodplain Overlay District (F). Checks to verify accuracy of the Elevation Certificate. In some instances, checks to see if the permit constitutes a substantial improvement to a building. Determines whether an as-built survey or a post-construction elevation certificate is on file before issuance of a CO.
- Building Floodplain Reviewer/Inspector – Review of building plans for flood proofing/elevation data accuracy. Determines that the Flood proofing Certificate is accurate and that the flood proofing was installed correctly.

#### 7. Procedure

The floodplain review process must **ALWAYS** begin with a zoning determination of the use of the new structure, addition, or any other type of development associated with the permit application. This informs reviewers as to changes of use and also allows reviewers to determine if new proposed uses are allowed within certain areas of the floodplain overlay. Certain uses are non-starters for permitting approval in developments or re-developments within the Floodway. Changes of uses within the floodway may require a Special Exception to change from one non-conforming use to another.

After use has been deemed to be compliant, see attached flow chart for the rest of the review process. This procedure is an assembly procedure, based on other defined, detailed procedures for specific tasks.

#### 8. References

- Zoning Ordinance, Chapter 36.2 of the Code of the City of Roanoke (1979), as amended.
- Section 36.2 -333 Floodplain Overlay District (F)
- Stormwater Management Ordinance, Chapter 11.6 of the Code of the City of Roanoke (1979), as amended.
- Uniform Statewide Building Code.



Procedure Name:  
**Floodplain Review  
 (Residential and Commercial)**

Procedure #: FP-001  
 Revision #: 0  
 Implementation Date:  
 Last Review/Update Date:  
 Approval:

Procedure Owner:

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**9. Definitions**

*Substantial Improvement* - Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds fifty (50) percent of the market value of the structure before the start of construction of the improvement. The term does not, however, include either:

1. Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official 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 section requirements that do not preclude the structure's continued designation as a historic structure. Documentation that a specific section 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 section requirements will be the minimum necessary to preserve the historic character and design of the structure

*Base Flood Elevation* - The water surface elevations of the base flood, that is, the flood level that has a one (1) 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.

Add more based on current projects - encroachment, etc

**10. Time Limits**

- Intake, initialization and scanning of documents - Completed at counter, within next business day for electronic submissions.
- Initial Zoning/Site Reviews - Complete and provide comments within 10 days of initialization.
- Initial Building Plan Review - Complete and provide comments within 10 days of initialization (5 days for residential permits).

**11. Revisions**

Date	Description of Revision



Procedure Flow Chart:  
**Zoning Floodplain Review - Commercial**

Procedure #: FP-001  
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- Required Submittals**
- Applicable permit application form
  - Site plan with floodplain/floodway indicated on the site plan
  - Building plan (with sealed drawing confirming dry/wet flood-proofing if proposed - only allowed on non-residential structures)
  - Signed and sealed elevation certificate with date
  - Total valuation of the proposed project

C

**Plan Revision/Resubmission**  
Applicant  
 Plans revised to address comments

**Resubmission Processing**  
Permit Technician

- Check for scope change
- Add reviews
- scan and/or upload
- If hard copy, add resubmission to file

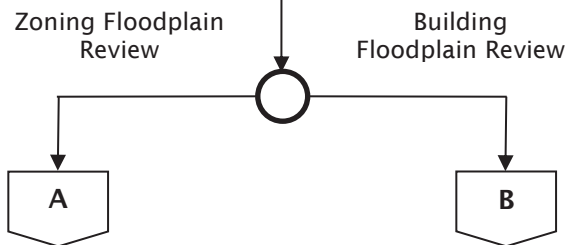
**Start**  
 Customer submits Building and Zoning permit application

**Permit Initialization**  
Permit Technician

- Identify project scope, permit type/subtype
- Check/link prerequisites
- Assign reviews
- Use/number of units
- Assess fees
- Scan and/or upload documents
- Note document location

**Zoning Use Determination**  
Zoning Floodplain Reviewer

- Identify zoning use of the property
- Identify if development is occurring in regulatory floodway
- Identify any change of use
- Determine if use is permitted in the floodway
- If new development in floodway, any use not permitted will result in permit denial.
- If change of use in floodway, applicant will need to submit application to BZA, prior to permit review



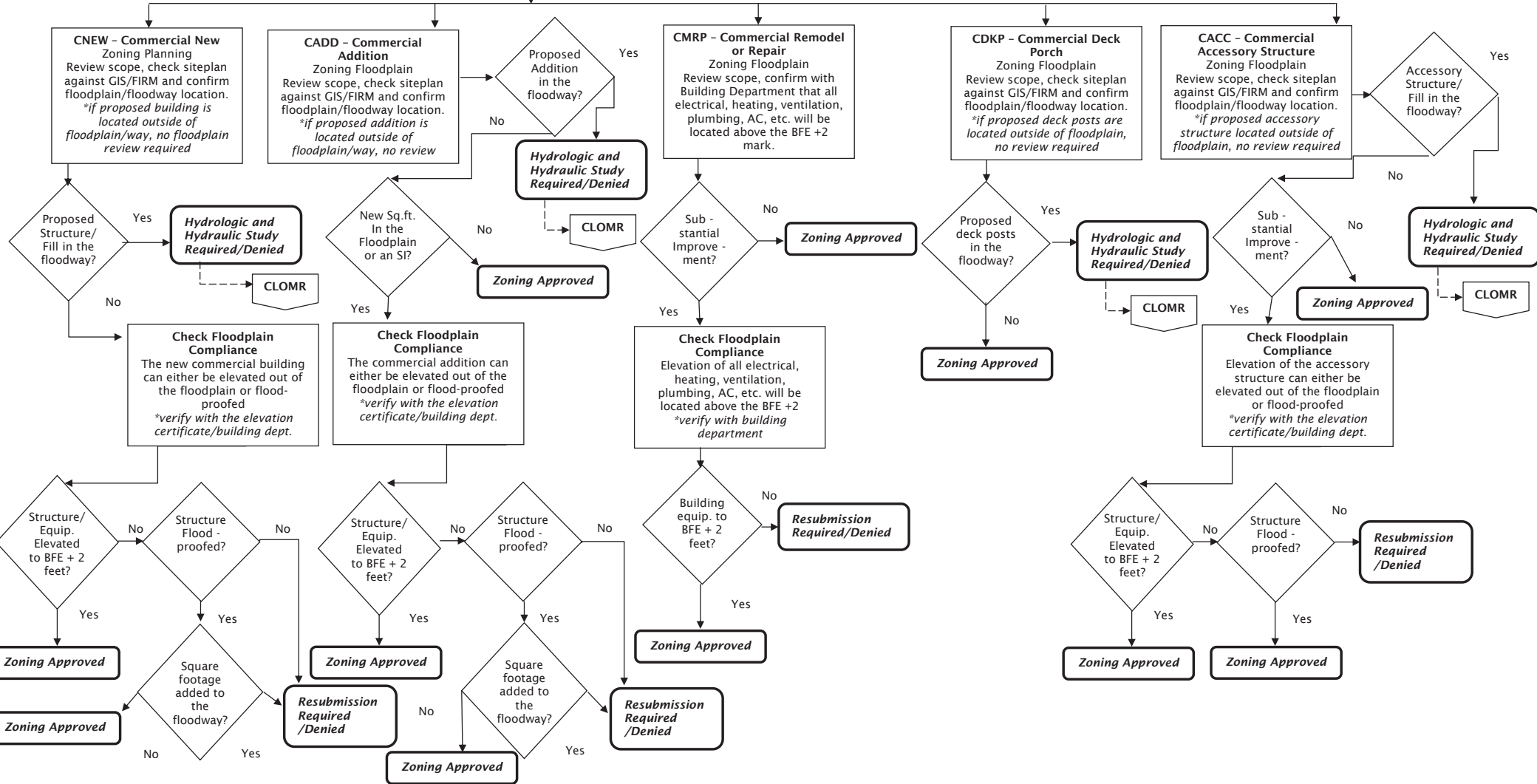


Procedure Flow Chart:

Zoning Floodplain Review - Commercial

Procedure #: FP-001  
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A

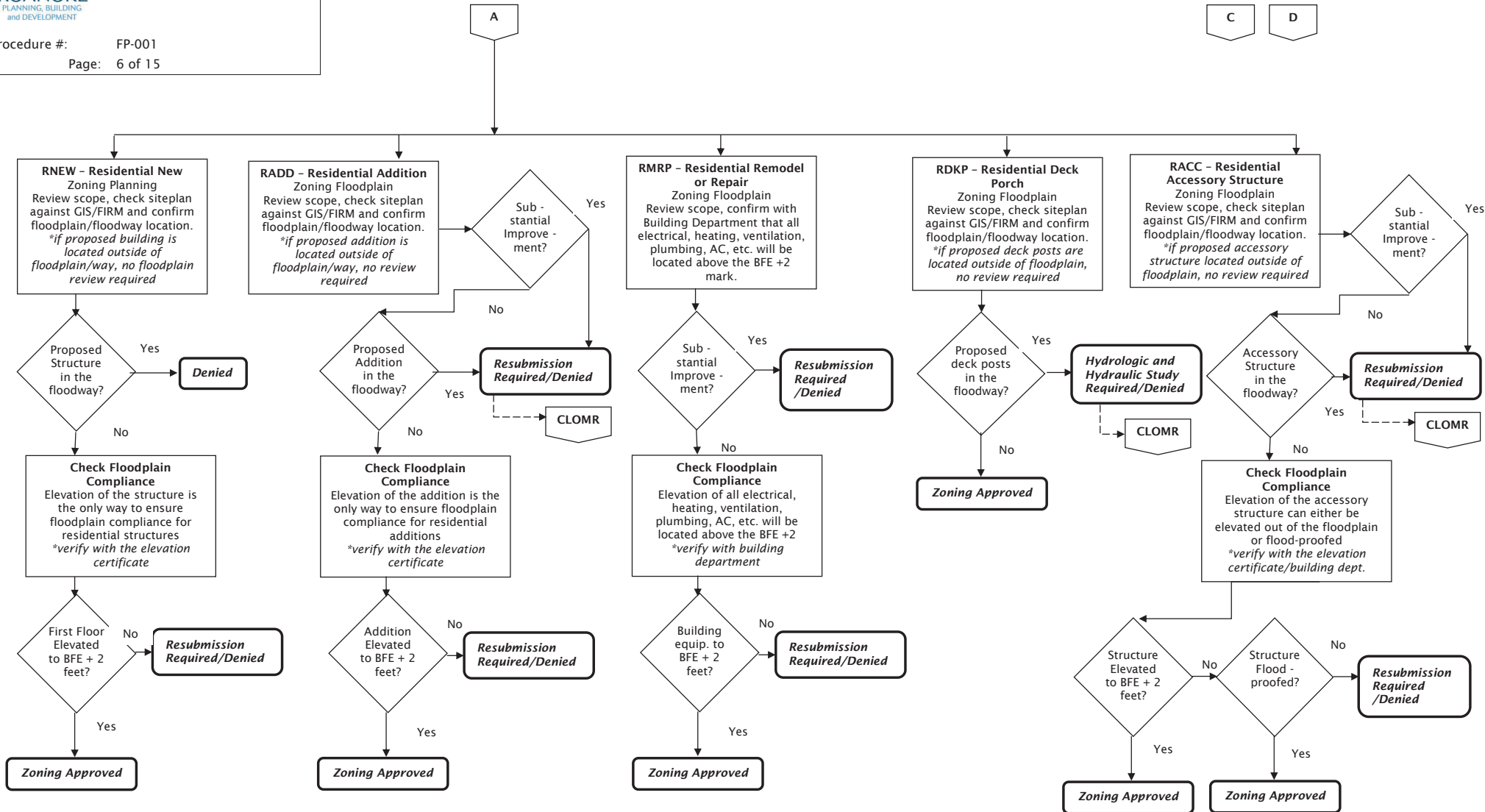




Procedure Flow Chart:

**Zoning Floodplain Review - Subdivisions and Comp Plans**

Procedure #: FP-001  
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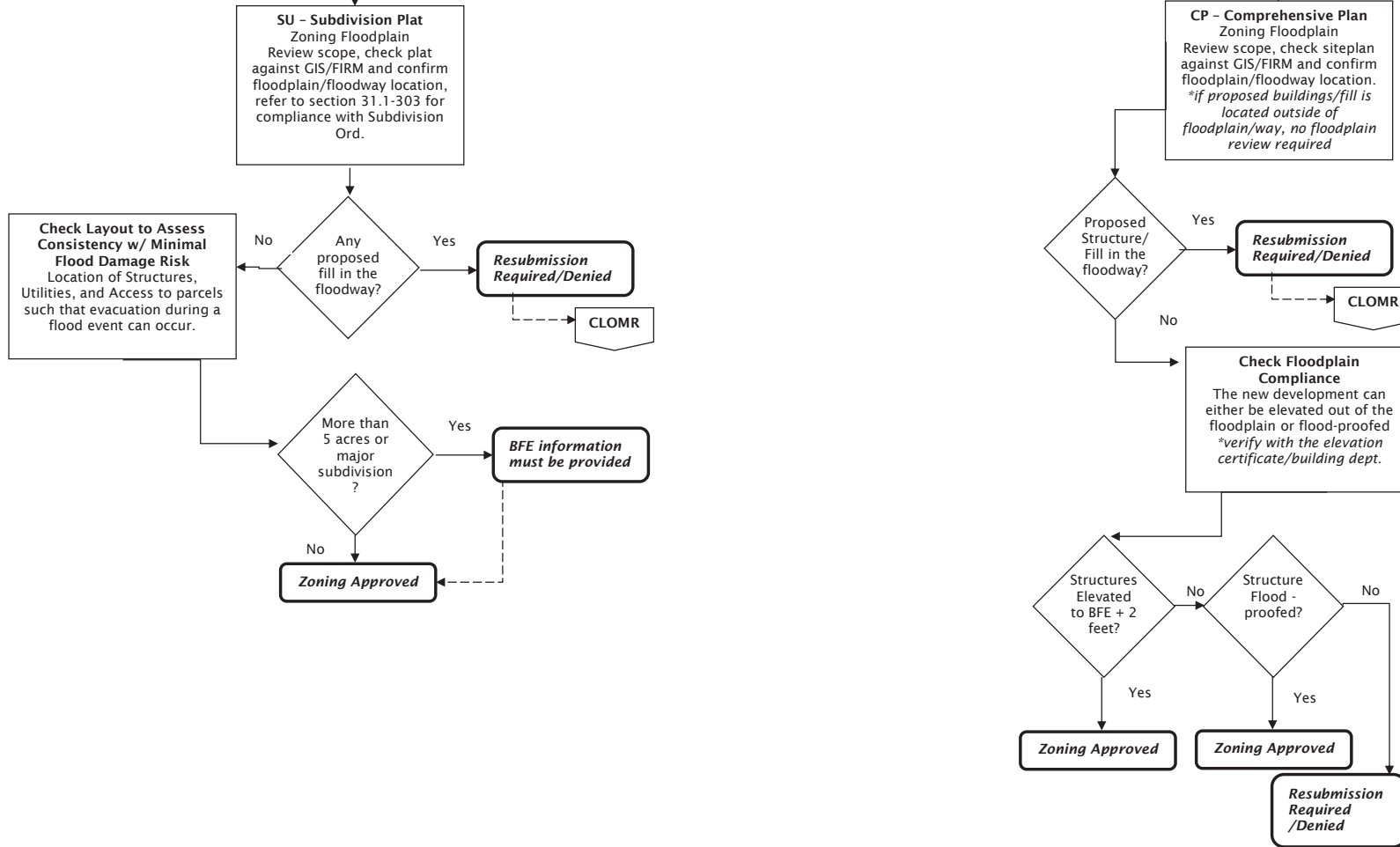


Procedure Flow Chart:

**Zoning Floodplain Review - Subdivisions and Comp Plans**

Procedure #: FP-001  
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A

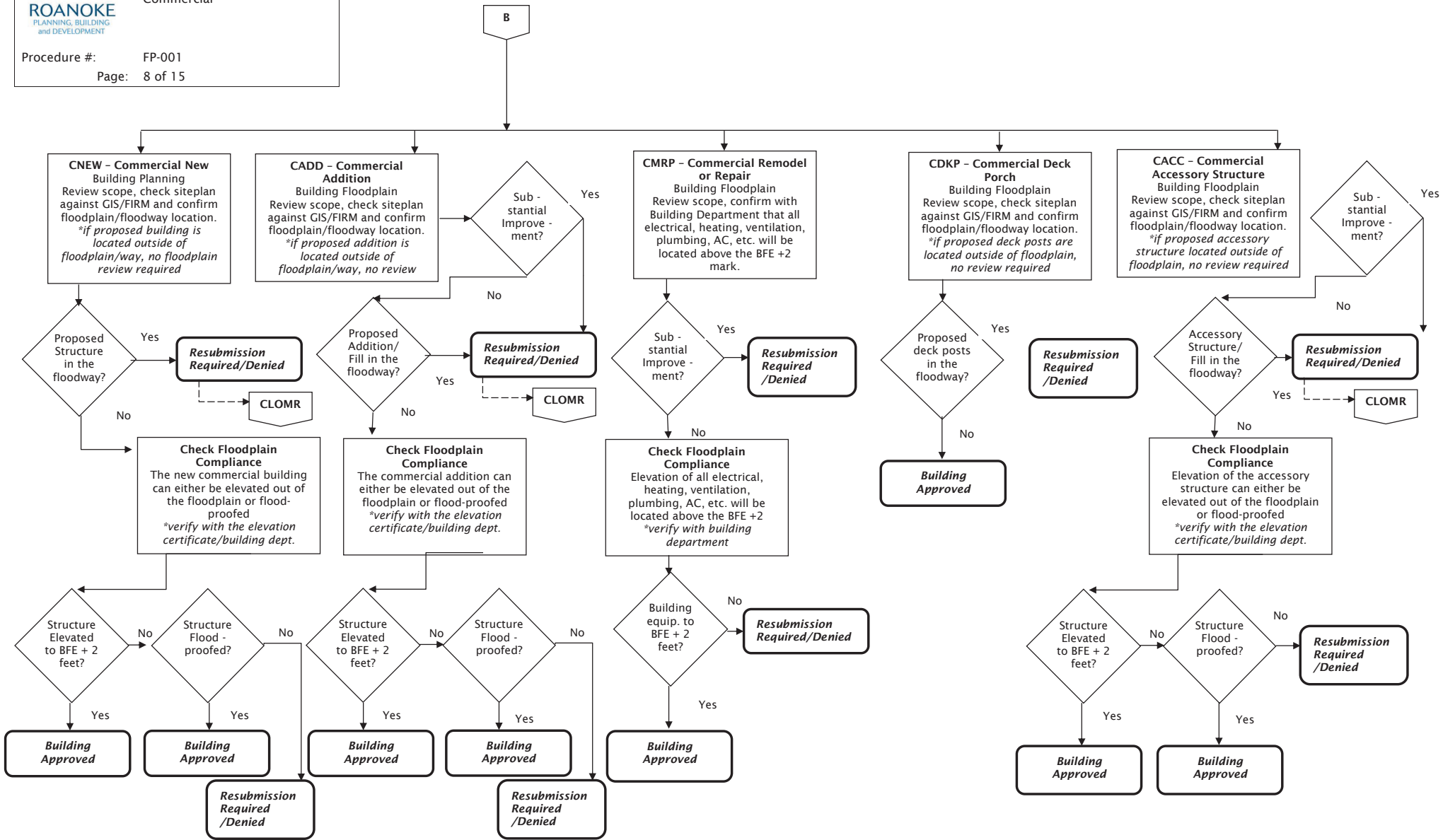




Procedure Flow Chart:

**Building Floodplain Review - Commercial**

Procedure #: FP-001  
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Procedure Flow Chart:

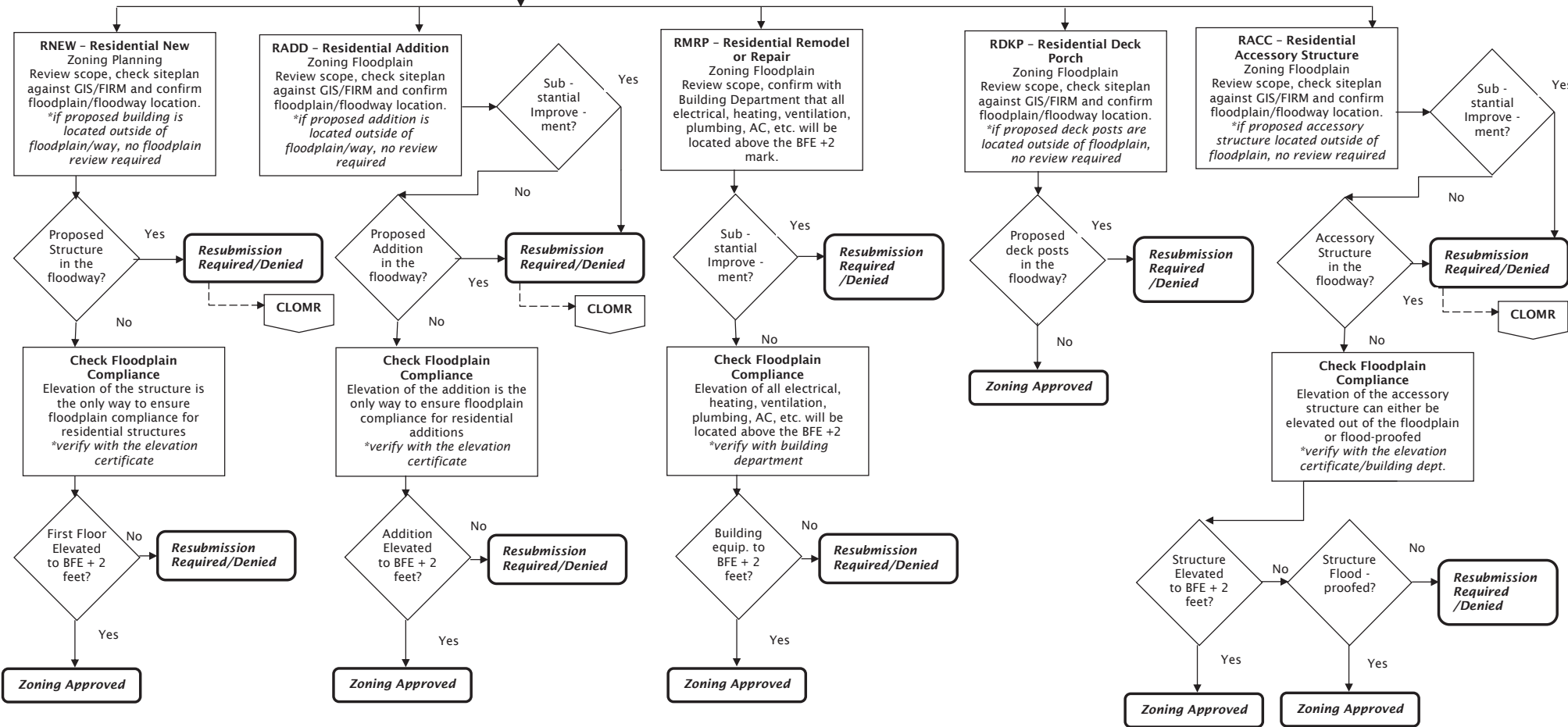
**Building Floodplain Review Residential**

Procedure #: FP-001  
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B

C

D





Procedure Flow Chart:

***Conditional Letter of Map  
Revision Review Process***

Procedure #: FP-001

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CLOMR

44 CFR 65.12:

“When a community proposes to permit encroachments upon an adopted regulatory floodway which will cause base flood elevation increases in excess of...(0.00 ft in a floodway) and/or [0.1 ft in a floodplain]...the community shall apply to the Administrator for conditional approval of such actions prior to permitting the encroachments to occur...”

44 CFR 60.3(d)(3):

“In the regulatory floodway, communities must prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge.”

Requirements:

1. Applicant must submit a MT-2 Form from FEMA
  - a. Describes data requirements for request
  - b. Helps applicant organize submittal
  - c. Allows for community involvement early on in the revision process
2. Include “No-Rise” Certification
  - a. Floodplain Manager will require that the applicant’s engineer certify that there will be no rise in flood heights due to any development within the floodplain.
  - b. The Community is required to review and approve the encroachment review (“no-rise” certification), however may request technical assistance and review from the FEMA Regional Office or state NFIP Coordinator. If this alternative is chosen, the Community must review the technical submittal package and verify that all supporting data are included in the package before sending it to FEMA.

Minor projects: Some projects are too small to warrant an engineering study and the certification. Many of these can be determined with logic: a sign post or telephone pole will not block flood flows. A driveway, road or parking lot at grade (without any filling) won’t cause a problem, either.

Building additions, accessory buildings, and similar small projects can be located in the conveyance shadow. This is the area upstream and downstream of an existing building or other obstruction to flood flows. Flood water is already flowing around the larger obstruction, so the addition of a new structure will not change existing flood flow. Upstream is measured at an angle of 1-to-1, downstream is measured at an angle of 4-to-1.

- c. To support a “No-Rise / No-Impact” certification for proposed developments encroaching onto the regulatory floodway, a community will require that the following procedures be followed:
  - i. Currently Effective Model Furnish a written request for the step-backwater hydraulic model for the specified stream and community, identifying the limits of the requested



Procedure Flow Chart:

***Conditional Letter of Map  
Revision Review Process***

Procedure #: FP-001

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data. A fee will be assessed for providing the data. Send data requests to: Federal Emergency Management Agency [http://www.fema.gov/fhm/st\\_order.shtml](http://www.fema.gov/fhm/st_order.shtml) or to: MOD RMC Region 4 Faxed to (678) 459-1030 to the attention of: "Back-up Technical Data Request"

- ii. Duplicate Effective Model Upon receipt of the step-backwater hydraulic model, the engineer should run the effective hydraulic model to duplicate the data in the effective FIS.
- iii. Existing Conditions Model Revise the duplicate effective model to reflect site-specific existing conditions by adding new cross-sections (two or more) in the area of the proposed development, without the proposed development in place. Regulatory floodway limits should be manually set at the new cross-section locations by measuring from the effective FIRM or FBFM. The cumulative reach lengths of the waterway should remain unchanged. The results of these analyses will indicate the base flood elevations and the regulatory floodway elevations for the effective hydraulic model revised to incorporate existing conditions at the proposed project site.
- iv. Proposed Conditions Model Modify the existing conditions models to reflect the proposed development using the new cross-sections, while retaining the currently adopted regulatory floodway widths. The overbank roughness parameters should remain the same unless a valid explanation of how the proposed development will impact the roughness parameters is included with the supporting data. The results of this floodway hydraulic model will indicate the regulatory floodway elevations for proposed conditions at the project site. These results must indicate NO impact on the base flood elevations, regulatory floodway elevations, or regulatory floodway widths shown in the duplicate Effective Model or in the Existing Conditions Model (items ii and iii above, respectively). The "no-impact" analysis along with supporting data and the original engineering certification must be reviewed by the appropriate community official prior to issuing a development permit. The original effective FIS model, the duplicate effective FIS model, the Existing Conditions Model, and the Proposed Conditions Model should be reviewed for any changes in the base flood elevations, regulatory floodway elevations and floodway widths. The "No-Rise / No-Impact" supporting data should include, but may not be limited to:
  1. Copy of the currently effective FIS hydraulic models (legible hard copy and a disc (if available))
  2. Duplicate effective FIS hydraulic models (hard copy and a disc).
  3. Existing conditions hydraulic models (hard copy and a disc).
  4. Proposed conditions hydraulics models (hard copy and a disc)
  5. Annotated effective FIRM or FBFM and topographic map, showing regulatory floodplain and floodway boundaries, the additional cross-sections, and the site location along with the proposed topographic modifications.
  6. Documentation clearly stating analysis procedures. All modifications made to the duplicate effective hydraulic models to correctly represent existing conditions, as well as those made to the existing conditions models to represent proposed conditions should be well documented and submitted with all supporting data.
  7. Annotated effective Floodway Data Table (from the FIS report).
  8. Statement defining source of additional cross-sections, topographic data, and other supporting information.
  9. Cross-section plots of the additional cross sections for existing and proposed conditions hydraulic models.



Procedure Flow Chart:

***Conditional Letter of Map  
Revision Review Process***

Procedure #: FP-001

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10. Certified planimetric (boundary survey) information indicating the location of structures on the property.
  11. Hard copy of all output files.
  12. Clear explanation of how roughness parameters were obtained (if different from those used in the effective hydraulic models).
  13. Engineering certification (sample attached).
- v. The engineering "No-Rise / No-Impact" certification and supporting technical data must stipulate NO impact or NO changes to the base flood elevations, regulatory floodway elevations, or regulatory floodway widths at the new cross-sections and at all existing cross-sections anywhere in the model. Therefore, the revised computer model should be run for a sufficient distance upstream and downstream of the development site to insure proper "No-Rise / No-Impact" certifications.



Procedure Flow Chart:

***Substantial Improvement /  
Damage***

Procedure #: FP-001

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*Substantial Improvement* – Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds fifty (50) percent of the market value of the structure before the start of construction of the improvement. The term does not, however, include either:

1. Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official 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 section requirements that do not preclude the structure's continued designation as a historic structure. Documentation that a specific section 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 section requirements will be the minimum necessary to preserve the historic character and design of the structure



Procedure Flow Chart:

**Substantial Improvement / Damage**

Procedure #: FP-001

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Process for determining Substantial Improvement/ Substantial Damage

1. If any of the three (3) items listed on the previous page match the description of the project, the project is not subject to the substantial improvements review process.
2. Determine the “Improvement Value” on the property (assessed value of the building). This can be done through the GIS website. An example of how to determine the improvement value can be seen below. If there is a discrepancy between the applicant’s valuation of the building and the valuation as prescribed by the Tax Assessor’s office, the applicant will be informed that an appraisal made by a licensed appraiser according to appraisal laws and regulations could be an option for them to raise this assessed valuation of the building, thereby allowing for potentially more improvements to be made before reaching the “substantial improvement/damage” threshold. It is important to note that the appraisal should only be accepted if the study was done prior to any improvement/damage.

Valuation Date	Land Value	Improvement Value	Total Value
2017-01-01	\$49,200	\$67,600	\$116,800
2016-01-01	\$49,200	\$60,400	\$109,600
2015-01-01	\$49,200	\$60,400	\$109,600
2014-01-01	\$49,200	\$60,400	\$109,600
2013-01-01	\$49,200	\$60,400	\$109,600

2. Open Trak-It and search under the parcel for all building permits, trade permits, or other permits that pertain to improvements to the specified building within the past 5 years. Tally the sum of all of the building costs related to those permits. If there are more than 5 permits that were completed during this time, create an excel spreadsheet that tabulates the cumulative cost and save it under attachments at the address level. Additional information about what should and should not be included in the costs associated with an improvement/damage project can be found in the FEMA Floodplain Management Handbook.
3. Divide the sum total cost of all permits over the past 5 years found in Step 2, in addition to the current project’s cost of improvement/damage, by the assessed value of the structure in Step 1. If this value is more than .50, then the applicant will need to improve





Procedure Flow Chart:

***Substantial Improvement /  
Damage***

Procedure #: FP-001

Page: 15 of 15

the structure to FEMA floodplain compliance. For residential structures, this means elevating the bottom of the first floor to the Base Flood Elevation, plus two feet. For Commercial buildings, the structure shall either be elevated or flood-proofed to the Base Flood Elevation, plus two feet.

4. Whenever our Department initiates a substantial improvement request, the applicant will be made aware that the improvement will be considered a substantial improvement. If the applicant moves forward, a note will be created on the parcel that indicates that a substantial improvement is being sought. The floodplain manager will also be made aware so that they can report to FEMA about the resulting substantial improvements and a log of the review process will be saved in TrakIt, the City permitting software database.

## APPENDIX C – EDUCATION AND OUTREACH

### Breakdown of Education and Outreach

#### **Regional Working Groups and Committees**

The City works with statewide agencies, other localities/municipalities, and stakeholders in the form of Committees to stay informed on regional water resource management topics, issues and goals, which include flooding and stormwater improvement initiatives. Once organized, these initiatives can then be passed onto residents to inform, and sometimes take action with preventative or enhanced water-related measures.

##### *Roanoke River Blueway Committee*

Formed in 2013 to promote planning, tourism, and outreach affairs in relation to the Roanoke River, and now a formal Committee with voting members under the Roanoke Valley Area Regional Commission. The group combines the City of Roanoke, Roanoke County, surrounding cities and counties, the National Park Services and others. The committee helps to organize events that promote awareness, stewardship, and education about the Roanoke River.

##### *Stormwater Advisory Committee (RCSWAC)*

The group combines the City of Roanoke, Roanoke County, surrounding counties, agencies, and continues to grow. This committee discusses current needs for floodplain management and infrastructure projects related to stormwater in conjunction with state and federally mandated stormwater requirements (City of Roanoke, 2018).

##### *Regional Pre-Disaster Mitigation Planning Committee*

The City of Roanoke, the County of Roanoke and several other localities participate in this committee to keep their residents informed and prepared for natural disasters through hazard mitigation planning such as the 2019 Regional Hazard Mitigation Plan which provides critically important information about flooding (Roanoke Valley-Alleghany Regional Commission, 2019).

##### *Citizen Advisory Committees*

Citizen advisory committees are utilized as needed for Citywide planning projects. Committees are comprised of a diversity of professionals and city residents and are established to review and provide feedback on the City's planning goals. As an example, this was utilized in City downtown planning of 2013-2017.

#### **Public Education Events**

The City also participates in, as well as sponsors, educational events to both educate and engage the community in local water quality and flooding issues. Often this occurs in partnership with local organizations or non-profits, such as the Clean Valley Council. These events span a wide range of formats to reach diverse community interests.

*Clean Valley Days* - Roanoke Clean Valley Council (CVC) organizes "Clean Valley Days" twice each year where local roads and water ways are cleaned up by volunteers.

*Green Academy* - Every year, the City joins forces with the Western Virginia Water Authority and Clean Valley Council to hosts a 5-week Green Academy with specific sessions that address water quality, conservation, stormwater management and BMPs.

*Environmental Summits* - Environmental Summits have been organized to educate the public on environmental issues and engage the community with planning of environmental outreach efforts. As a result of the 2018 summit, “Roanoke Clean and Green” was formed. This group of volunteers help to spread the word on “green initiatives” and best practices within the community.

*Roanoke Prepareathon* - Event hosted by the City during National Preparedness Month, in partnership with Emergency Management and Fire-EMS, to highlight local topics on floodplain management and flood mitigation for the community.

*Stormdrain Stenciling* - CVC helps lead a storm drain stencil marking program where volunteers are trained to do hands-on stenciling work on drainage inlets. Accompanied with this training is education not only about storm sewer inlets, but about water quality as a whole: local streams and rivers, and watersheds.

*Citizen Science* - Partnering with CVC, Stormwater sponsors a citizen science program to monitor water quality and benthic macroinvertebrates. Residents learn about local water quality at the stream, river and watershed level.

*Stormwater Workshops* - Partnering with CVC, Stormwater sponsors workshops on water quality and stormwater management and offers rain barrel workshops during certain times throughout the year

*Public Art Projects* - Partnering with the Roanoke Regional Arts commission, Stormwater sponsors public art projects to engage the public creatively to learn about and help creatively communicate water quality and other stormwater issues. Examples include inlet art, murals, photography, and jingle competitions.

### **Public Educational Outreach (Mail Delivery, Virtual and Other)**

A regular part of City functioning is informing and educating residents with pertinent information. This is done in a variety of formats as necessary according to the information and relevant audience, including taking accessibility and inclusivity into consideration. Interpretation and translations services and resources are available to City residents and visitors regardless of the language they speak. It is the policy of the City of Roanoke to ensure that limited English proficiency individuals have meaningful access to all services, programs, and activities.

#### *Notifications*

- Repetitive Loss Area - Repetitive Loss Area Analysis has been introduced to the City public in a letter mailed out last year to residents that are located within Repetitive Loss Areas. Additionally, this letter describes the NFIP, CRS program, and provides resources such as flood preparation steps, online flood plan maps, and the suggestion for permanent protection measures against floods. This letter also leads recipients to a Repetitive Loss survey that can be taken to evaluate possible Repetitive Loss properties. This survey helps the City to further identify Repetitive Loss Areas, which can then result in specifically tailored mitigation projects and/or more grant funding provided by FEMA for various flooding solutions.
- Special Flood Hazard Area – Annual mailer to approximately 360 real estate agents, lenders and insurance agents. Post card titled “Are you aware of the flood hazards?”, which provides resources for agents and lenders to share with property owners that possess properties within Special Flood Hazard Areas.

#### *Publications*

- Flooding in Roanoke – Annual brochure mailed to all residents and businesses located within the Special Flood Hazard area and/or a Repetitive Loss Area. The brochure promotes flood insurance, provides flood protection information, tips for flood preparedness including actions to take to reduce

flood damage to a home or business, flood map information services, and information about the natural drainage system and the importance of protecting natural floodplain functions.

- State of Our Waters – Mailed to all Stormwater fee payers, about 32,300 addresses, and available in public at City libraries and the City Municipal Building. Information includes local and national data on water pollution and climate change; new projects that relate to water quality such as stream restoration and infrastructure projects; floodplain preparedness information, and ways that the local community can help.
- Flood Preparedness and Recovery Guide – Brochure containing Disaster Response Resource Information, and important messaging such as “Turn Around, Don’t Drown”. The brochure provides a list of important resource phone numbers for emergencies and non-emergencies, as well as links to resources about flood response, residential flooding, special needs, and recovery after a flood.

#### *Virtual Tools*

- Social Media - City’s social media platforms include Facebook, Instagram, X (formerly Twitter) and Nextdoor. Through these platforms, information about specific floodplain and resilience issues including flood hazards; insuring property against flooding incidents; how to protect people and property from flooding hazards; responsible flood resistant development; and the importance of protecting natural floodplain functions is shared with the public.
- Website – The City maintains a public facing website with information on flood zones and insurance, flood safety, preventing flood damage, flood warnings, flood management, emergency preparedness, City events, and staff directories.
- SHARKS App - The City has funded a public information web-based application known as Stream Hydrology and Rainfall Knowledge System (SHARKS). Sharks relies on a system of rain gauges, USGS data, and automated computations incorporated into a website that allows you to determine past rainfall data and/or can determine areas that are experiencing a flood event in real time. This information is available to the public and can advise locals on what roads to avoid during storm events. This rainfall data can also be instrumental in further research to show hotspots of flood-prone areas.

## **APPENDIX D – PROPERTY ACQUISITION**

### **Property Acquisition SOP**

The City of Roanoke, must at times acquire certain real property rights from private owners to achieve annual and long-term program objectives of varying master plans and capital projects. These rights include the acquisition of vacant properties, and the acquisition and demolition of structures. This outlines the procedure for City staff to engage private property owners in voluntary sales of their property, ensure full transparency in the acquisition process, leverage resources for fair and equitable treatment of property owners and their tenants, and adhere to land preservation requirements of all properties acquired.

#### **1. Letters of Interest and Voluntary Participation**

Once a property has been identified as high priority to achieve overall objectives of a project or program, the Department Manager or Project Manager shall coordinate with their Economic Development Department representative to initiate contact with the property owner. This “Letter of Interest” should give an overview of the need for the property, the future use of the site, and listed source of funding. This LOI will not include a certified offer, City projects must gain City Council approval to obtain all property rights from private owners. The goal of the LOI is to gauge interest from the owner(s), that would warrant submission to Council. This also provides a personal approach to owner engagement on each project.

For projects funded by the Virginia Department of Emergency Management, FEMA, or other state agencies that are federal backed, a Voluntary Participation Agreement must be signed by each property owner for grant application submittal. This agreement demonstrates interest of the property owners, serves as support for readiness to proceed on the project, waives the rights of relocation for owners, protects the rights of the tenant, and reinforces the voluntary nature of each acquisition. The Voluntary Participation Agreement for FEMA’s FMA, PDM, and HMGP grants is attached as Exhibit A.

#### **2. Appraisals, Offers and Negotiations, and Sales Agreement**

If a property owner responds positively to the Letter of Interest, a submittal to City Council for approval of acquisition is required. Pending the project schedule, owner expectations, and time of Council approval; the project manager may also concurrently work with the Economic Development Department to hire a third-party appraiser to ensure fair and objective value estimation of the property. The third-party appraiser coordinates a visit to the property, and provides a detailed report to the City and property owner at no cost to the owner.

The appraised value reflects the current fair market value for the property, and is the basis for the offer letter. As this is a voluntary agreement, the property owners have the right to negotiate a different purchase price, and it is the City’s right to accept, decline, or renegotiate this counter-offer. It should be noted, the City is required to purchase each property at either the tax assessed or appraised value, whichever is higher. If the acquisition is funded through a grant, the appraised value is the amount in which can be reimbursed. If a property owner exercises their right to negotiate for a higher purchase price, the City must determine if paying 100% of the difference between appraised value and final offer meets cost/benefit.

Once a final price is agreed, City attorney’s office will prepare closing documents and sales agreement.

#### **3. Uniform Relocation Act**

If there are active renters at the property, the Federal Uniform Relocation Act may apply. Form II-3 URA Relocation Assistance for Tenants Fact Sheet is included as Exhibit B to assist in determining when a tenant may be eligible. 49 CFR 24.402 (part of the federal regulations governing the Uniform Relocation Act), requires the City to provide relocation funds for the tenant and ensure their new dwelling is decent, safe, and sanitary in addition to being comparable to their current rental.

Working closely with the tenants in their relocation, assisting in identifying a new dwelling that meets all federal grant requirements, and ensuring the new dwelling is decent, safe, and sanitary aligns with the City's goals of equitable treatment of both property owner and tenant. All of the tenant's rights are outlined in the Federal Uniform Relocation Act.

#### 4. Land Preservation and Deed Restrictions

In the sales agreement for each acquisition, an exhibit is included that furthermore restricts the deed from sale, development; maintaining the parcel as open space. An example of the deed restrictive language is included as Exhibit C, with an excerpt as follows:

“Federal program requirements consistent with 44 C.F.R. Part 80, the Grant Agreement, and the State-local Agreement, the following conditions and restrictions shall apply in perpetuity to the Property described in the attached deed and acquired by the Grantee pursuant to FEMA program requirements concerning the acquisition of property for open space:

a. Compatible uses. The Property shall be dedicated and maintained in perpetuity as open space for the conservation of natural floodplain functions. Such uses may include: parks for outdoor recreational activities; wetlands management; nature 1 PG )29b.; ~18 22 reserves; cultivation; grazing; camping (except where adequate warning time is not available to allow evacuation); unimproved, unpaved parking lots; buffer zones; and other uses consistent with FEMA guidance for open space acquisition, Hazard Mitigation Assistance, Requirements for Property Acquisition and Relocation for Open Space.

b. Structures. No new structures or improvements shall be erected on the Property other than:

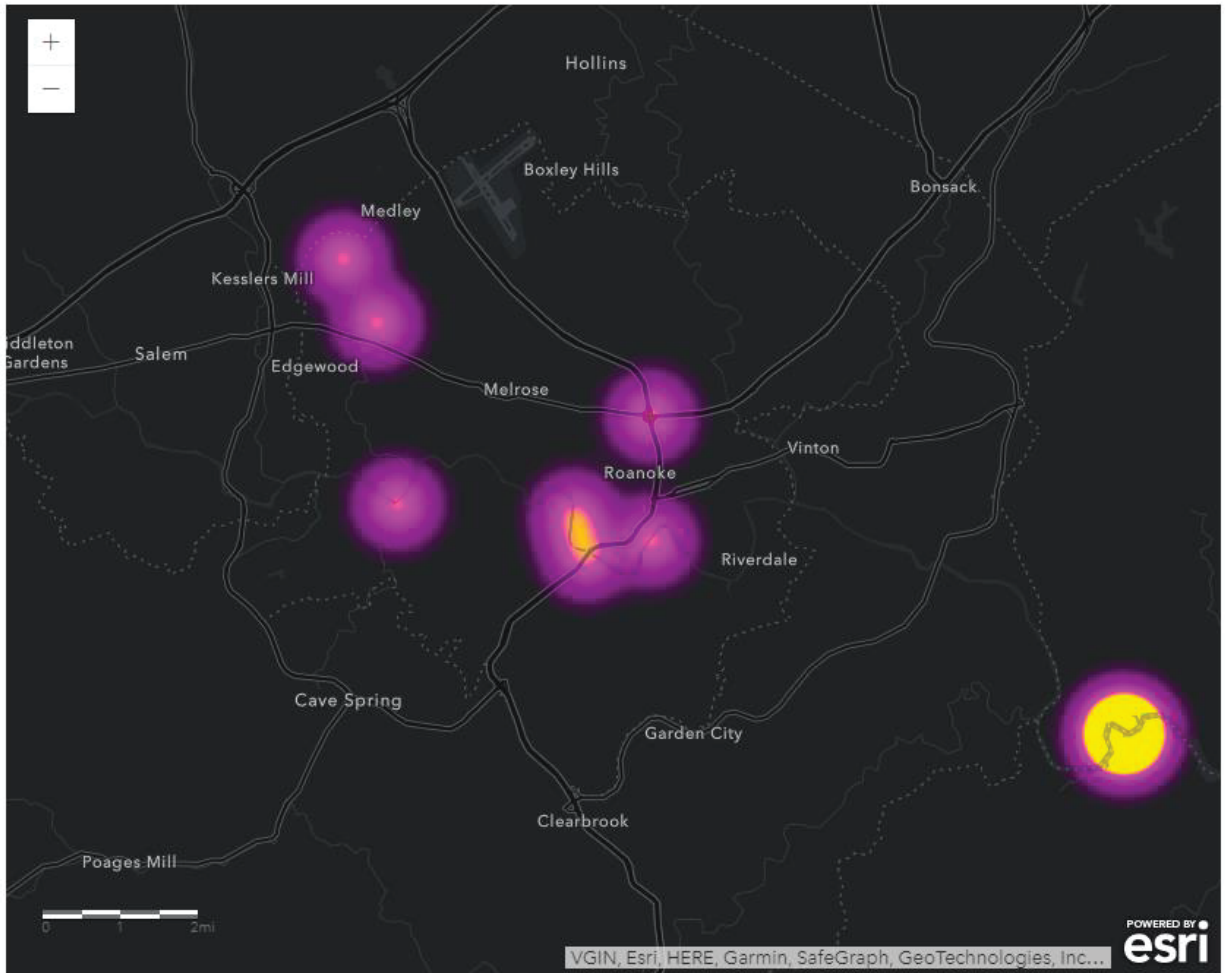
i. A public facility that is open on all sides and functionally related to a designated open space or recreational use;

ii. A public rest room; or

iii. A structure that is compatible with open space and conserves the natural function of the floodplain, including the uses described in Paragraph 1.a., above, and approved by the FEMA Administrator in writing before construction of the structure begins.”

## APPENDIX E – COMMUNITY SURVEY

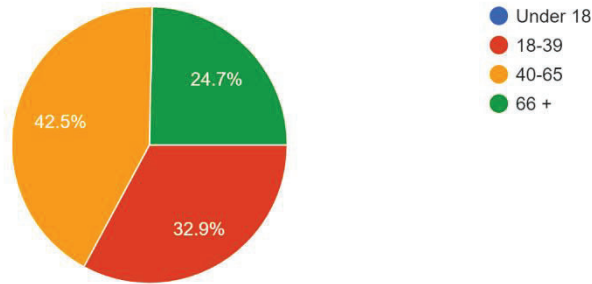
This Appendix contains Figures that portray the results of the community survey and map that were open from January 2023 through March 2023 for public input and resulted in 160 responses.



Resilience Plan Survey Responses

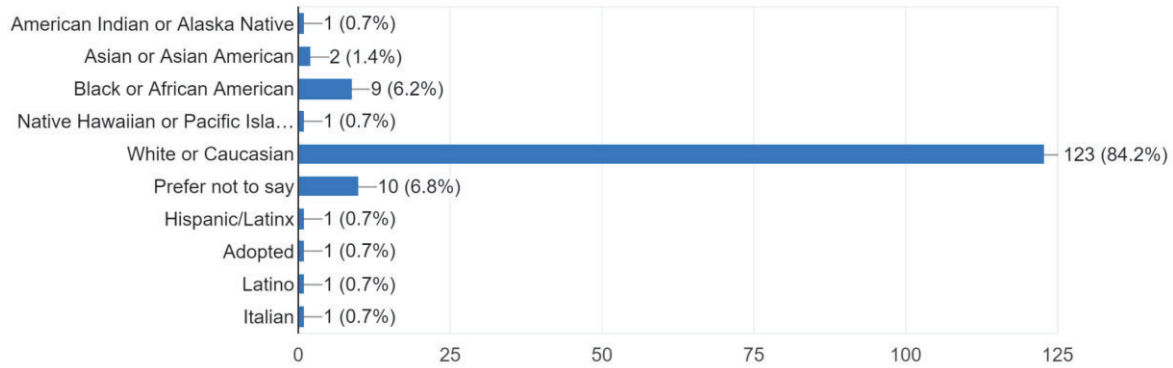
Please identify your age bracket.

146 responses



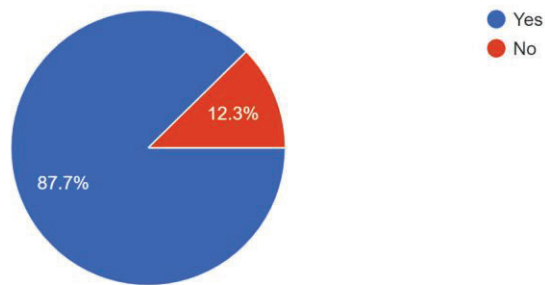
Please identify your race (select all that apply).

146 responses



Do you live in the City of Roanoke?

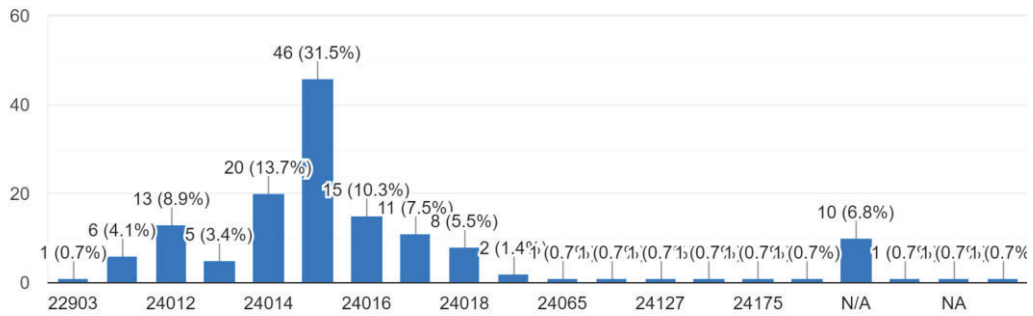
146 responses





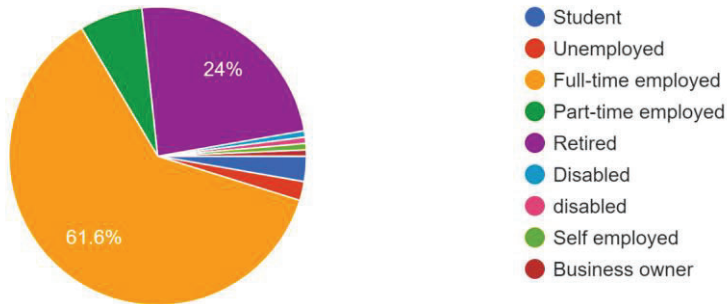
If you live in the City please provide your zip code. If this does not apply, please type "N/A".

146 responses



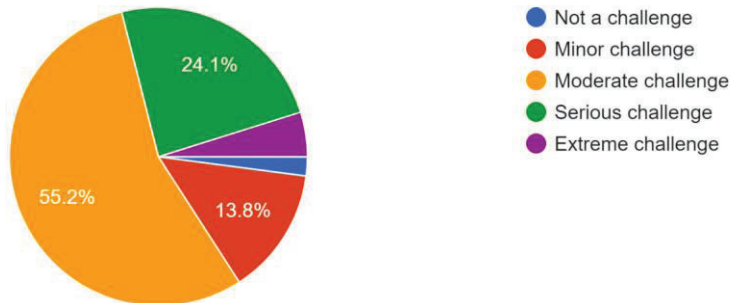
Please identify your occupational status.

146 responses



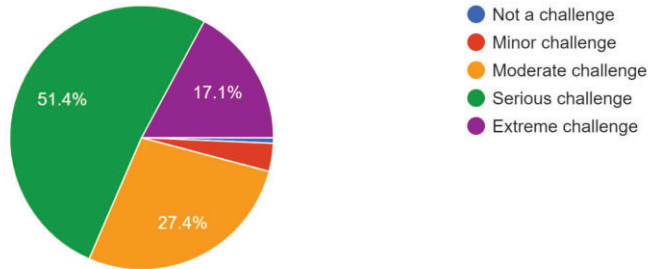
How much of a challenge do you feel flooding poses to your community currently?

145 responses



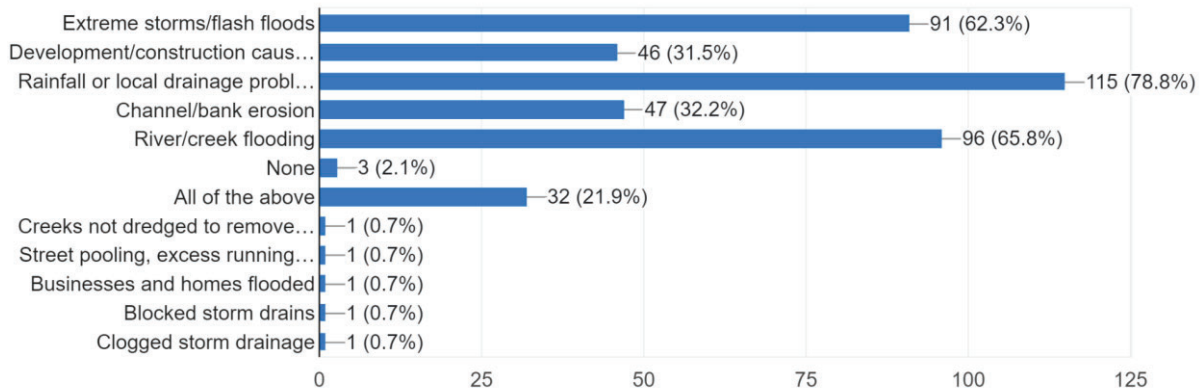
How much of a challenge do you feel flooding poses to your community in the next 20-40 years, given climate change?

146 responses



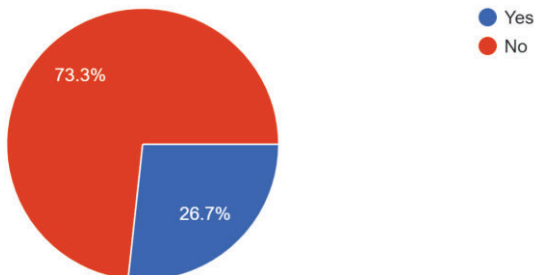
What type of flooding hazards have you witnessed in your community? Select all that apply.

146 responses



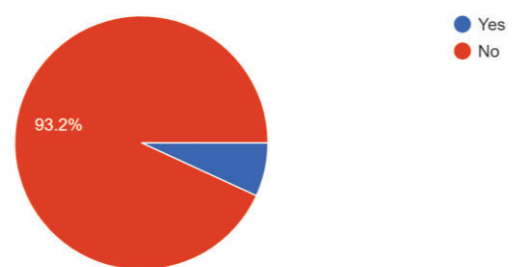
Has your home ever flooded?

146 responses



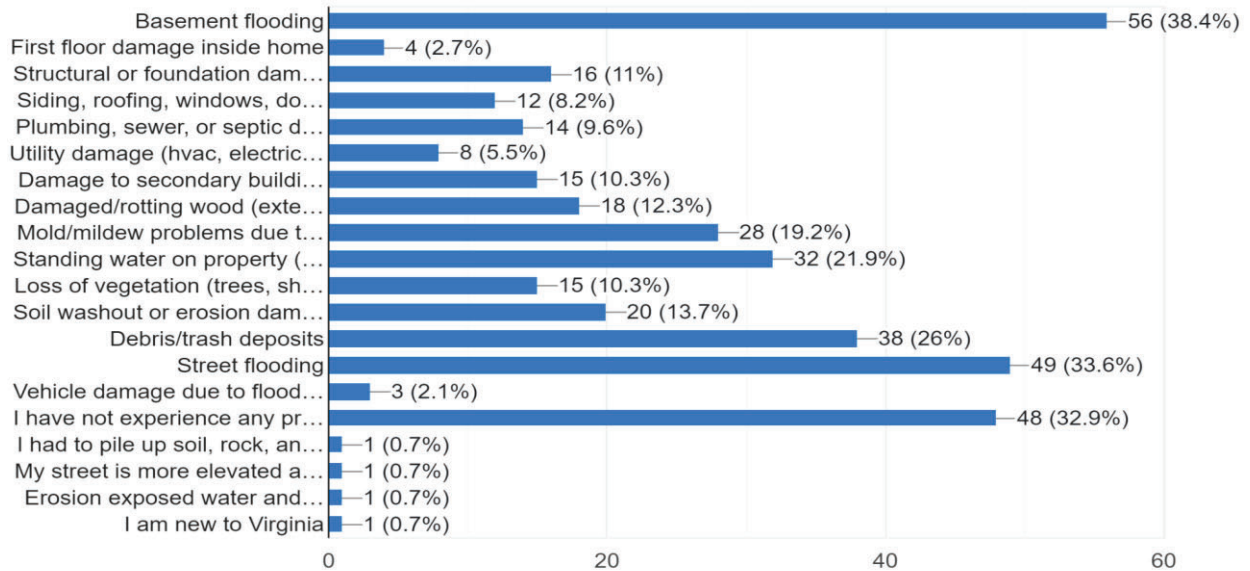
Has your business ever flooded?

146 responses



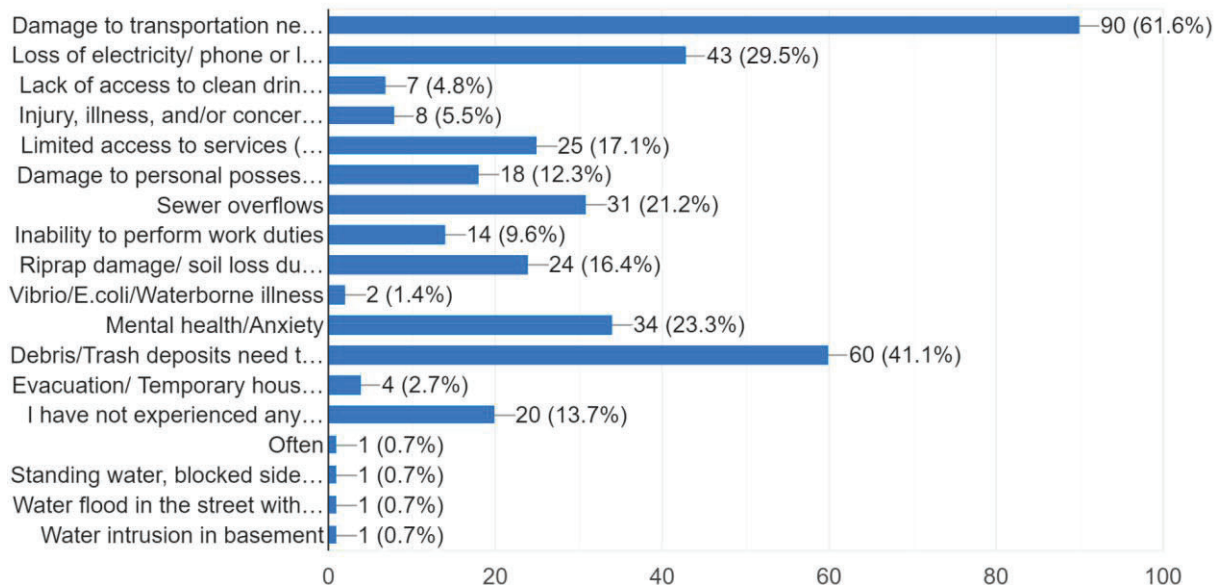
What type of property damage have you experienced resulting from a flood event? (select all that apply)

146 responses



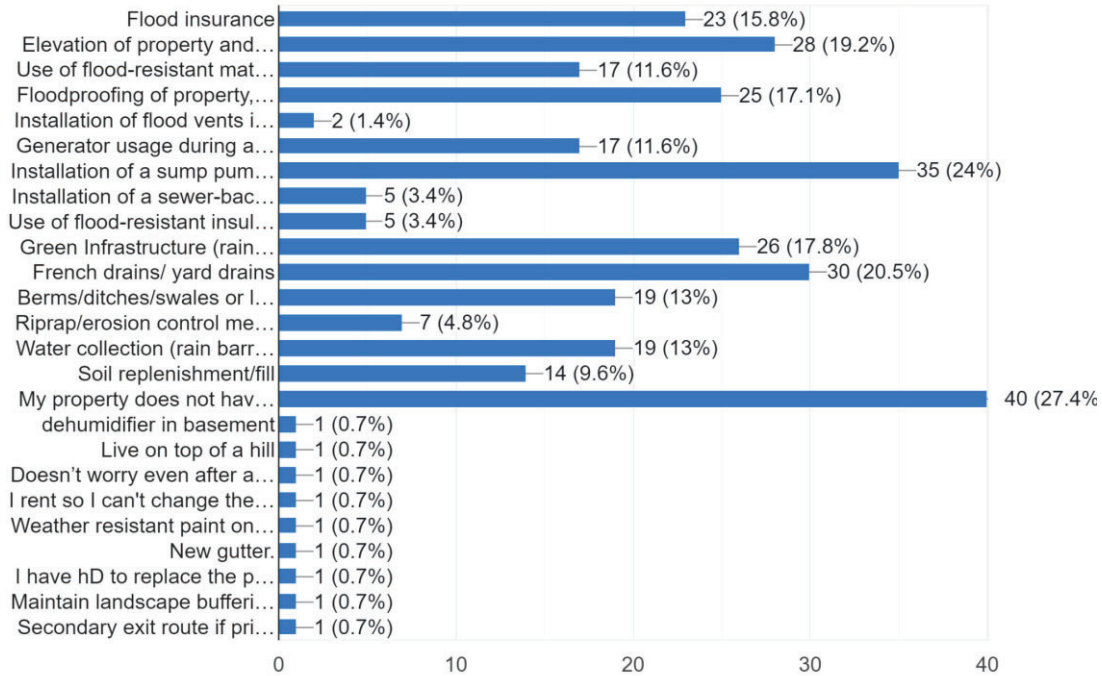
What type of negative impacts have you experienced resulting from a flood event? (select all that apply)

146 responses



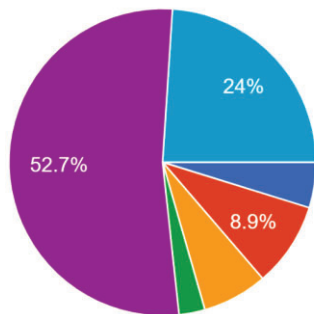
Do you currently have any prevention or mitigation measures in place on your property(ies)? (select all that apply)

146 responses



Have you ever considered moving to another location (inside or outside the City of Roanoke) to avoid future flood losses, impacts, or damage?

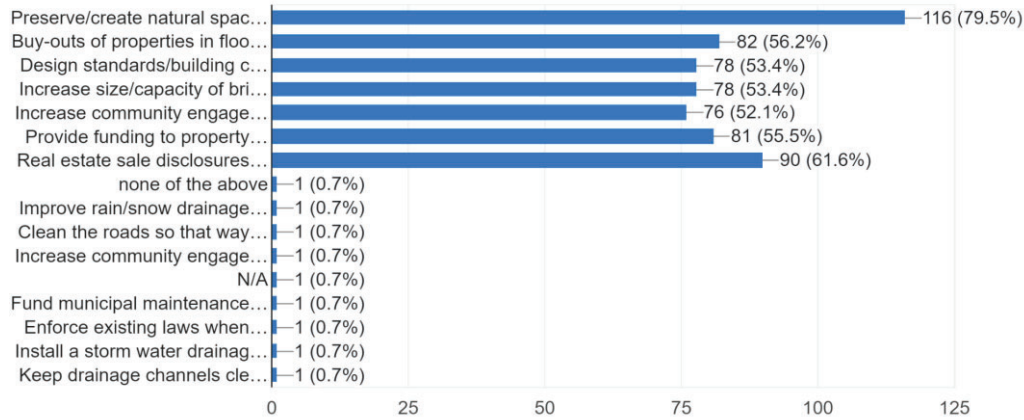
146 responses



- Yes - I am looking at buying/renting at a new location in the near future.
- Yes - I am considering buying/renting if flood events become more frequent.
- Yes - I have considered relocating but there are conditions that prevent me fr...
- No - I have considered leaving but I have nowhere else to go.
- No - I do not want to leave my current...
- No - My property never floods so it is...

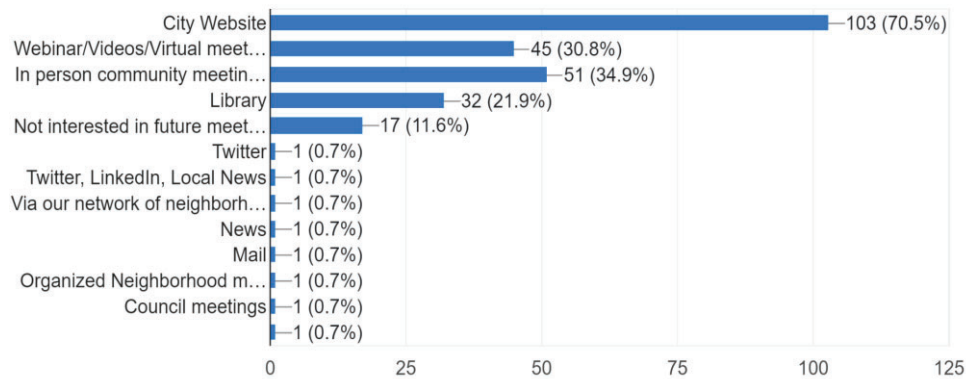
Do you believe any of the project types listed below would provide benefits to your community?  
(select all that apply)

146 responses



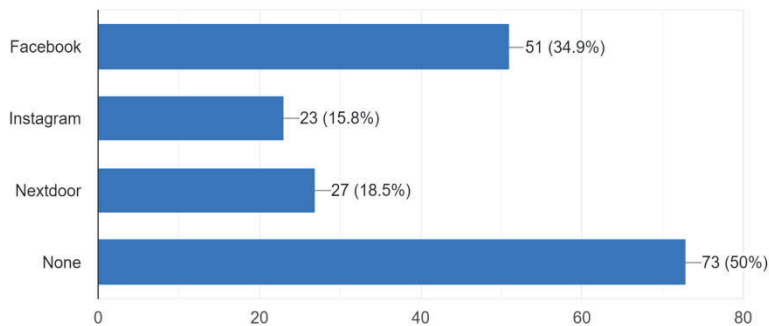
Other communication options for follow up (select all that apply)

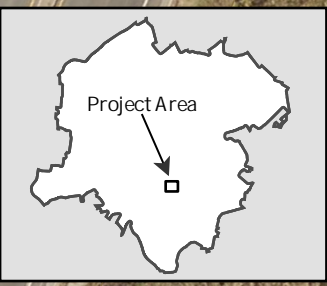
146 responses



Social Media, select which social media platform you prefer for updates or select none.

146 responses





Rebuild storm drain using vegetated swales

Stabilize and restore stream banks and floodplain with native trees and riparian grasses

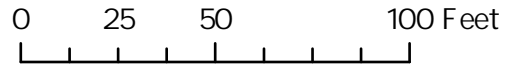
Proposed floodplain bench: +4.2 acre-ft flood storage

Realign channel and grade cross section based on natural channel design principles

- Large Deciduous Tree
- Small Deciduous Tree
- Shrub
- Ore Branch
- Streamside
- Riparian Seeding
- Native Meadow Seeding
- Mowed Access Path
- Vegetated Swale

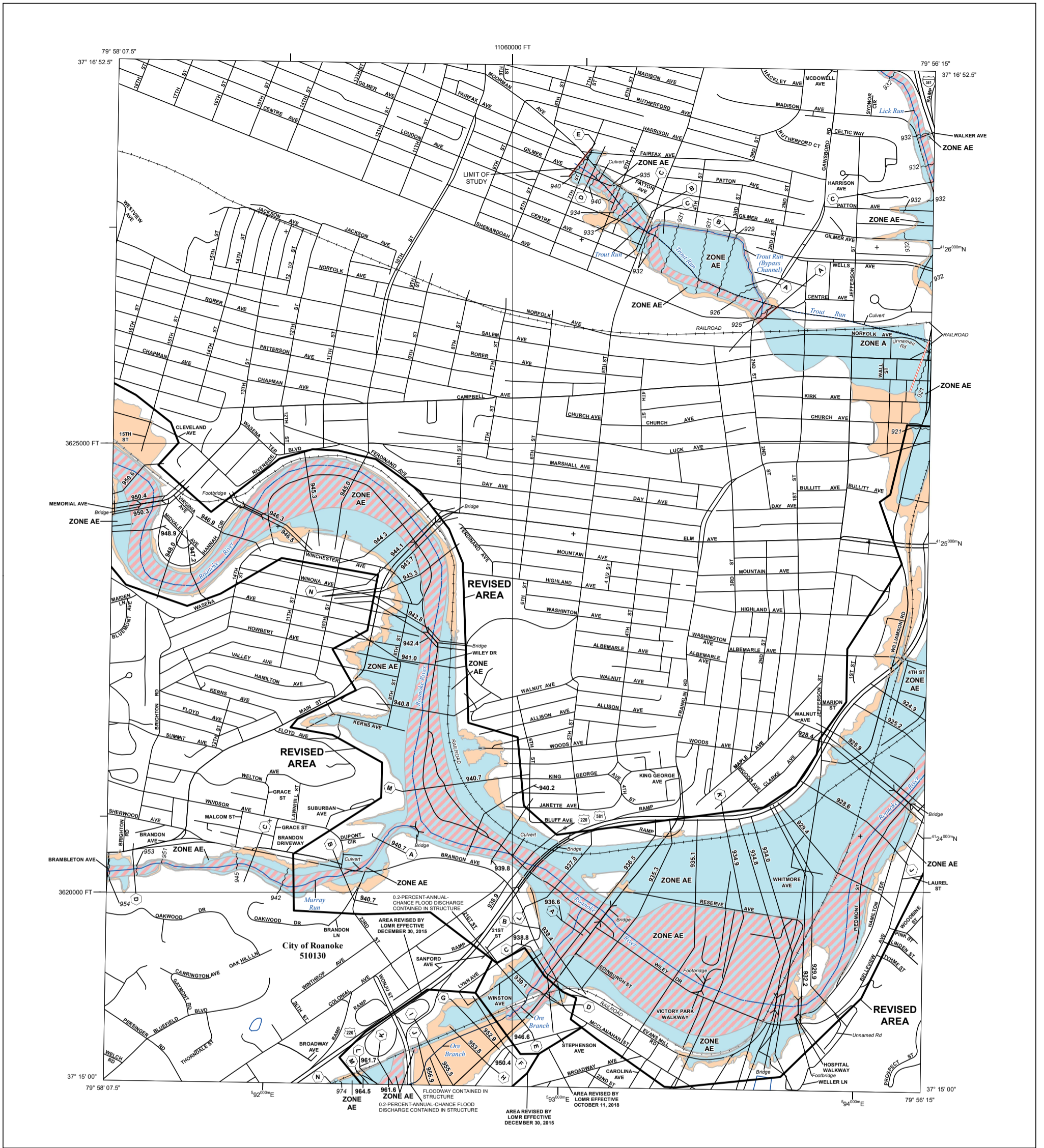
Project Area

Franklin Rd SW



Ore Branch Stream and Floodplain Restoration  
Proposed Project Map  
November, 2023





**FLOOD HAZARD INFORMATION**

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP  
 THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT [HTTP://MSC.FEMA.GOV](http://MSC.FEMA.GOV)

<b>SPECIAL FLOOD HAZARD AREAS</b>	Without Base Flood Elevation (BFE) Zone A, V, A99
	With BFE or Depth Zone AE, AO, AH, VE, AR
	Regulatory Floodway
<b>OTHER AREAS OF FLOOD HAZARD</b>	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
<b>OTHER AREAS</b>	NO SCREEN
	Areas Determined to be Outside the 0.2% Annual Chance Floodplain Zone X
	Area of Undetermined Flood Hazard Zone D
<b>GENERAL STRUCTURES</b>	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
<b>OTHER FEATURES</b>	Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

**NOTES TO USERS**

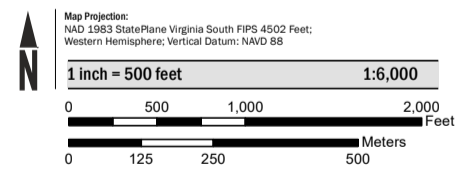
For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Mapping 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.

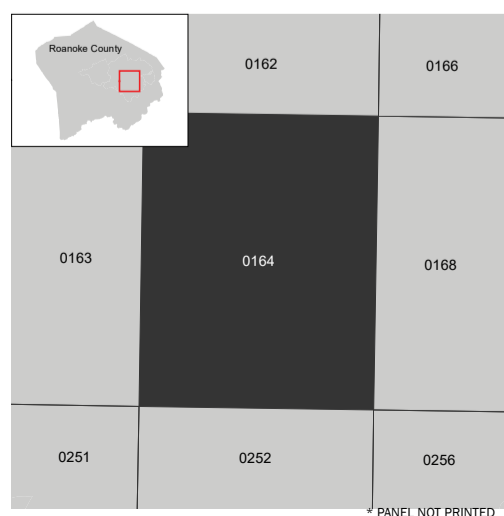
For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction. To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by Roanoke County. Road features shown on this FIRM have been updated using the 2022 TIGER/Line Shapefiles from the U.S. Census Bureau.

**SCALE**



**PANEL LOCATOR**



**NATIONAL FLOOD INSURANCE PROGRAM FLOOD INSURANCE RATE MAP**

ROANOKE COUNTY, VIRGINIA and Incorporated Areas  
 PANEL 164 of 310

COMMUNITY	NUMBER	PANEL	SUFFIX
ROANOKE, CITY OF	510130	0164	G

REVISED TO REFLECT LOMR EFFECTIVE: December 22, 2023

From Franklin Rd. Facing NW



• Holiday Inn at Franklin Road, S.W.



Office of City Engineer – November 1985



ABC13 – WSET – 5/22/2020 - <https://wset.com/news/local/evacuees-describe-being-rescued-from-a-hotel-in-roanoke>



Staff photo – November 7, 2022



Staff photo – March 24, 2023



Staff photo – June 29, 2023

From Franklin Rd. Facing W



WSLS.com

## ARCH HELPS PEOPLE EVACUATED FROM HOTEL IN FLOOD ROANOKE

WSLS10– 5/26/2020 - <https://www.wsls.com/news/local/2020/05/27/homeless-settle-into-new-hotels-after-being-evacuated-from-roanoke-hotel-during-flooding/>



Staff photo – November 7, 2022





Staff photo – March 24, 2023



Staff photo – June 29, 2023

From bridge facing US



Staff photo – Nov 12, 2020 – 11:22 AM



Staff photo - June 29, 2023

From George's Florist facing N



Staff photo – May 21, 2020



Staff photo - June 29, 2023





Staff photo – May 21, 2020



Staff photo – June 29, 2023

From Franklin Rd. facing W

• Holiday Inn at Franklin Road, S.W.



Office of City Engineer – November 1985



Staff Photo – June 29, 2023

## WebGrants Portal -> Scope of Work Document Crosswalk

Table provides a crosswalk between the WebGrants portal and the City's submitted Scope of Work narrative document

**Tab 5 - Scope of Work - Projects**

Order on Grants Portal	Item	Scope of Work Narrative Sections
1	Budget Narrative	5, Appendix B

**Tab 6 - Scope of Work Supporting Information - Projects**

Order on Grants Portal	Item	Scope of Work Narrative Sections
1	Population	4.1.a.
2	Historic Flooding data and Hydrologic Studies	4.1.b.
3	No Adverse Impact	4.1.c.
4	Ability to Provide Share of Cost	4.1.d.
5	Benefit-Cost Analysis	3.2; 3.4; 4.1.e
6	Repetitive Loss and or Severe Repetitive Loss Properties	4.1.g.i.
7	Residential and/or Commercial Structures	4.1.g.ii.
8	Critical Facilities/Infrastructure	4.1.g.iii.
9	Financial and Staff Resources	4.1.d, 4.2.a
10	Goals and Objectives	3.2
11	Approach Milestones and Deliverables	3.3
12	Relationship to Other Projects	4.6
13	Maintenance Plan	4.7
14	Criteria	4.8, Table 3

**Tab 10 - Supporting Documentation**

Order on Grants Portal	Item	Scope of Work Narrative Sections
1	Detailed map of the project area(s) (Projects/Studies)	Appendix C.1
2	FIRMette of the project area(s) (Projects/Studies)	Appendix C.2
3	Historic flood damage data and/or images (Projects/Studies)	Appendix D, Section 4.1.b.
4	A link to or a copy of the current floodplain ordinance	Appendix C.4
5	Maintenance and management plan for project	Section 4.7
6	A link to or a copy of the current hazard mitigation plan	Appendix C.6
7	A link to or a copy of the current comprehensive plan	Appendix C.7
8	Social vulnerability index score(s) for the project area	Section 4.2.b
9	Authorization to request funding from the Fund from governing body or chief executive of the local government	Appendix C.13
10	Signed pledge agreement from each contributing organization	Appendix A
11	Maintenance Plan	Section 4.7
12	Benefit Cost Analysis	Section 4.1.e.
13	Other Relevant Attachments	Appendix D-G

## WebGrants Portal -> Scope of Work Document Crosswalk

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9	Financial and Staff Resources	4.1.d, 4.2.a
10	Goals and Objectives	3.2
11	Approach Milestones and Deliverables	3.3
12	Relationship to Other Projects	4.6
13	Maintenance Plan	4.7
14	Criteria	4.8, Table 3

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12	Benefit Cost Analysis	Section 4.1.e.
13	Other Relevant Attachments	Appendix D-G



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IN THE COUNCIL OF THE CITY OF ROANOKE, VIRGINIA

The 16<sup>th</sup> day of October 2023.

No. 42806-101623.

A RESOLUTION authorizing the City Manager or his designee to submit an application to the Department of Conservation and Recreation (“DCR”) for grant funding under the Community Flood Preparedness Fund; and authorizing the City Manager or his designee to take such further actions and execute such further documents as may be necessary in connection with this application and grant funding.

BE IT RESOLVED by the Council of the City of Roanoke as follows:

1. City Council hereby authorizes the City Manager or his designee to submit an application to the DCR for Community Flood Preparedness Fund grant funding, such funding to be used to help communities reduce the impacts of flooding, for the 1<sup>st</sup> Street and Salem Drainage Improvements Project and the Ore Branch Restoration Project, all as more particularly described in the City Council Agenda Report dated October 16, 2023, with such application being approved as to form by the City Attorney.

2. The City Manager or his designee is further authorized to take any such further actions and execute such further documents, approved as to form by the City Attorney, as may be necessary to submit the above application to the DCR and to furnish such additional information as may be required for such application.

ATTEST:

*Cecelia J. McCoy*

City Clerk.

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DCR CFPF Grant Application  
One Branch Stream and Landscape  
Restoration

Total Cost: \$996,440.00

Proposed DCR 95% / City 5%

Due Nov 12, 2023

Applicants must have prior approval from the Department  
supporting documents by mail in lieu of the WebGrants po

## Appendix A: Application Form for Grant All Categories

Virginia Department of Conservation and Recreation  
Virginia Community Flood Preparedness Fund Grant Program

Name of Local Government: City of Roanoke, Virginia

Category Being Applied for (check one):

Capacity Building/Planning

Project

Study

NFIP/DCR Community Identification Number (CID) 510130

Name of Authorized Official and Title: Robert S. Cowell, Jr.; City Manager

Signature of Authorized Official: 

Mailing Address (1): 215 Church Ave SW

Mailing Address (2): \_\_\_\_\_

City: Roanoke State: VA Zip: 24011

Telephone Number: (540) 853-2333 Cell Phone Number: (    ) \_\_\_\_\_

Email Address: bob.cowell@roanokeva.gov

Contact and Title (If different from authorized official): Marcus F. Aguilar; Civil Engineer II

**Mailing Address (1):** 1802 Courtland Rd. NE

**Mailing Address (2):** \_\_\_\_\_

**City:** Roanoke **State:** VA **Zip:** 24012

**Telephone Number:** (\_\_\_\_) \_\_\_\_\_ **Cell Phone Number:** (540) 580-7209

**Email Address:** marcus.aguilar@roanokeva.gov

Is the proposal in this application intended to benefit a low-income geographic area as defined in the Part 1 Definitions? Yes X No \_\_\_\_\_

**Categories (select applicable activities that will be included in the project and used for scoring criterion):**

**Capacity Building and Planning Grants**

- Floodplain Staff Capacity.
- Resilience Plan Development
  - Revisions to existing resilience plans and modifications to existing comprehensive and hazard mitigation plans.
  - Resource assessments, planning, strategies, and development.
    - Policy management and/or development.
    - Stakeholder engagement and strategies.
- Other: \_\_\_\_\_

**Study Grants (Check All that Apply)**

- Studies to aid in updating floodplain ordinances to maintain compliance with the NFIP, or to incorporate higher standards that may reduce the risk of flood damage. This must include establishing processes for implementing the ordinance, including but not limited to, permitting, record retention, violations, and variances. This may include revising a floodplain ordinance when the community is getting new Flood Insurance Rate Maps (FIRMs), updating a floodplain ordinance to include floodplain setbacks, freeboard, or other



higher standards, RiskMAP public noticing requirements, or correcting issues identified in a Corrective Action Plan.

- Revising other land use ordinances to incorporate flood protection and mitigation goals, standards, and practices.
- Conducting hydrologic and hydraulic (H&H) studies of floodplains. *Changes to the base flood, as demonstrated by the H&H must be submitted to FEMA within 6 months of the data becoming available.*
- Studies and Data Collection of Statewide and Regional Significance.
- Revisions to existing resilience plans and modifications to existing comprehensive and hazard.
- Other relevant flood prevention and protection project or study.

**Project Grants and Loans (Check All that Apply – Hybrid Solutions will include items from both the “Nature-Based” and “Other” categories)**

**Nature-based solutions**

- Acquisition of property (or interests therein) and/or structures for purposes of allowing floodwater inundation, strategic retreat of existing land uses from areas vulnerable to flooding; the conservation or enhancement of natural flood resilience resources; or acquisition of structures, provided the acquired property will be protected in perpetuity from further development, and where the flood mitigation benefits will be achieved as a part of the same project as the property acquisition.
- Wetland restoration.
- Floodplain restoration.
- Construction of swales and settling ponds.
- Living shorelines and vegetated buffers.
- Permanent conservation of undeveloped lands identified as having flood resilience value by *ConserveVirginia* Floodplain and Flooding Resilience layer or a similar data driven analytic tool, or the acquisition of developed land for future conservation.
- Dam removal.
- Stream bank restoration or stabilization.
- Restoration of floodplains to natural and beneficial function.

**Other Projects**

- Structural floodwalls, levees, berms, flood gates, structural conveyances.
- Storm water system upgrades.
- Medium and large-scale Low Impact Development (LID) in urban areas.

- Developing flood warning and response systems, which may include gauge installation, to notify residents of potential emergency flooding events.
- Dam restoration.
- Beneficial reuse of dredge materials for flood mitigation purposes
- Removal or relocation of structures from flood-prone areas where the land will not be returned to open space.
- Acquisition of property (or interests therein) and/or structures for purposes of allowing floodwater inundation, strategic retreat of existing land uses from areas vulnerable to flooding; the conservation or enhancement of natural flood resilience resources; or acquisition of structures, provided the acquired property will be protected in perpetuity from further development, and where the flood mitigation benefits will **not be** achieved as a part of the same project as the property acquisition.
- Other project identified in a DCR-approved Resilience Plan.

**Location of Project or Activity (Include Maps):** Roanoke City, Virginia (see attached Map)

**NFIP Community Identification Number (CID#):** 510130

**Is Project Located in an NFIP Participating Community?**  Yes  No

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

**Flood Zone(s) (If Applicable):** Zone AE - Floodway

**Flood Insurance Rate Map Number(s) (If Applicable):** 51161C0164G

**Total Cost of Project:** \$996,448.08

**Total Amount Requested** \$946,625.68

**Amount Requested as Grant** \$946,625.68

**Amount Requested as Project Loan (not including short-term loans for up-front costs)**  
\$0

Amount Requested as Short-Term loan for Up-Front Costs (not to exceed 20% of amount requested as Grant) \_\_\_\_\_ \$0 \_\_\_\_\_

For projects, planning, capacity building, and studies in low-income geographic areas: Are you requesting that match be waived?  Yes  No

**Additional Information for Loan Requests**

**Requested Loan Security:** \_\_\_\_\_

(General Obligation, Lease, Revenue, Special Fund Revenue, and/or Moral obligation from other government entity)

**Desired loan term:** \_\_\_\_\_

**Since the date of your latest financial statements, did the applicant issue any new debt?** \_\_\_\_\_  
(If yes, provide details)

**Is there any pending or potential litigation by or against the applicant?** \_\_\_\_\_

**Attach five years of current annual financial statements (FY18-22) or refer to website if posted**  
(Not necessary for existing VRA borrowers) Not Applicable

**Attach FY2024 adopted budget or refer to website**

**Attach current Capital Improvement Plan**

**Attach adopted Financial Policies**

**Attach a list of the ten largest employers in the Applicant's jurisdiction.**

**Attach a list of the ten largest taxpayers in the Applicant's jurisdiction**

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**CITY OF ROANOKE, VIRGINIA  
ORE BRANCH STREAM AND FLOODPLAIN RESTORATION**

CID510130\_RoanokeCity\_CFPF-1



**Grant Application Submitted to:**

Virginia Department of Conservation and Recreation

Community Flood Preparedness Fund

November 12, 2023

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**Cover Photo** shows the floodprone hotel and conference center at the project site that was demolished in 2022 (top left), the site in its existing condition (right) and an example of what the site would look like following the proposed stream restoration project in this grant application (bottom, Washington Park Stream Restoration, City of Roanoke, Virginia)

## **1. INTRODUCTION**

In this grant proposal, the City of Roanoke, Virginia requests funding from the Department of Conservation and Recreation's (DCR's) Community Flood Preparedness Fund (CFPF) in support of a proposed stream and floodplain restoration project on Ore Branch, a flood prone stream in Roanoke City, Virginia. The scope of this project includes restoration of the stream using natural channel design principles, excavation of a 4.2 ac-ft. floodplain bench, uncapping several existing storm drain pipes, and replanting the entire 2.4 acre site with native grasses, trees and pollinator meadow. This project will provide significant flood risk reduction benefits to the surrounding area, will improve water quality and will provide an opportunity for flood-related education and passive recreation for the community. This project is submitted as a nature based solution, and as such the City is requesting 95% DCR CFPF funding for the full delivery project cost of \$996,448.08. This project will be managed by the City's Stormwater Division, and we anticipate that this project will be a significant contribution to our goal of transforming the Roanoke River and its tributaries into community assets, focal points, and sources of pride for those that live, work, learn and play in its watershed.

This proposal is organized using the same hierarchy as DCR's Round 4 CFPF grant manual for ease of review. The content in this document mirrors that in the WebGrants Portal, but allows for more robust narrative, tables, figures and appendices.

## **2. ORGANIZATIONAL INFORMATION**

See Appendix A – Project Application Form

## **3. SCOPE OF WORK NARRATIVE**

The narrative provided in this section provides the information requested in Part IV.B. Scope of Work Narrative in the Round 4 CFPF Manual.

### **3.1 NEEDS AND PROBLEMS**

Ore Branch is a small stream in the southern part of the City of Roanoke with a highly developed watershed (3.8 sq. mi., 30% impervious cover), whose drainage begins on the western face of Mill Mountain and flows generally north along the US-220 corridor, then through south Roanoke before draining into the Roanoke River. Intense rainfall has caused repeated flooding along Ore Branch – and in particular in the downstream-most stream mile where the stream flattens before it converges with the Roanoke River. Flooding along Ore Branch is caused by three factors: (1) the significant amount of development in the watershed; (2) the almost complete lack of floodplain storage capacity along the waterway and (3) backwater from the Roanoke River preventing Ore Branch from draining under certain larger-scale storms (i.e. tropical storm systems). This flooding impacts 20 structures within Ore Branch's regulatory Floodway; 48 structures within the Zone AE 1% floodplain; the intersection of Franklin Rd. SW and Brandon Ave. SW [average daily traffic (ADT) between 8,300 - 20,000 vehicles per day (VPD)]; and the Roanoke River Greenway/Wiley Drive (ADT 1,000 pedestrians per day, 350 VPD).

In addition to the flood impacts along Ore Branch, the waterway is also subject to water quality issues. Ore Branch's benthic macroinvertebrate community is severely impaired as evidenced by a median

Virginia Stream Condition Index (VSCI) of 39<sup>1</sup> as compared to The Virginia Department of Environmental Quality's (DEQ's) threshold for aquatic life impairment of 60. This indicates that the stream is not functioning correctly – this score is in lowest ~5% of all Virginia streams from an ecological standpoint. This poor function is most likely due to (1) a lack of habitat for aquatic species within/adjacent to the stream; (2) the increased energy of flood flows from the lack of floodplain access and (3) a lack of organic material (e.g. wood, leaves, etc.) input from the watershed. In its current state, Ore Branch is a net liability with respect to achieving aquatic life water quality standards on the Roanoke River in accordance with the DEQ's Total Maximum Daily Load Implementation (TMDL) Implementation Plan.

### **3.2 GOALS AND OBJECTIVES**

The City's long range strategic objective for Ore Branch, the Roanoke River and the remainder of the City's waterways is to reduce flood risk and improve water quality. Progress towards these goals began on Ore Branch in 2022 with the City's acquisition and demolition of a highly flood prone hotel and conference center on a 2.4 acre site (Figure 1A), which set the stage for the proposed stream and floodplain restoration in this grant proposal. The acquisition and demolition was a \$4.8M project funded by FEMA's Pre-Disaster Mitigation (PDM) grant program, and was completed in late 2022 (Figure 1B). While the PDM project mitigated the on-site flood risk, it did not materially reduce flood risk for surrounding structures and infrastructure nor did it improve water quality.

As such, the proposed project in this grant application continues the significant but still incomplete work of the acquisition/demolition project at this site by de-culverting and re-opening the existing channel and by excavating the floodplain bench on either side of the stream to provide an additional 4.2 acre-ft. of floodplain storage (Appendix C.1 and Appendix E). The channel and floodplain bench will then be re-naturalized with native riparian grasses and trees which will diffuse flood flows, improve ecological function, stabilize the site and provide a space for passive recreation. In addition, several undersized storm drain pipes will be removed and replaced with natural vegetated swales. The proposed "flood sponge" at this site will lower flood depths at and upstream of the site, thereby reducing flood risk for the numerous surrounding flood prone structures and roadways previously described. The stream restoration, which will be based on Natural Channel Design principles will also reduce erosive flows to the Roanoke River and improve the conditions for a thriving aquatic ecosystem in accordance with the DEQ's TMDL Implementation Plan.

The final objective of this project is to improve the public's understanding of nature-based flood resilience by providing passive recreational opportunities on a site that applies these principles in a functional and attractive fashion. Educational signage will be installed that describes the City's principles of flood resilience, explains how they were applied to this site, and shows before (flooded hotel and conference center) and after (restored stream and floodplain) photographs (see example, Appendix F). This educational messaging has two purposes: (1) build community support for similar flood resilience efforts implemented by the City; and (2) encourage residents and business owners to take similar actions as flood resilience partners since the City has finite resources to apply towards flood resilience projects.

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<sup>1</sup> Median based on nine samples collected between 2019 and 2023





**(A) Pre Demolition – Aug 17, 2022**



**(B) Post Demolition – June 29, 2023**

**Figure 1 – Project site (A) prior to demolition of hotel and conference center; (B) after demolition was completed (i.e. existing conditions)**

### 3.3 WORK PLAN

In order to execute the proposed work in a timely fashion, a proposed plan of work is provided in Table 1; this table assumes a grant award of January 2024 with a three year period of performance ending in January 2027. Note that right-of-way acquisition is not included in the work plan, as the proposed work will all take place on an existing City-owned property and the project therefore will not require any acquisition of right-of-way.

**Table 1 – Proposed project work plan for Ore Branch Stream and Floodplain Restoration. WSSI = Wetland Studies and Solutions Inc.**

Task	Description	Resp. Party	Begin Date	End Date	% Complete	Deliverables
01 - Public Engagement	Develop, administer, analyze public survey	City	8/1/2022	11/3/2022	100%	Reimagining the Ramada Community Survey Report
02 –Eng./ Landscape Design	Develop stream/ floodplain restoration and landscape plan	WSSI	1/9/2023	8/31/2024	95%	Final Design Plans and Specifications
03 – Permitting	Prepare, submit, acquire necessary Local, State, Federal permits	WSSI	9/1/2023	8/31/2024	25%	Approved Permit Documentation
04 – Contractor Procurement	Invitation to Bid, Contract Negotiation, Execution	City	8/31/2024	9/30/2024	0%	Executed Construction Contract
05 - Construction	Mobilize, Build, Complete, Document project	City/ Contractor	10/15/2024	12/14/2024	0%	Weekly Reports and Photographs
06 - Post-Construction	Grant Closeout, Monitoring, Invasive Species Mgmt.	City	12/14/2024	2/12/2025	0%	As-Built Drawings, Final Photos; Final Accept Letter; O&M Reports

Public engagement for the proposed project began in August 2022 when the former hotel and conference center had been demolished, providing a “clean slate” for the public to visualize potential ideas. The public input survey was completed and analyzed in November 2022 (attached in Appendix G), and the results directed the work proposed in this grant application. Once public engagement was complete, the City engaged Wetland Studies and Solutions Inc. (WSSI) to provide the engineering design for the stream and floodplain restoration and a landscaping plan for the site (attached in Appendix E), and to develop, submit and acquire all necessary permits. At the time of this grant submittal, the design plans are at approximately 95% complete, and the permitting process has been started. It is estimated that all permits

will be acquired by August 2024, though this is subject to the permitting agencies – note that the proposed work plan allows for permit delays while still completing the project well within the three-year period of performance.

With respect to long-term maintenance of the project, the City’s Stormwater Division will be responsible for periodic invasive species management, repair of any in-stream features, annual bush-hogging where prescribed, and selective mowing and string-trimming to assure public utility. Based on similar stream/floodplain restoration projects performed elsewhere in the City, it is anticipated that the maintenance load will be largest in the first year after the project is completed, but will diminish over time as the ecosystem becomes fully established. As stream restoration projects are constructed with dynamic, natural materials, the lifespan of these types of projects is at least 50 years though conceivably much longer.

### **3.4 EVALUATION**

The principal and most immediate indicator of success for this project is the successful provision of 4.2 acre-ft. of additional floodplain storage capacity and the successful establishment of stream and floodplain plantings as proposed by the 95% design plans (Appendix E). In order to assure that the project meets the requirements of the grant agreements, City staff will perform bi-weekly meetings with the design consultant (WSSI) and weekly inspection of construction phase activity. Construction phase management will also be supported by WSSI.

Once the project is complete, the next indicator of success is a reduced frequency and severity of flooding in the area immediately adjacent to the project site. This includes the following public rights-of-way:

- Roanoke River Greenway near Franklin Rd. bridge
- Wiley Dr. SW near Franklin Rd. bridge
- Franklin Rd. SW near Edinburgh St. SW
- Brandon Ave. SW west of Franklin Rd. SW

It is anticipated that reduced frequency and severity of flooding would prevent lost time due to flood-related road closures for the 1,000 – 20,000 vehicles and/or pedestrians per day that use these roads and Greenway. In addition, it is also anticipated that implementation of the proposed project would reduce flood frequency and severity at the following private properties:

- 1911 Franklin Rd. SW
- 1917 Franklin Rd. SW
- 1941 Franklin Rd. SW
- 1942 Franklin Rd. SW
- 1953 Franklin Rd. SW
- 2001 Franklin Rd. SW
- 2008 Winston Ave. SW

These outcomes can be measured by documenting storm event rainfall severity (i.e. rainfall recurrence interval in years) using the City’s rain gage network, and the corresponding flood impacts (if any) related to the storm events.

This project is taking place in U.S. Census Block 3003 in Roanoke City (Block ID 517700030003003) with a total area of the Block of 8.69 acres. While the total project footprint is 2.4 acres, it is anticipated

that flood mitigation benefits will be realized at all of the properties listed above, totaling 9.18 acres of project impact (i.e. greater than one Census Block).

## **4. SUPPORTING DOCUMENTS FOR PROJECT APPLICATIONS**

### **4.1 PROJECT INFORMATION**

The following subsections provide information requested on PDF p.28/50 of the CFPF Round 4 Grant Manual and mirrors the “Scope of Work Supporting Information – Projects” tab in the WebGrants portal.

- a. Population – Provide population data for the local government in which the project is taking place, including identification of any low-income geographic area and the estimated number of residents that will be impacted by this project.**

The US Census Bureau’s estimated population of the City of Roanoke was 97,847 as of July 2022. While it is difficult to estimate the population benefiting from this project, we estimate that the flood risk reduction realized by this project will benefit users of the roadways, greenways and nearby business operations enumerated in Section 3.4. As this proposed project site is adjacent to the City’s most-used section of Greenway (~1,000 pedestrians per day), it is also anticipated that the site will provide significant passive recreational benefits.

The median household income of City of Roanoke is \$48,476 while the median household income of Virginia is \$80,615 (both from 2020 U.S. Census); the City’s median income is 60.1% of the statewide median, designating the City as a “Low-income geographic area” as per the DCR definition.

- b. Historic flooding data and hydrologic studies projecting flood frequency – 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.**

Based on a Letter of Map Revision (LOMR) for the Roanoke River that was approved by FEMA on August 2, 2023 nearly the entirety of the project site is located in the regulatory Floodway, and the remainder of the site is encompassed by Zone AE 1% Annual Chance floodplain. Flooding at the site can be caused by intense rainfall over the Ore Branch watershed (i.e. pluvial driven), protracted rainfall over the much larger Roanoke River basin (i.e. fluvial driven) or a combination of the two. Hydraulic modeling by WSSI for the design of this project suggest that the site begins to flood at approximately the 10% annual chance flood along Ore Branch and modeling by a separate consultant for the Roanoke River LOMR suggest that the larger Roanoke River can also cause the site to flood at the 10% annual chance flood. Adjacent roadways and structures begin to see flooding at a slightly larger recurrence interval, between the 10-25% annual chance floods. Research performed as part of the PDM grant application identified fourteen records of flooding at the subject property and the surrounding area since 1985 (Table 2), though this information was limited to insurance claims and may not completely capture the flood history of this property. A number of historical flooding photographs of the site are provided in Appendix D

**Table 2 – Dates of known historical flood events at the subject property with insurance claim information where available. Note that this list only contains flood events with a corresponding insurance claim, and may therefore not comprise a complete flood history.**

<b>Date</b>	<b>Loss</b>	<b>Description</b>
November 4, 1985	Not available	Election day flood of 1985
April 21, 1992	\$7,477.60	Upstream from site at Franklin/Wonju intersection
May 15, 2003	\$182,191.00	Former Ramada buildings A&B (1927 Franklin Rd)
August 1, 2004	\$43,355.30	Former Ramada building A (1927 Franklin Rd)
September 4, 2004	\$110,171.00	Former Ramada buildings A&B (1927 Franklin Rd) and Franklin/Wonju intersection
September 28, 2004	\$291,834.00	Former Ramada buildings A&B (1927 Franklin Rd)
June 6, 2005	\$36,214.00	Former Ramada building B (1927 Franklin Rd)
June 27, 2005	\$29,287.50	Former Ramada building A (1927 Franklin Rd)
June 26, 2006	\$70,606.40	Former Ramada buildings A&B (1927 Franklin Rd)
July 23, 2009	\$58,655.80	Former Ramada building B (1927 Franklin Rd)
April 16, 2011	\$1,796.91	Former Ramada building B (1927 Franklin Rd)
July 30, 2011	\$5,046.77	Former Ramada building A (1927 Franklin Rd)
September 11, 2018	\$176,229.00	Former Ramada buildings A&B (1927 Franklin Rd)
October 11, 2018	\$138,941.00	Former Ramada buildings A&B (1927 Franklin Rd)

**c. No adverse impact – Studies, data, reports must demonstrate proposed project minimizes flood vulnerabilities and does not create flooding or increased flooding (adverse impact) to other properties.**

As part of the design work for this project WSSI is performing hydraulic modeling to demonstrate no net rise in 1% annual chance water surface elevations resulting from this project. A draft version of this analysis is provided in Appendix E (Sheet 13, “V. Floodplain Analysis” and Sheets 14-15) and will be submitted for approval to the City’s Floodplain Administrator.

**d. The ability of the local government to provide its share of the cost – 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.**

The total proposed project cost as outlined in Section 5 and Appendix B is \$996,448.08; as the proposed project incorporates nature based solutions and as the City is a low-income community, it is anticipated that the match for this project would be 95% DCR/5% City. This would require a commitment of \$49,822.40 by the City, though a portion of this has already been encumbered for the pre-award design and permitting work by WSSI. As such, the total additional commitment needed from the City would be \$40,200.00 which would be appropriated out of the City’s FY2025 general obligation bond issuance on July 1, 2024. In FY2025, it is anticipated that the Stormwater Division’s component of the bond issuance will be \$3M, of which this project would only require a small portion. This project is identified in the Stormwater Division’s capital improvement program, further demonstrating the City’s commitment to funding this project.

- e. **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. (<https://www.fema.gov/grants/tools/benefit-cost-analysis>)**

As the proposed project cost is less than \$2M, no FEMA benefit-cost analysis is provided. Instead, narrative of project benefits are provided in Section 3.2, and metrics for evaluation of these benefits is provided in Section 3.4.

- f. **The administration of local floodplain management regulations – The Department will determine if the community is in good standing with the NFIP. If applicable, provide the Department with a link to the current floodplain ordinance, or attach a PDF or Word document of the ordinance.**

The City's Floodplain Regulations are included in the City's Zoning Ordinance - City Code Sec. 36.2-333 – Floodplain Overlay District (F), and a direct hyperlink to the ordinance is below: [https://library.municode.com/va/roanoke/codes/code\\_of\\_ordinances?nodeId=CORO1979\\_CH36\\_2ZO\\_ART3RESPZODI\\_DIV5OVDI\\_S36.2-333FLOVDIF](https://library.municode.com/va/roanoke/codes/code_of_ordinances?nodeId=CORO1979_CH36_2ZO_ART3RESPZODI_DIV5OVDI_S36.2-333FLOVDIF)

- g. **Other Necessary Information to Establish Project Priority:**

- i. **Repetitive Loss and/or Severe Repetitive Loss Properties - Do not provide the addresses for these properties but include an exact number of repetitive loss and/or severe repetitive loss structures within the project area. Work with the local floodplain administrator or emergency manager to find this information. If they do not have a list of repetitive loss/severe repetitive loss structures, the Department can assist them in accessing these lists for NFIP insured structures. Please note, that repetitive loss and/or severe repetitive loss often occurs outside of the SFHA and to properties not captured in NFIP reporting. All flooding involving these properties should be tracked and addressed by the community.**

No repetitive loss (RL) or severe repetitive loss (SRL) properties are within or adjacent to the project site. There are several RL properties upstream of this location that may realize some minor risk mitigation benefits from the proposed project.

Over time, it is anticipated that the City will continue to implement projects in the Ore Branch watershed consistent with currently identified capital projects and ongoing implementation of our Flood Resilience Plan. These projects would build on the improvements of this project and improve overall flood resilience in the watershed.

- ii. **Residential and/or Commercial Structures - 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. (250 Words)** Proposed project will provide benefits to a number of structures as defined in Section 3.1, but will not otherwise impact any existing structures (i.e. no right-of-way acquisition or modifications to existing structures are proposed). This site formerly contained a highly

flood prone hotel and conference center that was acquired by the City and demolished in 2022 under a FEMA pre-disaster mitigation grant.

**iii. Critical Facilities/Infrastructure - If there are critical facilities/infrastructure within the project area, describe each facility. (250 Words)**

No critical facilities/infrastructure within project area

#### **4.2 NEED FOR ASSISTANCE**

Identify and describe any relevant issues or problems that will be addressed by the project.

**a. Explain the local government’s financial and staff resources. Identify relevant staff members (floodplain administrators, planners, emergency managers, building officials, engineers) employed with the local government. Identify relevant software the local government has access to. Explain the local government’s capabilities. (250 Words)**

The City of Roanoke Stormwater Division has a backlog of approximately \$150M in neighborhood drainage projects, \$90M in downtown flooding projects and \$150M in water quality projects. By comparison, the City’s annual bond issuance for Stormwater projects is typically \$3M supplemented with \$0.5M in cash revenue. As such, it is imperative that the City leverage external funding in order to achieve the long-range goals of flood risk mitigation and improved water quality. To work towards these goals, the City has a Stormwater technical staff comprised of a Division Manager, three senior engineers, one water quality administrator, three junior engineers, one project inspector, two GIS/Asset Management staff and two environmental specialists. The Stormwater Division also has over 40 front-line operations employees that build and maintain stormwater assets, and the Division collaborates heavily with the City’s Planning Building and Development Department, City Engineer’s office, and Emergency Managers.

This particular project will be managed by a senior stormwater engineer (P.E.), with the support of a junior engineer (E.I.T.), GIS specialist and project inspector. The design and permitting team at WSSI includes a senior engineer (P.E., CFM), a junior engineer (E.I.T.) and a staff scientist. Modeling for floodplain analysis and permitting will be performed by WSSI using HEC-RAS 1-D Steady State modeling, to be reviewed by the City’s Floodplain Administrator. All design work will be performed using AutoCAD Civil3D.

**b. The Department will prioritize low-income geographic areas for funding.**

**i. The Department will consider the project area’s social vulnerability index score when reviewing grant applications. The Social Vulnerability Index layer, available through [Virginia Flood Risk Information System \(VFRIS\)](#), will be used for this review.**

The social vulnerability index (SVI) for the census block group 517700030003 in which this project is located is designated as “High” in the VFRIS (2020).

**ii. This index is based on census block data; the index score for the census block that contains the project area should be used. If the project area falls within multiple census blocks, please provide the scores for all census blocks. The average score for the project area will be used for scoring the application.**

The reviewer should note that the GIS layers provided in the VFRIS are at the census block group level, not the block level

#### **4.3 ALTERNATIVES**

**If the project proposed does not employ a nature-based or hybrid solution and the total project cost is greater than \$2 million, describe at least one alternative that could reasonably address the issue identified. Please also consider the No Action Option as a third alternative as part of the analysis. Explain these alternatives and the reason the proposed project was selected.**

This project proposes a nature-based solution and the total project cost is less than \$2M. As such, no alternatives analysis are required for this grant application.

#### **4.4 GOALS AND OBJECTIVES**

**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. (250 Words)**

See Section 3.2.

#### **4.5 APPROACH, MILESTONES AND DELIVERABLES**

**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 potential project partners (250 Words)**

See Section 3.3.

#### **4.6 RELATIONSHIP TO OTHER PROJECTS**

**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 through the CFPF, 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. (250 Words)**

Project site formerly contained a highly flood prone hotel and conference center that was acquired by the City and demolished in 2022 under a FEMA pre-disaster mitigation (PDM) grant. City is now working on administrative close out of PDM grant. Project is part of the City's broader floodplain management program, which includes the \$72.5M Flood Reduction Project constructed in partnership with the U.S. Army Corps of Engineers. The City also has ~\$14.5M in additional grants either funded or under review for acquisition and demolition, constructed wetlands, stream restoration, bridge hydraulic improvements and automated flood gates across the City's service area.

#### **4.7 MAINTENANCE PLAN**

**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 demonstrating how they will be maintained, managed, and monitored after the lifespan of this award for a minimum of ten years or the expected lifespan of the project, whichever is longer. (250 Words)**

As this project uses nature-based solutions, it is anticipated that maintenance at the site will require the following:

- Invasive species identification and removal – once every two months during growing season
- Selective mowing and string trimming – once every two months during growing season
- Bush hogging of meadow areas – once per year
- Adjustment of stone and wood structures – as needed

Maintenance will be the responsibility of the City of Roanoke’s Stormwater Division; the Division presently has the capabilities to maintain this site, and continues to grow its green infrastructure maintenance crews.

#### **4.8 CRITERIA**

**Describe how the project meets each of the applicable scoring criteria contained in Appendix D and provide the required documentation where necessary. Documentation can be incorporated into the Scope of Work Narrative or included as attachments to the application.**

The DCR grant criteria are listed in Table 3 (next page) with scores for the proposed project, a description and the pertinent supporting section in the “Reference” column. With respect to the “Eligible Projects” category, we would note that the acquisition and demolition of the existing flood prone hotel was already completed under the PDM grant.

**Table 3 – DCR CFPF Grant Criteria from Round 4 manual**

<b>Criteria</b>	<b>Points Available</b>	<b>Proposed Project</b>	<b>Description</b>	<b>Reference</b>
Eligible Projects	30	25	Floodplain/Stream restoration	Section 3.2, 3.3
Social Vulnerability Index Score	10	8	VFRIS "High"	Section 4.2
Community scale of benefits	30	30	>100% of Census Block 3003 (8.69 acres)	Section 3.4
Expected lifespan of project	10	10	Over 20 years	Section 3.3
Remedy for NFIP probation/ suspension	5	0	No	-
Proposed project part of a low-income geographic area	10	10	City of Roanoke designated as low income	Section 4.1a
Proposed project implements a Chesapeake Bay TMDL	5	5	Project will make progress towards City's benthic impairment/corresponding TMDL	Section 3.2

*TOTAL*      100      88



**APPENDIX A - PROJECT APPLICATION FORM**

Applicants must have prior approval from the Department to submit applications, forms, and supporting documents by mail in lieu of the WebGrants portal.

## Appendix A: Application Form for Grant and Loan Requests for All Categories

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Virginia Department of Conservation and Recreation  
Virginia Community Flood Preparedness Fund Grant Program

Name of Local Government: City of Roanoke, Virginia

Category Being Applied for (check one):

Capacity Building/Planning

Project

Study

NFIP/DCR Community Identification Number (CID) 510130

Name of Authorized Official and Title: Robert S. Cowell, Jr.; City Manager

Signature of Authorized Official:  \_\_\_\_\_

Mailing Address (1): 215 Church Ave SW

Mailing Address (2): \_\_\_\_\_

City: Roanoke State: VA Zip: 24011

Telephone Number: (540) 853-2333 Cell Phone Number: (    ) \_\_\_\_\_

Email Address: bob.cowell@roanokeva.gov

Contact and Title (If different from authorized official): Marcus F. Aguilar; Civil Engineer II

**Mailing Address (1):** 1802 Courtland Rd. NE

**Mailing Address (2):** \_\_\_\_\_

**City:** Roanoke **State:** VA **Zip:** 24012

**Telephone Number:** (\_\_\_\_) \_\_\_\_\_ **Cell Phone Number:** (540) 580-7209

**Email Address:** marcus.aguilar@roanokeva.gov

Is the proposal in this application intended to benefit a low-income geographic area as defined in the Part 1 Definitions? Yes X No \_\_\_\_\_

**Categories (select applicable activities that will be included in the project and used for scoring criterion):**

**Capacity Building and Planning Grants**

- Floodplain Staff Capacity.
- Resilience Plan Development
  - Revisions to existing resilience plans and modifications to existing comprehensive and hazard mitigation plans.
  - Resource assessments, planning, strategies, and development.
    - Policy management and/or development.
    - Stakeholder engagement and strategies.
- Other: \_\_\_\_\_

**Study Grants (Check All that Apply)**

- Studies to aid in updating floodplain ordinances to maintain compliance with the NFIP, or to incorporate higher standards that may reduce the risk of flood damage. This must include establishing processes for implementing the ordinance, including but not limited to, permitting, record retention, violations, and variances. This may include revising a floodplain ordinance when the community is getting new Flood Insurance Rate Maps (FIRMs), updating a floodplain ordinance to include floodplain setbacks, freeboard, or other

higher standards, RiskMAP public noticing requirements, or correcting issues identified in a Corrective Action Plan.

- Revising other land use ordinances to incorporate flood protection and mitigation goals, standards, and practices.
- Conducting hydrologic and hydraulic (H&H) studies of floodplains. *Changes to the base flood, as demonstrated by the H&H must be submitted to FEMA within 6 months of the data becoming available.*
- Studies and Data Collection of Statewide and Regional Significance.
- Revisions to existing resilience plans and modifications to existing comprehensive and hazard.
- Other relevant flood prevention and protection project or study.

**Project Grants and Loans (Check All that Apply – Hybrid Solutions will include items from both the “Nature-Based” and “Other” categories)**

**Nature-based solutions**

- Acquisition of property (or interests therein) and/or structures for purposes of allowing floodwater inundation, strategic retreat of existing land uses from areas vulnerable to flooding; the conservation or enhancement of natural flood resilience resources; or acquisition of structures, provided the acquired property will be protected in perpetuity from further development, and where the flood mitigation benefits will be achieved as a part of the same project as the property acquisition.
- Wetland restoration.
- Floodplain restoration.
- Construction of swales and settling ponds.
- Living shorelines and vegetated buffers.
- Permanent conservation of undeveloped lands identified as having flood resilience value by *ConserveVirginia* Floodplain and Flooding Resilience layer or a similar data driven analytic tool, or the acquisition of developed land for future conservation.
- Dam removal.
- Stream bank restoration or stabilization.
- Restoration of floodplains to natural and beneficial function.

**Other Projects**

- Structural floodwalls, levees, berms, flood gates, structural conveyances.
- Storm water system upgrades.
- Medium and large-scale Low Impact Development (LID) in urban areas.

- Developing flood warning and response systems, which may include gauge installation, to notify residents of potential emergency flooding events.
- Dam restoration.
- Beneficial reuse of dredge materials for flood mitigation purposes
- Removal or relocation of structures from flood-prone areas where the land will not be returned to open space.
- Acquisition of property (or interests therein) and/or structures for purposes of allowing floodwater inundation, strategic retreat of existing land uses from areas vulnerable to flooding; the conservation or enhancement of natural flood resilience resources; or acquisition of structures, provided the acquired property will be protected in perpetuity from further development, and where the flood mitigation benefits will not be achieved as a part of the same project as the property acquisition.
- Other project identified in a DCR-approved Resilience Plan.

**Location of Project or Activity (Include Maps):** Roanoke City, Virginia (see attached Map)

**NFIP Community Identification Number (CID#):** 510130

**Is Project Located in an NFIP Participating Community?**  Yes  No

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

**Flood Zone(s) (If Applicable):** Zone AE - Floodway

**Flood Insurance Rate Map Number(s) (If Applicable):** 51161C0164G

**Total Cost of Project:** \$996,448.08

**Total Amount Requested** \$946,625.68

**Amount Requested as Grant** \$946,625.68

**Amount Requested as Project Loan (not including short-term loans for up-front costs)**  
\$0



Amount Requested as Short-Term loan for Up-Front Costs (not to exceed 20% of amount requested as Grant) \_\_\_\_\_ \$0 \_\_\_\_\_

For projects, planning, capacity building, and studies in low-income geographic areas: Are you requesting that match be waived?  Yes  No

**Additional Information for Loan Requests**

**Requested Loan Security:** \_\_\_\_\_

(General Obligation, Lease, Revenue, Special Fund Revenue, and/or Moral obligation from other government entity)

**Desired loan term:** \_\_\_\_\_

**Since the date of your latest financial statements, did the applicant issue any new debt?** \_\_\_\_\_  
(If yes, provide details)

**Is there any pending or potential litigation by or against the applicant?** \_\_\_\_\_

**Attach five years of current annual financial statements (FY18-22) or refer to website if posted**  
(Not necessary for existing VRA borrowers) Not Applicable

**Attach FY2024 adopted budget or refer to website**

**Attach current Capital Improvement Plan**

**Attach adopted Financial Policies**

**Attach a list of the ten largest employers in the Applicant's jurisdiction.**

**Attach a list of the ten largest taxpayers in the Applicant's jurisdiction**

## **APPENDIX B - DETAILED BUDGET NARRATIVE SUPPLEMENTAL INFORMATION**

This Appendix contains two attachments supplementing the budget narrative provided in Section 5 of this Grant Proposal. The three attachments include:

1. Engineer's cost estimate showing individual items, unit costs, and total costs.
2. An executed Task Order for design and permitting services for the Ore Branch Stream and Landscape Restoration Project



**City of Roanoke**  
**Stormwater Capital Improvement Projects**  
**Engineers Estimate**



Project: Ore Branch Stream and Floodplain Restoration  
 Area: 2.4 acres  
 Length: ~400 LF  
 Contractor: TBD  
 Estimator: WSSI (NAS) - Materials; City Stormwater (MFA, RCM, JC) Other

SECTION	ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTALS
<b>1.0</b>	<b>Mobilization</b>					
1.1	Mobilization	1	LS	\$35,000.00	\$35,000.00	
1.2	City Land Disturbance Permitt	1	LS	\$2,000.00	\$2,000.00	
						\$37,000.00
<b>2.0</b>	<b>Construction Surveying</b>					
2.1	Construction Stakeout	350	LF	\$12.00	\$4,200.00	
2.2	As-Built	350	LF	\$12.00	\$4,200.00	
						\$8,400.00
<b>3.0</b>	<b>Erosion/Sediment Control</b>					
3.1	Temporary Construction Entrance w/ WR	1	EA	\$3,500.00	\$3,500.00	
3.2	Super Silt Fence	200	LF	\$8.50	\$1,700.00	
3.3	Tree Protection/Orange Mesh Safety Fence	800	LF	\$0.70	\$560.00	
3.4	Silt Fence	300	LF	\$5.00	\$1,500.00	
3.5	Pump Around Diversion/Dewatering	4	WK	\$5000.00	\$20,000.00	
3.6	Filter Bag	1	EA	\$400.00	\$400.00	
						\$27,660.00
<b>4.0</b>	<b>Construction Access</b>					
4.1	Deck Mats (as needed)	100	LF	\$75.00	\$7,500.00	
						\$7,500.00
<b>5.0</b>	<b>Clearing and Demolition</b>					
5.1	Clearing & Grubbing, Light	0.25	AC	\$3,000.00	\$750.00	
5.2	Concrete Demolition/Disposal (Geopiers, Pipe)	120	TN	\$90.00	\$10,800.00	
						\$11,550.00
<b>6.0</b>	<b>Grading</b>					
6.1	Excavation	6300	CY	\$15.00	\$94,500.00	
6.2	Stripping Topsoil (6" depth on cut areas)	780	CY	\$15.00	\$11,700.00	
6.3	Supplemental Topsoil Import (3" depth)	390	CY	\$70.00	\$27,300.00	
6.4	Load and Haul off-site	6770	CY	\$55.00	\$372,350.00	
6.6	Site Grading - Fine	1.40	AC	\$12,000.00	\$16,800.00	
						\$522,650.00
<b>7.0</b>	<b>Channel Restoration</b>					
7.1	Modified Cross Vane	1	EA	\$17,500.00	\$17,500.00	
7.2	Log Vane w/ Rock Sill (J-Hook)	1	EA	\$9,500.00	\$9,500.00	
7.3	Log Sills/Habitat Features	2	EA	\$2,500.00	\$5,000.00	
7.4	Rock Step (Tributary)	2	EA	\$2,500.00	\$5,000.00	
7.5	Tributary End Walls (EW-1)	3	EA	\$7,500.00	\$22,500.00	
7.6	Class A1 Outlet Protection	18	TN	\$85.00	\$1,530.00	
7.7	Class A1 Reinforced Bed Material	635	TN	\$100.00	\$63,500.00	
7.8	Imbricated Rock Wall	70	LF	\$200.00	\$14,000.00	
						\$138,530.00
<b>8.0</b>	<b>Vegetation</b>					
8.1	Permanent Meadow Seed and Straw	7140	SY	\$0.55	\$3,927.00	
8.2	Permanent Riparian Buffer Seeding and Straw/Matting	2250	SY	\$0.90	\$2,025.00	
8.3	Permanent Streamside Seed and Straw	585	SY	\$0.65	\$380.25	
8.4	Live Stakes	978	EA	\$8.00	\$7,824.00	
8.5	2-in Cal Trees	34	EA	\$312.00	\$10,608.00	
8.6	5-ft Height Trees	102	EA	\$103.00	\$10,506.00	
8.7	18-in Shrubs (1-gal)	80	EA	\$22.00	\$1,760.00	
8.8	Riparian Buffer Plantings (1-gal)	576	EA	\$22.00	\$12,672.00	
8.9	Invasive Species Control	1	LS	\$2500.00	\$2,500.00	
8.10	Supplemental Watering	1	LS	\$2500.00	\$2,500.00	
						\$54,702.25
<b>9.0</b>	<b>Miscellaneous Materials</b>					
9.1	Coir Fiber Matting	2834	SY	\$9.00	\$25,506.00	
9.2	Educational Signs	2	EA	\$2000.00	\$4,000.00	
						\$29,506.00
	<b>STREAM RESTORATION CONSTRUCTION SUBTOTAL</b>					<b>\$837,498.25</b>
	<b>10% CONTINGENCY</b>					<b>\$83,749.83</b>
	<b>TOTAL</b>					<b>\$921,248.08</b>

## **Contract Task Order**

Vendor / Contract Number: Wetland Studies and Solutions Inc. / IDIQ5WSS

Purchase Order #: CT221220000418

Date: 12/20/2022

**The terms and conditions of the above referenced Contract apply to this Contract Task Order and are incorporated by reference. The parties acknowledge and agree that the Contract, the RFP issued by the City, the Consultant's Proposal submitted in response to the RFP, and this Contract Task Order, constitutes the entire agreement between the parties with respect to the provision of On-Call Architecture, Engineering and Construction Support Services.**

### **SCHEDULE 1: GENERAL DESCRIPTION AND SCOPE OF SERVICES**

In the attached Consultant's proposal is a Description of the Project(s) and Work for which the Consultant has been engaged.

#### **SCOPE OF SERVICES:**

The Consultant covenants and agrees to provide all necessary On-Call Architecture, Engineering and Construction Support Services required to professionally accomplish the work and services, as set forth within this Contract Task Order. This Contract Task Order identifies the specific Phase(s) of service for which the Consultant is being engaged, along with the Consultant's compensation and time for performance. The Scope of Work is included in the attached Consultant's proposal.

### **SCHEDULE 2: PROJECT SCHEDULE AND DELIVERABLES**

The attached proposed schedule details how the Consultant plans to achieve completion of performance within the time specified within this Contract Task Order. Review and acceptance of the Project Schedule by the Owner shall not relieve the Consultant of any of its responsibility to timely complete performance in accordance with the agreed Contract Task Order. The Project Schedule shall incorporate sufficient time for preparation and review of documents and submittals. The schedule is included in the attached Consultant's proposal.

### **SCHEDULE 3: CONSULTANT'S PERSONNEL AND SUBCONSULTANTS CHART**

In performing the Services, the Consultant shall utilize its own staff and such other persons or firms as are identified within the attached Consultant's proposal. The Consultant may not substitute any other staff, individual(s) or firms without the advance written consent of the Owner. Under no circumstances shall the Owner be required to consent to or accept any substitution(s) if to do so would require an increase in any

amount(s) required to be paid to the Consultant for this Project, or a decrease in the Services described under this Contract Task Order.

**SCHEDULE 4: CONSULTANT’S SCHEDULE OF SERVICES AND FEES**

The Consultant shall choose to be compensated on either a Fixed Sum or Percentage Basis, or on a Time Basis, as detailed below.

**1 - Fixed Sum Basis or Fixed Percentage Basis**

In the attached Consultant’s proposal is a Fixed Sum or Fixed Percentage for the services that the Consultant shall supply in its performance of the Project(s) under this Contract Task Order.

Consultant's Cost of Services as a Fixed Sum: \$

**2 - Time Basis**

In the attached Consultant’s proposal is a list of all billable services that the Consultant may supply in its performance of individual Project(s) under this Contract Task Order, and the hourly rates at which those services will be billed for the duration of this Contract Task Order. The Consultant shall set forth its hourly rates for standard services that would be necessary to perform the range of services listed in Schedule 1.

Not to Exceed Amount: \$75,200.00

Unless otherwise indicated within the Project Schedule, this Contract Task Order serves as a Notice to Proceed for the Project(s) and Work described within this Contract Task Order.

DocuSigned by:  
*Pamela Simpkins*  
05925E4EF0FD48E...  
Pamela Simpkins, CPPB, VCO  
Purchasing Manager

12/20/2022  
Date



## SHORT FORM CONTRACT PROFESSIONAL SERVICES AGREEMENT

<b>CLIENT:</b>	City of Roanoke – Stormwater Division	<b>DATE:</b>	November 17, 2022 (Rev. 12/7)
<b>ADDRESS:</b>	1802 Courtland Road NE Roanoke, VA 24012	<b>VIA E-MAIL:</b>	marcus.aguilar@RoanokeVA.gov
		<b>PROJECT NAME:</b>	Ore Branch Site Plan
		<b>WSSI PROJECT #:</b>	TBD
<b>ATTENTION:</b>	Marcus Aguilar, PhD, PE	<b>WSSI PROP. #:</b>	P20524A

Per your request in our September 20<sup>th</sup> meeting, and follow up discussions, Wetland Studies and Solutions, Inc. (WSSI) will provide professional services under our current IDIQ On-Call Support Services Contract (IDIQ5WSS) and in accordance with the scope of work outlined below. Services are aimed at developing a proposed site plan for beneficial reuse of the City-owned property between the railroad and Wiley Drive (area of the former Ramada Inn property). It is understood that plans must conform with deed restrictions which stem from Federal Emergency Management Agency (FEMA) funding. Revisions to this proposal have been made based on City staff comments received December 2, 2022.

### GENERAL DESCRIPTION

Based on correspondence with City staff, WSSI understands that the City is seeking to develop a site plan for beneficial reuse of the City-owned property along Franklin Road, at the former Ramada Inn. The City intends to explore easements on adjacent property(ies) to allow a slight extension of channel modifications upstream to the existing railroad property. The project area lies within the FEMA regulatory floodplain. Property acquisition and ongoing demolition for the Ramada parcel were facilitated through FEMA grant funds, thus requiring that the long-term use of the property adhere to limitations on use associated with deed restrictions.

WSSI understands that the City has and is currently collecting feedback from the community on the preferred use of the property. WSSI will coordinate with City staff to ensure consideration of stakeholder feedback in the development of a Final Site Plan which maximizes ecological value and recreational uses. WSSI efforts will focus on landscape and stream restoration elements, while identifying the location of possible parking areas and site access corridors.

### SCOPE AND FEE

**Task A – Review of Deed Restrictions, Stakeholder Feedback, and Site Survey Information**  
**Hourly per Attachment A, not to exceed \$ 4,060**

WSSI design staff will review information provided by the City regarding local stakeholder input on the preferred character and use of the project area. WSSI will also review, and format digital drawing files provided by the City (developed by Lumsden Associates) as a basis for site plan design drawings. Following a review of relevant information, WSSI staff will hold design kickoff meeting with City staff to discuss specific site concerns or issues prior to site plan development. This meeting will serve as a basis for Task B site investigation.

**Task B – Site Investigation and Supplemental Survey**  
**Hourly per Attachment A, not to exceed \$ 7,740**

A site investigation and supplemental survey will be performed to augment survey information provided by City staff. The site investigation will focus on elements related to stream restoration (visual inspection and documentation of the existing walled channel areas, channel geometry between the site and Wiley Drive, and bridge crossing characteristics), soils investigation using a hand auger to allow nutrient and organic matter testing, and photographic documentation of the site to support design and permit coordination.

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We anticipate limited need for additional field-run survey and will utilize this capped hourly task for any additional location services identified during the site investigation. This task assumes that City staff will provide detailed information related to previously established benchmarks and site survey control to support collection of supplemental survey data. This task assumes any survey will occur within the project parcel and outside the road right-of-way (i.e. no traffic control is required). If survey data is needed on adjacent parcels where data has not previously been collected a separate task order may be required.

### **Task C – Cultural and Endangered and Threatened Species (ETS) Resource Assessments**

**Fixed Fee**

**\$ 2,910**

WSSI staff will assist the Client in determining whether this site will achieve a high probability in facing cultural resource or ETS issues during the Clean Water Act permitting process by:

- C.1 Coordinating with the Virginia Department of Conservation and Recreation (DCR), the Virginia Department of Wildlife Resources (DWR), and the U.S. Fish & Wildlife Service (USFWS) using their Information, Planning, and Conservation System (IPaC) regarding any documented endangered or threatened species (ETS), or non-listed species or communities considered rare by DCR, DWR, or USFWS, on or near this site. WSSI will summarize the results of this coordination in a letter to Client.
- C.2 Review the topography, United States Geological Survey (USGS) maps, and Virginia Department of Historic Resources (DHR) V-CRIS (Virginia Cultural Resources Information System) to determine if historic sites are documented on this site or adjacent to it and the likelihood that a Phase I Cultural Resources survey will be recommended by DHR during the Clean Water Act process.

### **Task D – Site Plan with Stream Restoration**

**Hourly per Attachment A, not to exceed**

**\$ 28,740**

Based on data and discussions from Task A and B, WSSI design staff will develop a draft Site Plan including proposed stream restoration measures. The entirety of the subject site lies within the FEMA regulatory floodplain/floodway. Plans and recommendations will be developed to avoid any influence on existing flooding conditions. (It is assumed that a return to a vegetated/partially forested condition will not constitute a significant change in conditions with relation to floodplain management.) Planting stock and methodologies will consider flood potential and avoid methods which could be adversely impacted by a high flow event prior to full vegetative establishment.

Prior to submission of the draft site plan WSSI will coordinate trail location, parking location/size, and the desired planting palette (species, etc.) with City landscape/parks staff and incorporate feedback into the draft landscape plan. Formal plan development will occur following consensus on desired site conditions which best balance ecological goals, aesthetics, recreation, and safety concerns. Note - Informal collaboration (e.g. design sketches, draft planting area boundaries, preliminary stream grading) will occur throughout the site plan development process.

The draft Site Plan will include the following elements:

- 1) Grading, profile, and in-stream structure details (as required) associated with stream corridor modifications,
- 2) A landscape plan detailing soil preparation and amendments, planting and seeding areas, and recommended planting/seeding schedules for a wide variety of native plants,
- 3) Identification of areas for the creation of surface parking in accordance with deed restrictions (area identification only, no design specifics)
- 4) Trail access corridors to create a linkage between the nearby Roanoke River Greenway and the project site (no detailed design beyond inclusion of a standard City trail detail)
- 5) Identification of siting for future landscape or recreational enhancements
- 6) Cost estimate





### ASSUMPTIONS AND EXCLUSIONS

1. This proposal does not include any geotechnical investigations or recommendations. Soil testing is limited to typical characteristics necessary for determining fertilization needs for native plantings.
2. Hydrology – Due to the limited extent of the design reach, channel modifications/grading will be based solely on application of the most appropriate USGS regional curve and the need to achieve a no rise condition. Detailed hydrologic modeling/hydrologic analysis for channel sizing is not included (nor warranted).
3. No structural design of site features (bridges, surface parking, culverts, trails, recreational equipment, etc.) is included in this proposal.
4. Scope assumes field survey will be limited and plan development will be largely based on information provided by the City. Should site investigation determine a more extensive survey effort is necessary, such services will be subject to an additional services proposal.
5. The proposed landscape plan will not substantially change topography for the site (aside from channel modifications along Ore Branch where excavation will occur). Soil amendment may be necessary for seedbed preparation. This proposal assumes minor variation in surface conditions associated with tillage, compost amendment, and/or plant establishment will be amenable to FEMA/VDEM plan reviewers.
6. Due to unique site characteristics and prior development, no formal Waters of the United States delineation will be conducted. This proposal assumes WOTUS features are limited to the Ore Branch stream channel, as defined by the existing top of banks/top of wall.
7. HEC-RAS floodplain modeling included in this scope is limited to a pre-post analysis based on established FEMA flows. This included effort is intended to provide sufficient detail and information to demonstrate no rise conditions and allow for local approval by the City Floodplain Administrator. No FEMA submissions or coordination are included in this scope.
8. Assumes subsurface utilities are located or inactive and excavation of stream bank areas will not require utility relocation.

### FEES

TASK	FEE
A. Review of Deed Restrictions, Stakeholder Feedback, and Site Survey Information (Hourly, Not to Exceed)	\$ 4,060
B. Site Investigation and Supplemental Survey (Hourly, Not to Exceed)	\$ 7,740
C. Cultural and Endangered and Threatened Species (ETS) Resource Assessments (Fixed Fee)	\$ 2,910
D. Site Plan w/ Stream Restoration (Hourly, Not to Exceed)	\$ 28,740
E. Clean Water Act Permitting (Hourly, Not to Exceed)	\$ 8,200
F. Plan Revisions, Hydraulic Modeling, & Construction Specifications (Hourly, Not to Exceed)	\$ 14,580
G. VSMP Permitting and SWPPP Preparation (Fixed Fee)	\$ 3,280
H. Meetings and Coordination (Hourly, Not to Exceed)	\$ 5,440
Z. Reimbursables (Not to Exceed) <sup>1</sup>	\$ 250
<b>Total</b>	<b>\$ 75,200</b>

<sup>1</sup>Milage, laboratory testing, printing, and field supplies

### PROJECT SCHEDULE AND DELIVERABLES

A separate deliverable is not associated with Task A. Information will be incorporated into Site Plan development/design. Task B deliverables will consist of supplemental data (including survey) and soil test results

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obtained during the site investigation. Task C deliverables will include a brief report detailing database research and findings, as well as recommendations regarding further site study and anticipated permit requirements. Task D deliverables will be a draft site plan. Task E deliverables will include a complete permit application and relevant project documentation (including appropriate specifications). Deliverables for Task F will be a final site plan revised based on City feedback and comments, with additional floodplain modeling information and E&S plan data. Task G deliverables will be a DEQ Registration Statement and project SWPPP.

Proposed Schedule: (ver. 11/17/2022)

Work Tasks	Project Timeline						
	(After Notice to Proceed)						
	DEC	JAN '23	FEB	MAR	APR	MAY	JUN
TASK A - REVIEW OF DEED REST., STAKEHOLDER INFO, AND SURVEY	█	█					
TASK B - SITE INVEST. & SUPPLEMENTAL SURVEY	█	█					
TASK C - CULTURAL AND ETS RESOURCE ASSESSMENT		█	█				
TASK D - SITE PLAN W/ STREAM RESTORATION			█	█	█	█	
TASK E - CWA PERMITTING (FEDERAL, STATE)					█	█	
TASK F - PLAN REV., HYDRAULIC MODELING, & CONST SPECS.						█	█
TASK G - VSMP PERMITTING AND SWPPP							█
TASK H - MEETINGS AND COORDINATION	Occurs throughout design and implementation						

 Denotes Review Period

**Note:** Assumes task order authorization by December 1, 2022.

L:\Proposals\2022\SW VAI\City of Roanoke\_Ore Branch\2022-11-17\_Ore Branch Schedule.xls\Master Exhibit C

A site investigation will be scheduled within four (4) weeks of authorization of this proposal by City staff, with the design kickoff meeting within four (4) to six (6) weeks of authorization. The draft Site Plan will be developed and submitted within ten (10) weeks of the kickoff meeting. Following review and comment receipt, WSSI staff will revise the draft Site Plan and finalize the plan within four (4) weeks. Permit preparation will occur concurrently with Task F. The permit approval timeline will be subject to agency review. The VSMP registration statement and SWPPP will be prepared with four (4) weeks of final Site Plan submission. Task H will occur on an as-needed basis. This timeline represents the expected project duration but is subject to change based on City or FEMA/VDEM review and comment.

The price is only fixed for sixty (60) days from the date of this proposal. Billing will be according to the enclosed Attachment A - Rate Schedule, with reimbursables billed under Task Z. Attachment B provides a breakdown of Tasks and associated effort/hours. Our fee for services will be invoiced as outlined above and detailed in Attachment B. Attachments are incorporated by reference herein.

If this short form contract outlines your understanding of the scope of services, please sign below and return a copy to our office. Thank you for the opportunity to present this proposal.

Sincerely,  
**Wetland Studies and Solutions, Inc.**



Nathan A. Staley, PE, CFM, LEED AP, ENV SP  
 Manager - Engineering

**CLIENT ACCEPTANCE:**

Signature: \_\_\_\_\_

Accepted by (print name): \_\_\_\_\_

Client Name: \_\_\_\_\_

Date: \_\_\_\_\_

By signing above, you are creating a legal obligation between the client listed on this proposal and Wetland Studies and Solutions, Inc. (WSSI). This obligation cannot be transferred to a third party without prior written consent from both WSSI and the third party.

Enclosures: Attachment A, Attachment B

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CLIENT'S PREFERRED METHOD OF INVOICE SUBMISSION

How would you like to receive invoices for this project?

Mail: Invoice(s) will be mailed to the address listed on this proposal.

E-mail: Invoice(s) will be emailed to \_\_\_\_\_

Other: Please provide instructions below:

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**Attachment A**

The following is a listing of the Wetland Studies and Solutions, Inc. (WSSI) rates for professional and reprographic services for central and southwestern Virginia. These rates will remain in effect through December 31, 2022, after which time they may be adjusted to reflect our current labor and overhead costs.

**PROFESSIONAL SERVICES**

Operations Manager	\$260.00	Consultant III	\$150.00
Director III	\$235.00	Consultant II	\$135.00
Director II	\$215.00	Consultant I	\$115.00
Director I	\$180.00	Technician III	\$90.00
Principal III	\$225.00	Technician II	\$80.00
Principal II	\$155.00	Technician I	\$70.00
Principal I	\$130.00	Assistant	\$55.00
Consultant V	\$190.00	Admin. Assistant	\$60.00
Consultant IV	\$170.00	Intern	\$27.00

**TYPICAL REIMBURSABLE COSTS****In-house Reprographic Services<sup>1</sup>**

	Rate/Square Foot		Rate/Sheet
Paper Cad plots (B&W)	\$0.35	B&W Xerox (8.5x11)	\$0.10
Paper Cad plots (Color)	\$0.75	Color Xerox (8.5x11)	\$0.85
Mylar Cad plots	\$2.00		
Color Cad plots – Photo quality	\$4.00	Standard Report Supplies	minimum \$6.00/rpt

GIS and CAD system charges are included in billable rates. Reimbursable expenses shall include the following:

Local automobile travel @ currently approved IRS rate	Leica Robotic Total Station @ \$30 per hour <sup>2</sup>
All-Terrain Vehicle use @ \$10 per hour <sup>2</sup>	UAV (Drone) Photo/Video @ \$30 per hour <sup>2</sup>
Tractor @ \$35 per hour/\$750 per week/\$2,250 per month <sup>2</sup>	Hydrone-RCV @ \$30 per hour <sup>2</sup>
Morooka @ \$35 per hour/\$900 per week/\$2,700 per month <sup>2</sup>	Dino 6 Dredge @ \$1,500 per week/\$5,000 per month <sup>2</sup>
Buggy @ \$10 per hour <sup>2</sup>	6" trash pump @ \$725 per week/\$2,000 per month <sup>2</sup>
2200 Bobcat Utility Vehicle @ \$15 per hour <sup>2</sup>	Resistograph @ \$100 per day <sup>2</sup>
T-300 Bobcat @ \$45 per hour/\$1,000 per week/\$2,500 per month <sup>2</sup>	Ground Penetrating Radar @ \$500 per day <sup>2</sup>
E60 Bobcat Trackhoe @ \$60 per hour/\$1,300 per week/\$3,400 per month <sup>2</sup>	Bailers Disposable (Polyethylene) @ \$7 each <sup>2</sup>
Mudd-Ox @ \$35 per hour/\$275 per day/\$1,000 per week <sup>2</sup>	PID Meter @ \$85 per day <sup>2</sup>
17' Jon boat @ \$10 per hour <sup>2</sup>	Oil/Water Interface Probe @ \$35 per day <sup>2</sup>
20' boat-115 hp @ \$50 per hour <sup>2</sup>	Water Level Indicator @ \$25 per day <sup>2</sup>
Portable Electro-Fisher @ \$300 per day/\$900 per week <sup>2</sup>	pH Meter @ \$15 per day <sup>2</sup>
Mower @ \$10 per hour <sup>2</sup>	PPE-Level D @ \$10 per day <sup>2</sup>
Aluminum Medallion Tree Tags @ \$0.10 each	Commercial Grade Tablet GPS Unit (≥3 meters horizontal) @ \$25 per day <sup>2</sup>
	Differential Grade GPS Unit (≤1 meter) @ \$118 per day <sup>2</sup>

The following expenses shall be charged at cost plus a 20% administrative processing fee:

- Permit and review fees, public notice advertisements;
- Air travel, rental vehicles, lodging and meals for sites not within commuting distance from local WSSI office;
- Third party vendor photocopying or reproduction of drawings or documents as requested by Owner or consultants;
- Postage and expedited delivery services requested by Owner or consultants;
- Artifact Archival Storage Fees; and,
- Third party consulting services, as authorized by Client, for services such as surveying, archeology, endangered species searches, geotechnical surveys, septic field-testing, permeability tests, etc.

<sup>1</sup> WSSI maintains hard copy files and report copies for our records, regardless of Client deliverables. These in-house copies will be billed in accordance with the listed reprographic pricing.

<sup>2</sup> Excluding operator; mobilization included in hourly, daily, weekly, or monthly rate.

**Attachment B - Consulting Services  
Ore Branch Site Plan  
Manhour Breakdown**

Date Prepared: 11/17/22

Labor Class Titles

Work Tasks	Operations Manager	Director III	Consultant V	Consultant IV	Consultant III	Consultant II	Consultant I	Technician III	Technician II	Technician I	Sub-Contract	Total Hours	Total Cost
			Project Manager	Senior Surveyor	Senior Engineer	Project Engineer	Design Engineer						
<i>Labor Rate</i>	\$ 260.00	\$ 235.00	\$ 190.00	\$ 170.00	\$ 150.00	\$ 135.00	\$ 115.00	\$ 90.00	\$ 80.00	\$ 70.00	N/A		
<b>Design Phase Services</b>													
Task A - Review of Deed Restrictions, Stakeholder Feedback, and Site Survey Info (HNTE)			8			12	8					28	\$ 4,060
Task B - Site Investigation and Supplemental Survey (HNTE)			10			16	32					58	\$ 7,740
Task C - Cultural and ETS Resource Assessments (Fixed Fee)			2				22						\$ 2,910
Task D - Site Plan w/ Stream Restoration (HNTE)			30		80		96						\$ 28,740
Task E - Clean Water Act Permitting (HNTE)			16		8			44					\$ 8,200
Task F - Plan Revisions, Hydraulic Modeling, & Construction Specifications (HNTE)			12		36		60						\$ 14,580
Task G - VSMP Permitting and SWPPP Preparation (Fixed Fee)			4		4				24				\$ 3,280
Task H - Meetings and Coordination (HNTE)			16		16								\$ 5,440
Design Phase Subtotal Hours	0	0	90	0	144	16	210	44	24	0		58	
Design Phase Subtotal Cost	\$ -	\$ -	\$ 17,100	\$ -	\$ 21,600	\$ 2,160	\$ 24,150	\$ 3,960	\$ 1,920	\$ -			\$ 74,950
<b>Design Phase Costs</b>											<b>ODC's</b>	\$ 250	
											<b>TOTAL COST</b>	<b>\$ 75,200</b>	

L:\Proposals\2022\SW VA\City of Roanoke\_Ore Branch\2022-10-12\_Ore Branch Manhours.xls]ODC's

**Certificate Of Completion**

Envelope Id: AA9E9F2504404EE288F580A91FC20A5B	Status: Completed
Subject: Complete with DocuSign: IDIQ Request 1121_Wetland Studies_Stormwater_Approval Needed.pdf	
Source Envelope:	
Document Pages: 10	Signatures: 1
Certificate Pages: 4	Initials: 0
AutoNav: Enabled	Envelope Originator:
Envelope Stamping: Enabled	Stanley Wells
Time Zone: (UTC-05:00) Eastern Time (US & Canada)	215 Church Avenue SW
	Room 202
	Roanoke, VA 24011
	stanley.wells@roanokeva.gov
	IP Address: 4.35.228.43

**Record Tracking**

Status: Original	Holder: Stanley Wells	Location: DocuSign
12/20/2022 11:42:09 AM	stanley.wells@roanokeva.gov	

**Signer Events**

Pamela Simpkins  
 pamela.simpkins@roanokeva.gov  
 Purchasing Manager  
 City of Roanoke  
 Security Level: Email, Account Authentication (Optional)

**Signature**

DocuSigned by:  
  
 Pamela Simpkins  
 65325E4EF6FD48E...  
 Signature Adoption: Pre-selected Style  
 Using IP Address: 4.79.207.126

**Timestamp**

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 Viewed: 12/20/2022 2:31:08 PM  
 Signed: 12/20/2022 2:31:43 PM

**Electronic Record and Signature Disclosure:**  
 Accepted: 3/26/2020 4:22:11 PM  
 ID: a959ad4a-889b-4be0-93d7-275f44213506

**In Person Signer Events**

**Signature**

**Timestamp**

**Editor Delivery Events**

**Status**

**Timestamp**

**Agent Delivery Events**

**Status**

**Timestamp**

**Intermediary Delivery Events**

**Status**

**Timestamp**

**Certified Delivery Events**

**Status**

**Timestamp**

**Carbon Copy Events**

**Status**

**Timestamp**

**Witness Events**

**Signature**

**Timestamp**

**Notary Events**

**Signature**

**Timestamp**

**Envelope Summary Events**

**Status**

**Timestamps**

Envelope Sent	Hashed/Encrypted	12/20/2022 11:43:03 AM
Certified Delivered	Security Checked	12/20/2022 2:31:08 PM
Signing Complete	Security Checked	12/20/2022 2:31:43 PM
Completed	Security Checked	12/20/2022 2:31:43 PM

**Payment Events**

**Status**

**Timestamps**

**Electronic Record and Signature Disclosure**

## APPENDIX C - CHECKLIST FOR ALL CATEGORIES

This Appendix includes the following requested information for items in **bold** below. Other items reference respective sections in this scope of work, or provide hyperlinks as appropriate.

1. **Detailed map of the project area**
2. **FIRMette of the project area**
3. Historic flood damage data and or/images - see Appendix D and Section 4.1.b
4. A link or copy of the current floodplain ordinance – see [https://library.municode.com/va/roanoke/codes/code\\_of\\_ordinances?nodeId=CORO1979\\_CH36.2Z\\_O\\_ART3RESPZODI\\_DIV5OVDI\\_S36.2-333FLOVDIF](https://library.municode.com/va/roanoke/codes/code_of_ordinances?nodeId=CORO1979_CH36.2Z_O_ART3RESPZODI_DIV5OVDI_S36.2-333FLOVDIF)
5. Non-fund-financed maintenance and management plan for project extending a minimum of 10 years from project close – see Section 4.7
6. A link to the current Hazard Mitigation Plan - [https://rvarc.org/wp-content/uploads/2019/08/RVAR\\_Hazard\\_Mitigation\\_Plan\\_2019.pdf](https://rvarc.org/wp-content/uploads/2019/08/RVAR_Hazard_Mitigation_Plan_2019.pdf)
7. A link to the current comprehensive plan - <https://planroanoke.org/city-plan-2040/>
8. Social Vulnerability Index scores for the project area from VFRIS Layer – “Moderate” - see Section 4.2.b
9. If applicant is not a town, city, or county, letters of support from affected localities – N/A
10. Letter of support from impacted stakeholders – N/A
11. Budget Narrative – See Section 5 with supplemental documentation in Appendix B
12. Benefit Cost Analysis Narrative – see Section 4.1.e
13. **Authorization to request funding from the Fund from governing body or chief executive of the local government**
14. Signed pledge agreement from each contributing organization – see Appendix A
15. Detailed budget narrative for all costs - See Section 5 with supplemental documentation in Appendix B



Rebuild storm drain using vegetated swales

Proposed floodplain bench: +4.2 acre-ft flood storage

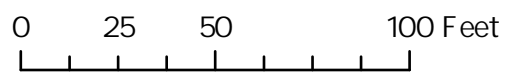
Stabilize and restore stream banks and floodplain with native trees and riparian grasses

Realign channel and grade cross section based on natural channel design principles

- Large Deciduous Tree
- Small Deciduous Tree
- Shrub
- Ore Branch
- Streamside
- Riparian Seeding
- Native Meadow Seeding
- Mowed Access Path
- Vegetated Swale

Project Area

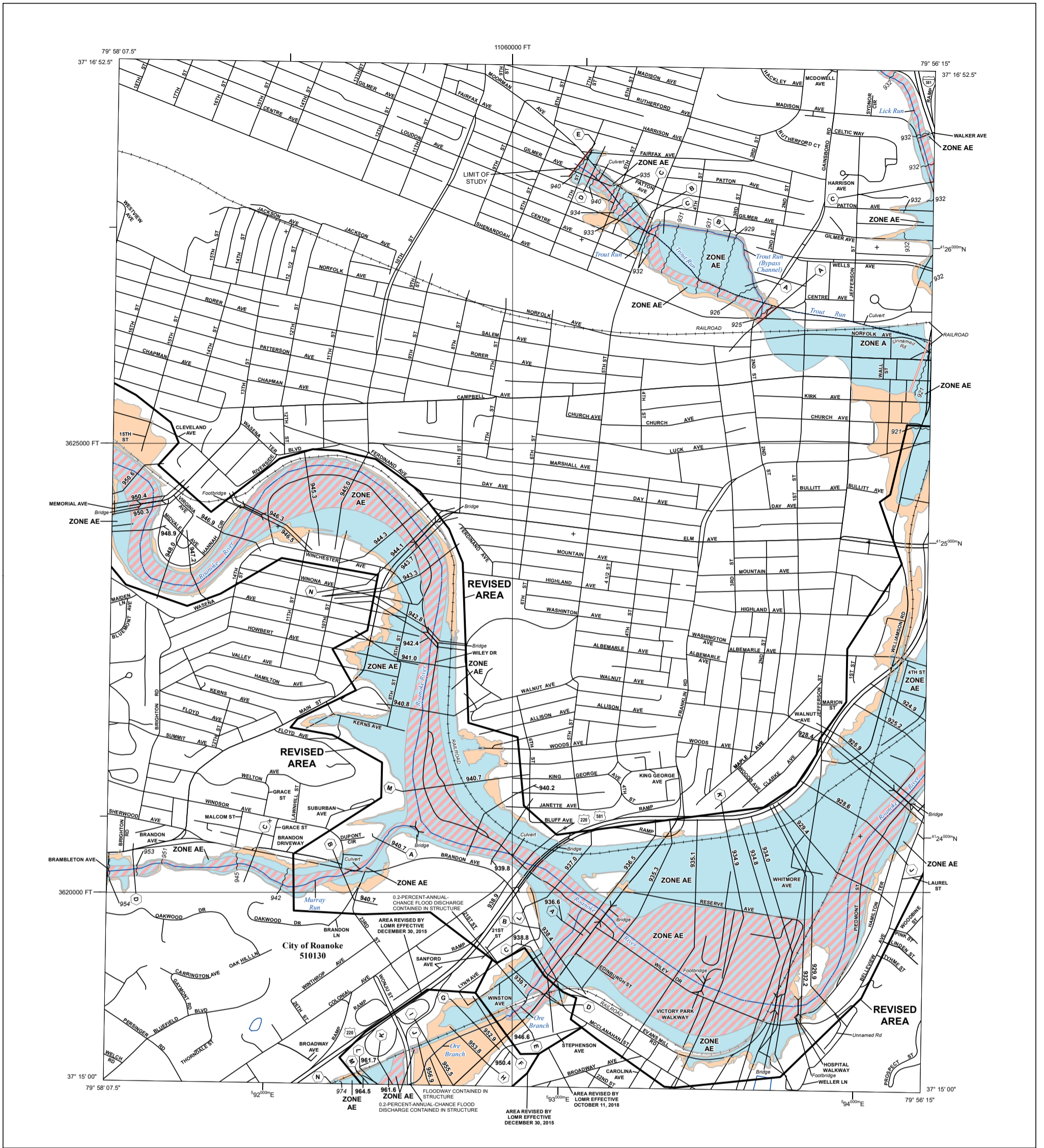
Franklin Rd SW



Ore Branch Stream and Floodplain Restoration  
Proposed Project Map  
November, 2023

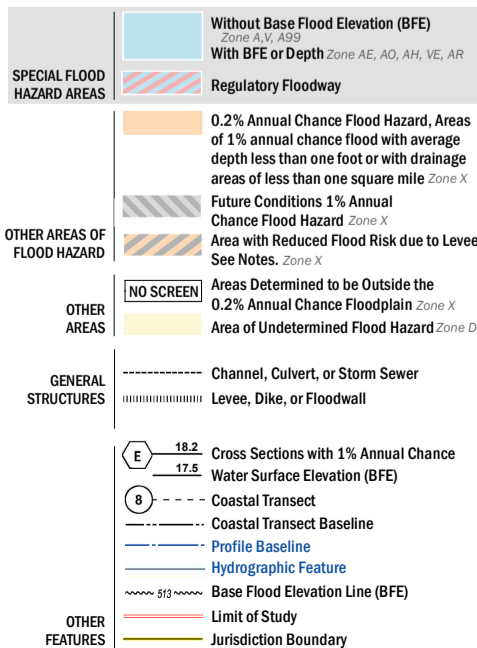






**FLOOD HAZARD INFORMATION**

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP  
 THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT [HTTP://MSC.FEMA.GOV](http://MSC.FEMA.GOV)



**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.

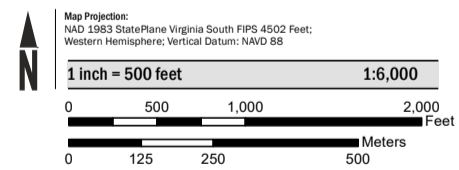
Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

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

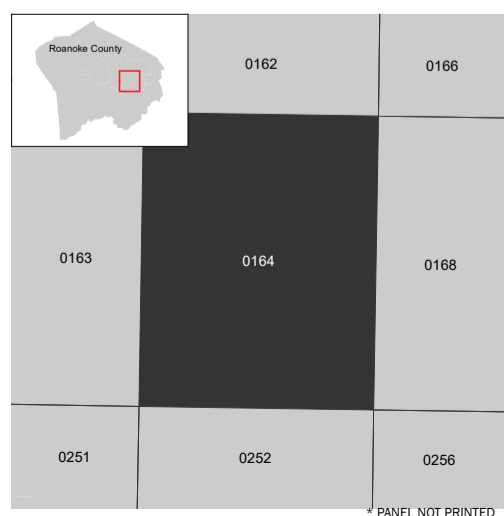
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by Roanoke County. Road features shown on this FIRM have been updated using the 2022 TIGER/Line Shapefiles from the U.S. Census Bureau.

**SCALE**



**PANEL LOCATOR**



**NATIONAL FLOOD INSURANCE PROGRAM  
 FLOOD INSURANCE RATE MAP**

ROANOKE COUNTY, VIRGINIA  
 and Incorporated Areas  
 PANEL 164 of 310



COMMUNITY	NUMBER	PANEL	SUFFIX
ROANOKE, CITY OF	510130	0164	G

**REVISED TO REFLECT LOMR EFFECTIVE: December 22, 2023**

IN THE COUNCIL OF THE CITY OF ROANOKE, VIRGINIA

The 16<sup>th</sup> day of October 2023.

No. 42806-101623.

A RESOLUTION authorizing the City Manager or his designee to submit an application to the Department of Conservation and Recreation (“DCR”) for grant funding under the Community Flood Preparedness Fund; and authorizing the City Manager or his designee to take such further actions and execute such further documents as may be necessary in connection with this application and grant funding.

BE IT RESOLVED by the Council of the City of Roanoke as follows:

1. City Council hereby authorizes the City Manager or his designee to submit an application to the DCR for Community Flood Preparedness Fund grant funding, such funding to be used to help communities reduce the impacts of flooding, for the 1<sup>st</sup> Street and Salem Drainage Improvements Project and the Ore Branch Restoration Project, all as more particularly described in the City Council Agenda Report dated October 16, 2023, with such application being approved as to form by the City Attorney.

2. The City Manager or his designee is further authorized to take any such further actions and execute such further documents, approved as to form by the City Attorney, as may be necessary to submit the above application to the DCR and to furnish such additional information as may be required for such application.

ATTEST:

*Cecelia J. McCoy*

City Clerk.

**APPENDIX D - ORE BRANCH SITE HISTORICAL FLOODING PHOTOS**

From Franklin Rd. Facing NW

• Holiday Inn at Franklin Road, S.W.



Office of City Engineer – November 1985



ABC13 – WSET – 5/22/2020 - <https://wset.com/news/local/evacuees-describe-being-rescued-from-a-hotel-in-roanoke>



Staff photo – November 7, 2022



Staff photo – March 24, 2023





Staff photo – June 29, 2023

From Franklin Rd. Facing W



WSLS.com

## ARCH HELPS PEOPLE EVACUATED FROM HOTEL IN FLOOD ROANOKE

WSLS10– 5/26/2020 - <https://www.wsls.com/news/local/2020/05/27/homeless-settle-into-new-hotels-after-being-evacuated-from-roanoke-hotel-during-flooding/>



Staff photo – November 7, 2022



Staff photo – March 24, 2023



Staff photo – June 29, 2023

From bridge facing US



Staff photo – Nov 12, 2020 – 11:22 AM





Staff photo – June 29, 2023

From George's Florist facing N



Staff photo – May 21, 2020



Staff photo - June 29, 2023



Staff photo – May 21, 2020



Staff photo – June 29, 2023

From Franklin Rd. facing W

• Holiday Inn at Franklin Road, S.W.



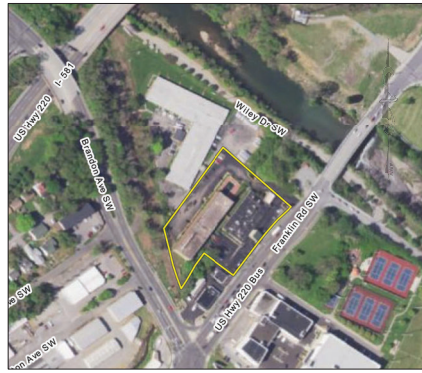
Office of City Engineer – November 1985





Staff Photo – June 29, 2023

**APPENDIX E - 95% ENGINEERING AND LANDSCAPING DESIGN PLANS, DRAFT  
NO-RISE FLOODPLAIN ANALYSIS**



WSSI 2018 NATURAL COLOR IMAGERY  
1927 FRANKLIN RD SW  
SCALE: 1"=300'

# CITY OF ROANOKE STORMWATER DIVISION

PUBLIC WORKS BUILDING  
1802 COURTLAND ROAD  
ROANOKE, VA 24012

## ORE BRANCH SITE PLAN

CITY SW PLAN #####  
CITY PLANNING #####



SHEET INDEX	
01	COVER SHEET
02	EXISTING CONDITIONS PLAN
03	GRADING PLAN
04	LONGITUDINAL PROFILE
05-07	CONSTRUCTION DETAILS
08	PLANTING PLAN
09-10	PLANTING NOTES AND DETAILS
11-12	VEGETATION, SEEDING SCHEDULE AND SOIL TEST
13	DESIGN NARRATIVE
14-15	MODELED FLOODPLAIN CROSS SECTIONS
16	MODELED FLOODPLAIN CROSS SECTIONS- PLANVIEW

# STREAM RESTORATION DESIGN

OCTOBER 30, 2023

### REVISIONS

No.	Date	Remarks	By

APPROVED FOR CONSTRUCTION	
_____ STORMWATER MANAGER	_____ DATE
_____ DIRECTOR OF PUBLIC WORKS	_____ DATE
_____ DEPUTY CITY MANAGER	_____ DATE

5450 Peters Creek Road • Suite 110  
Roanoke, Virginia 24019  
Phone: 540-795-6180  
www.wetlands.com

DESIGN ENGINEER / SURVEYOR  
FIRM NAME: Wetland Studies and Solutions, Inc.  
ADDRESS: 5450 Peters Creek Road, Suite 110  
Roanoke, VA 24019  
PHONE NO: (540) 795.6180 FAX NO: (703) 679.5601  
PROJ. MANAGER: Nathan A. Staley EMAIL: nstaley@wetlands.com

ORE BRANCH STREAM RESTORATION  
FINAL DESIGN  
CITY OF ROANOKE, VA

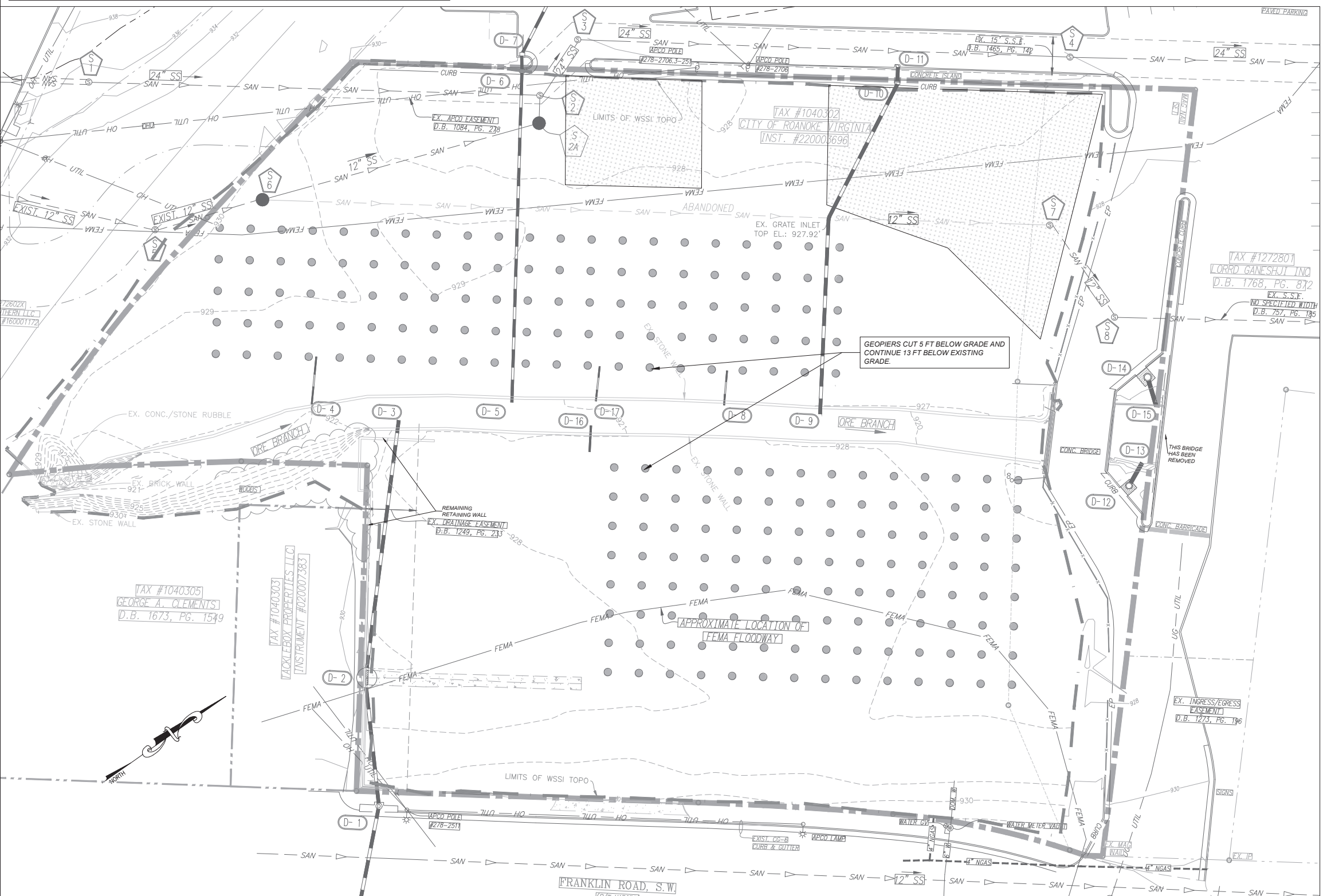
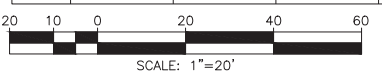
CITY PROJ. NUMBER  
###  
PLAN REVIEWER  
SHEET 1 OF 16

Existing Storm Sewer Table					
#	STRUCTURE	RIM	INV. OUT	INV. IN	INV. IN(2)
D1	Storm Drop Inlet	929.68'	921.81' (18" RCP)	921.92' (18" RCP)	
D2	Storm Grate	927.12'	921.12' (12" RCP)	921.17' (12" RCP)	
D3	End of Pipe		920.44' (15" RCP)		
D4	End of Pipe		926.31' (6" Metal)		
D5	End of Pipe		923.04' (12" RCP)		
D6	Grate	927.41'	924.95' (12" RCP)	925.06' (12" CMP)	
D7	Storm Grate	927.50'	925.40' (12" RCP)	925.45' (12" RCP)	
D8	End of Pipe		925.30' (6" Metal)		
D9	End of Pipe		921.84' (12" RCP)		
D10	Storm Grate	927.15'	924.27' (12" RCP)		924.35' (12" RCP)
D11	Storm Grate	926.58'	925.68' (12" RCP)		
D12	Storm Drop Inlet	927.23'			
D13	End of Pipe		921.08' (18" RCP)		
D14	End of Pipe		919.55' (18" CMP)		
D15	Storm Drop Inlet	927.12'			
D16	End of Pipe		922.59' (8" Metal)		
D17	End of Pipe		926.49' (6" Metal)		

Existing Sanitary Sewer Table							
#	STRUCTURE	WVWA#	WVWA#	RIM	INV. OUT	INV. IN(1)	INV. IN(2)
S1	Sewer Manhole	08A-1004.0	08A-1004.0	935.85'	921.18' (24" RCP)	921.30' (24" RCP)	
S2	Sewer Manhole	08A-1003.0	08A-1003.0	927.59'	922.34' (24" RCP)	922.61' (24" RCP)	
S3	Sewer Manhole	08A-1002.0	08A-1002.0	927.85'	921.71' (24" RCP)	921.95' (24" RCP)	
S4	Sewer Manhole	08A-1001.0	08A-1001.0	928.18'	920.92' (24" RCP)	920.98' (24" RCP)	
S5	Sewer Manhole	08A-0003.4	08A-0003.4	Location Unknown			
S6	Sewer Manhole	08A-0003.0	08A-0003.0	929.06'	923.07' (12" Terra)	924.04' (6" Terra)	923.26' (12" Terra)
S7	Sewer Manhole	08A-0002.0	08A-0002.0	928.30'	919.33' (12" HDPE)	920.67' (8" Terra)	919.64' (12" Terra)
S8	Sewer Manhole	08A-0001.0	08A-0001.0	927.32'	918.84' (12" Terra)	920.22' (6" Terra)	919.06' (12" HDPE)

### EXISTING CONDITIONS LEGEND

	-750-	WSSI SURVEYED 1' CONTOURS		CONCRETE
	-750-	LUMSDEN 2' CONTOURS		TIMBER GUARD RAIL
		SITE BOUNDARY		GEOPIER
		PARCEL BOUNDARY		
		BOUNDARY OF WSSI SURVEY		
		NATURAL GAS LINE		
		OH UTILITY LINE		
		UG UTILITY LINE		
		EXISTING STORM PIPE		
		SANITARY LINE		



**SURVEY NOTES:**

1. This map has been oriented horizontally to The Virginia Coordinate System of 1983, South Zone, NAD83 and vertically to Project Datum with control supplied by Lumsden Associates, P.C. on February 24, 2023, and confirmed by WSSI using Real Time Network (RTN) GPS. Additional field locations of post-demo survey conditions were completed on March 08, 2023.
2. All base map information within the limits shown, including boundary, topography, and physical improvements was provided to WSSI on February 15, 2023 by Lumsden Associates, P.C., and is used with their permission.
3. The entire site lies within a FEMA regulatory floodplain. Floodway extents are shown, with regulatory floodplain boundaries lying beyond pictured areas.

**ORE BRANCH STREAM RESTORATION  
FINAL DESIGN**

Roanoke, Virginia

**Existing Conditions Plan**

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REVISIONS		App. By	By
No.	Date	Description	

DATE: OCTOBER, 2023      SCALE: 1" = 20'

Horizontal Datum: NAD 83  
Vertical Datum: BY LUMSDEN  
Boundary and Topo Source: WSSI and LUMSDEN

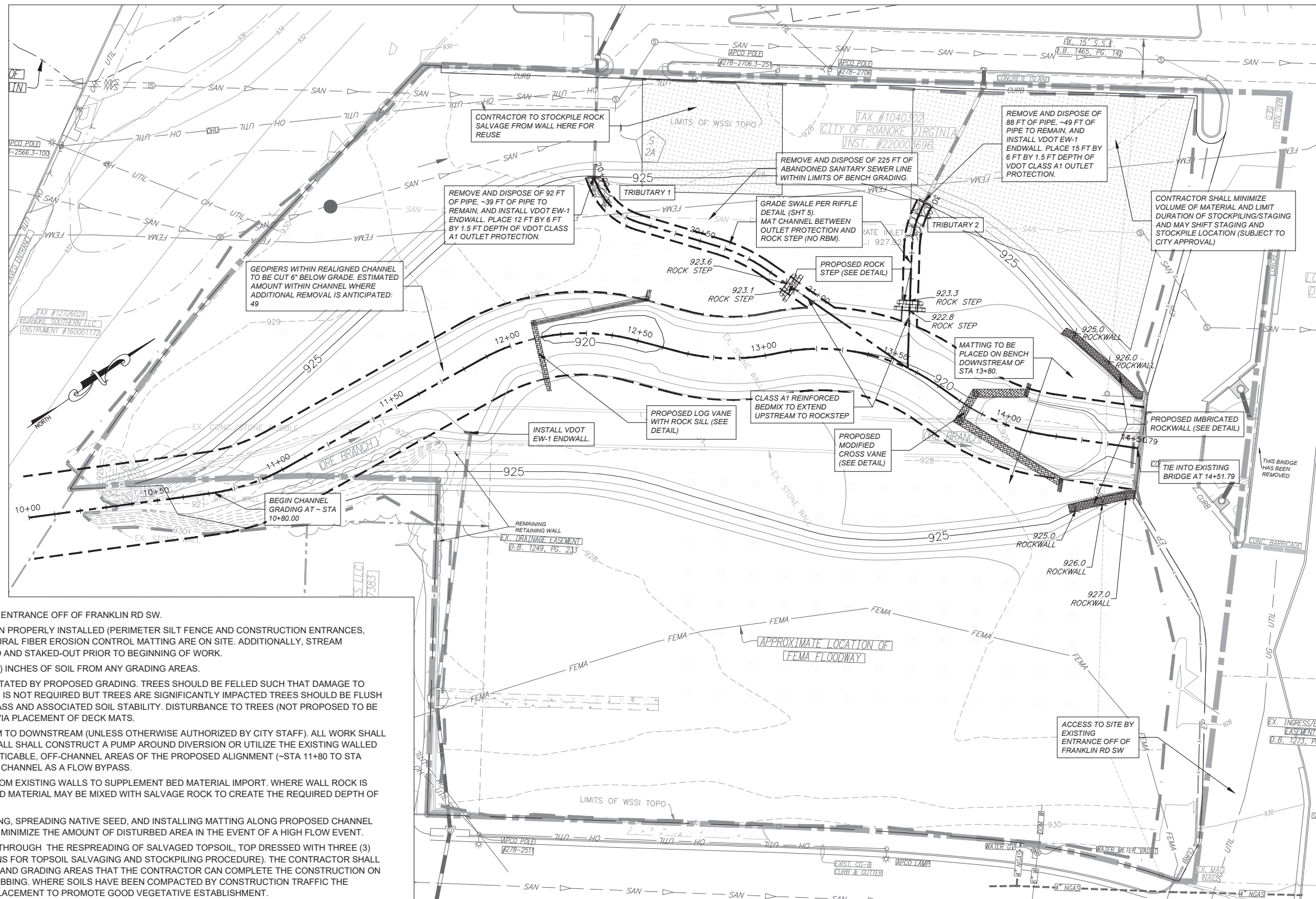
Design	Draft	Approved
JAB	JAB	NAS

Sheet #  
**02 of 16**

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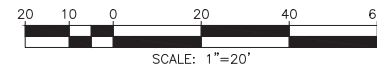
**GRADING LEGEND**

- 2000— MAJOR CONTOURS (1' C.I.)
- MINOR CONTOURS (1' C.I.)
- TEMPORARY STOCKPILE
- LIMIT OF DISTURBANCE
- PROPOSED CENTERLINE
- PROPOSED BANKFULL



**SEQUENCE OF CONSTRUCTION**

1. SITE ACCESS AND MOBILIZATION SHALL BE FROM THE EXISTING ENTRANCE OFF OF FRANKLIN RD SW.
2. NO GRADING SHALL BEGIN UNTIL ALL E&S CONTROLS HAVE BEEN PROPERLY INSTALLED (PERIMETER SILT FENCE AND CONSTRUCTION ENTRANCES, ETC.) AND THE SPECIFIED STABILIZATION SEED MIXES AND NATURAL FIBER EROSION CONTROL MATTING ARE ON SITE. ADDITIONALLY, STREAM CENTERLINE AND LIMITS OF DISTURBANCE SHALL BE SURVEYED AND STAKED-OUT PRIOR TO BEGINNING OF WORK.
3. THE CONTRACTOR SHALL STRIP AND STOCKPILE THE TOP SIX (6) INCHES OF SOIL FROM ANY GRADING AREAS.
9. TREES PROPOSED TO BE REMOVED SHALL BE CUT AS NECESSITATED BY PROPOSED GRADING. TREES SHOULD BE FELLED SUCH THAT DAMAGE TO SURROUNDING TREES IS MINIMIZED. IN AREAS WHERE GRADING IS NOT REQUIRED BUT TREES ARE SIGNIFICANTLY IMPACTED TREES SHOULD BE FLUSH CUT AND THE ROOT BALL LEFT IN PLACE TO PRESERVE ROOTMASS AND ASSOCIATED SOIL STABILITY. DISTURBANCE TO TREES (NOT PROPOSED TO BE REMOVED) ADJACENT TO ACCESS AREAS SHALL BE MINIMIZED VIA PLACEMENT OF DECK MATS.
10. STREAM WORK SHALL GENERALLY PROGRESS FROM UPSTREAM TO DOWNSTREAM (UNLESS OTHERWISE AUTHORIZED BY CITY STAFF). ALL WORK SHALL OCCUR IN THE DRY. IF FLOW IS PRESENT THE CONTRACTOR SHALL CONSTRUCT A PUMP AROUND DIVERSION OR UTILIZE THE EXISTING WALLED CHANNEL AS A FLOW BYPASS. TO THE GREATEST EXTENT PRACTICABLE, OFF-CHANNEL AREAS OF THE PROPOSED ALIGNMENT (~STA 11+80 TO STA 13+60) SHALL BE CONSTRUCTED WHILE UTILIZING THE EXISTING CHANNEL AS A FLOW BYPASS.
16. WHERE FEASIBLE, THE CONTRACTOR SHALL SALVAGE ROCK FROM EXISTING WALLS TO SUPPLEMENT BED MATERIAL IMPORT. WHERE WALL ROCK IS SALVAGED GRAVEL, SAND, AND TOPSOIL FRACTIONS OF THE BED MATERIAL MAY BE MIXED WITH SALVAGE ROCK TO CREATE THE REQUIRED DEPTH OF REINFORCED BED MATERIAL.
17. CONTRACTOR SHALL WORK PROGRESSIVELY, FINISHING GRADING, SPREADING NATIVE SEED, AND INSTALLING MATTING ALONG PROPOSED CHANNEL AREAS IMMEDIATELY UPON ACHIEVING FINAL GRADE. THIS WILL MINIMIZE THE AMOUNT OF DISTURBED AREA IN THE EVENT OF A HIGH FLOW EVENT.
18. FINAL GRADES OUTSIDE OF THE CHANNEL SHALL BE ACHIEVED THROUGH THE RESPREADING OF SALVAGED TOPSOIL, TOP DRESSED WITH THREE (3) INCHES OF IMPORTED SCREENED TOPSOIL. (SEE SPECIFICATIONS FOR TOPSOIL SALVAGING AND STOCKPILING PROCEDURE). THE CONTRACTOR SHALL ONLY CLEAR AND GRUB AS MUCH OF THE PROPOSED CHANNEL AND GRADING AREAS THAT THE CONTRACTOR CAN COMPLETE THE CONSTRUCTION ON AND HAVE STABILIZED IN THE SAME DAY AS CLEARING AND GRUBBING. WHERE SOILS HAVE BEEN COMPACTED BY CONSTRUCTION TRAFFIC THE CONTRACTOR SHALL SCARIFY SUBGRADE PRIOR TO TOPSOIL PLACEMENT TO PROMOTE GOOD VEGETATIVE ESTABLISHMENT.
19. ALL DISTURBED AREAS SHALL BE SEEDDED WITH RIPARIAN SEED MIX UNLESS OTHERWISE SPECIFIED IN THE PLANTING PLAN. NATURAL FIBER MATTING SHALL BE PLACED PER THE TYPICAL RIFFLE DETAIL AND AS OTHERWISE INDICATED IN THE PLAN, STAKED TO MANUFACTURERS SPECIFICATIONS USING BIODEGRADABLE STAKES. (NOTE: SEED MUST BE SOWN IMMEDIATELY PRIOR TO MATTING PLACEMENT.)
20. ONCE ALL PROPOSED GRADING IS COMPLETE THE CONTRACTOR SHALL RESTORE ALL STAGING/STOCKPILE AND ACCESS AREAS TO PRE-EXISTING CONDITIONS USING THE APPROPRIATE SEED MIX WHERE INDICATED AS WELL AS STRAW MULCH OR MATTING PER LOCAL REQUIREMENTS AND THE VIRGINIA E&S HANDBOOK. PLANTINGS SHALL BE INSTALLED PER THE PLANTING PLAN AND SPECIFICATIONS AND ADHERING TO THE SPECIFIED TIME OF YEAR PLANTING WINDOWS.
21. THE CONTRACTOR SHALL ASSESS THE POST-CONSTRUCTION CONDITIONS OF EXISTING INFRASTRUCTURE, REPAIRING ANY DAMAGE NOT OTHERWISE SPECIFIED IN THESE PLANS TO PRE-EXISTING CONDITIONS OR BETTER.
22. CONTRACTOR SHALL REMOVE E&S MEASURES AND RETURN ANY REMAINING DISTURBED AREAS TO A PRE-CONSTRUCTION CONDITION.
23. CONTRACTOR TO FOLLOW ALL APPLICABLE OSHA REQUIREMENTS.



SEE SHEETS 05-07 FOR CONSTRUCTION DETAILS

THE ENTIRE SITE IS WITHIN A FEMA REGULATORY FLOODPLAIN

SEE EXISTING CONDITIONS SHEET FOR ADDITIONAL LEGEND INFORMATION

**ORE BRANCH STREAM RESTORATION  
FINAL DESIGN**

Roanoke, Virginia

Grading Plan



REVISIONS	
No.	Description

Horizontal Datum: NAD 83  
Vertical Datum: BY LUMSDEN  
Boundary and Topo Source: WSSI and LUMSDEN

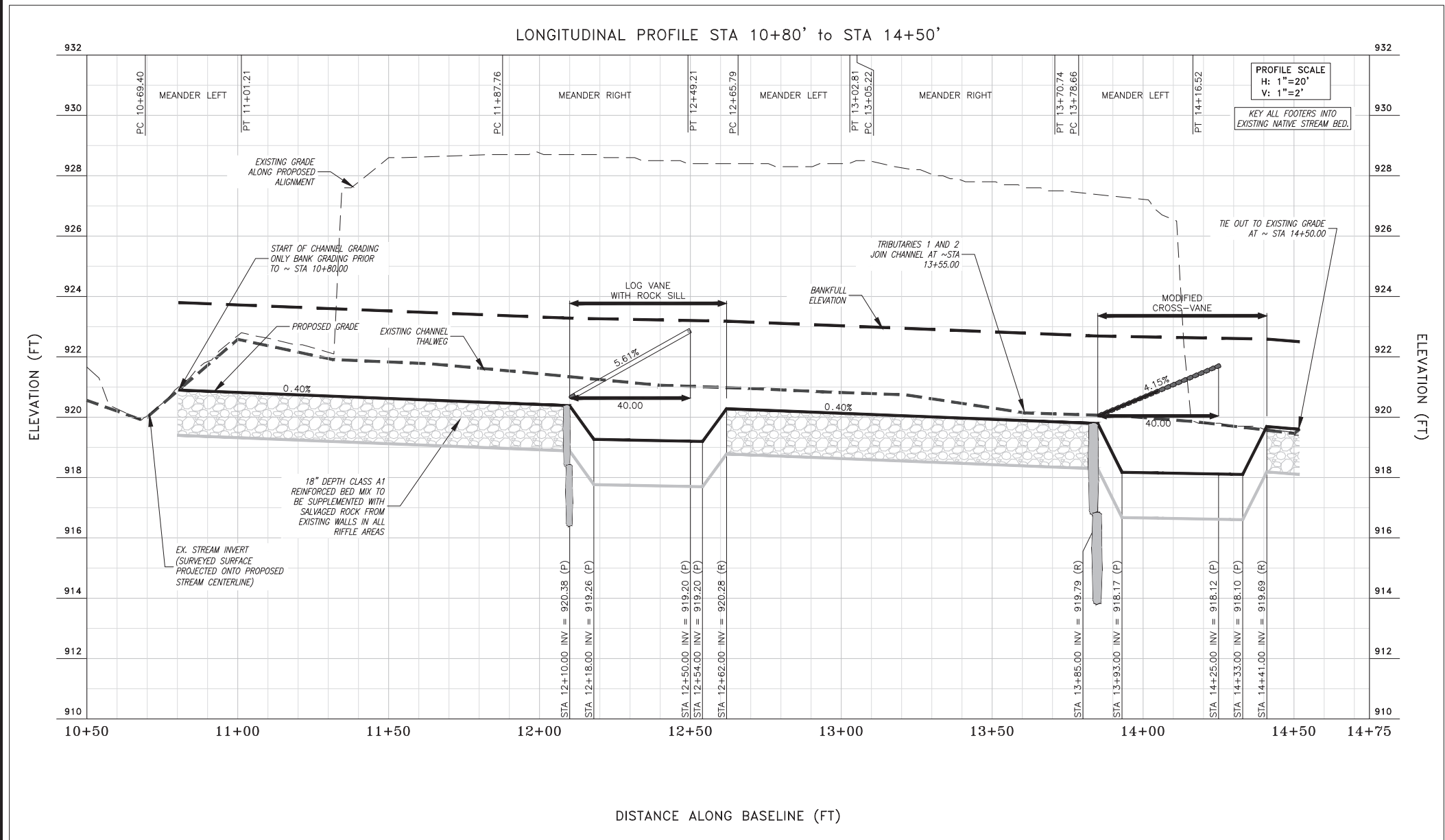
Design	Draft	Approved
JAB	JAB	NAS

Sheet #  
03 of 16

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**Wetland**  
Soil and Solutions, Inc.  
a DAVEY company  
5450 Peters Creek Road • Suite 110  
Roanoke, Virginia 24019  
Phone: 540-795-6180  
www.wetlands.com

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#### PROFILE LEGEND

- EXISTING STREAM INVERT PROJECTED TO PROPOSED CENTERLINE
- PROPOSED STREAM INVERT ALONG PROPOSED CENTERLINE
- STRUCTURE ROCK
- CLASS A1 REINFORCED BED MIX
- BANKFULL ELEVATION

#### "CL A1 REINFORCED BED"<sup>1</sup> MIXTURE SPECIFICATIONS

THE REINFORCED BED MIXTURE SPECIFIED BELOW MUST BE APPROVED BY THE C.O.R. PRIOR TO BEING PLACED IN THE STREAM CHANNEL.

MATERIAL	SIZE (D <sub>50</sub> )	PORTION	PERCENT (%)
ROCK <sup>2</sup> VDOT CL A1 RIPRAP	6.7 - 10.8 in (170 - 274 mm)	2 BUCKETS	35 - 40%
BANK RUN <sup>3</sup> GRAVEL	0.08 - 2.5 in (2 - 64 mm) (D <sub>50</sub> = 1.3 in)	2 BUCKETS	35 - 40%
COARSE SAND <sup>4</sup>	0.04 - 0.08 in (1 - 2 mm)	0.75 BUCKET	12 - 17%
TOPSOIL <sup>5</sup>	LOAM OR SILT LOAM WITH 3-5% ORGANIC CONTENT	0.5 BUCKET	7 - 12%

<sup>1</sup> THE REINFORCED BED SHALL BE A MINIMUM OF 18" IN DEPTH. SEE LONGITUDINAL PROFILE FOR LOCATIONS AND THICKNESS.

<sup>2</sup> THE ROCK PORTION OF THE MIXTURE SHALL CONSIST OF RIVER WASHED COBBLE (TAN, YELLOW, OR BROWN) WITH THE SPECIFIED D<sub>50</sub>. THE VOIDS FILLED WITH A MIXTURE OF SAND, GRAVEL, AND TOPSOIL. THE COMBINATION OF PARTICLE SIZES SPECIFIED IN CONJUNCTION WITH THE FILLING OF THE VOIDS, WILL RESULT IN A VERY RESISTANT, ARMORED SUBSTRATE THAT WILL BE CAPABLE OF WITHSTANDING MUCH GREATER SHEAR STRESS THAN THE COMPUTATION OF THE REQUIRED D<sub>50</sub> WOULD SUGGEST.

<sup>3</sup> BANK RUN GRAVEL MAY INCLUDE UP TO 5% CLAY, SILT, AND/OR SAND, AND UP TO 25% COBBLE (D<sub>50</sub> = 3" TO 8"). GRAVEL MUST HAVE NATURAL COLOR (TAN, YELLOW, OR BROWN).

<sup>4</sup> THE SAND PORTION OF THE MIXTURE SHALL CONSIST OF A WELL MIXED SAND PREDOMINANTLY 1.0 MILLIMETERS TO 2.0 MILLIMETERS IN SIZE, SUBJECT TO ENGINEER APPROVAL (I.E. WASHED CONCRETE SAND IS NOT REQUIRED). SAND MUST BE WHITE, TAN, YELLOW, OR BROWN IN COLOR.

<sup>5</sup> THE TOPSOIL PORTION OF THE MIXTURE SHALL CONSIST OF 50% SIFTED, UNWASHED COARSE SAND (WITH FINES ALLOWED), 25% COMPOSTED LEAF/BARK MULCH, 25% MINERAL SILT OR FINER MATERIAL (STONE DUST FROM ROCK CRUSHING OPERATIONS OR ANY SILT/CLAY).

Wetland  
Studies and Solutions, Inc.  
a DAMEC company  
5450 Peters Creek Road • Suite 110  
Roanoke, Virginia 24019  
Phone: 540-795-6180  
www.wetlands.com

### ORE BRANCH STREAM RESTORATION FINAL DESIGN

Roanoke, Virginia

### Longitudinal Profile

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REVISIONS		Rev. App. By	Date	Description
No.	Date	Rev.	App. By	Description

DATE: OCTOBER, 2023      SCALE: AS NOTED

Horizontal Datum: NAD 83  
 Vertical Datum: BY LUMSDEN  
 Boundary and Topo Source: WSSI and LUMSDEN

Design	Draft	Approved
JAB	JAB	NAS

Sheet #  
**04 of 16**



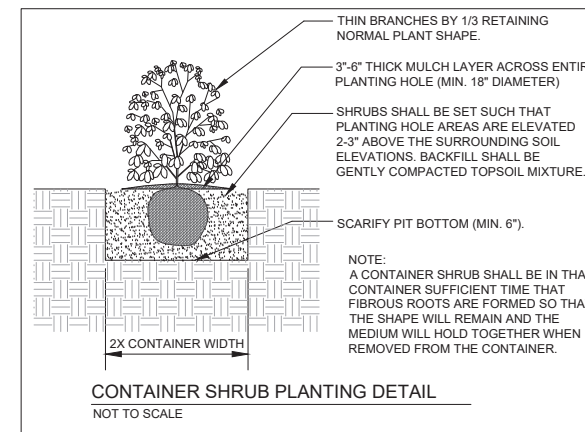
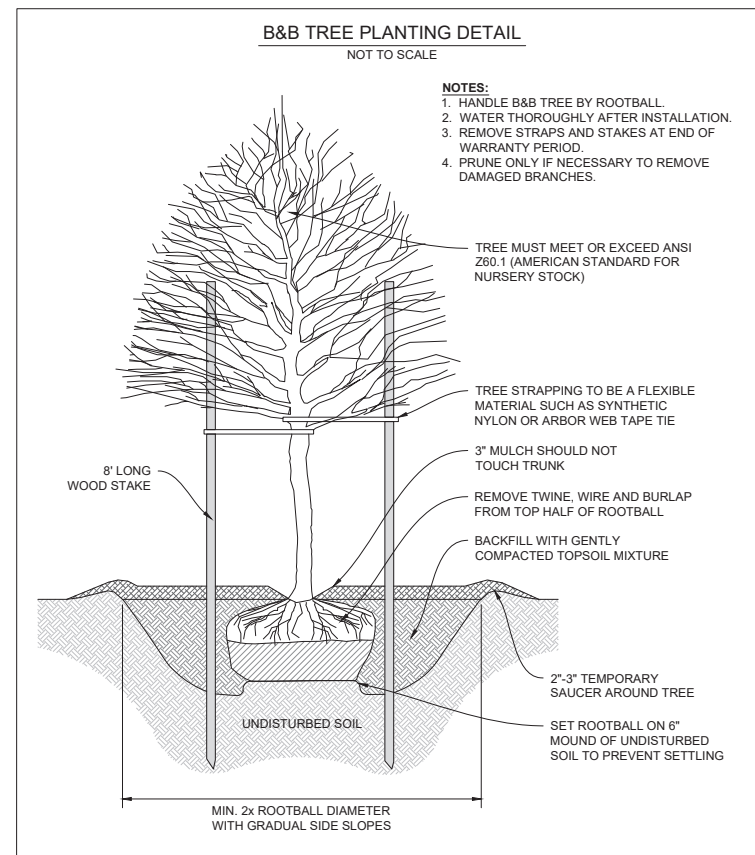
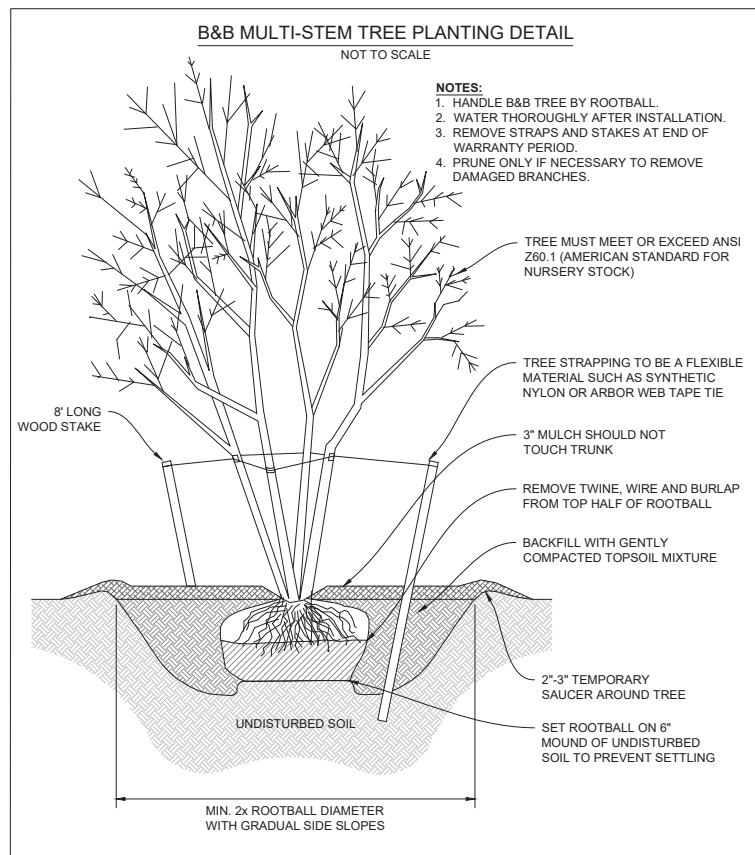






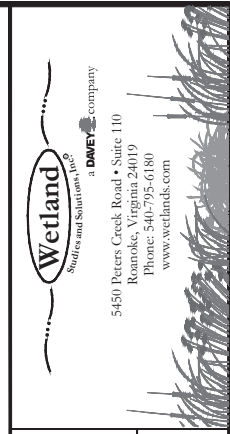






**THIS PLAN IS FOR PLANTING PURPOSES ONLY**

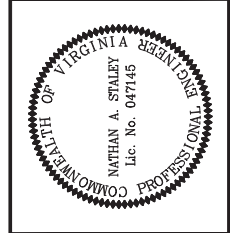
**PLEASE REFER TO PLANTING PLAN SHEETS FOR LEGEND**



**ORE BRANCH STREAM RESTORATION**  
**FINAL DESIGN**  
Roanoke, Virginia

**Planting Notes and Details Cont**

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REVISIONS		Rev. No.	App. By
No.	Date	Description	

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Vertical Datum: N/A  
Boundary and Topo Source: N/A

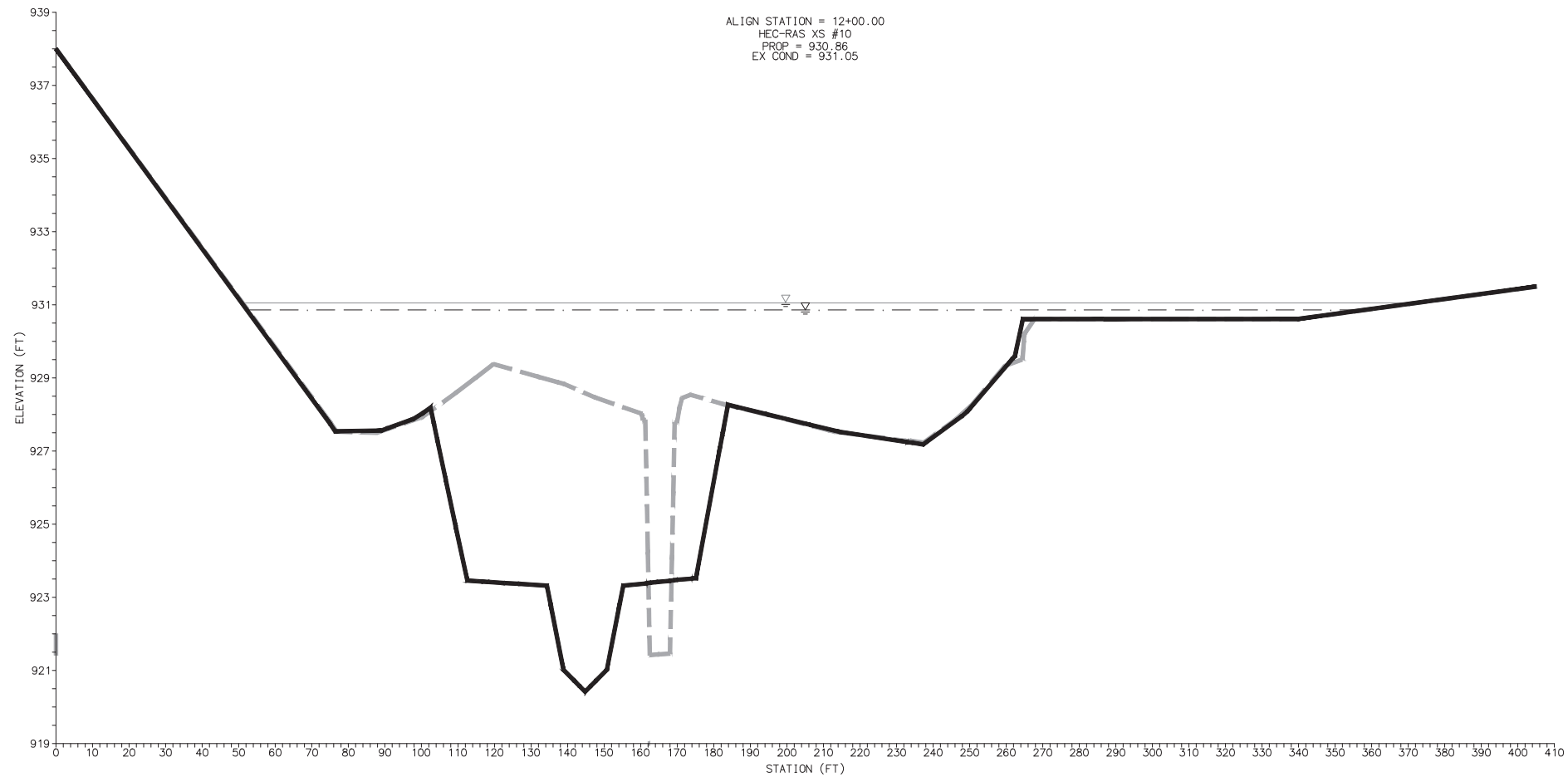
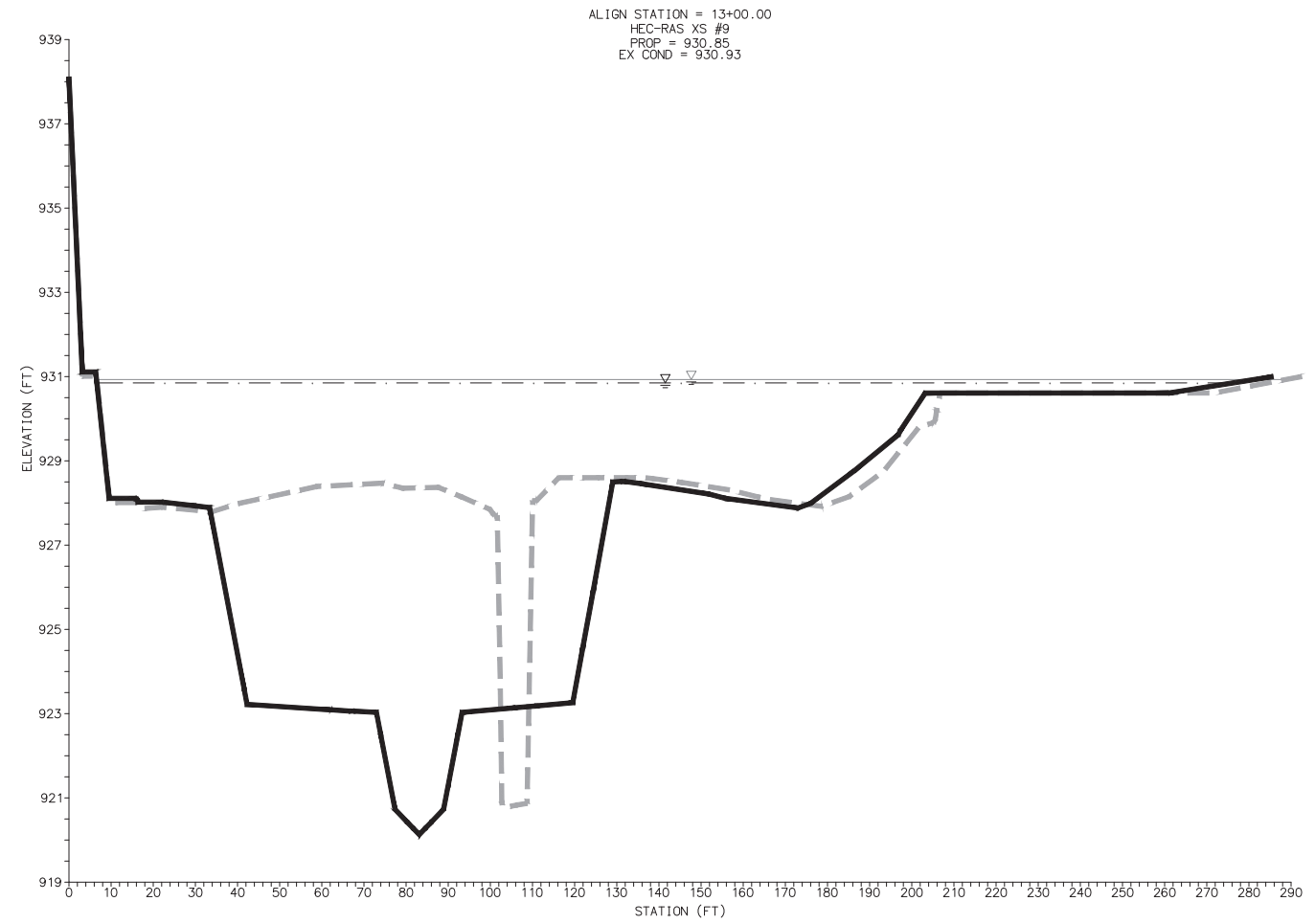
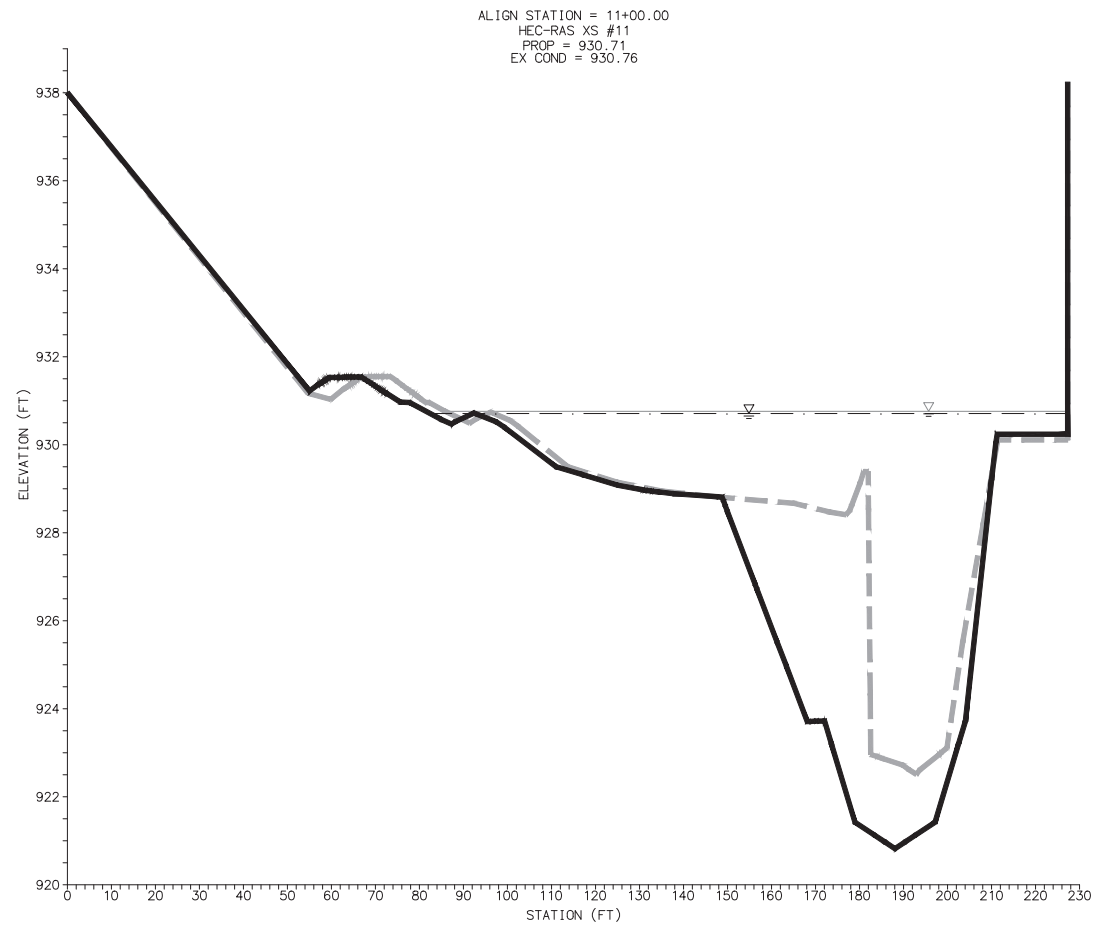
Design	Draft	Approved
JAB	SEH	NAS

Sheet #  
**09 of 16**







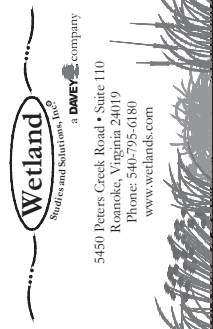


---	EXISTING GRADE
—	PROPOSED GRADE
...	EXISTING 10 YR.
-.-	PROPOSED 10 YR.

Table 1. Modeled changes in 10-year water surface elevation as a result of proposed restoration, see sheet 16 for cross section planview locations.

XS	FEMA Flow 10 yr (1,688 cfs) Δ WSE (ft)
11	-0.05
10	-0.19
9	-0.08
8	-0.03
7	-0.04
6	-0.04

THIS SHEET FOR DISPLAY OF FLOODPLAIN DATA/CROSS-SECTIONS ONLY.



ORE BRANCH STREAM RESTORATION  
FINAL DESIGN  
Roanoke, Virginia  
Modeled Floodplain Cross Sections

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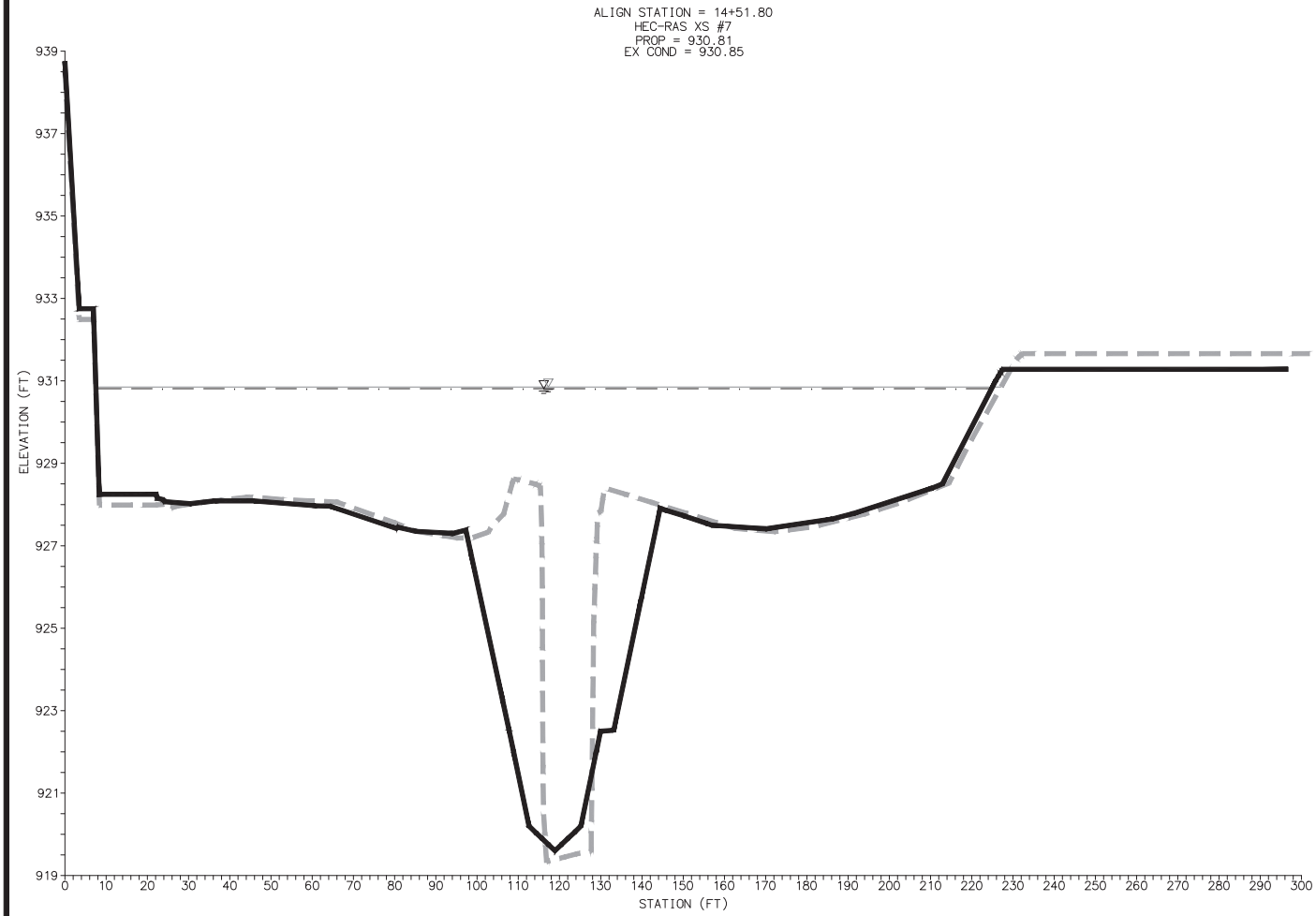
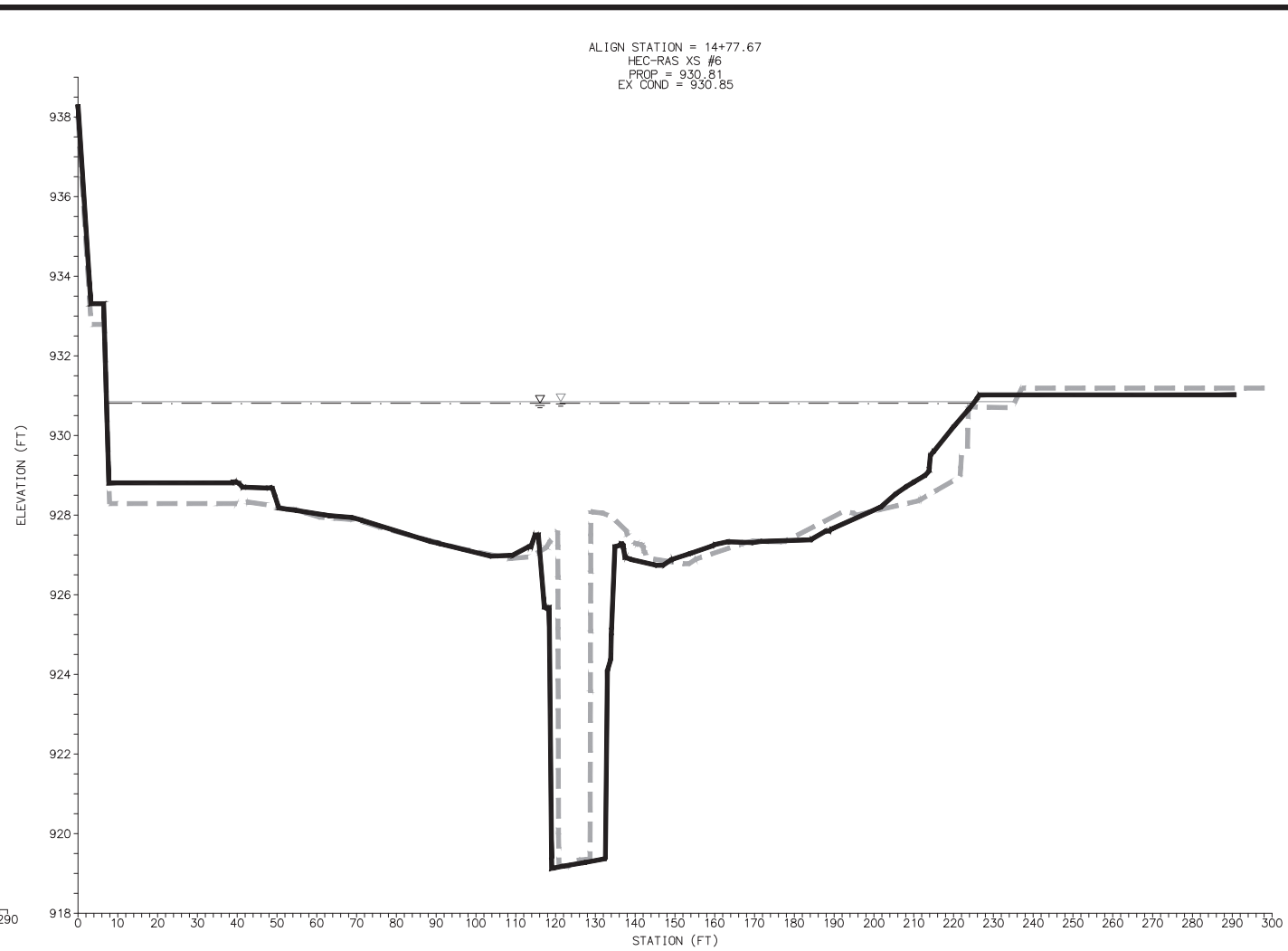
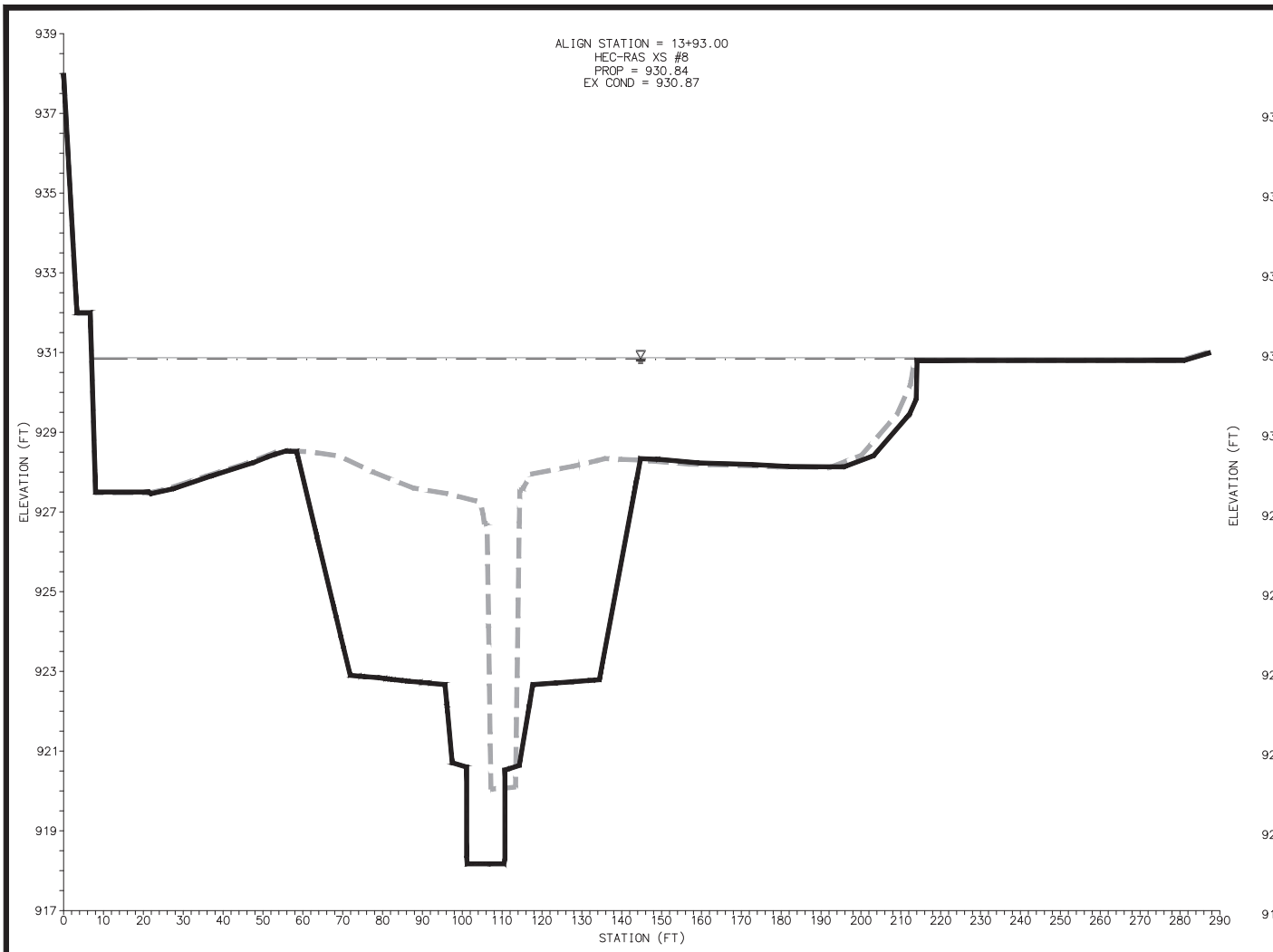


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No.	Description		
		OCTOBER, 2023	N/A

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Design	Draft	Approved
JAB	JAB	NAS
Sheet #		
14 of 16		

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- EXISTING GRADE
- PROPOSED GRADE
- ... EXISTING 10 YR.
- .- PROPOSED 10 YR.

THIS SHEET FOR DISPLAY OF FLOODPLAIN DATA/CROSS-SECTIONS ONLY.

**FLOODPLAIN NO-RISE / NO-IMPACT STATEMENT OF FINDING**

Wetland Studies and Solutions, Inc. (WSSI) has designed and prepared plans for a channel restoration project referred to as Ore Branch Stream Restoration for the City of Roanoke Stormwater Division.

A review of the scope and nature of the work proposed within the FEMA floodplain associated with Ore Branch concludes that such work will have no-impact on the floodplain and result in no-rise in the published base flood elevations of Ore Branch based on the following:

1. The proposed work is limited to excavation of floodplain material to create a lower floodplain terrace and placement of in-stream structures to provide channel stability. The work includes removal of an existing confined, walled channel section.
2. On-site survey data was used to develop a design which increases channel cross section size and conveyance capacity, while reestablishing a more natural channel form.
3. Proposed stabilization activities were modeled in HEC-RAS to assess potential floodplain impacts. A comparison of existing conditions and proposed conditions models indicates no increase to floodplain elevation or extents.
4. The entirety of the project area is submerged and subject to backwater effects from the Roanoke River during the regulatory flood event.

Based on a review of the proposed work, a finding of No-Rise / No-Impact is provided for the above referenced project.

Sincerely,  
**WETLAND STUDIES AND SOLUTIONS, INC.**  
*Nathan A. Staley*  
 Nathan A. Staley, P.E., CFM  
 Manager - Engineering

L:\32000s\32200\32299\02\Admin\04-ENGR\10-Hydraulics\2023-10-19\_FPL Statement of Finding.docx

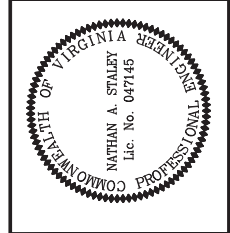
5450 Peters Creek Road, Suite 110, Roanoke, Virginia 24019 • Phone 540.795.6180 • Fax 703.679.5601  
 nstaley@wetlands.com • wetlandstudies.com

**Wetland**  
 Studies and Solutions, Inc.  
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 5450 Peters Creek Road • Suite 110  
 Roanoke, Virginia 24019  
 Phone: 540-795-6180  
 www.wetlands.com

**ORE BRANCH STREAM RESTORATION  
 FINAL DESIGN**  
 Roanoke, Virginia

**Modeled Floodplain Cross Sections (Cont)**

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REVISIONS		Rev. No.	App. By	Date	Scale
No.	Description				

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 Boundary and Topo Source: N/A

Design	Draft	Approved
JAB	JAB	NAS

Sheet #  
**15 of 16**

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## APPENDIX F - EXAMPLE EDUCATIONAL SIGN

The figure below shows an example educational sign from a project completed by Roanoke City Stormwater in 2019. The proposed sign at the Ore Branch site would be similar in construction and information content, but would be tailored to the specifics of the project.



## **APPENDIX G - PUBLIC INPUT SURVEY**

# Reimagining the Ramada Community Survey – Next Steps for Ramada<sup>1</sup>

## Background

In Spring 2022, the City of Roanoke purchased the Ramada Inn and Conference Center property (1927 Franklin Rd. SW) with plans to demolish the building and repurpose the land as permanent floodplain open space. Demolition of the hotel commenced in August 2022, and concurrently City staff began the process of envisioning the future of the site. This included a number of discussions amongst Stormwater, Parks and Recreation, Economic Development and Transportation staff, and the creation of a community input survey. A key aspect of this envisioning process is that the severe flood risk of this property is realized in two land restrictions:

1. A deed restriction to prevent future development that would impose flood risk – a condition of the FEMA program that co-funded the acquisition and demolition project.
2. The property is almost completely circumscribed by the regulatory Floodway, a FEMA Special Flood Hazard Area (SFHA) that further limits development form and usage on the property.

As such, the purpose of the envisioning process is to converge on the highest and best use for the former Ramada property given the severe flood risk of the property and the related land restrictions. Staff devised the community input survey based on understanding of both the deed restriction and the Floodway zoning restriction, though it is important to understand that any proposed development on the site will need to gain approval from FEMA, regardless of whether it appears to conform with the deed restriction. The objective of the survey was to provide the community with a list of options that appear to conform with the land restrictions, and to gain insight on how the community envisions the future of the former Ramada property.

## Methods

The “Reimagining the Ramada” Community Survey was created using Google Forms and was advertised through four local news media outlets, social media and sign boards posted along the Greenway with QR Codes linking to the survey. The survey was published on September 30, 2022 and remained open until October 31, 2022. A printout of the entire survey is provided in Appendix A, but a general description is provided here.

Respondents were first given details about the extent of the property, and the previously described land restrictions. Several maps and figures were provided to better define the extent of the property and demonstrate the existing state of the land. Question 1 provided five pre-defined options with example photographs, plus an “Other” option in a “check all that apply” configuration. The five pre-defined options were divided into Phase I and II based on the level of effort required to implement the project. The five pre-defined options were:

1. Open Space (Phase I)
2. Canoe-kayak tube launch site (Phase II)
3. Flowers and trees (Phase I)
4. Stream/Wetland restoration (Phase II)
5. Pollinator/wildflower meadow (Phase I)

---

<sup>1</sup> Survey, analysis and report by City of Roanoke Stormwater staff. Project file including original Word document is located in the server directory [here](#).

Question 2 simply read “Please submit any comments or concerns here:”, which allowed community members to provide any other information in an open ended format.

Survey results from the Google Form are dynamically linked to a Google Sheet, where they were read into the R scripting language for further analysis. The R script generates a summary bar graph and several summary tables. The bar graph was created by removing the “other” responses from Question 1 and counting the number of times each pre-defined choice was selected. Text mining was used to analyze open-ended comments from the community placed in Question 1 “Other” and Question 2. Text mining allows for rapid extraction of information from unstructured text by treating unstructured text as data frames of individual words and searching for common patterns. Tables were generated that summarized the most commonly used single words and bigrams (i.e. word pairs) in descending order.

## Results and Discussion

A total of 654 responses were submitted between 9/30/22 and 10/31/22, though no respondent tracking was imposed and it was therefore not possible to determine repeat respondents. While the total responses provided sufficient data for analysis, it should be noted that the number of responses only constitutes 0.7% of Roanoke City’s population and 0.2% of the metropolitan statistical area. The web-based survey delivery was designed to gain the broadest amount of input, though it is acknowledged that this creates selection bias against non-technology users. The use of the sign boards with QR code may also have biased results towards Greenway users, though it is not known what percentage of respondents accessed the survey through the QR code.

A summary of the results of Question 1 are shown in Table 1, with the percentages out of the total 654 respondents shown. These results indicate that the most desirable options of the menu provided are a pollinator/wildflower meadow and stream/wetland restoration, with a difference of only 8 total votes. The remainder of the options did not appear to be undesirable, though open space had the lowest number of votes at 163.

**Table 1 – Response to Question 1: “Please select any options that interest you”. Note that percentages do not sum to 100% as respondents were able to choose as many options as desired, and many respondents chose multiple options.**

Response	Count	Percentage
Pollinator/wildflower meadow	373	57.0%
Stream/wetland restoration	361	55.2%
Canoe-kayak-tube launch site	280	42.8%
Flowers and trees	236	36.1%
Open space	163	24.9%

The 208 unstructured comments that respondents placed in the “other” category of Question 1 and in Question 2 provided some additional context although only 32% of all respondents provided unstructured comments. The single word matches and bigrams provided a helpful starting point to organize the ideas in a systematic fashion. Several single word matches were not analyzed further due to the ambiguity with which they were used (“space”, “city”, “site”, etc.). With those exclusions, the most commonly used single word was “parking” (n = 38) with all but two requesting additional parking in the area, many to access the adjacent Greenway – the second most used single word (n = 33). Respondents that mentioned the Greenway generally asked for “connection to” or “extension of” the existing Roanoke River Greenway and/or adjacent parks – “park” was tied for second most used word (n

= 33). Park related ideas were numerous and did not converge on a single idea; 10 respondents asked for a dog park; 9 asked for a bike park or mountain bike course; others (n = 1 each) asked for Frisbee golf, futsal, amphitheater, skate park, etc. The term "launch" was the next most used (n = 21) with seven respondents noting either the logistical problems with placing a launch on this site or requesting that it be integrated with the broader whitewater park effort; all others provided additional details supporting the idea. The word "trees" was also used 21 times, with general support for tree planting with the caveat that appropriate spacing should be used to prevent vagrancy. The word "garden" was the next most used (n = 19) with reference to "community", "children's", "flower", "botanical", "urban", "beer" gardens.

The intent of the remaining high frequency terms ["access" (n = 15), "water" (n = 13), "wetland" (n = 12)] was captured as previously described, except for the term "homeless" (n = 11) with respondents variably requesting a shelter on this location or requesting that homeless camps not be allowed here. Analysis of bigrams further supports the previous discussion, with the most commonly identified word pairs being "green space" (n = 10), "Roanoke river", "wetland restoration (n = 7 each), "dog park", "kayak launch", "launch site" (n = 6 each).

### **Summary**

The open-ended results suggest that a broader list of pre-defined options in Question 1 may have been desirable, however it was not possible to include many of these options because of the land restrictions on the property. The results of the survey generally point to a desire for thoughtfully landscaped open space and a restoration of Ore Branch to a more natural form, with connection to the Greenway and surrounding parks. The canoe/kayak/tube launch was also supported, though numerous respondents noted the practical problems with the placement of a launch site at this location. Overall, the survey provides a relatively clear community perspective on the property, though it is reiterated the final outcome is still subject to engineering due diligence, local floodplain ordinance and FEMA approval.

**Appendix A – “Reimagining the Ramada” Export of Google Form Survey**



# Reimagining the Ramada

The City of Roanoke was awarded a Federal Emergency Management Agency (FEMA) grant to acquire and remove the Ramada Inn and Conference Center and create permanent open space.

Property Details: 2.4 acres; located at 1927 Franklin Rd SW near the Roanoke River Greenway. This site is in the floodway. Because of this, **FEMA prohibits structures and impervious surfaces from being built here.**

**Survey Closes October 31, 2022.**

"Phase I" refers to post-demolition work to take place in Fiscal Year 2023.

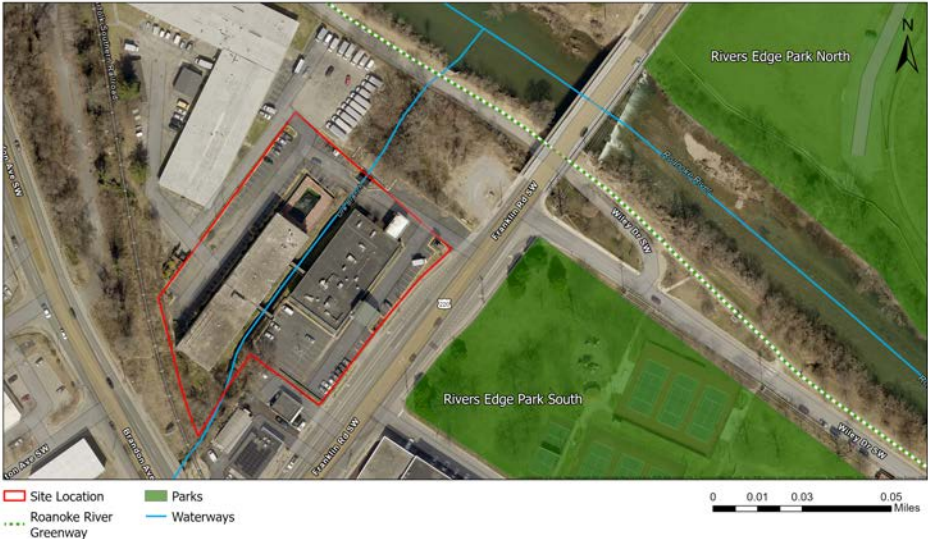
"Phase II" refers to stream channel work to take place in Fiscal Year 2024.

\* Required

## What would you like to see in this space?

Keep in mind that because this area is in the floodway, FEMA prohibits structures and impervious surfaces from being built on this site, even bathrooms or benches.

## Ramada Property Map



**Aerial View of Ramada Footprint**

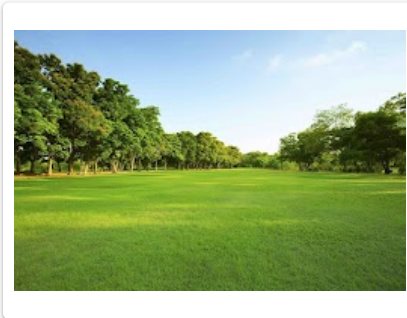


**Facing Upstream on Ore Branch (Pre-demolition Photo)**

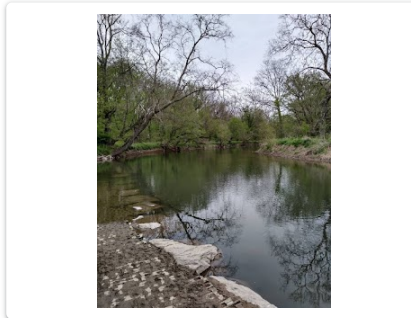


1. Please select any options that interest you: \*

Check all that apply.



Open space (Phase I of project)



Canoe-kayak-tube launch site (Phase II of project)

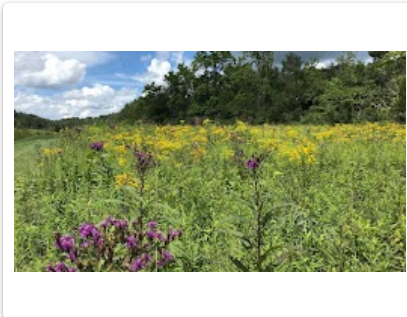


Flowers and trees (Phase I of project)



Stream/Wetland restoration (Phase II of project)

Other: \_\_\_\_\_



Pollinator/wildflower meadow (Phase I of project)

2. Please submit any comments or concerns here:

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## WebGrants Portal -> Scope of Work Document Crosswalk

Table provides a crosswalk between the WebGrants portal and the City's submitted Scope of Work narrative document

**Tab 5 - Scope of Work - Projects**

Order on Grants Portal	Item	Scope of Work Narrative Sections
1	Budget Narrative	5, Appendix B

**Tab 6 - Scope of Work Supporting Information - Projects**

Order on Grants Portal	Item	Scope of Work Narrative Sections
1	Population	4.1.a.
2	Historic Flooding data and Hydrologic Studies	4.1.b.
3	No Adverse Impact	4.1.c.
4	Ability to Provide Share of Cost	4.1.d.
5	Benefit-Cost Analysis	3.2; 3.4; 4.1.e
6	Repetitive Loss and or Severe Repetitive Loss Properties	4.1.g.i.
7	Residential and/or Commercial Structures	4.1.g.ii.
8	Critical Facilities/Infrastructure	4.1.g.iii.
9	Financial and Staff Resources	4.1.d, 4.2.a
10	Goals and Objectives	3.2
11	Approach Milestones and Deliverables	3.3
12	Relationship to Other Projects	4.6
13	Maintenance Plan	4.7
14	Criteria	4.8, Table 3

**Tab 10 - Supporting Documentation**

Order on Grants Portal	Item	Scope of Work Narrative Sections
1	Detailed map of the project area(s) (Projects/Studies)	Appendix C.1
2	FIRMette of the project area(s) (Projects/Studies)	Appendix C.2
3	Historic flood damage data and/or images (Projects/Studies)	Appendix D, Section 4.1.b.
4	A link to or a copy of the current floodplain ordinance	Appendix C.4
5	Maintenance and management plan for project	Section 4.7
6	A link to or a copy of the current hazard mitigation plan	Appendix C.6
7	A link to or a copy of the current comprehensive plan	Appendix C.7
8	Social vulnerability index score(s) for the project area	Section 4.2.b
9	Authorization to request funding from the Fund from governing body or chief executive of the local government	Appendix C.13
10	Signed pledge agreement from each contributing organization	Appendix A
11	Maintenance Plan	Section 4.7
12	Benefit Cost Analysis	Section 4.1.e.
13	Other Relevant Attachments	Appendix D-G

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13	Other Relevant Attachments	Appendix D-G

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1	Detailed map of the project area(s) (Projects/Studies)	Appendix C.1
2	FIRMette of the project area(s) (Projects/Studies)	Appendix C.2
3	Historic flood damage data and/or images (Projects/Studies)	Appendix D, Section 4.1.b.
4	A link to or a copy of the current floodplain ordinance	Appendix C.4
5	Maintenance and management plan for project	Section 4.7
6	A link to or a copy of the current hazard mitigation plan	Appendix C.6
7	A link to or a copy of the current comprehensive plan	Appendix C.7
8	Social vulnerability index score(s) for the project area	Section 4.2.b
9	Authorization to request funding from the Fund from governing body or chief executive of the local government	Appendix C.13
10	Signed pledge agreement from each contributing organization	Appendix A
11	Maintenance Plan	Section 4.7
12	Benefit Cost Analysis	Section 4.1.e.
13	Other Relevant Attachments	Appendix D-G



## WebGrants Portal -> Scope of Work Document Crosswalk

Table provides a crosswalk between the WebGrants portal and the City's submitted Scope of Work narrative document

**Tab 5 - Scope of Work - Projects**

Order on Grants Portal	Item	Scope of Work Narrative Sections
1	Budget Narrative	5, Appendix B

**Tab 6 - Scope of Work Supporting Information - Projects**

Order on Grants Portal	Item	Scope of Work Narrative Sections
1	Population	4.1.a.
2	Historic Flooding data and Hydrologic Studies	4.1.b.
3	No Adverse Impact	4.1.c.
4	Ability to Provide Share of Cost	4.1.d.
5	Benefit-Cost Analysis	3.2; 3.4; 4.1.e
6	Repetitive Loss and or Severe Repetitive Loss Properties	4.1.g.i.
7	Residential and/or Commercial Structures	4.1.g.ii.
8	Critical Facilities/Infrastructure	4.1.g.iii.
9	Financial and Staff Resources	4.1.d, 4.2.a
10	Goals and Objectives	3.2
11	Approach Milestones and Deliverables	3.3
12	Relationship to Other Projects	4.6
13	Maintenance Plan	4.7
14	Criteria	4.8, Table 3

**Tab 10 - Supporting Documentation**

Order on Grants Portal	Item	Scope of Work Narrative Sections
1	Detailed map of the project area(s) (Projects/Studies)	Appendix C.1
2	FIRMette of the project area(s) (Projects/Studies)	Appendix C.2
3	Historic flood damage data and/or images (Projects/Studies)	Appendix D, Section 4.1.b.
4	A link to or a copy of the current floodplain ordinance	Appendix C.4
5	Maintenance and management plan for project	Section 4.7
6	A link to or a copy of the current hazard mitigation plan	Appendix C.6
7	A link to or a copy of the current comprehensive plan	Appendix C.7
8	Social vulnerability index score(s) for the project area	Section 4.2.b
9	Authorization to request funding from the Fund from governing body or chief executive of the local government	Appendix C.13
10	Signed pledge agreement from each contributing organization	Appendix A
11	Maintenance Plan	Section 4.7
12	Benefit Cost Analysis	Section 4.1.e.
13	Other Relevant Attachments	Appendix D-G

## WebGrants Portal -> Scope of Work Document Crosswalk

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**Tab 5 - Scope of Work - Projects**

Order on Grants Portal	Item	Scope of Work Narrative Sections
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**Tab 6 - Scope of Work Supporting Information - Projects**

Order on Grants Portal	Item	Scope of Work Narrative Sections
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5	Benefit-Cost Analysis	3.2; 3.4; 4.1.e
6	Repetitive Loss and or Severe Repetitive Loss Properties	4.1.g.i.
7	Residential and/or Commercial Structures	4.1.g.ii.
8	Critical Facilities/Infrastructure	4.1.g.iii.
9	Financial and Staff Resources	4.1.d, 4.2.a
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**Tab 10 - Supporting Documentation**

Order on Grants Portal	Item	Scope of Work Narrative Sections
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6	A link to or a copy of the current hazard mitigation plan	Appendix C.6
7	A link to or a copy of the current comprehensive plan	Appendix C.7
8	Social vulnerability index score(s) for the project area	Section 4.2.b
9	Authorization to request funding from the Fund from governing body or chief executive of the local government	Appendix C.13
10	Signed pledge agreement from each contributing organization	Appendix A
11	Maintenance Plan	Section 4.7
12	Benefit Cost Analysis	Section 4.1.e.
13	Other Relevant Attachments	Appendix D-G